Kenya - Road Traffic Crashes 2012-2023

Sveta Milusheva

Report generated on: June 6, 2024

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Identification

SURVEY ID NUMBER
KEN_2012-2023_RTC_v01_M

TITLE
Road Traffic Crashes 2012-2023

SUBTITLE
Derived from Crowdsourced Reports from Ma3Route

ABBREVIATION OR ACRONYM
RTC 2012-23

COUNTRY/ECONOMY

Name	Country code
Kenya	KEN

ABSTRACT
This project geolocated the location of road traffic crashes based on crowdsourced reports of crashes from Ma3Route, a mobile/web/SMS platform that crowdsources transport data

KIND OF DATA
Observation data/ratings [obs]

UNIT OF ANALYSIS
Road traffic crashes

Version

VERSION DESCRIPTION
The datasets contain the time and location of road traffic crashes in Kenya (primarily Nairobi); crash information is derived from crowdsourced reports from @Ma3Route. Ma3Route is a mobile/web/SMS platform that crowdsources transport data and provides users with information on traffic, road traffic crash (RTC), matatu directions and driving reports. Users post RTC or traffic information to Ma3Route, where Ma3Route then publishes the post on Twitter. Tweets from @Ma3Route were queried using the Twitter API (tweets were no longer queried once Twitter rebranded to X).

VERSION DATE
2024-05-20

Coverage

GEOGRAPHIC COVERAGE
Primarily Nairobi, Kenya

Producers and sponsors

PRIMARY INVESTIGATORS

Name	Affiliation
Sveta Milusheva	World Bank

FUNDING AGENCY/SPONSOR

Name
World Bank

Sampling

SAMPLING PROCEDURE
All tweets from @Ma3Route from August 2012 to July 2023

Data collection

DATES OF DATA COLLECTION

Start	End	Cycle
2012-08-01	2023-07-12	1

DATA COLLECTION MODE
Internet [int]

Access policy

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CITATION REQUIREMENTS
Milusheva S, Marty R, Bedoya G, Williams S, Resor E, et al. (2021) “Applying machine learning and geolocation techniques to social media data (Twitter) to develop a resource for urban planning.” PLOS ONE 16(2): e0244317. https://doi.org/10.1371/journal.pone.0244317

ACCESS AUTHORITY

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DISCLAIMER
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Metadata production

DDI DOCUMENT ID
DDI_KEN_2012-2023_RTC_v01_M

PRODUCERS

Name	Abbreviation	Affiliation	Role
Development Data Group	DECDG	World Bank	Documentation of the DDI

DATE OF METADATA PRODUCTION
2024-05-23

Data Dictionary

Data file	Cases	Variables
ma3route_crashes_algorithmcode.dta Includes crashes from August 2012 through July 2023; whether a tweet reports a crash and the geolocation of the crash are determined by the described in Milusheva et al. (2021)	31064	10
ma3route_crashes_manualcode.dta Includes crashes from July 2017 through July 2018; whether a tweet reports a crash and the geolocation of the crash are manually coded.	2595	10

Data file: ma3route_crashes_algorithmcode.dta

Includes crashes from August 2012 through July 2023; whether a tweet reports a crash and the geolocation of the crash are determined by the described in Milusheva et al. (2021)

Cases:	31064
Variables:	10

Variables

ID	Name	Label	Question
V2	crash_id	Unique crash ID	
V3	crash_datetime	Date/time of the crash (using date/time of the first tweet that reported the crash	
V4	crash_date	Date of the crash (using date of the first tweet that reported the crash)	
V5	latitude	Latitude	
V6	longitude	Longitude	
V7	n_crash_reports	Number of tweets that reported crash	
V8	contains_fatality_words	Whether the tweet contains one of the words: 'dead', 'died', 'body', 'killed', or 'fatal'	
V9	contains_pedestrian_words	Whether the tweet contains the word: 'pedestrian'	
V10	contains_matatu_words	Whether the tweet contains the word: 'matatu'	
V11	contains_motorcycle_words	Whether the tweet contains one of the words: 'boda', 'motorycle', or 'motor cycle'	

Total: 10

Data file: ma3route_crashes_manualcode.dta

Includes crashes from July 2017 through July 2018; whether a tweet reports a crash and the geolocation of the crash are manually coded.

Cases:	2595
Variables:	10

Variables

ID	Name	Label	Question
V12	crash_id	Unique crash ID	
V13	crash_datetime	Date/time of the crash (using date/time of the first tweet that reported the crash	
V14	crash_date	Date of the crash (using date of the first tweet that reported the crash)	
V15	latitude	Latitude	
V16	longitude	Longitude	
V17	n_crash_reports	Number of tweets that reported crash	
V18	contains_fatality_words	Whether the tweet contains one of the words: 'dead', 'died', 'body', 'killed', or 'fatal'	
V19	contains_pedestrian_words	Whether the tweet contains the word: 'pedestrian'	
V20	contains_matatu_words	Whether the tweet contains the word: 'matatu'	
V21	contains_motorcycle_words	Whether the tweet contains one of the words: 'boda', 'motorycle', or 'motor cycle'	

Total: 10

CONTAINS_MATATU_WORDS: Whether the tweet contains the word: 'matatu'

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	28523	91.8%
1	Yes	2541	8.2%

CONTAINS_MOTORCYCLE_WORDS: Whether the tweet contains one of the words: 'boda', 'motorycle', or 'motor cycle'

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	29922	96.3%
1	Yes	1142	3.7%

CRASH_ID: Unique crash ID

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: 1 Maximum: 31064
Type: Continuous Decimal: 0 Width: 5 Range: 1 - 31064 Format: Numeric

CRASH_DATETIME: Date/time of the crash (using date/time of the first tweet that reported the crash

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid:

Type: Continuous Width: 20 Range: - Format: character

CRASH_DATE: Date of the crash (using date of the first tweet that reported the crash)

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid:
Type: Continuous Width: 10 Range: - Format: Date

LATITUDE: Latitude

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: -3.10000000200807 Maximum: -0.565402313796744
Type: Continuous Decimal: 0 Width: 18 Range: -3.10000000200807 - -0.565402313796744 Format: Numeric

LONGITUDE: Longitude

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: 36.2839500025994 Maximum: 37.8794900005407
Type: Continuous Decimal: 0 Width: 16 Range: 36.2839500025994 - 37.8794900005407 Format: Numeric

N_CRASH_REPORTS: Number of tweets that reported crash

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: 1 Maximum: 66
Type: Discrete Decimal: 0 Width: 2 Range: 1 - 66 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
1		25252	81.3%
2		3551	11.4%
3		1047	3.4%
4		445	1.4%
5		241	0.8%
6		163	0.5%
7		89	0.3%

8		86	0.3%
9		40	0.1%
10		23	0.1%
11		24	0.1%
12		20	0.1%
13		17	0.1%
14		10	0%
15		4	0%
16		13	0%
17		5	0%
18		3	0%
19		5	0%
20		3	0%
21		3	0%
22		1	0%
23		2	0%
25		2	0%
26		2	0%
27		1	0%
28		1	0%
30		1	0%
31		1	0%
32		1	0%
34		1	0%
35		1	0%
38		1	0%
40		1	0%
41		1	0%
46		1	0%
51		1	0%
66		1	0%

CONTAINS_FATALITY_WORDS: Whether the tweet contains one of the words: 'dead', 'died', 'body', 'killed', or 'fatal'

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	28780	92.6%
1	Yes	2284	7.4%

CONTAINS_PEDESTRIAN_WORDS: Whether the tweet contains the word: 'pedestrian'

Data file: ma3route_crashes_algorithmcode.dta

Overview

Valid: 31064 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	30120	97%
1	Yes	944	3%

CRASH_ID: Unique crash ID

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: 1 Maximum: 3115
Type: Continuous Decimal: 0 Width: 4 Range: 1 - 3115 Format: Numeric

---

CRASH_DATETIME: Date/time of the crash (using date/time of the first tweet that reported the crash

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid:
Type: Continuous Width: 20 Range: - Format: character

CRASH_DATE: Date of the crash (using date of the first tweet that reported the crash)

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid:
Type: Continuous Width: 10 Range: - Format: Date

LATITUDE: Latitude

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: -4.059868 Maximum: 1.257331
Type: Continuous Decimal: 0 Width: 18 Range: -4.059868 - 1.257331 Format: Numeric

---

LONGITUDE: Longitude

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: 34.145808 Maximum: 40.171389
Type: Continuous Decimal: 0 Width: 16 Range: 34.145808 - 40.171389 Format: Numeric

---

N_CRASH_REPORTS: Number of tweets that reported crash

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: 1 Maximum: 67
Type: Discrete Decimal: 0 Width: 2 Range: 1 - 67 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
1		2014	77.6%
2		321	12.4%
3		112	4.3%
4		54	2.1%
5		29	1.1%
6		16	0.6%
7		8	0.3%
8		8	0.3%
9		9	0.3%
10		5	0.2%
11		2	0.1%
12		2	0.1%
13		1	0%
14		4	0.2%
15		2	0.1%
16		1	0%
18		2	0.1%
20		1	0%
35		1	0%
42		1	0%
49		1	0%
67		1	0%

CONTAINS_FATALITY_WORDS: Whether the tweet contains one of the words: 'dead', 'died', 'body', 'killed', or 'fatal'

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	2429	93.6%

1	Yes	166	6.4%

CONTAINS_PEDESTRIAN_WORDS: Whether the tweet contains the word: 'pedestrian'

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	2534	97.6%
1	Yes	61	2.4%

CONTAINS_MATATU_WORDS: Whether the tweet contains the word: 'matatu'

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	2386	91.9%
1	Yes	209	8.1%

CONTAINS_MOTORCYCLE_WORDS: Whether the tweet contains one of the words: 'boda', 'motorycle', or 'motor cycle'

Data file: ma3route_crashes_manualcode.dta

Overview

Valid: 2595 Invalid: Minimum: 0 Maximum: 1
Type: Discrete Decimal: 0 Width: 1 Range: 0 - 1 Format: Numeric

Questions and instructions

CATEGORIES

Value	Category	Cases	
0	No	2500	96.3%
1	Yes	95	3.7%

Documentation

Technical documents

Road Traffic Crashes Derived from Crowdsourced Reports from Ma3Route - Dataset Description

Title	Road Traffic Crashes Derived from Crowdsourced Reports from Ma3Route - Dataset Description
Country	Kenya
Language	English
Filename	documentation.pdf

Trauma Surgery & Acute Care Open

Geospatial relationship of road traffic crashes and healthcare facilities with trauma surgical capabilities in Nairobi, Kenya: defining gaps in coverage

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Received 22 September 2017
Revised 4 November 2017
Accepted 7 November 2017

ABSTRACT

Background Road traffic injuries (RTIs) are a cause of significant morbidity and mortality in low- and middle-income countries. Access to timely emergency services is needed to decrease the morbidity and mortality of RTIs and other traumatic injuries. Our objective was to describe the distribution of roadtrafficcrashes (RTCs) in Nairobi with the relative distance and travel times for victims of RTCs to health facilities with trauma surgical capabilities.

Methods RTCs in Nairobi County were recorded by the Ma3route app from May 2015 to October 2015 with latitude and longitude coordinates for each RTC extracted using geocoding. Health facility administrators were interviewed to determine surgical capacity of their facilities. RTCs and health facilities were plotted on maps using ArcGIS. Distances and travel times between RTCs and health facilities were determined using the Google Maps Distance Matrix API.

Results 89 percent (25/28) of health facilities meeting inclusion criteria were evaluated. Overall, health facilities were well equipped for trauma surgery with 96% meeting WHO Minimal Safety Criteria. 76 percent of facilities performed greater than 12 of three preselected 'Bellweather Procedures' shown to correlate with surgical capability. The average travel time and distance from RTCs to the nearest health facilities surveyed were 7 min and 3.4 km, respectively. This increased to 18 min and 9.6 km if all RTC victims were transported to Kenyatta National Hospital (KNH).

Conclusion Almost all hospitals surveyed in the present study have the ability to care for trauma patients. Treating patients directly at these facilities would decrease travel time compared with transfer to KNH. Nairobi County could benefit from formally coordinating the triage of trauma patients to more facilities to decrease travel time and potentially improve patient outcomes.

Level of evidence III

INTRODUCTION

Emergency medical services, including trauma surgical services, are an essential part of a highly functioning health system, especially in low- and middle-income countries (LMICs), where trauma kills more people than tuberculosis, malaria and HIV combined.[1]

Among traumatic events, road traffic injuries (RTIs) are a leading cause of morbidity and mortality in LMICs. They are the eighth most common cause of death overall and the leading cause of death in people 15–29 years old.[2 3] Additionally, LMICs share a disproportionate burden of RTIs: 80% of RTI deaths occur in LMICs but only 53% of the world's vehicles are registered there.[4] In order to prevent these deaths, many reforms are needed, including improved road safety management, improved road design, improved vehicle safety, increased safe usage of roads, and faster access to definitive medical services.[4]

Kenya suffers from up to 8000 RTI-related deaths per year.[4] RTIs were the second leading cause of traumatic injury in a community survey of Nairobi slums, the leading cause of death from trauma in Western Kenya, and, most recently, the leading cause of admission to the Kenyatta National Hospital (KNH) Accident and Emergency (A&E) department.[5–7] Additionally, it has been shown that when *matatus* (semi-public 'busses' which ferry passengers between informal stops) are involved in RTIs, occupants commonly require hospital admission.[8] Though there is a burgeoning emergency medical community, Kenya lacks a universal emergency medical services system. Most victims of RTIs are still transported to health facilities by 'good Samaritans' or family members.[5 9 10]

Recently, there has been an increased interest in using geographic information systems (GIS) techniques in understanding the relationship of populations to the availability and distribution of healthcare services, especially in a global surgical context. A macro-level study of nine countries showed that the proportion of a country's population living within a 2-hour drive of essential surgical services varied from 17% (Somaliland) to 84% (Pakistan).[11] Studies in Zambia[12] and Ghana[13] have attempted to use more granular mapping techniques to estimate countrywide access to surgical services and inform health systems planning. Of note, the Ghana study was able to identify five health facilities which were already providing some surgical services and had large catchment areas, making them ideal 'targets' for the expansion of their surgical services to increase timely access to care.[14]

Decreasing travel time to definitive surgical care is important for victims of traumatic injury. Multiple studies have shown that longer prehospital time results in increased mortality for trauma patients and that trauma patients in rural areas are less likely to survive hospitalization.[15–17] Currently, most traumatic injuries in Nairobi are brought to

To cite: Shaw BI, Wangara AA, Wambua GM, *et al. Trauma Surg Acute Care Open* 2017;**2**:1–5.

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KNH, the main public hospital, due to lack of insurance for most Nairobians.[18]

In the present study, we sought to understand the distribution of road traffic crashes (RTCs) in Nairobi and the relative distance and travel times for potential victims of RTCs to health facilities with trauma surgical capabilities. Specifically, we sought to evaluate the current 'base case' of all RTC victims seeking care at KNH to alternatives where RTC victims may be treated at alternative hospitals located around Nairobi. We believed that this would lead to a statistically and clinically significant decrease in travel time from the site of the RTC to definitive care.

Methods

Nairobi County houses the capital of Kenya with a population of 3.1 million people in ~700 km^2 with a population density of 4515 persons per km^2.[19] Ma3route is a traffic reporting app that allows users to easily report RTCs with both text descriptions and pictures. They reach a reported 400 000 users per day.[20] RTCs from Ma3route were collected between May 2015 and October 2015. RTCs were geocoded by matching descriptions of incidents to a custom database of landmarks in the Nairobi area to determine approximate latitude and longitude coordinates. RTCs were considered verified if they were reported more than once or if there was a picture of the RTC attached to the report. Verified RTCs in Nairobi County with complete latitude and longitude coordinates were included in the analysis.

Health facilities with a Kenya Essential Package for Health Level of IV or greater as reported in the Kenya Master Facility List were identified. This list was reviewed by local collaborators to ensure completeness; overlooked facilities were added. Facilities that currently provided emergency care to adults and had an inpatient ward were included. Latitude and longitude coordinates were determined for all facilities using both Google Maps and verification by global positioning system device by the study investigator.

Health facilities that were included in the study were surveyed using an instrument that included previously validated questions on WHO Minimal Safety Criteria, number of index procedures performed, and availability of equipment and staffing.[12 13] The survey was initially piloted in a 10% sample of facilities and then administered to the remainder of facilities. There were no changes to the survey.

The GIS software mapping software ArcGIS (Esri, Redlands, California, USA) was used to plot the locations of both RTCs and health facilities in Nairobi to create a visual representation of the data. Maps were created in order to determine which facilities were closest to RTC 'hot spots.' Distances and travel times between each RTC and all health facilities identified were computed using the Google Maps Distance Matrix API (Google, Mountain View, California, USA), which accounted for traffic and time of day. Shortest travel time and distance from each RTC to health facilities were analyzed using Stata (Statacorp, College Station, Texas, USA). Descriptive statistics of RTC from the Ma3route data set and health facility surveys were computed. A kernel density plot of RTC time of day was created. Travel times and distances under multiple scenarios were computed.

Written consent was obtained from all participating health facilities.

RESULTS

RTCs in the Ma3route data set

Overall, there were 986 RTCs reported in Nairobi County through the Ma3route app from May to October 2015. Of these, 69% reported information regarding vehicles involved. Police or an ambulance attended only 9.5% and 2.4% of the RTCs, respectively. Only 5.4% of RTCs were described as having 'fatalities' by the reporting individuals (table 1). Most of the reported RTCs occurred during morning and evening commute times (figure 1).

Table 1 Road traffic crash characteristics for Ma3route data collected between May 2015 and October 2015 (n=982)

Characteristic	N (%)
Vehicle involved	
Car	382(39)
Truck	173(18)
Bus/*matatu*	266(27)
Pedestrian	92 (9.4)
Motorcycle	66 (6.7)
Other	20 (2.0)
Unknown	300(31)
Attended by?	
Police	93 (9.5)
Ambulance	24 (2.4)
Fatality reported at scene	53 (5.4)

Health facility survey results

The Kenya Master Facility List and discussion with local experts yielded 28 facilities. Of these, 25 (89%) completed health facility surveys (table 2). The facilities were generally well equipped for safe surgery, with 24 out of 25 (96%) meeting all of the WHO Minimal Safety Criteria. Additionally, most were facile with the index procedures surveyed, with 76% performing greater than 12 of each index operation (exploratory laparotomy, open fracture repair, and cesarean section) each year. Very few facilities (20%) had 24 hours staffing by surgeons, obstetricians, and anesthetists. When facilities were stratified by type (faith based, private, or public), there were no clear differences in WHO Minimal Safety Criteria, index operation performance, or staffing.

There were no significant differences in equipment availability between facilities by facility type. However, all faith-based facilities had CT scanners, whereas some private and some public facilities did not. All facilities were well equipped with anesthesia

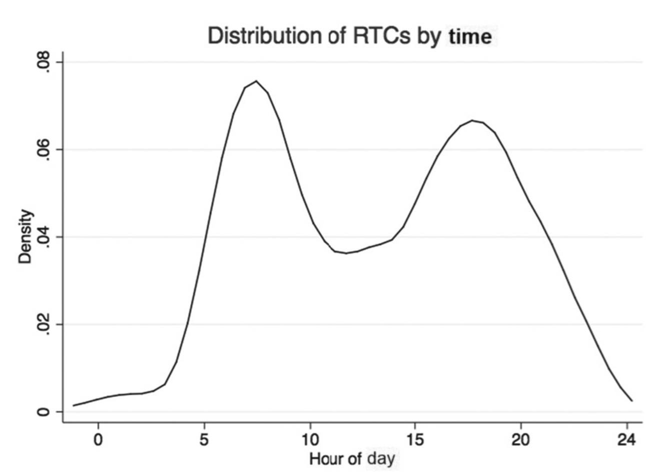

Figure 1 Kernel density plot of road traffic crashes (RTCs) by hour of day.

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Table 2 Hospital staffing and operative capacity by facility type

Facility type*	All (n=25)	Faith based (n=4)	Private (n=17)	Public (n=4)	P value
Anesthesia, Surgery, Ortho, Ob/Gyn On- Call—N (%)	21(84)	3 (75)	16(94)	2 (50)	P=0.083
Anesthesia, Surgery, Ortho, Ob/Gyn 24/7—N (%)	5 (20)	1 (25)	3 (17)	1 (25)	P=1.0
Meets WHO Minimal Safety Criteria—N (%)	24(96)	4 (100)	16(94)	4 (100)	P=1.0
Perform >12 of three Index Operations—N (%)	19(76)	3 (75)	13(77)	3 (75)	P=1.0

*Faith-based facilities are those operated directly by religious organization. Private facilities are those operated by any private organization with varying levels of affiliation with the Ministry of Health. Public facilities are those operated directly by the Ministry of Health.

equipment and sterile instruments. Fewer facilities across all groups had good availability of blood of all types (table 3).

Geospatial analysis

A map detailing the geospatial distribution of RTCs in Nairobi is shown in figure 2. The highest density of RTCs were on Thika Road east of the city, Waiyaki Road west of the city, and Mombasa Road south of the city. A full 44% of all RTCs recorded occurred on six major roadways. There appears to be a lower density of RTCs in the city center compared with transition zones between peri-urban and urban areas. For example, there were many RTCs reported where Thika Road transitions from a high-speed highway to an urban road.

Travel time and distance

The median travel time from the site of the RTC to a receiving hospital was 7 min if all hospitals were included (table 4). Due to its central importance in trauma systems in Nairobi, multiple scenarios involving KNH were compared. The median travel time increases to 18 min if only KNH is used as a receiving hospital for RTC patients. If trauma surgical services for all patients were expanded to the next optimally placed hospital included in our survey, the travel time would decrease to 14 min. It would further decrease to 11 min if including the next two optimally placed hospitals. The median travel distance is 3.4 km if all hospitals are included (table 5). If only KNH is used, the median distance to a facility is 9.6 km. This median distance decreases to 7.4 km if including the next optimally placed hospital and 6.8 km if including the two next optimally placed hospitals.

DISCUSSION

We found an acceptable density of health facilities with trauma surgical capabilities in Nairobi, Kenya, with all patients less than 1 hour away from definitive care.

Geospatial mapping, distance analysis, and travel time analysis confirm that there are many well-equipped health facilities that are positioned to receive trauma surgical patients.

In the present study, cars (39%) and busses (27%) were the most commonly reported vehicles involved in RTCs. A countrywide study found vehicle passengers were the most common victims of road traffic injuries accounting for about 50% of all RTIs.[21]

However, pedestrians had a higher rate of fatalities than any other group in both national and international studies.[4 21] Though it is unclear if our data capture all pedestrian road traffic injuries as they may not cause significant traffic delays, our data does successfully identify the most incident RTC that causes injury.

Overall, the health facilities surveyed in the current study were well equipped. Compared with a previous study evaluating hospitals that cared for trauma patients across Kenya, there was greater availability of oxygen and anesthesia equipment.[8] This increase in resources is likely due to our mix of facilities, large urban setting, and the fact that the majority of facilities surveyed were private. Supply of blood products was low across facilities of all types indicating a continued need to strengthen blood banking capabilities.

Unsurprisingly, both the distance and the travel time to the nearest health facilities in this urban setting were very low. However, these times were significantly higher when using only KNH as the destination for all RTI victims. We found that expanding access to a single additional, optimally placed, hospital would significantly decrease travel time from 18 to 14 min if expanding access to one hospital and to 11 min if expanding access to two hospitals. We believe these differences to be a gross underestimate in improvement given limitations in modeling traffic patterns on the Google Maps platform.

Additionally, data from Botchey *et al* actually showed much longer transport times from patients who presented to four hospitals in the Nairobi region, with a median time of 162 min. The authors cite the lack of coordinated prehospital care as a potential cause of the long prehospital time, as only 8.5% of patients arriving at KNH arrived by ambulance.[5] This is in line with our findings of a relatively high density of health facilities in Nairobi. Lack of ambulance transport means that individuals would be even more susceptible to changes in traffic patterns as private vehicles do not have the right of way. Continued investment in a coordinated prehospital system may be useful. A new 'ride hailing' like system called Flare (similar to Uber or Lyft) may accelerate the ability of Nairobi to deploy emergency services more efficiently.[22]

There are definite limitations to our study. First, the ability of our road user reported data to capture all meaningful RTCs that cause injury is unknown. However, the data are concordant with some prior studies of road traffic injuries in Kenya.[21] Additionally, we only used reported RTCs that could be verified by

Table 3 Per cent availability of equipment by facility type

Facility type	All (n=25) (%)	Faith based (n=4) (%)	Private (n=17) (%)	Public (n=4) (%)	*P value
Availability of Anesthesia Equipment—Med (IQR)	100 (100–100)	100 (95–100)	100 (100–100)	100 (100–100)	0.42
Availability of Sterile Instruments—Med (IQR)	100 (100-–100)	100 (95–100)	100 (100–100)	100 (100–100)	0.42
Availability of CT Scanner Med(IQR)	90 (0–100)	90 (45–95)	90 (0–100)	50 (0–100)	0.99
Availability of Blood Products Med (IQR)	70 (50–100)	75 (55–85)	70 (50–100)	60 (45–85)	0.76

*All comparisons by Kruskal-Wallis test.

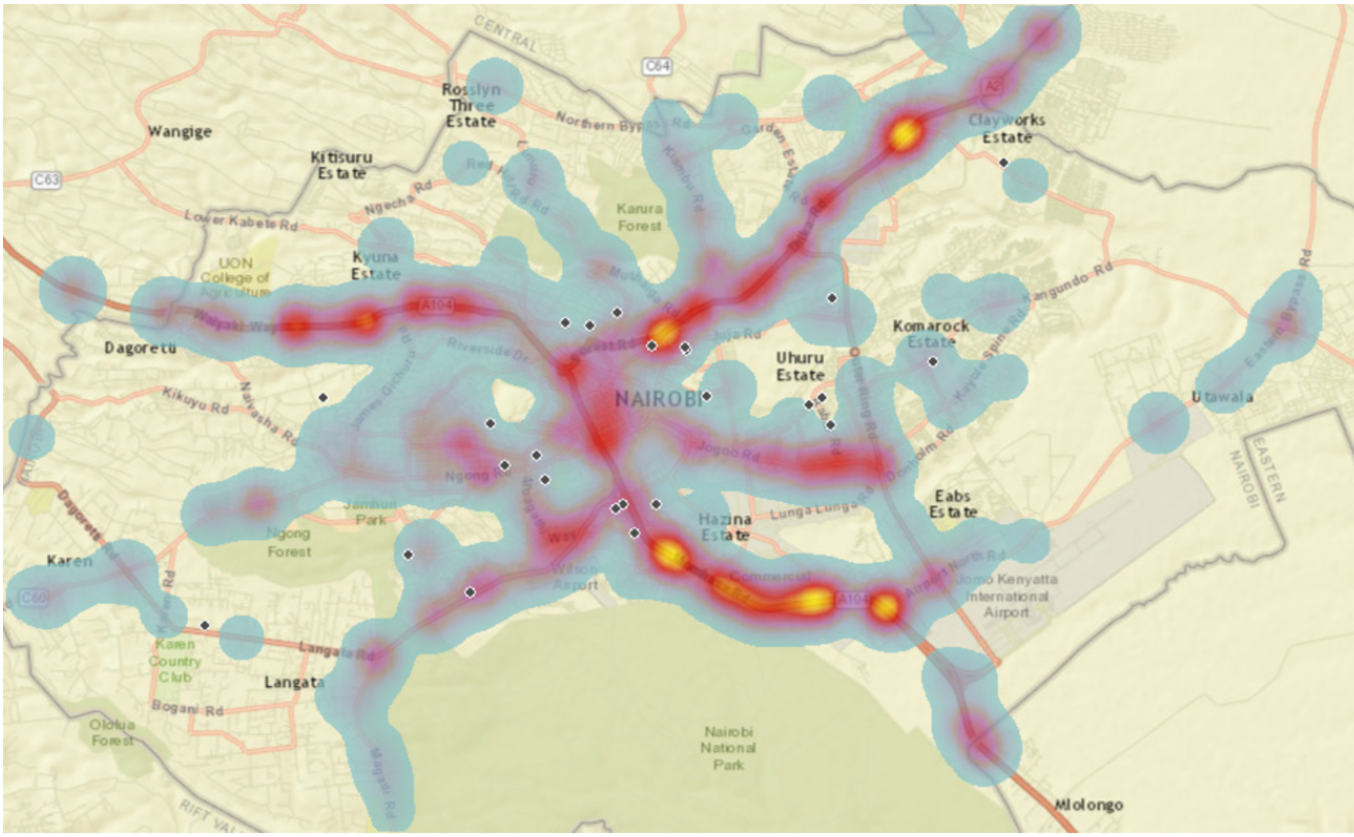

Figure 2 Geospatial distribution of road traffic incidents and health facilities in Nairobi, Kenya.

either multiple reports or upload of a picture to the Ma3route app. Though this likely decreased our sensitivity to detect all RTCs, it helped to ensure that our data were meaningful and likely captured more significant (ie, more morbid) RTCs. Our evaluation of health facility surgical capabilities relied entirely on reported responses, which may be subject to desirability bias. We attempted to minimize this bias by informing our respondents that the data would only be presented in aggregate. The Google Maps Distance Matrix API is not yet robust in its traffic predictions, especially around rush hour times, in Nairobi. Though we made every effort to account for traffic patterns in the travel time analysis, the data presented are still likely underestimates. Better adjustment for traffic patterns and corroboration with prospectively recorded travel times would allow more accurate travel time estimation.

The present study shows the feasibility of combining novel data from industry, government maintained data sets, and prospective data for the comprehensive evaluation of a multifaceted public health problem. Though data sources here are heterogeneous, they each add to our ability to evaluate the accessibility of trauma surgical services in Nairobi. As private industry plays an important and increasing role in both direct healthcare delivery and healthcare systems more broadly,[23] future research should be open to diverse data sources to facilitate a more thorough understanding of these complex challenges.

Overall, Nairobi is well equipped to care for patients in traumatic RTIs. Continued thoughtful implementation of programs to expand access to care is needed to ensure that all patients are treated promptly after road traffic injuries. As Kenya seeks to define its 'Kenya Policy on Emergency Medical Care', which is currently undergoing final drafting, we believe that our findings are of great interest to policymakers. The data strongly argue for the utilization of existing resources in non-public facilities for the provision of emergency surgical care. By expanding access to definitive resuscitative procedures at non-public hospitals and more thoroughly coordinating care, Kenya has an opportunity to decrease morbidity and mortality from RTIs.

Table 4 Travel time to health facility under different conditions

Condition	Time of transport (Min)—Med(IQR)	P value*
All health facilities	7 (5–12)	Reference value
Kenyatta National Hospital (KNH)only	18 (13–22)	P<0.001
KNH+1	14 (9–19)	P<0.001
KNH+2	11(7–15)	P<0.001

*All comparisons by Kruskal-Wallis with Dunn's post test.

Table 5 Distance to health facility under different conditions

Condition	Distance (km)—Med(IQR)	P value
All health facilities	3.4 (2.0–5.9)	Reference value
Kenyatta National Hospital (KNH) only	9.6 (6.5–14.1)	P<0.001
KNH+1	7.4 (5.6–11.0)	P<0.001
KNH+2	6.8 (4.3–9.6)	P<0.001

*All comparisons by Kruskal-Wallis with Dunn's post test.

Acknowledgements We would like to heartily thank Elizabeth Resor for the original Ma3route data set and for her help in the conceptualisation of this work. We would also like to thank Ma3route for allowing the use of their data. Finally, we would like to thank all of the hospital administrators who participated in the study.

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Contributors BIS and AAW contributed to the design, implementation, analysis and writing of this project. GMW and CJ contributed to the design, implementation, analysis and writing of this research. JK contributed to the implementation and analysis of this research. JMM contributed to the design of this research and writing of this research. RAD contributed to the design, implementation and writing of this research.

Competing interests None declared.

Ethics approval The study was approved by both the University of California, San Francisco and KNH institutional review boards.

Provenance and peer review Not commissioned; externally peer reviewed.

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Kenya Vital Statistics

REPORT

2023

REPUBLIC OF KENYA

Civil Registration Services

Recording life's most vital events.

Every human life counts.

Kenya Vital Statistics

REPORT 2023

Published by:

Department of Civil Registration

Hass Plaza 4th Floor, Lower Hill Road,

P.O Box 49179- 00100 Nairobi

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- Email: : secretary@crs.go.ke
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Published 2024

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Recommended citation: CRS, 2024. Kenya Vital Statistics Report, 2023.. Nairobi, Kenya.

Recording life's most vital events

Every human life counts.

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Terms & Concepts

Age-specific fertility rate (ASFR): The annual number of births to women of a particular age group per 1,000 women in that age group.

Age-specific mortality rate (ASMR): This is the total number of deaths to residents of a specified age or age group in a specified geographic area (country, state, county, etc.) divided by the population of the same age or age group in the same geographic area (for a specified time period, usually a calendar year) and multiplied by 100,000

Burial Permit: Official document, usually issued only for a legally registered death, authorizing the removal of the dead body to the cemetery or other final disposal.

Causes of Death: All diseases, morbid conditions, or injuries that either resulted in or contributed to death and the circumstances of the accident or violence that produced any such injuries. Symptoms or modes of dying, such as heart failure or asthenia, are not considered to be causes of death for vital statistics purposes.

Certifier (of Cause of Death): Person authorized by law to issue a certificate, in a prescribed format, stating the underlying and contributory causes of death and other facts related to the event for submission to the local registrar or other appropriate authority. The certifier is usually the clinician who attended to the deceased in his or her last illness; in the case of deaths of persons who were not attended to during the last illness, then by a clinician; or in the case of deaths due to violence or injury, then the medical-legal officer (e.g., physician or medical examiner).

Civil Registrar: Official authorized by law to register the occurrence and charged with the responsibility for civil registration of vital events in a well-defined area and for recording and reporting information on those vital events for legal and statistical purposes.

Civil Registration System: The institutional, legal, and technical settings established by the government to conduct civil registration in a technical, sound, coordinated and standardized manner throughout the country, considering cultural and social circumstances particular to the country.

Civil Registration: This is the act of recording and documenting vital events in a person's life (birth, marriage, divorce, adoption, and death and causes of death).

Complete Civil Registration: When every vital event that has occurred to the members of the population of a particular country (or area), within a specified period, has been registered in the civil registration system, i.e., has a vital registration record. Thus, the system has attained 100-percent coverage. Any deviation from complete coverage is measured by "coverage error."

Completeness of registration: This is the proportion of vital events that are registered. It is the number of registered vital events divided by an estimate of the actual number of vital events that occurred in the same population during a specific period of time.

Crude birth rate (CBR): The number of live births relative to the size of that population during a given period, usually one year. It is expressed as the number of live births per 1,000 population per year.

Crude death rate (CDR): The number of deaths relative to the size of that population during a given period, usually one year. It is expressed as the number of deaths per 1,000 population per year.

Data adjustment: Refers to a set of procedures employed to: improve coverage, classification, timing, and valuation of the data; conform to an accounting and recording basis; or address data quality differences in compiling specific data sets.

Data redistribution: Involves the transfer of data from one distribution to another, with the main objective being to enhance its applicability for statistical analysis.

Date of Occurrence: The exact date when the event occurred; it should be expressed in terms of day, month, and year, as well as hour and minute, if appropriate (for live births, fetal deaths, and deaths).

Date of Registration: The day, month, and year when an entry of registration of a vital event is made in the civil register.

Death: Death is the permanent disappearance of all evidence of life at any time after live birth has taken place (postnatal cessation of vital functions without capability of resuscitation). This definition excludes fetal deaths.

Delayed Registration: The registration of a vital event after the prescribed period denoted in existing laws, rules, or regulations (including any grace period, if one is specified). A late registration is the registration of a vital event after the prescribed time period but within a specified grace period. In Kenya, the grace period is from the third to sixth month following the event.

Fetal death (also referred to as 'stillbirth'): 'Death prior to the complete expulsion or extraction from the mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles.'(UN, 2014) Note that this definition broadly includes all terminations of pregnancy other than live births, as defined above.

Infant Mortality Rate: A vital statistics summary rate based on the number of infant deaths occurring during the same period of time, usually a calendar year, i.e., the number of deaths under 1 year of age occurring in a given geographical area during a given year, per 1,000 live births occurring among the population of the given geographical area during the same year.

Informant: The individual or institution whose responsibility, designated by law, is to report to the local registrar the fact of the occurrence of a vital event and to provide all the information and characteristics related to the event. The informant must be able not only to supply the accurate information necessary for registration, i.e., for legal purposes, but also the particulars required for statistical purposes.

Late Registration: A late registration is the registration of a birth or death after the legally specified time period but within a specified grace period. The grace period is usually considered to be six months after the vital event.

Live Birth: A live birth is the result of the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which after such separation breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered to be live born.

Neonatal mortality rate (NMR): Probability (expressed as a rate per 1,000 live births) of a child born in a specific year or period dying in the first 30 days of life, if subject to age-specific mortality rates of that period.

Population Pyramid: This is the distribution of a population by age groups and sex.

Quality Control: This is the systematic process of ensuring that births and deaths data collected, analyzed, and reported conform to established standards of accuracy, reliability, and relevance.

Quality assurance: This refers to strategies and procedures for ensuring the quality of vital statistics.

Sex Ratio: This is the ratio of males to females in a population and is often expressed as the number of males per 100 females.

Timeliness in Register-Based Vital Statistics: For every vital event registered within the interval specified by legislation, a statistical report form has been forwarded to the agency responsible for the compilation of vital statistics within the established time schedule of the vital statistics program, and the production, publication, and dissemination of the vital statistics is prompt enough to serve the users' needs.

Timeliness in Registration: This element of a vital event report is determined by the difference between the date of the event and the date of its registration when compared to the interval specified by legislation.

Total fertility rate (TFR): The sum of age-specific fertility rates for females aged between 15 and 49 during a specified period, usually one year. It is an estimate of the average number of children a cohort of women would bear if they went through their childbearing years experiencing the same age-specific fertility rates.

Under-5 mortality rate (U5MR): The probability of a child born in a specific year or period dying before reaching the age of 5, if subject to age-specific mortality rates of that period. The under-5 mortality rate as defined here is strictly speaking not a rate (i.e., the number of deaths divided by the number of populations at risk during a certain period of time) but a probability of death derived from a life table and expressed as rate per 1,000 live births.

Underlying Cause of Death: The cause of death to be used for primary statistical tabulation purposes has been designated as the underlying cause of death. The underlying cause of death is defined as '(a) the disease or injury which initiated the train of events leading directly to death, or (b) the circumstances of the accident or violence which produced the fatal injury..

Verbal Autopsy: VA is a process for diagnosing causes of death based on responses collected from families and/or caregivers to a series of structured questions on the signs and symptoms experienced by the deceased, and their duration. These responses are usually reviewed by a physician to determine the probable cause of death.

Vital Event Record: A legal document entered in the civil register which attests to the occurrence and characteristics of a vital event.

Vital Event: The occurrence of a live birth, death, fetal death, marriage, divorce, adoption, legitimation, recognition of parenthood, annulment of marriage, or legal separation.

Vital Statistical Record: A document or record containing items of information concerning an individual vital event that meets the needs for vital statistics compilation.

Vital Statistics System: In the context of defining a system as a set of interacting or independent components forming an integrating whole and for the purposes of these principles and recommendations, the vital statistics system's components are (a) legal registration, (b) statistical reporting of, and (c) collection, compilation, and dissemination of statistics pertaining to vital events. The vital events of interest are live births, adoptions, legitimations, recognition; deaths and fetal deaths; and marriages, divorces, separations, and annulments of marriage.

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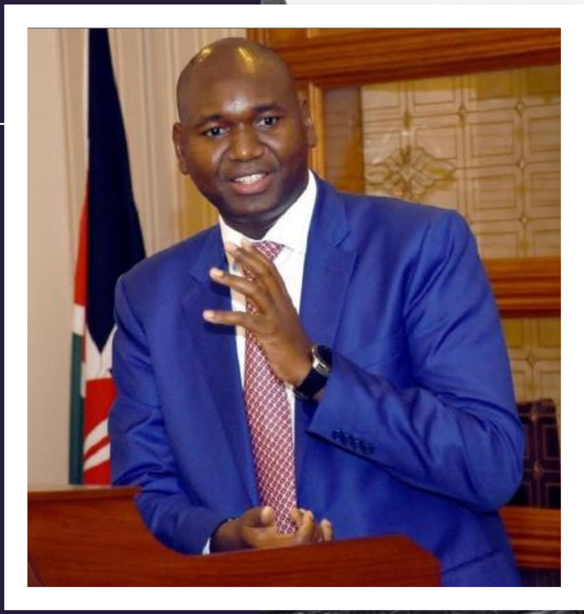


Foreword

AMB. (PROF.) JULIUS K. BITOK, MBS
Principal Secretary,
State Department For Immigration
and Citizen Service

The production of the 2023 Kenya Vital Statistics Report was coordinated by the Civil Registration Services through the continued support of development partners, the Kenya National Bureau of Statistics in collaboration with the Ministry of Health, the Population Studies and Research Institute of the University of Nairobi and other stakeholders. This has ensured that the production of an annual vital statistics report is a continuous process. The production and compilation of this report follows the UN principles and recommendations for vital statistics reports as well as the guidelines developed by UNECA for the region.

The 2023 Kenya Vital Statistics Report is the eleventh in a series of annual CRVS reports produced since 2010. The report aims to provide a snapshot of the 2023 vital statistics extracted from the civil registration system. The report covers births, deaths and causes of death registered in health facilities and the community in Kenya. The analysis, compilation, review and validation of this report was performed by CRS, KNBS and other key stakeholders.

A complete CRVS system should provide vital statistics for births and deaths for evidence-based decision-making and key indicators of fertility and mortality.

The report covers births, deaths and causes of death registered in health facilities and the community in Kenya. The analysis, compilation, review and validation of this report was performed by CRS, KNBS and other key stakeholders.

The Government of Kenya recognizes that a well-functioning CRVS system plays a central role in attaining good governance, economic and social development of a nation as envisioned in the Kenya Vision 2030. Furthermore, Kenya has also committed to achieving various targets set out in regional and global frameworks on sustainable development. Therefore, the information provided in this report will be used in tracking and reporting the progress made by the country in achieving these targets.

It is my sincere hope that this report will be useful in informing related policies and decisions and guiding strategic interventions aimed at strengthening the CRVS system in Kenya.

“

A complete CRVS system should provide vital statistics for births and deaths for evidence-based decision-making and key indicators of fertility and mortality

Acknowledgment

PAUL D. MWANGEMI
Secretary,
Civil Registration Services

The Kenya Vital Statistics Report 2023 was developed by Civil Registration Service (CRS) in partnership with various Government Agencies and key development partners. First, we wish to acknowledge the support, leadership and policy guidance by the Government of Kenya through the Ministry of Interior and National Administration and the State Department for Immigration and Citizen Service.

Second, we are indebted to the concerted effort of various Government Ministries, departments, agencies, international and local organizations for their technical support during the collection, compilation, analysis, peer review, validation, publishing, launch and dissemination of this report.

These include Kenya National Bureau of Statistics (KNBS), United Nations Population Fund (UNFPA) Kenya, National Government Administration (NGA), Ministry of Health (MOH),

We are indebted to the concerted effort of various Government Ministries, departments, agencies, international and local organizations for their technical support during the collection, compilation, analysis, peer review, validation, publishing, launch and dissemination of this report.

Population Studies and Research Institute (PSRI), the Kenya Medical Research Institute (KEMRI Welcome Trust), UN Women, National Council for Population Development (NCPD) and Vital Strategies.

Third, we acknowledge the financial support of the UNFPA Kenya and World Bank- Eastern Africa Regional Statistics Program for Results (EARSPforR) through KNBS.

Lastly, we wish to appreciate the CRS Directors and staff from Civil Registration Services for their contribution towards the generation of this report.

"The production and compilation of this report follows the UN principles and recommendations for vital statistics reports as well as the guidelines developed by UNECA for the region

Acronyms & Abbreviations

ABN	Acknowledgement of Birth Notification
AG	Attorney General
ASFR	Age Specific Fertility Rate
ASMR	Age Specific Mortality Rate
CD	Communicable Diseases
CDC	Center for Disease Control and Prevention
CoD	Cause of Death
CRDP	Civil Registration Demonstration Project
CRP	Civil Registration Program
CRO	Civil Registration Office
CRS	Civil Registration Services
CRVS	Civil Registration and Vital Statistics
CRVSS	Civil Registration and Vital Statistics System
HIS	Health Information system
ICD	International Classification of Diseases
IOM	International Organization for Migration
KDHS	Kenya Demographic and Health Survey
KNBS	Kenya National Bureau of Statistics
KNEC	Kenya National Examination Council
KPHC	Kenya Population and Housing Census
KVSR	Kenya Vital Statistics Report
MCH	Maternal and Child Health
MDAs	Ministry, Departments and State Agencies
MoH	Ministry of Health
MCCD	Medical Certification of Cause of Death
NCD	Non-Communicable Disease
NCPD	National Council for Population Development

NEMIS	ational Education Management Information System
NGA	National Government Administration
NGO	Non-Governmental Organization
NHIF	National Hospital Insurance fund
NIIMS	National Integrated Identity Management System
PSRI	Population Studies and Research Institute
RA	Registration Agent
SDG	Sustainable Development Goal
TB	Tuberculosis

EXECUTIVE SUMMARY

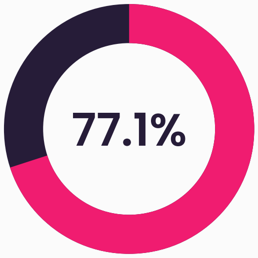
Introduction

The 2023 Kenya Vital Statistical Report was prepared in accordance with the United Nations Principles and recommendations, the Constitution of Kenya 2010 and the Registration of Births and Death Act (Cap 149 Laws of Kenya). The Act mandates Civil Registration Services Directorate to register births and deaths occurring in the country and for Kenyans occurring abroad. The 2023 Kenya Vital Statistical Report (KVSR) provides information that can help monitor and evaluate the registration of vital events (births and deaths) in Kenya.

The report provides key highlights on births and deaths registration completeness by various characteristics including live birth by sex of child, place of occurrence, age of mother, marital status, mother's level of education and foreign births registration. It also highlights death by place of occurrence, deaths by age and sex, deaths my marital status, neonatal deaths, crude death rate, foreign registration of deaths, causes of death and leading causes of deaths for different age groups that occurred within the year 2023.

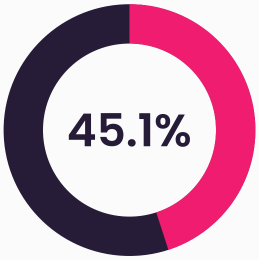
This report was generated using data from health facilities and community registration. The report is organized in seven chapters namely: 1) Introduction, 2) The Civil Registration System; 3) Methodology and

Data quality 4) Births Registration, 5) Deaths Registration 6) Causes of death 7) Conclusion and Recommendations.



The National birth registration completeness in 2023, a decline from a rate of 80.6 percent in 2022

The National birth registration completeness in 2023 was 77.1 percent. This was a decline from a completeness rate of 80.6 percent in 2022. A total of 12 counties attained birth registration completeness of 90 percent and above. These are: Nairobi City (131.6%), Kericho (127.5), Nyamira 123.2% Kisii (101.7%), Kiambu (100.4%), Uasin Gishu (100.2%), Mombasa (96.3%), Kilifi (95.9%), Kisumu (93.9%), Tharaka Nithi (93.7%), Taita Taveta (92.5%) and Siaya (90.3%). Nine counties in the Arid areas had the lowest birth registration completeness; Wajir (12.2%), Mandera (13.9%), Samburu (34.3%), Turkana (35.8%), Tana River (44.3%), Marsabit (46.8%), Garissa (52.5%), Narok (52.8%) and Isiolo (56.5%).



National death registration completeness in 2023, a decline from 47.6 percent recorded in 2022

Nationally, death registration completeness in 2023 was 45.1 percent which was a decline from 47.6 percent recorded in 2022. The proportion of registered deaths in health facilities increased slightly from 53.0 percent in 2022 to 54.9 percent in 2023. Conversely, the proportion of registered deaths in the community decreased from 47.0 percent to 45.1 percent during the same period

The counties with highest proportion of deaths registered in health facilities in 2023 were Uasin Gishu (80.1%), Kericho (78.0%) and Nairobi City (76.7%) while those with highest proportion of community death registration were Mandera (88.8%), Wajir (85.2%) and Vihiga (76.3%).

Over the past five years, from 2019 to 2023, pneumonia has emerged as the leading cause of death while cancer is on an upward trend moving to number two killer disease in 2023. Among persons aged between 50 and 59 years, cancer was the leading cause of death during the period under review. Among the neonates, prematurity and asphyxia were the leading cause of death. Additionally, injuries and cancer were the leading causes of death for persons aged 15-49 years.

CHAPTER ONE

Introduction

Vital statistics constitute the collection of statistics on vital events in a lifetime of a person as well as relevant characteristics of the events themselves and of the person and persons concerned. This includes live births, deaths and fetal deaths, marriage, registered partnership, separation, divorce, legal dissolution of registered partnerships and annulment of marriage, adoption, legitimation, and recognition. The critical source of vital statistics are records of vital events derived from civil registration system, which refers to the continuous gathering of information on all relevant vital events occurring within the boundaries of a country or a well-defined area within a country (UN, 2014).

Vital events recorded in the civil registration system in Kenya is confined to births and deaths which, provide crucial and critical information on the population in the country. Vital statistics and their subsequent analysis and interpretation are essential for socioeconomic planning and informed decision-making, setting targets, monitoring and evaluating social and economic programs including health and population interventions, measurement of demographic indicators including quality of life, life expectancy, the infant mortality, population estimates and projections, fertility and nuptiality.

The Kenya Vision 2030 and the Bottom-up Economic transformation agenda (BETA) which are the main government

The critical source of vital statistics are records of vital events derived from civil registration system, which refers to the continuous gathering of information on all relevant vital events occurring within the boundaries of a country

blueprints can be realized effectively when the country's population profiles in terms of numbers and key social and economic indicators are known as evidenced in the KVSR. Vital statistics are also invaluable for planning, monitoring, and evaluating various programs such as those dealing with primary health care, social security, family planning, maternal and child health, nutrition, education, public housing, and monitoring progress towards achievement of targets of regional and global frameworks on sustainable development. These include, East African Community Vision 2050, African Union Agenda 2063, ICPD25 Kenya Country Commitments, Addis Ababa Declaration on Population and Development (AADPD), 2030 Agenda for Sustainable Development.

The Kenya Vision 2030 and the Bottom-up Economic transformation agenda (BETA) which are the main government blueprints can be realized effectively when the country's population profiles in terms of numbers and key social and economic indicators are known as evidenced in the KVSR

The Civil Registration Services in Kenya is responsible for registration of all births and deaths that occur in the country. One of the core functions of CRS is to process, analyze, and disseminate vital statistics. To this end, CRS has prepared the Kenya Vital Statistics Report (KVSR) on an annual basis since 2010. The vital events covered in this report are those that occurred and notified at the health facilities and the community and were registered in 2023 including events that occurred outside Kenya and were registered upon request by either individuals or family members.

The main objective of the report is to present information on the status of registered events to inform policy and enhance use of quality vital statistics for evidence-based decision making

1.2 Objectives of the report

The main objective of the report is to present information on the status of registered events to inform policy and enhance use of quality vital statistics for evidence-based decision making.

The specific objectives are:

- To present registration completeness, patterns and trends of birth and death registration at national and county level.
- To present gaps, challenges, opportunities and recommendations for improvement of vital events registration in Kenya.

1.3 Scope of the report

This report presents data on births, deaths and causes of death by various characteristics that were registered in 2023. Other vital events like marriage, divorce, judicial separation, adoption, and judicial declaration of paternity are under the Office of the Attorney General (AOG) and are not covered in this report. The analysis of births and deaths is limited to national and county levels. The report also focuses on the number of events registered within the officially stipulated period of six months from the date of occurrence from health facilities and community.

1.4 Country profile

1.4.1 Geographical and ecological characteristics

Kenya is located on the Eastern Coast of Africa, and covers an area of about 591,6970 square kilometers. It lies between latitudes 40

North and 40 South and longitudes 340 East and 40 West. The equator runs through the country dividing it into almost two equal parts. Kenya borders five (5) countries, namely, Somalia to the East, Ethiopia to the North, South Sudan to the Northwest, and Uganda to the West and Tanzania to the South as shown in Map 1.1. To the Southeast, Kenya borders the Indian Ocean along a coastline that is approximately 536 kilometers long. The lowest point in the country is at the coastline which is zero meters above sea level while the highest point is at the Batian peak of Mount Kenya which is 5,199 meters above sea level.

More than 80 percent of Kenya is classified as arid and semi-arid lands, which are mainly found in the Northern and Eastern parts of the country. The remaining part of the country is classified as arable land, which sustains the largely agricultural Kenyan economy as well as providing settlement for most of the country's population. In addition to the land area, the country also has notable water masses, which include Lake Victoria and Lake Turkana. The Great Rift Valley, which is part of the East African Rift that runs from Mozambique to Ethiopia, is a notable physical feature found in Kenya's landscape.

Kenya's water resources are classified into two sources; surface water and groundwater represented by lakes, rivers, reservoirs, swamps, springs, dams, water pans and groundwater. Kenya's main water catchment areas include Lake Victoria North, Lake Victoria South, Rift Valley, Athi, Tana and Ewaso Nyiro North.

"More than 80 percent of Kenya is classified as arid and semi-arid lands, which are mainly found in the Northern and Eastern parts of the country. The remaining part of the country is classified as arable land, which sustains the largely agricultural economy as well as providing settlement for most of the country's population

Administratively, Kenya is divided into 47 Counties, which are further divided into 380 sub-counties, 986 divisions, 3,963 locations and 9,058 sub-locations as at 2023.

8.6

Kenya's population, in millions, in 1962 which has risen fivefold to 47.6 million people enumerated during the 2019 Kenya Population and Housing Census and is projected to reach 51.5 million in 2023

1.4.2 Cultural and religious diversity

Kenya is founded on a cultural diversity as recognized by the Constitution of Kenya (2010) which emphasizes the value of culture and cultural heritage. The Constitution of Kenya obligates the Government to promote various forms of cultural expression.

The ethnic groups in Kenya define the country's vibrant cultural diversity as evident from the numerous traditional and religious practices. In addition to this, Kenya hosts a sizable population of foreign nationals who contribute to the country's cultural and religious diversity. English and Kiswahili are Kenya's official languages while Christianity and Islam are the main religions.

1.4.3 Demographic profile

Kenya's population has increased more than five-fold from 8.6 million people in 1962 to 47.6 million people enumerated during the 2019 Kenya Population and Housing Census and is projected to reach 51.5 million in 2023. Table 1.1 presents Kenya's population from 1962 to 2019 and a population projection for 2023.

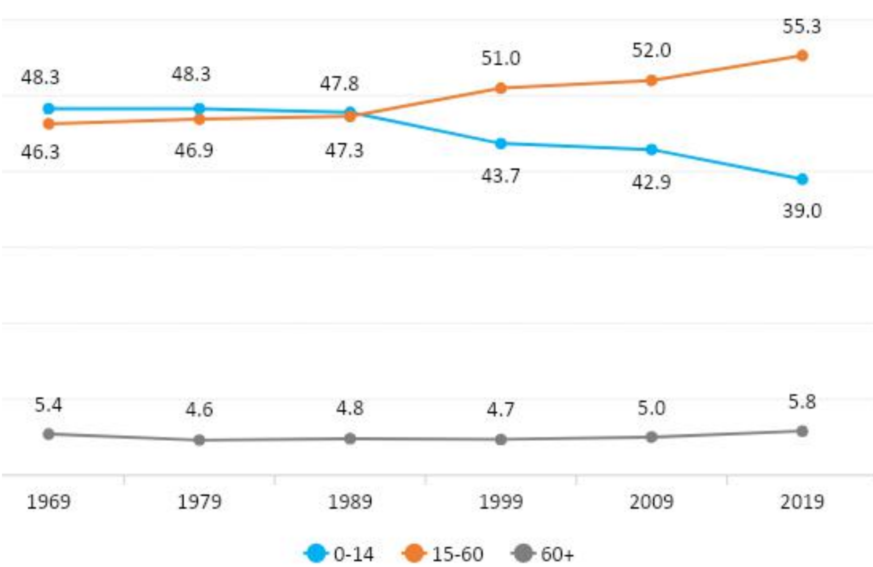
Table 1.1: Kenya's Population,1962-2023

Year	Population (millions)
1962	8.6
1969	10.9
1979	15.3
1989	21.4
1999	28.5
2009	37.7
2019	47.6
2023	51.5

Source: KNBS

In 1969, the proportion of the population of children below 15 years old was 48 percent of the total population and by 2019, this proportion had reduced to 39 percent as shown in Figure 1.1. The proportion of the population aged 15 - 60 years to total population increased from 46 percent in 1969 to 55 percent in 2019. However, the proportion of the population of older persons (age 60+ years) has remained almost the same, ranging between five and six percent over the period.

Figure 1. 1 Trends in proportion of select population age groups in Kenya (1969-2019)

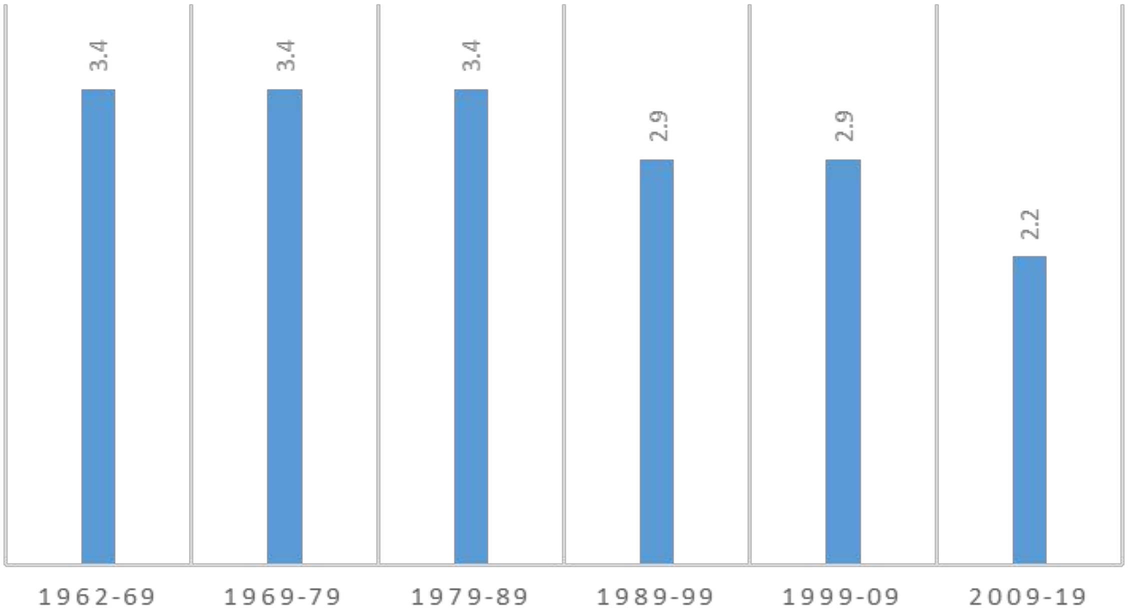


The proportion of the population aged 15 - 60 years to total population increased from 46 percent in 1969 to 55 percent in 2019

1.5 Intercensal growth rate

This is the rate at which a population grows or declines between two census counts. It is calculated by comparing the population counts from one census to the next, and then determining the average annual growth rate over the intercensal period and is often expressed as a percentage. Figure 1.2 shows the intercensal growth rate from 1962 to 2019. The population growth rate has declined from 3.4 percent in 1962 to 2.2 percent in 2019. This can be attributed to the declining fertility rate in the country as shown in Table 1.2.

Figure 1.2: Intercensal growth Rate, 1962-2019



Source: 2019 KPHC, Kenya National Bureau of Statistics

1.6 Total fertility rate

The Total Fertility Rate (TFR) is a standard demographic indicator that is used internationally to estimate the average number of children born per woman in a population. In Kenya, a decline in fertility has been experienced over the years as shown in Table 1.2. TFR has declined from 6.7 in 1989 to 3.4 in 2022.

The Total Fertility Rate (TFR) is a standard demographic indicator that is used internationally to estimate the average number of children born per woman in a population.

Table 1.2: Total Fertility Rate, 1989-2022

Year	TFR
1989	6.7
1993	5.4
1998	4.7
2003	4.9
2008	4.6
2014	3.9
2022	3.4

1.7 Population of selected age-groups

Table 1.3 presents population projections for older persons aged 60 years and above, women of reproductive age (15-49), youth aged 15-24 years and children under the age of 15 years for the period 2020 to 2045.The overall population is projected to grow from 48.8 million in 2020 to 70.2 million in 2045. The youth population is expected to grow from 10.4 million in 2020 to 12.3 million in 2045 while that of older persons is projected to grow from 2.7 million to 6.4 million over the same period. The population of women of reproductive age is projected to reach 19.2 million in 2045 up from 12.9 million in 2020.

The youth population is expected to grow from 10.4 million in 2020 to 12.3 million in 2045 while that of older persons is projected to grow from 2.7 million to 6.4 million over the same period.

Table 1.3: Projected Population of Selected Age-groups, 2020-2045

Selected Age-group	2020	2025	2030	2035	2040	2045
Total population (million)	48.8	53.3	57.8	62.2	66.3	70.2
Youth- 15-24 (million)	10.4	11.1	11.6	11.9	12.1	12.3
Children under age 15 (million)	18.1	18.5	18.8	19	19	19
Women of reproductive age 15-49 (million)	12.9	14.5	16	17.3	18.4	19.2
Older Persons - 60 and above (million)	2.7	3	3.4	4.2	5.2	6.4

Source: KNBS...Analytical report on population projections 2019.

1.8 Childhood mortality

Table 1.4 presents neonatal, infant and under-five mortality rates for the period 2003 to 2022. There has been a slow decline in neonatal mortality rate from 33 per 1,000 live births in 2003 to 21 per 1,000 live births in 2022. Over the same period, the infant mortality rate declined from 77 per 1,000 live births in 2003 to 32 per 1,000 live births in 2022. Similarly, under five mortality has been declining from 115 per 1,000 live births in 2003 to 41 per 1,000 live births in 2022.

There has been a slow decline in neonatal mortality rate from 33 per 1,000 live births in 2003 to 21 per 1,000 live births in 2022.

Table 1.4: Childhood Mortality Rates, 2003-2022

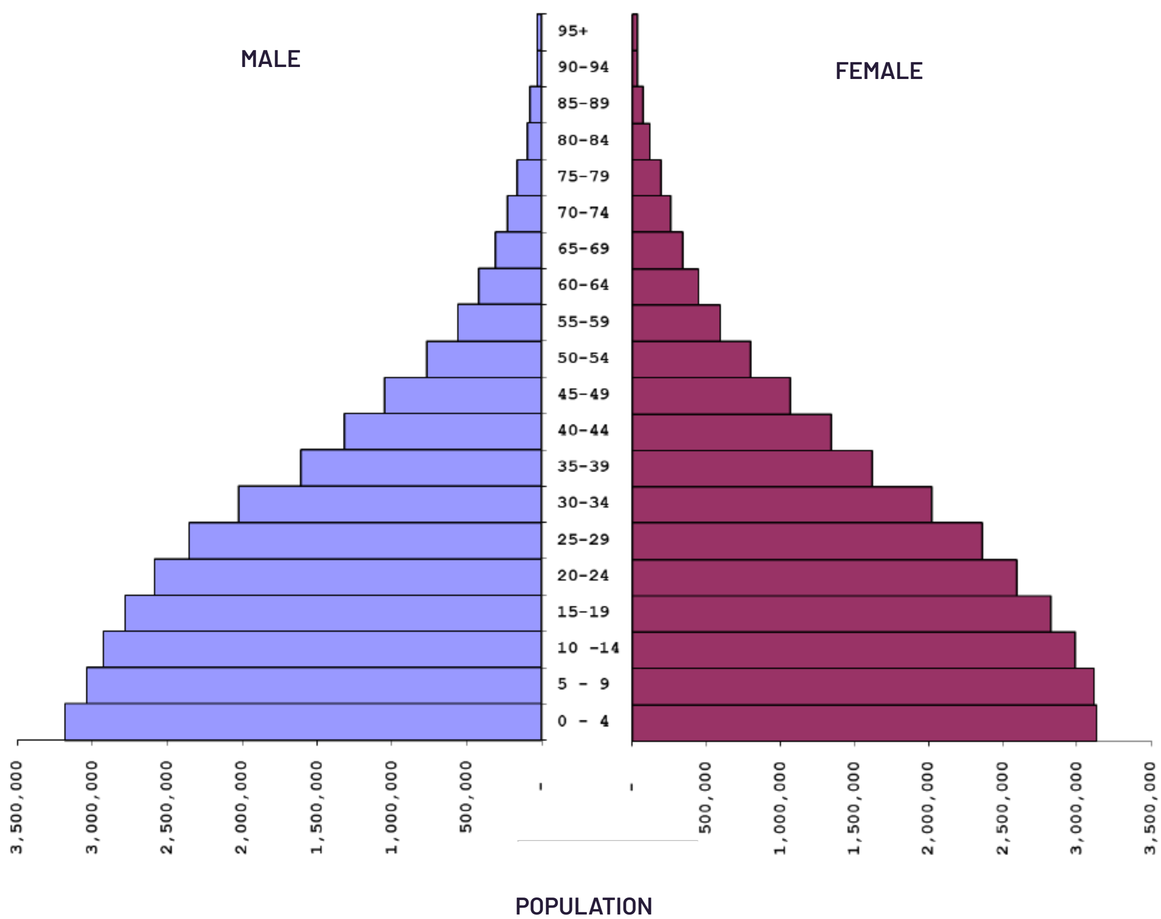
	2003 KDHS	2008/09 KDHS	2014 KDHS	2022 KDHS
Neonatal Mortality rate	33	31	22	21
Infant mortality rate	77	52	39	32
Under-five mortality rate	115	74	52	41

Source: KDHS, 2022

1.9 Population pyramid

The population of Kenya in 2023, as depicted in the pyramid in Figure 1.2. was projected to be 51.5 million comprising 25.5 million males and 26 million females.

Figure 1.3: Population Pyramid of Kenya, 2023



1.10 Data sources

The data on registered births and deaths used for development of this report was generated from the Civil Registration System. The expected births and deaths for 2023 were derived from the 2019 KPHC and the 2022 Kenya Demographic and Health Survey (KDHS).

The primary data for the production of this report was extracted from the following registration tools:

- **Form B1** which is a register of birth that captures comprehensive data about birth events (live and stillbirths in the community and health facilities) (refer to Appendix A1).
- **Form BDA1** which is a register of birth for Kenyan citizens born abroad. (Appendix A4)
- **Form D1** which is a register of death for collecting vital information on the death and medical certification of cause of death in health facilities and community deaths following post-mortem examination (Appendix A2).
- **Form D2** which is a register of death for collecting vital information on the death and nature of cause of death that occur in the community (Appendix A3).
- **Form BDA2** which is a register of death and cause of death for Kenyan citizens who have died abroad (Appendix A5).

CHAPTER TWO

2.1 Introduction

This chapter provides an outline of the history of CRS, the legal framework, administrative as well as the organizational structure. It also discusses the registration processes and information flows involved in the production and dissemination of vital statistics. In conclusion, the chapter highlights challenges faced by the department, available opportunities that can be harnessed to improve civil registration.

2.2 History of Civil Registration

The registration of births and deaths in the East African Protectorate, which corresponds to present day Kenya, started in 1904 and was restricted to Europeans and Americans residing in the territory. The 1902 East Africa Order in Council, which formalized colonial rule in the territory provided the legal basis for such registration. In 1928, the Births and Deaths Registration Ordinance No. 2 was enacted, which provided for compulsory registration of births and deaths of Europeans, Americans and Asians residing in Kenya. As for Africans, it merely made it mandatory to register deaths, and did not specifically deal with registration of births.

The compulsory registration of all births and deaths was progressively introduced in Kenya. It was first made mandatory in Nyeri District and Nairobi City on 12th March 1963, followed by Mombasa and Nakuru municipalities, as well as Bungoma and Kwale Districts by 1st July 1965. Thereafter, it was extended to more districts, and on 1st September 1971, all districts were declared compulsory registration areas.

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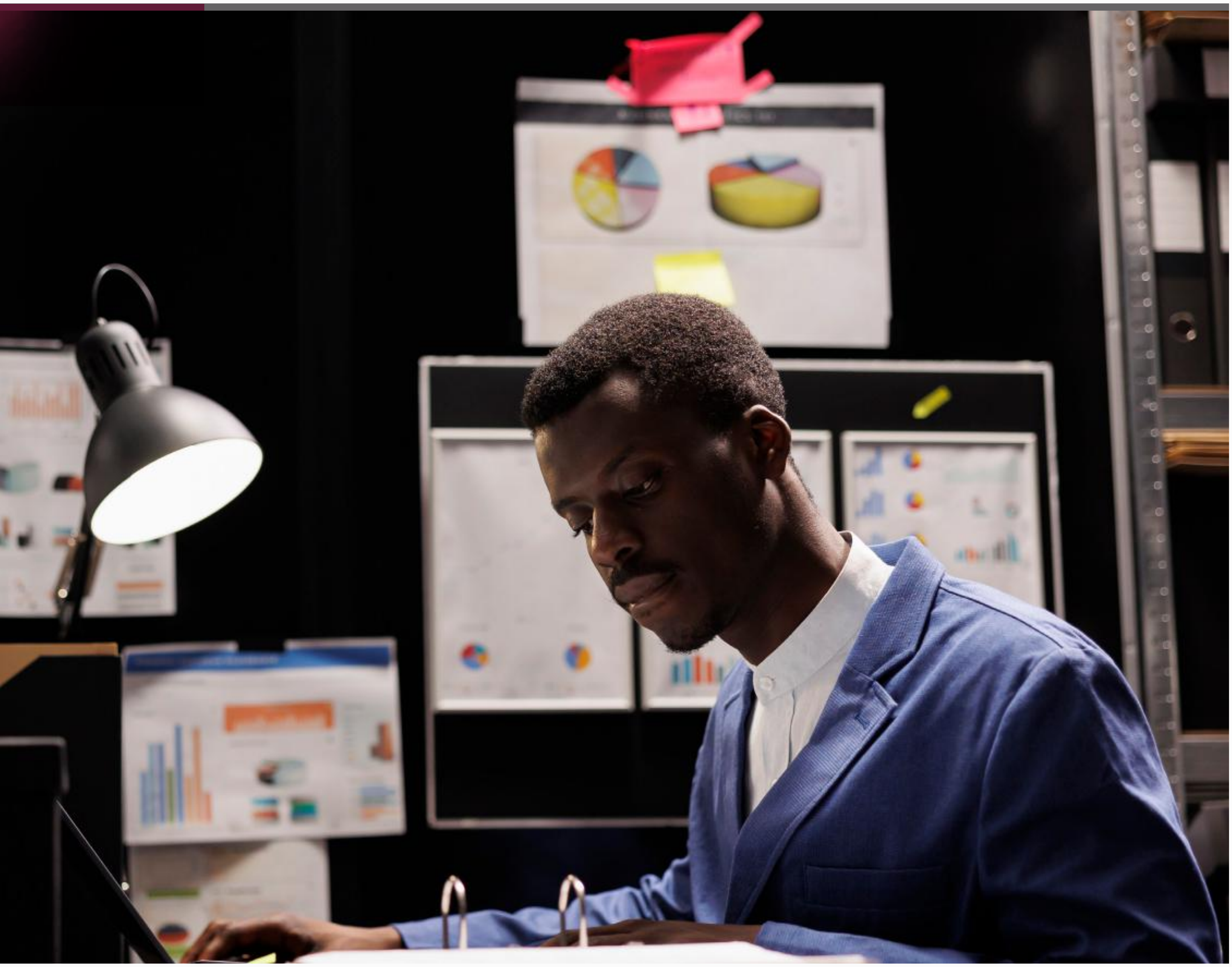

Initially, civil registration was conducted centrally with the Registrar General responsible for issuing certificates. There were deputy registrars who registered births and deaths occurring in the districts. The deputy registrars moved and registered events around their areas of operation and were paid honoraria based on the number of records filled. They then transmitted the records to the Registrar General, who issued the certificates.

However, the system was prone to abuse, as some deputy registrars would fill the forms for imaginary events just to earn the honoraria. In 1982, deputy registrars were replaced by assistant registrars who became fully in charge of the districts. A new system of registration involving registration agents was

In 1982, deputy registrars were replaced by assistant registrars who became fully in charge of the districts. A new system of registration involving registration agents was piloted in several districts in 1984

piloted in several districts in 1984. The rationale for the new system was provided by a pilot study called the Civil Registration Demonstration Project (CRDP) conducted between 1982 and 1985 by the Government in partnership with UNFPA. The CRDP initiative confirmed the need to shift from the bureaucracy-based registration system to an agent-based approach that embraced community-based reporting.

In the new system, registration agents were involved in registration of births and deaths occurring in their respective areas. The new system was piloted in several districts, with Phase I occurring in Murang'a, Nyeri, Kirinyaga and Lurambi Division in Kakamega District. Phase II of the pilot took place in Kisumu, Kakamega, Uasin Gishu and Embu Districts in 1984.

In the new system, Assistant chiefs were gazetted as registration agents to capture events that occurred within the community, while medical personnel captured events that occurred in health facilities.

Since 2018, the department has a Regional Coordinator who heads each region. The Regional Coordinator oversees operations within counties and sub counties in that region

The project was successful as it led to an exponential improvement in the number of births and deaths registered within the pilot districts.

The Government, therefore, fully adopted the CRDP and converted it to Civil Registration Program (CRP), which it rolled out progressively to other districts until 2009 when all districts were covered.

Before 1990, Civil Registration was a function carried out in the Registrar General's office located within the AG's Chambers in Sheria House. In 1990, a department responsible for the function, headed by a Principal Civil Registrar, was created, and moved to the Office of the President.

In the endeavor to improve civil registration and service delivery to citizens, a director was made to head the Department and, subsequently, a Secretary who is assisted by several Directors. The Department has its headquarters in Hass Plaza along Lower Hill Road in Nairobi City.

Since 2018, the department has a Regional Coordinator who heads each region. The Regional Coordinator oversees operations within counties and sub counties in that region.

By reason of Executive Order No. 1 of January 2023 on the Organization of Government of the Republic of Kenya, the department is currently domiciled in the Ministry of Interior and National Administration, State Department for Immigration and Citizen Services.

2.3 Legal and administrative issues

In Kenya, birth and death registration is governed by the Births and Deaths Registration Act, Cap 149 Laws of Kenya. The Act came into effect in 1928 as the Births and Deaths Registration Ordinance and progressively made it mandatory to register all births and deaths that occur in Kenya, regardless of nationality, and permits the optional registration of births and deaths of Kenyan citizens that occur abroad.

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Appointment of registration areas and registrars is as follows;

(1) The Cabinet Secretary may, by notice in the Gazette, appoint any area to be a registration area for the purposes of this Act.

(2) The Cabinet Secretary may appoint fit and proper persons to be the registrars and deputy registrars for each registration area and a fit and proper person to be the registrar of births and deaths occurring outside Kenya.

The Act makes it punishable by law where a notice of a reportable birth or death is not given as required. Section 22 of CAP 149 provides that a "person who fails to give notice of a birth or death the registration of which is compulsory, or who refuses to furnish any of the prescribed particulars, or who contravenes Section 21 of this Act

Besides the Births and Deaths Registration Act, the CRS also administers part of the Legitimacy Act [CAP 145], which empowers it to re-register births of individuals who were born out of wedlock but were legitimized by their parents' subsequent marriage [GOK, 1931], recognition or custom.

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Further, the Act makes it punishable by law where a notice of a reportable birth or death is not given as required. Section 22 of CAP 149 provides that a "person who fails to give notice of a birth or death the registration of which is compulsory, or who refuses to furnish any of the prescribed particulars, or who contravenes Section 21 of this Act, and any person who willfully gives any false information or particulars for the purpose of registration, shall be guilty of an offence and be liable to a fine not exceeding five hundred shillings or to imprisonment for a term not exceeding six months, or to both such fine and such imprisonment". As a result of

the coming into force of the Constitution 2010, sections 7 and 29 of the Act were amended in 2022 to allow for recognition of the intersex. This was meant to conform to Article 27 (4) of the Constitution which provides in part that, "the State shall not discriminate directly or indirectly against any person on any ground, including race, sex, pregnancy, marital status, health status, ethnic or social origin, color, age, disability, religion, conscience, belief, culture, dress, language or birth".

CRS also maintains an adoption register for adopted children and issues birth certificates to adopted children in accordance with the Children's Act, Cap 151 as amended in 2022. To achieve a sustainable and efficient registration process, the national population database should be connected to the foundational civil registration systems as recommended by international standards and the UN Legal Identity Agenda. The Government, therefore, seeks to automate the CRS system and issue a Unique Personal Identifier (UPI) at birth to be retired at death.

This move is aimed at realizing SDG target 16.9 which seeks to provide legal identity for all people including birth registration by 2030. Thus, it is essential to ensure the interoperability of all relevant systems and integration of data within the identity landscape to ensure successful use of the UPI which will establish a reliable and accurate "single source of truth".

2.4 Milestones towards improvement of KVSR production

CRS has over the years made significant improvements in the production of KVSR. This has been made possible through collaboration, cooperation and partnership with various stakeholders who have provided technical and financial support towards the realization of the same. The following are among the notable milestones that have been realized:

1) Mainstreamed KVSR production as an annual activity since 2013
2) Signed an MOU with Demographic Surveillance Sites for collaboration and data sharing in 2012.
3) Developed, launched, and disseminated 2022 KVSR.
4) Improvement of data capture /collection tools.
5) Improvement of data quality by cleaning data using STATA
6) Training the Statistics section on data analysis software.

To achieve a sustainable and efficient registration process, the national population database should be connected to the foundational civil registration systems as recommended by the UN Legal Identity Agenda

2.5 Organizational structure, registration processes and information flows

The structure of CRS and information flows during the registration process are presented in this section. It also describes the procedure involved in the issue of birth and death certificates, records transfer and offers an explanation on procedures involved in the registration of late events.

2.5.1 Organizational structure of civil registration

CRS is headed by a Secretary. It is divided into two divisions, Field Registration services and Statistics and research, with each division having several sections. The sections are; Registration and Field Services; National Registry; Statistics and Research. Details of the organizational structure are shown in Figure 2.1.

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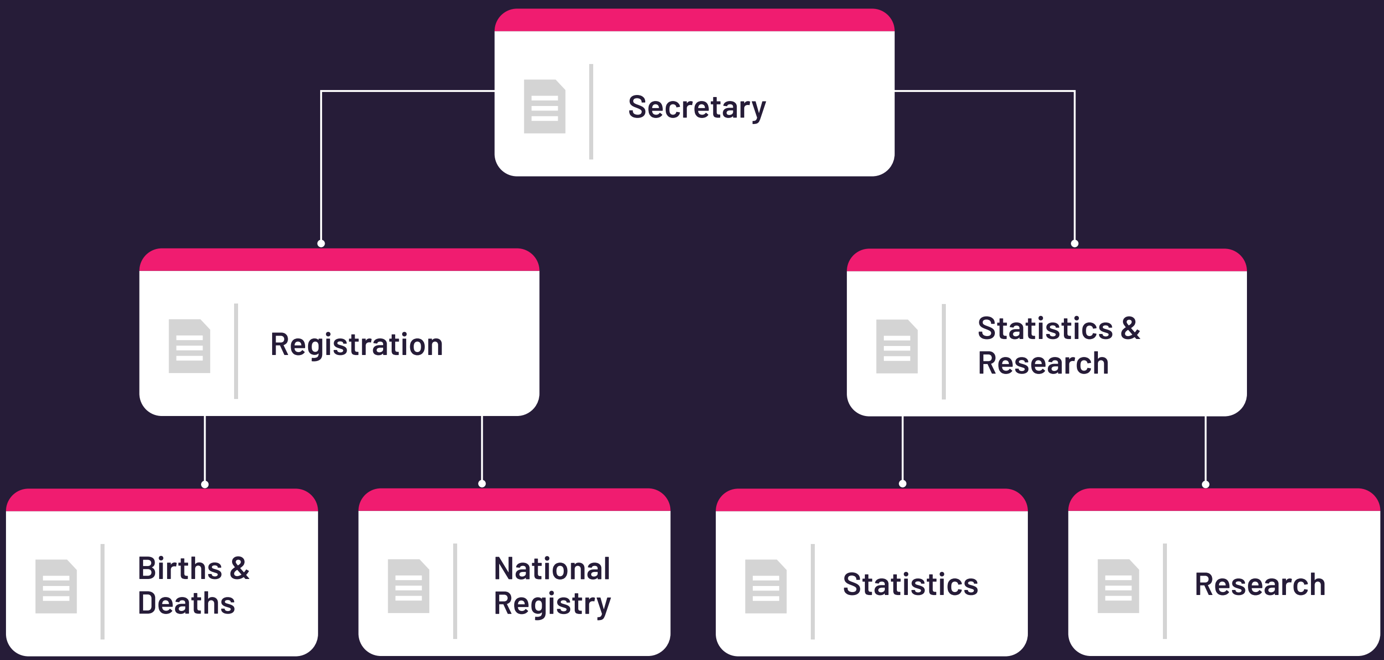
***Figure 2.1:* CRS Organization Structure in Kenya**



2.5.2 Registration processes and information flows

CRS in Kenya is agent based whereby vital events are captured by either the assistant chiefs for home events or by health records personnel for events that occur in health facilities. The registration process starts when an informant provides information to the registration agent (RA) concerning a vital event.

The informant can be an immediate relative, next of kin or any other person who may have information concerning the occurrence of such an event as required under Sections 11 and 13 of the Births and Deaths Registration Act. The RA is mandated to record the particulars of a birth event in a B1 form for both home and health facility births as provided

CRS in Kenya is agent based whereby vital events are captured by either the assistant chiefs for home events or by health records personnel for events that occur in health facilities

under Section 10 of the Act. For death events, the RA captures the particulars in a D1 or D2 form if the event occurred in a health facility or home respectively as required under Section 16 of the Act. In both cases, the RA issues a birth notification for birth or a burial permit for death to the informants, respectively.

Section 24 of the Act provides that it shall be the duty of every registrar, at the close of each week, to forward to the medical officer of health in whose area his registration area is situated, and to the Principal Registrar, a statement of the births and deaths registered by him during such a week.

The RA then transmits the filled forms in duplicate to the Sub-County Registrar for verification and registration. The Registrar upon verifying the accuracy and completeness of the forms submitted, signs the register, stamps on the register the date of registration and assigns a unique entry number. This process qualifies the forms as valid registers for birth or death. The Registrar then compiles vital statistics for the sub-counties under their jurisdiction in a prescribed birth or death template which is sent to the statistics section for preliminary cleaning, collation and further analysis.

Section 24 of the Act provides that it shall be the duty of every registrar, at the close of each week, to forward to the medical officer of health in whose area his registration area is situated, and to the Principal Registrar, a statement of the births and deaths registered by him during such a week.

Figure 2.2: Registration processes and information flows

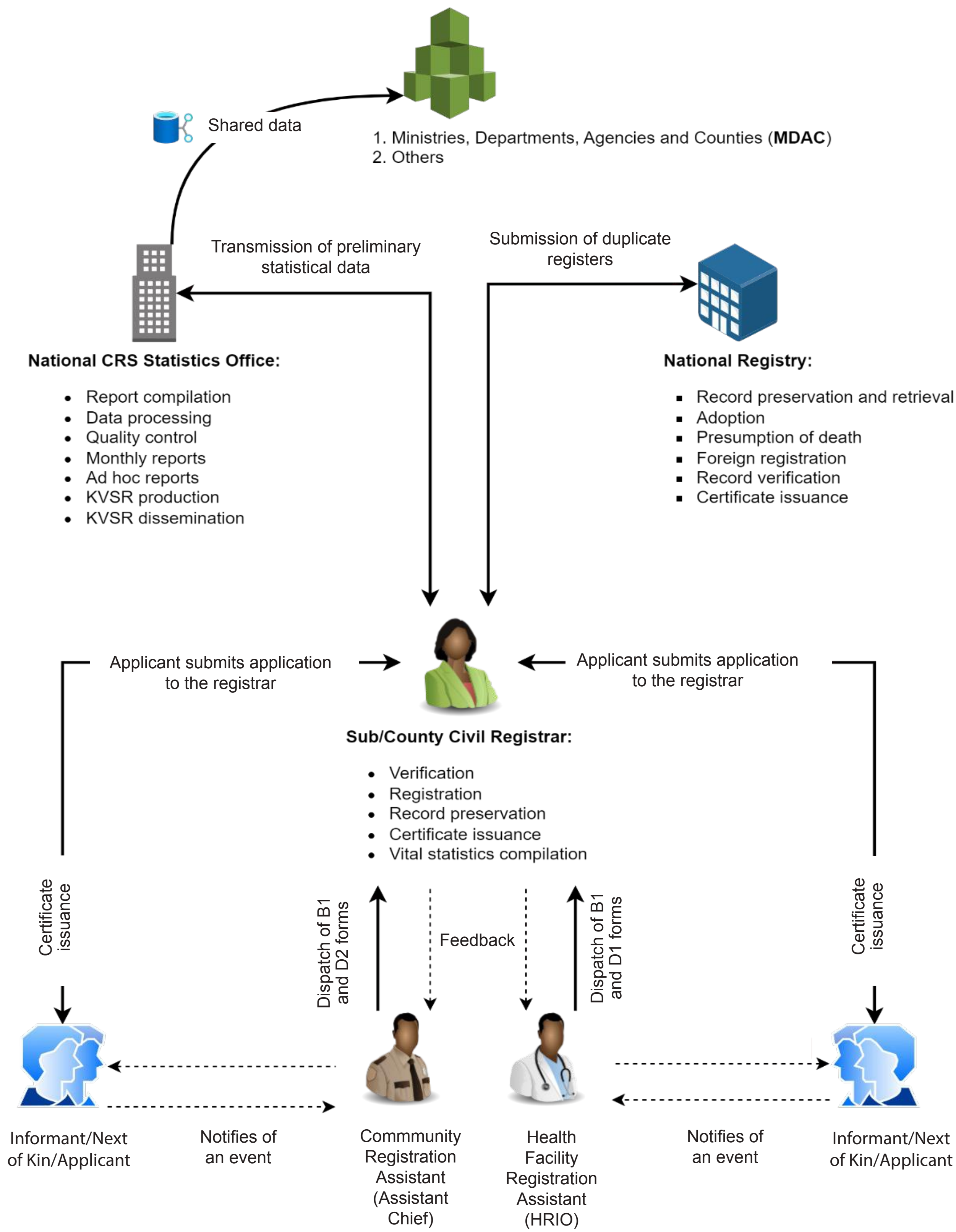


Figure 2.2 provides a summary of information flows during registration and other processes involved in the production of vital statistics, records preservation, and dissemination.

2.5.3 Late registration

Section 8 of the Cap 149 provides that, "A registrar shall not register a birth or death after the expiration of six months from the date of such birth or death, except upon receiving the written authority of the Principal Registrar issued in accordance with the rules, and upon payment of the prescribed fee".

In Kenya, births and deaths registrations are required to be done within six months from the date of occurrence; this is referred to as current registration. Events reported upon expiry of six months from the date of occurrence are considered as late registration

In Kenya, births and deaths registrations are required to be done within six months from the date of occurrence; this is referred to as current registration

For an applicant to obtain a birth or death certificate, a formal application to the Sub-County Registrar using forms B4 (Appendix A8) and D4 (Appendix A9) for birth and death respectively has to be made

Quality Control

Completed birth and death records from registration agents are submitted to the Sub-County Registrar who checks them for completeness and accuracy. At this stage, forms that are identified to have gaps or inconsistent data are returned to the agent for appropriate corrections and re-submitted to the Registrar

and attract a penalty of Ksh.100. The applicant for a late registration is expected to complete forms (GP138A & A1 [Appendix A10 & A11] for events that occurred before CRP & B3 [Appendix A12] for CRP events) as required under Section. The B3 form must be certified by both the Chief and Assistant Chief of the area where the event occurred. Late registration is done by the Sub-County Registrar at their own discretion and does not form part of vital statistics.

2.5.4 Issuance of documentation

For an applicant to obtain a birth or death certificate, a formal application to the Sub-County Registrar using forms B4 (Appendix A8) and D4 (Appendix A9) for birth and death respectively has to be made. The applicant is required to attach a birth notification or burial permit. A search is then done to retrieve the respective register, verification is done and the required amount to be paid is indicated on the application form. Upon payment of the prescribed fee, a birth or death certificate is printed and issued to the applicant.

2.5.5 Transmission Of Data

The completed birth and death records from the registration agents are submitted to the Sub-County Registrar who checks them for completeness and accuracy. At this stage, forms that are identified to have gaps or inconsistent data are returned to the agent for appropriate corrections and re-submitted to the Registrar. The Sub-County Registrar assesses the forms and appends his/her signature, stamps a date of registration and a unique entry number qualifying the form into a valid register of birth or death.

The next step involves data extraction from the registers into a data compilation tool, an MS Excel template. The data from the Excel templates is used to populate CRP forms 5, 21, 24/25, and 34 (Appendix A15 to A18). These CRP forms are a summary of various aspects of registration such as by place of registration and type of registration as well as summaries on certification and registration materials consumption. The completed CRP forms are thereafter transmitted to the CRS Statistics section every month.

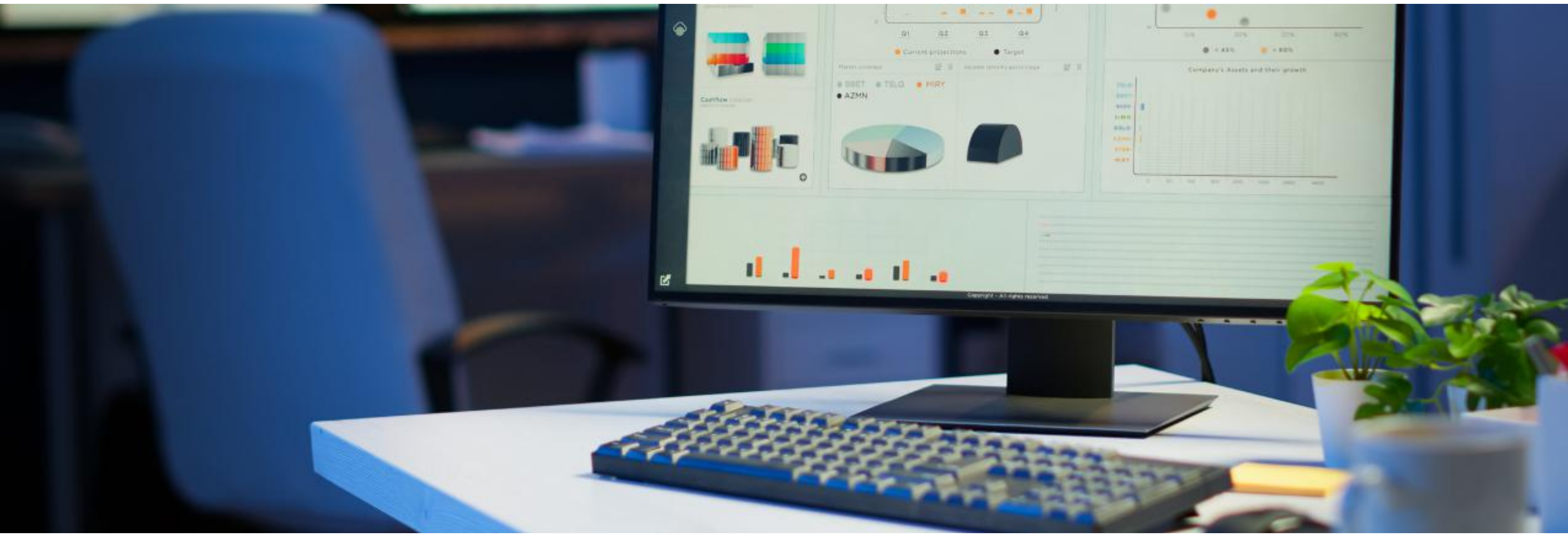
At the national level, the statistics section verifies and validates the Excel templates together with the CRP forms and gives necessary feedback to the Sub-County Registrars for any variance and inconsistency. Finally, preliminary data cleaning is done after which the data is merged into counties, regions, and a national database that is used for analysis and production of the annual KVSR.

2.6 Opportunities and challenges of CRVS

2.6.1 Opportunities

Various opportunities exist that CRS can tap into to improve the registration of births and deaths as well as the generation of vital statistics. Some of the opportunities are:

Various opportunities exist that CRS can tap into to improve the registration of births, deaths and generation of vital statistics

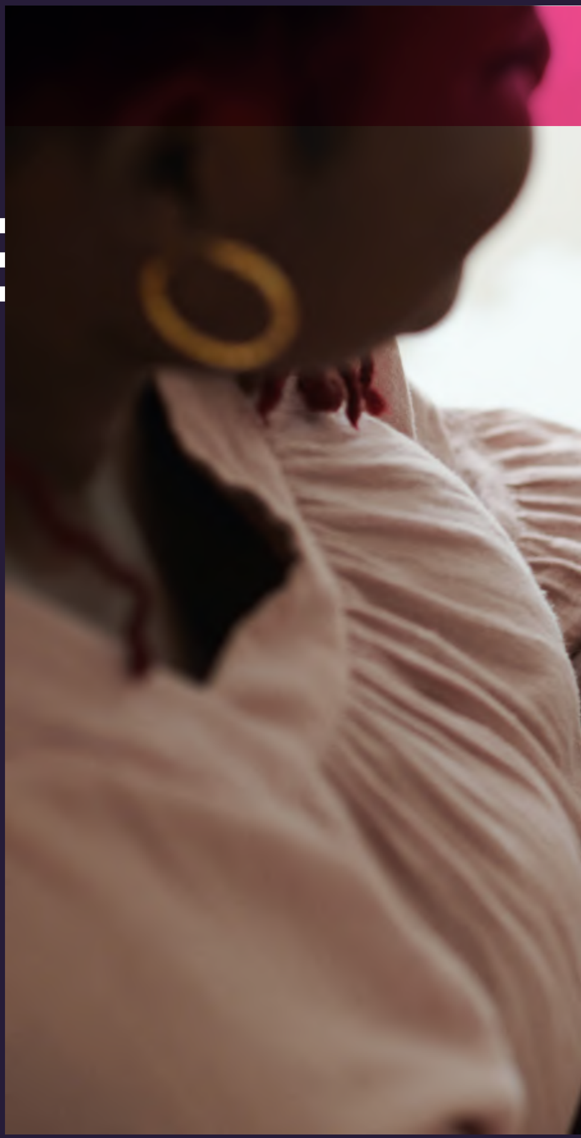


1) The Departments participate in international forums aimed at improving CRVS such as the UN Legal Identity, ID for Africa and Agenda 2063, and the African Conference for Ministers responsible for Civil Registration. These fora provide an opportunity for global dialogues where CRVS experts meet, share experiences, best practices and set priorities for CRVS improvement.
2) Demand for birth certificates by government agencies e.g. KEMIS (Kenya Education management information system), National Examination registration and National Health Insurance Fund (NHIF) for their process has improved birth registration and birth certificates uptake.
3) Increased demand for vital statistics by government agencies and the public to support policy formulation and decision making.
4) UPI program is expected to generate a unique personal identifier through CVRSS which is a key enabler to the National Government agenda of digitizing all services.
5) Ongoing legal review of the civil registration law, Cap 149 which will broaden the scope and mandate of CRS as envisioned in the UN Principles and recommendations for Vital statistics.
6) Linkage of Community health promoters and Assistant Chiefs will help improve birth and death registration quality completeness.

2.6.2 Challenges

1) Insufficient budgetary allocation affecting CRVS programs.
2) Inadequate capacity building across all levels of the CRVS ecosystem.
3) Low awareness of the existence of vital statistics data.
4) Low coverage of CRS service delivery points (Offices). CRS is operating in 153 sub-counties across the country against the 380 sub-counties in Kenya.

CHAPTER THREE



3.1 Introduction

This chapter outlines methods for estimating completeness of births and deaths that have been registered, in addition to computing the expected number of births and deaths in 2023. It also highlights the data quality controls employed in data generation for developing this report, data assurance mechanisms, timeliness and availability of the vital statistics, completeness of the registration process, accuracy, and adjustments of the data.

3.2 Methodology

The methodology applied in this report entails estimation of birth and death completeness. .

3.2.1 Estimation of birth registration completeness

Completeness of birth registration is the proportion of registered events to the expected number of events. The expected births were computed for women of reproductive age (15-49 years) at the national and county levels. The Age Specific Fertility Rates (ASFR) from the 2022 Kenya Demographic and Health Survey were multiplied by the corresponding 2023 projected female population, from the 2019 Kenya Population and Housing Census.

The expected births were obtained based on the following formula;

$$Expected\ Births = \sum_{i=1}^{n} X_i \pi_i$$

The Age Specific Fertility Rates from the 2022 Kenya Demographic and Health Survey were multiplied by the corresponding 2023 projected female population, from the 2019 Kenya Population and Housing Census

Where *Xi* is the ASFR for the women in age group i;

πi is the population of the age group *i* as per the 2023 population projection and;

n is the number of the age groups among the population under consideration

Table 3.1: ***Expected Births by Age, 2023 – Based on 2022 KDHS ASFR***

Age Group	Projected Population 2023 (πi)	ASFR (Xi)	Expected Births 2023
15 -19	2,825,803	0.073	206,284
20 – 24	2,595,460	0.179	46,4587
25 – 29	2,359,466	0.172	405,828
30 – 34	2,023,473	0.137	277,216
35 – 39	1,621,476	0.087	141,068
40 – 44	1,340,998	0.035	46,935
45 – 49	1,068,400	0.005	5,342
TOTAL	**13,835,075**		**1,547,260**

Source: KNBS

Birth registration completeness is calculated using;

$$Birth\ registration\ completeness = \frac{Actual\ registered\ live\ births}{Expected\ births} \times 100$$

3.2.2 Estimation of death registration completeness

The estimation of deaths completeness was calculated using the 2023 population projections derived from the 2019 census and corresponding Age-Specific Mortality Rates (ASMRs). The ASMRs generated from the 2019 KPHC were assumed to remain constant during the period of this report. The expected deaths at the national and county are obtained using the following formula,

$$Expected\ Deaths = \sum_{i=1}^{n} Xi\pi i$$

Where: ***Xi*** is the ASMR in age group i;

πi is the population of the age group i as per the 2023 population projection and;

n is the number of the age groups among the population under consideration

Table 3.2: ***Expected deaths by age, 2023***

Age group	Projected population for Male 2023	Age Specific Mortality Rate Male	Expected deaths Male	Projected population for Female 2023	Age Specific Mortality Rate Female	Expected deaths Female
<1	642,225	0.0399	25,625	633,625	0.0333	21,100
1-4	2,540,244	0.0038	9,653	2,495,871	0.0044	10,982
5-9	3,034,364	0.001	3,034	3,112,470	0.001	3,112
10-14	2,926,360	0.0007	2,048	2,989,357	0.0006	1,794
15-19	2,778,344	0.0025	6,946	2,825,803	0.0016	4,521
20-24	2,581,961	0.0035	9,037	2,595,460	0.0022	5,710
25-29	2,355,120	0.004	9,420	2,359,466	0.0027	6,371
30-34	2,024,482	0.0048	9,718	2,023,473	0.0032	6,475
35-39	1,606,550	0.0062	9,961	1,621,476	0.0039	6,324
40-44	1,319,104	0.0084	11,080	1,340,998	0.0049	6,571
45-49	1,047,189	0.0119	12,462	1,068,400	0.0064	6,838
50-54	770,329	0.0171	13,173	797,425	0.0091	7,257
55-59	562,071	0.0247	13,883	593,646	0.0135	8,014
60-64	419,936	0.0362	15,202	449,090	0.0207	9,296
65-69	308,688	0.0525	16,206	339,693	0.0324	11,006
70-74	232,637	0.0743	17,285	264,059	0.0514	13,573
75-79	164,646	0.1031	16,975	196,459	0.0811	15,933
80-84	97,957	0.1419	13,900	119,991	0.1257	15,083
85-89	77,706	0.2027	15,751	75,080	0.1911	14,348
90-94	27,761	0.2853	7,920	37,897	0.2753	10,433
95+	31,610	0. 4552	15,906	36,578	0. 4759	17,845
TOTAL	**25,549,285**		**253,668**	**25,976,317**		**202,146**
Total Expected Deaths	**455,814**					

Source: KNBS

Death registration completeness for both the national and county levels were calculated using the following formula,

$$\textit{Death registration completeness} = \frac{\textit{Actual registered deaths}}{\textit{Expected number of deaths}} \times 100$$

3.3 Data Quality

Quality vital statistics are expected to be complete, consistent, accurate, timely, relevant, reliable, and available in a user-friendly format. According to United Nations Principles and Recommendations for a vital statistics system, "The quality of vital statistics is measured according to completeness, correctness or accuracy, availability and timeliness" (UN, 2014).

3.3.1 Data quality assurance

Globally, the quality of vital statistics is determined by the effectiveness of the quality assurance mechanisms and the actual data collection in terms of coverage, completeness of registration and errors in data content. In efforts to ensure high data quality, the crs has put in place various data quality assurance mechanisms to ensure data collected from the field is complete and errors are minimized.

The Civil Registration System in Kenya has put in place standard operating procedures to guide registrars and registration assistants in data management. This is to ensure quality at every operational stage to avoid errors and missing values on some variables. Quality assurance is emphasized at the point of data capture where most of the errors are likely to be introduced.

3.3.2 Data quality control

Quality control (qc) refers to the application of methods or processes that determine whether data meets overall quality goals and defined quality criteria for individual values (rasmussen, et al. 2014). Vital statistics data collection systems use well-defined procedures and processes that apply to data control measures. In this report, data quality issues identified were mainly; duplicates, typing errors and erroneous or missing information. The development of this report adopted edit specifications during data cleaning and validation. Duplicate entries on events were identified based on unique entry numbers and erroneous entries were dealt with in accordance with the nature of the errors. For example, the missing values for age were replaced with digits 99 for births and 999 for deaths, while blank qualitative variables were replaced with "not stated".

3.3.3 Timeliness and availability

Timely registration and reporting of vital events are essential for effective planning, resource allocation, public health interventions and research. Timeliness is defined by the time taken to register a vital event and depends on the specified timelines.

In Kenya, timely registration refers to a birth or a death that is notified and registered within six months of occurrence (current registration). Late registration, on the other hand, refers to the registration of a birth or a death after six months of its occurrence.

The Civil Registration System in Kenya has put in place standard operating procedures to guide registrars and registration assistants in data management to ensure quality at every operational stage to avoid errors and missing values on some variables.

In Kenya, timely registration refers to a birth or a death that is notified and registered within six months of occurrence (current registration)

Management of timeliness and availability of data in civil registration services is done through the following steps: -

1) The registration assistants submit birth and death records to the registrars at the civil registration services office by the end of every month;
2) The registrar prepares the statistical summaries in a prescribed format and transmits them to the statistics unit at the headquarters by the 10th of every month;
3) CRS prepares monthly, quarterly, annual and ad hoc reports;
4) CRS develops and disseminates the kvsr by end of march of each year.

3.4 Completeness of registration

Data completeness in registration is the extent to which a dataset contains all the necessary elements and observations for analysis. This enhances the integrity and reliability of analysis, preventing

Data completeness in registration is the extent to which a dataset contains all the necessary elements and observations for analysis.This enhances the integrity and reliability of analysis, preventing gaps in understanding and supporting more robust decision-making processes

gaps in understanding and supporting more robust decision-making processes. CRS undertakes the following to ensure data completeness; integrating data from all the 47 counties, ensuring all relevant variables are available for analysis, imputing for any missing variables, incorrect or incomplete entries are refered back to the registrars for corrections.

3.5 Accuracy

In vital statistics, accuracy means that data items in the statistical report have been accurately filled in and no errors have been introduced during the transcription of data from vital records to the statistical report (if this is the case) or during the processing stages (coding, editing, imputation and tabulation) (who 2013).

The following checks to establish the accuracy of data were undertaken during the development of this report:

Clarification was sought from the registrars to verify the correctness of information captured in the reporting templates where errors or gaps were identified during data cleaning.

3.6 Data adjustment and redistribution

Data adjustment refers to a set of procedures which are employed to: improve coverage, classification, timing, and valuation of the data; conform to an accounting and recording basis; or address data quality differences in compiling specific data sets.

For this report, data adjustment and redistribution were not done.

3.7 Limitations

The following are the limitations faced with the preparation of this report:

1) Manual registration processes which are likely to introduce errors in the data collection process.
2) The community reported causes of death by the assistant chiefs are lay diagnosis affecting the quality of the cause of death.
3) Data collection tool for death does not conform to icd 11

The current use of excel sheets as data aggregation toolis prone to errors.

In vital statistics, accuracy means that data items in the statistical report have been accurately filled in and no errors have been introduced during the transcription of data from vital records to the statistical report or during the processing stages

CHAPTER FOUR

Key Findings

Birth registration completeness declined from **80.6 percent** in 2022 to **77.1 percent** in 2023

More male at **51 percent** live births were registered compared to female at **49 percent** live births.

About **99 percent** of the registered live births occurred in a health facility.

Thirty percent of live births occurred among females aged 20-24.

About **86 percent** of live births occurred among married women.

*Nairobi City County had the highest completeness at 131.6 percent while Wajir County had the lowest at **12.2 Percent.***

*Registered community births increased from **12,214** in 2022 to **16,166** in 2023.*

4.1 Introduction

This chapter presents information on live birth registration completeness, sex ratio and live birth registration by sex of child, place of occurrence, age of mother, marital status, and education level between 2019 and 2023.

The chapter also provides fertility measures based on live births registered in 2023. Birth registration is a key milestone towards acquiring personal rights and accessing government services. While birth registration does not in itself confer citizenship to a child, it is essential to ensure the right of every child to acquire a nationality, as it constitutes an important form of proof of the link between an individual and the State.

4.2 Birth registration completeness between 2019 and 2023

Table 4.1 presents birth registration trends in Kenya between 2019 and 2023. The expected births in 2023 were 1,547,260. The registered number of births during the same year was 1,192,884, representing a coverage of 77.1 percent. Most of the births in 2023 (99%) were registered in a health facility. Table 4.1 further shows that more males than females new borns were registered.

Table 4.1: Indicators in Birth registration from 2019 to 2023

Indicator	2019	2020	2021	2022	2023
Expected	1,328,252	1,410,795	1,443,542	1,514,825	1,547,260
Expected Males	673,941	715,822	732,392	768,606	785,063
Expected Females	654,311	694,973	711,060	746,219	762,197
Registered	1,186,144	1,126,762	1,200,190	1,221,444	1,192,884
Completeness (%)	89.3**	80	83	81	77
Male	603,774	575,454	612,434	619,929	608,471
Female	582,774	551,308	587,756	601,515	584,242
Sex ratio at Birth	104	104	104	103	104
Community Births	52,309	25,728	26,316	12,598	16,166
Health Facility Births	1,133,835	1,101,034	1,173,874	1,208,846	1,176,714

**Note that there were 4 cases of intersex births and 167 cases where sex of the child was not indicated in 2023 included in total registered births*

***-Revised based on the 2019 KPHC figures*

4.3 Birth registration completeness

The analysis of birth registration focuses on live births that were registered within six months from the time of occurrence. Table 4.2 presents the results of live birth registration by national and County between 2019 and 2023.

Six counties that reported the highest birth registration completeness of 100 percent and above were; Nairobi City at 131.6 percent, Kericho at 127.5 percent, Nyamira at 123.2 percent, Kisii at 101.7 percent, Kiambu at 100.4 percent and Uasin Gishu at 100.2 percent. The high completeness in Nairobi, Kiambu, Kisii and Uasin Gishu could be attributed to better health facilities.

It is not clear from the data why Kericho and Nyamira have such a high completeness.

During the period under review, 12 counties attained 90 percent and above birth registration completeness while twenty-three (23) Counties had birth registration above national birth registration of 77.1 percent.

Counties that reported the lowest birth registration completeness were Wajir at 12.2 percent, Mandera at 13.9 percent, Samburu at 34.3 percent, Turkana at 35.8 percent, Tana River at 44.3 percent, and Marsabit at 46.8 percent.

The Counties with the lowest registration completeness are generally those within arid and semi-arid areas. This could be attributed to vastness, cultural and religious beliefs, nomadic lifestyle, and insecurity.

Table 4.2: ***Births Registration by County, 2019-2023***

Code	National and County	Expected					Registered					Completeness				
		2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
	Kenya	1,556,157	1,410,795	1,443,452	1,514,825	1,547,260	1,186,144	1,126,762	1,200,190	1,221,444	1,192,884	76.2	79.9	83.1	80.6	77.1
001	Mombasa	39,978	36,110	36,491	34,418	34,923	35,994	30,459	32,680	34,166	33,642	90.0	84.4	89.6	99.3	96.3
002	Kwale	31,160	28,699	29,522	30,370	31,640	22,965	19,498	21,291	20,791	19,341	73.7	67.9	72.1	68.5	61.1
003	Kilifi	58,616	43,127	44,407	43,478	44,684	45,949	41,226	42,633	49,857	42,836	78.4	95.6	96.0	114.7	95.9
004	Tana River	12,982	11,301	11,699	12,725	13,235	5,380	4,889	6,305	5,603	5,862	41.4	43.3	53.9	44.0	44.3
005	Lamu	4,405	4,113	4,241	5,077	7,323	3,958	3,526	4,413	4,241	4,355	89.9	85.7	104.1	83.5	59.5
006	Taita Taveta	8,155	8,768	8,929	8,977	9,116	8,448	8,197	8,065	8,618	8,430	103.6	93.5	90.3	96.0	92.5
007	Garissa	36,095	27,099	28,144	32,331	33,341	12,983	10,432	15,201	16,321	17,507	36.0	38.5	54.0	50.5	52.5
008	Wajir	38,521	35,386	36,975	45,064	47,194	6,327	5,900	9,141	7,957	5,770	16.4	16.7	24.7	17.7	12.2
009	Mandera	28,465	43,885	46,331	60,178	63,104	12,342	8,224	10,167	8,057	8,762	43.4	18.7	21.9	13.4	13.9
010	Marsabit	14,466	20,924	21,792	27,115	28,335	8,346	7,894	10,185	10,404	13,264	57.7	37.7	46.7	38.4	46.8
011	Isiolo	9,453	7,636	7,878	9,847	10,173	5,816	5,301	5,657	5,894	5,745	61.5	69.4	71.8	59.9	56.5
012	Meru	37,742	36,556	37,129	39,625	40,225	31,883	34,584	33,684	34,048	32,642	84.5	94.6	90.7	85.9	81.1
013	Tharaka Nithi	9,938	8,681	8,866	9,734	9,842	7,363	8,341	10,074	9,730	9,222	74.1	96.1	113.6	100.0	93.7
014	Embu	14,562	13,874	14,057	15,157	15,283	14,042	13,392	12,501	12,203	13,740	96.4	96.5	88.9	80.5	89.9
015	Kitui	31,232	26,443	27,357	33,756	34,565	25,520	22,953	24,123	23,146	23,209	81.7	86.8	88.2	68.6	67.1
016	Machakos	40,008	32,160	32,624	34,600	34,863	27,656	25,141	27,828	25,276	26,849	69.1	78.2	85.3	73.1	77.0
017	Makueni	23,340	19,969	20,484	24,757	25,192	18,247	19,002	19,631	21,347	21,466	78.2	95.2	95.8	86.2	85.2
018	Nyandarua	15,757	15,467	15,899	19,765	20,175	11,196	11,918	12,058	10,945	11,431	71.1	77.1	75.8	55.4	56.7
019	Nyeri	15,066	16,183	16,333	19,061	19,259	15,788	16,689	16,316	16,251	15,552	104.8	103.1	99.9	85.3	80.8
020	Kirinyaga	10,986	13,124	13,207	14,221	14,322	11,506	13,220	13,811	12,951	12,865	104.7	100.7	104.6	91.1	89.8
021	Muranga	21,713	23,735	24,026	28,661	29,100	19,046	20,994	21,840	19,516	20,399	87.7	88.5	90.9	68.1	70.1
022	Kiambu	65,877	66,863	67,570	63,231	64,194	71,923	69,483	60,663	69,216	64,422	109.2	103.9	89.8	109.5	100.4

Table 4.2: ***Births Registration by County, 2019-2023 (Cont'd)***

023	Turkana	46,631	43,388	45,031	51,027	53,568	15,665	16,667	17,337	17,841	19,176	33.6	38.4	38.5	35.0	35.8
024	West Pokot	30,056	23,211	24,228	28,899	30,198	10,756	13,333	15,523	14,819	17,282	35.8	57.4	64.1	51.3	57.2
025	Samburu	13,428	10,495	10,915	12,237	12,863	4,952	4,012	5,178	4,817	4,418	36.9	38.2	47.4	39.4	34.3
026	Trans Nzoia	38,675	27,569	28,669	33,486	34,127	25,052	22,463	23,195	23,914	24,975	64.8	81.5	80.9	71.4	73.2
027	Uasin Gishu	36,919	31,423	32,397	32,641	33,253	29,080	33,911	34,809	33,975	33,313	78.8	107.9	107.4	104.1	100.2
028	Elgeyo Marakwet	13,876	12,519	12,915	14,608	15,032	10,564	11,026	12,494	12,157	10,882	76.1	88.1	96.7	83.2	72.4
029	Nandi	27,918	22,411	23,166	26,775	27,331	17,921	16,209	18,313	18,346	18,251	64.2	72.3	79.1	68.5	66.8
030	Baringo	22,564	18,694	19,333	22,927	23,735	12,487	12,731	14,336	13,627	14,612	55.3	68.1	74.2	59.4	61.6
031	Laikipia	14,466	14,862	15,227	17,137	17,650	16,932	14,283	16,897	16,894	15,145	117.0	96.1	111.0	98.6	85.8
032	Nakuru	67,455	62,007	63,587	68,061	69,835	68,156	57,507	62,019	63,622	59,945	101.0	92.7	97.5	93.5	85.8
033	Narok	49,300	38,932	40,608	46,179	48,572	18,838	20,765	25,468	23,775	25,625	38.2	53.3	62.7	51.5	52.8
034	Kajiado	45,689	34,746	35,566	36,910	37,746	25,084	27,354	30,312	35,282	33,607	54.9	78.7	85.2	95.6	89.0
035	Kericho	29,953	23,165	23,832	26,068	26,473	33,166	23,121	28,677	28,027	33,749	110.7	99.8	120.3	107.5	127.5
036	Bomet	30,039	23,490	24,263	27,208	27,685	27,420	24,570	30,601	23,478	21,292	91.3	104.6	126.1	86.3	76.9
037	Kakamega	61,302	47,741	49,516	57,360	58,662	48,519	43,944	46,835	48,967	48,760	79.1	92.0	94.6	85.4	83.1
038	Vihiga	18,003	13,808	14,223	17,550	17,789	13,872	12,256	12,219	14,416	12,839	77.1	88.8	85.9	82.1	72.2
039	Bungoma	60,900	45,186	47,031	54,145	55,022	46,058	46,905	50,966	51,966	40,836	75.6	103.8	108.4	96.0	74.2
040	Busia	31,656	24,518	25,424	28,521	29,352	30,515	21,025	20,613	21,603	20,496	96.4	85.8	81.1	75.7	69.8
041	Siaya	32,540	27,079	27,913	31,274	32,191	29,988	28,967	27,836	30,316	29,058	92.2	107.0	99.7	96.9	90.3
042	Kisumu	37,729	32,410	33,232	34,425	35,061	32,275	31,351	35,061	33,255	32,921	85.5	96.7	105.5	96.6	93.9
043	Homa Bay	47,527	32,795	34,016	37,713	39,253	29,174	27,868	31,052	30,897	30,631	61.4	85.0	91.3	81.9	78.0
044	Migori	47,636	35,211	36,708	39,854	41,310	33,278	32,648	32,981	35,292	35,587	69.9	92.7	89.8	88.6	86.1
045	Kisii	38,993	30,491	31,184	33,604	33,930	27,846	32,336	30,596	33,931	34,507	71.4	106.1	98.1	101.0	101.7
046	Nyamira	17,277	13,445	13,858	14,976	15,060	10,868	12,995	19,463	20,635	18,557	62.9	96.7	140.4	137.8	123.2
047	Nairobi	136,668	129,866	130,258	105,362	105,672	145,000	137,252	139,142	143,054	139,109	106.1	105.7	106.8	135.8	131.6

The Map 4.1 provides a complete pictorial presentation of live birth registration completeness by County in 2023.

Map 4.1: *Birth registration completeness in Kenya, 2023*

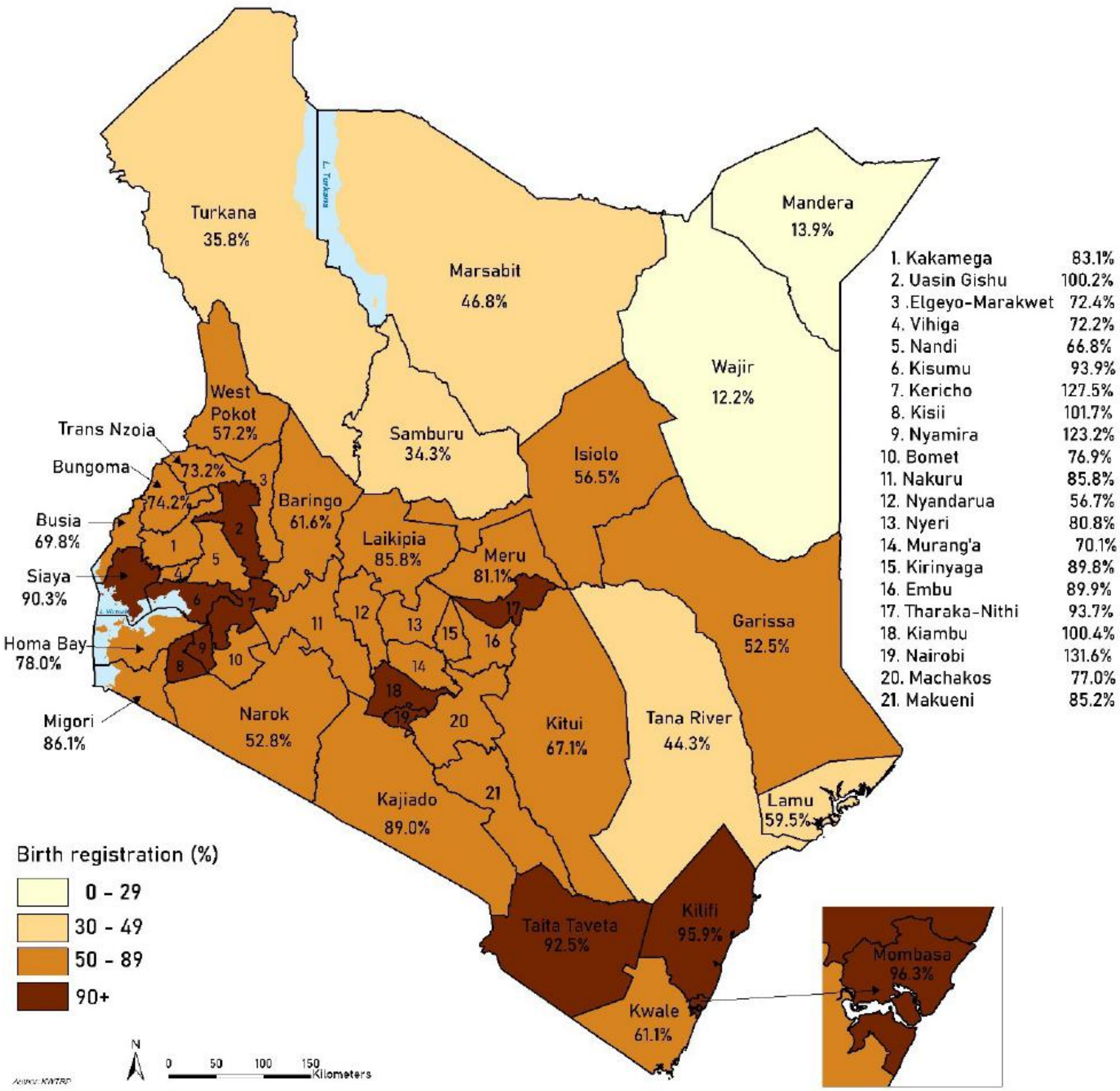


Figure 4.1: Birth registration completeness by County, 2023

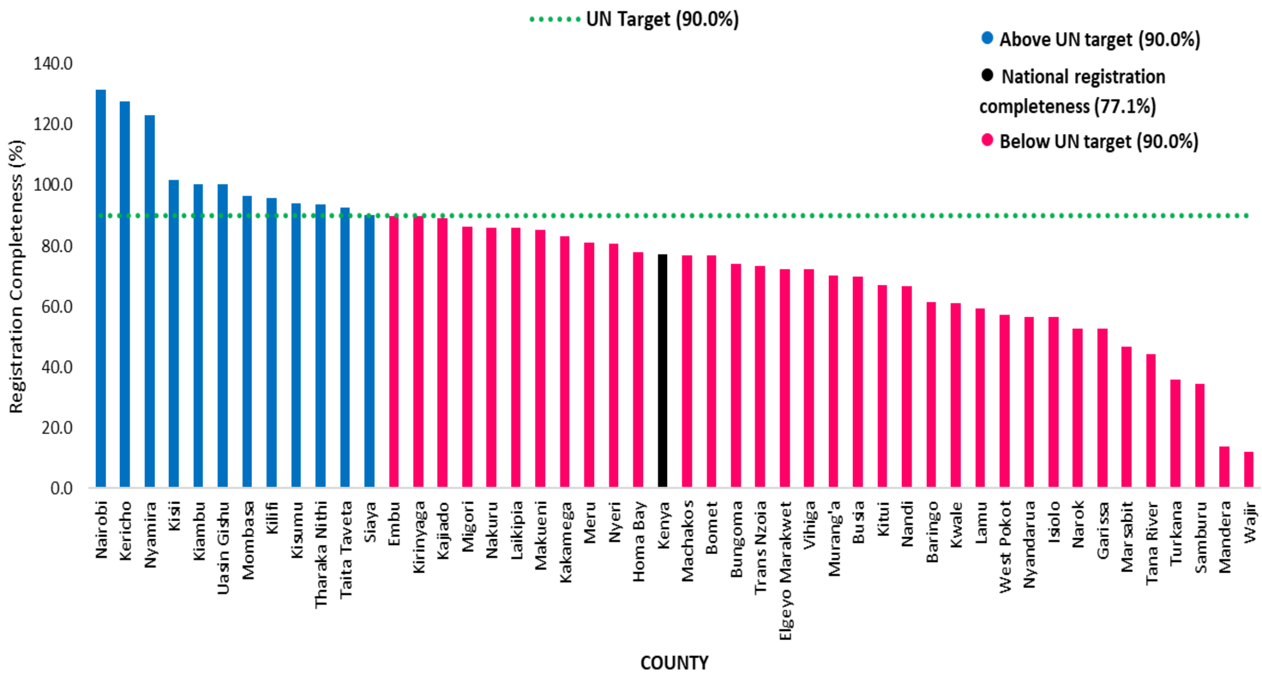
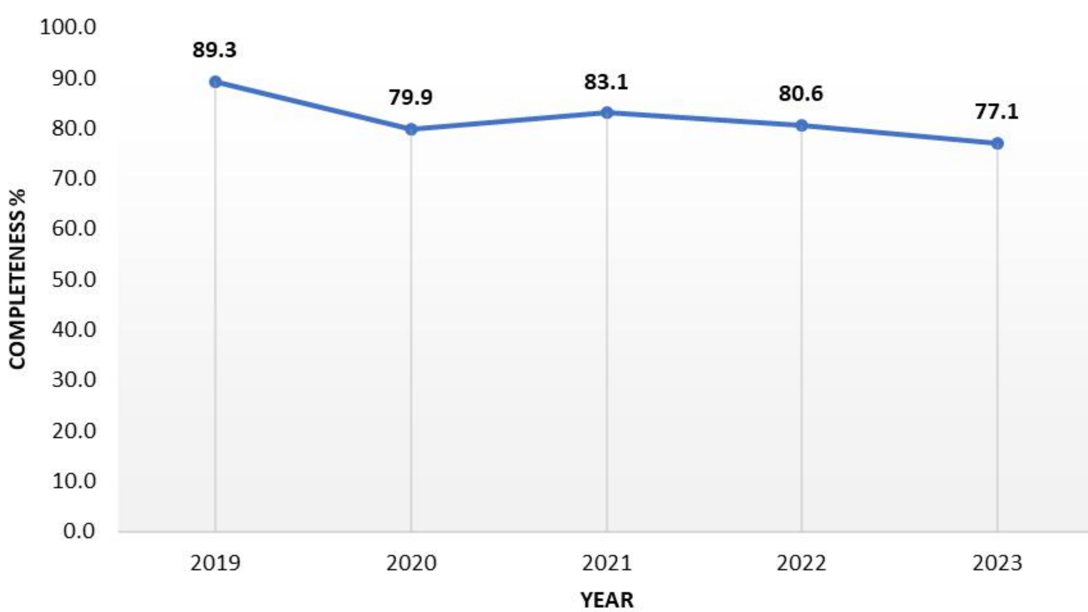


Figure 4.2 presents trends in birth registration completeness in the years 2019 to 2023. Nationally, the live birth registration completeness declined from 83.1percent in 2021 to 77.1 percent in 2023.



4.4 Sex ratio at birth

The sex ratio in a population refers to the number of males relative to the number of females. It is normally expressed as a percentage. At birth, the general sex ratio is considered to be 105 but could range from 103 to 107.

The National and County sex ratio results are presented in Table 4.3. The result shows the National sex ratio increased to 104.1 in 2023 from 103.1 in 2022 and was within the expected normal range. The County distribution shows that 29 Counties reported sex ratios within the expected range. However, Marsabit, Mandera, Garissa, Elgeyo/Marakwet, Baringo and Nyeri reported slightly higher sex ratios which could be attributed to over-reporting of male births. In addition, 12 Counties namely, Kiambu, Laikipia, Kitui, Machakos, Bungoma, Tharaka-Nithi, Wajir, Vihiga, Nyandarua, Siaya and Muranga reported slightly lower sex ratios with Kilifi recording the lowest at 94.4 which could be attributed to under-reporting of male births

The sex ratio in a population refers to the number of males relative to the number of females. It is normally expressed as a percentage. At birth, the general sex ratio is considered to be 105 but could range from 103 to 107

Table 4.3: National and County sex ratio, 2021-2023

Code	National/ County	2021	2022	2023
	National	104.2	103.1	104.1
001	Mombasa	103.7	102.8	107.2
002	Kwale	103.7	107.3	107.4
003	Kilifi	99.6	97.5	94.4
004	Tana River	107.0	109.5	106.8
005	Lamu	108.3	108.4	102.6
006	Taita/Taveta	108.0	101.9	104.1
007	Garissa	110.7	109.1	111.6
008	Wajir	103.9	104.4	100.6
009	Mandera	109.9	116.8	118.1
010	Marsabit	116.1	119.8	122.8
011	Isiolo	105.6	101.9	103.4
012	Meru	103.6	107.1	104.9
013	Tharaka-Nithi	102.6	105.7	101.4
014	Embu	98.2	103.7	103.3
015	Kitui	103.4	104.1	102.2
016	Machakos	106.8	100.1	101.9
017	Makueni	107.2	102.4	105.2
018	Nyandarua	97.7	101.5	99.2
019	Nyeri	102.9	103.2	108.8
020	Kirinyaga	104.0	103.5	106.4
021	Muranga	106.3	103.2	98.3
022	Kiambu	102.4	103.7	102.4
023	Turkana	107.2	105.6	104.3
024	West Pokot	104.2	106.9	105.6
025	Samburu	111.8	106.9	104.8
026	Trans Nzoia	100.7	104.5	104.9
027	Uasin Gishu	105.2	102.1	104.0
028	Elgeyo/ Marakwet	107.0	106.3	110.9
029	Nandi	102.4	101.7	104.1
030	Baringo	109.6	108.6	109.5
031	Laikipia	102.5	104.5	102.4
032	Nakuru	101.1	104.2	104.6
033	Narok	104.7	106.2	104.0
034	Kajiado	87.2	99.7	105.8
035	Kericho	104.9	98.9	107.2
036	Bomet	108.2	106.1	105.5
037	Kakamega	101.8	100.8	103.4
038	Vihiga	106.6	102.1	99.9
039	Bungoma	104.3	100.0	101.8
040	Busia	105.6	101.0	103.5
041	Siaya	111.4	102.9	98.5
042	Kisumu	105.2	102.5	104.1
043	Homa Bay	100.6	102.3	102.8
044	Migori	106.7	104.7	104.4
045	Kisii	104.6	103.8	105.3
046	Nyamira	104.6	98.6	103.0
047	Nairobi City	107.2	102.0	105.1

4.5 Registered live births by background characteristics

This section provides information on registered live births by select background characteristics which include sex of child, place of occurrence, mother's age, marital status and education level.

4.5.1 Registered live births by sex

Information on the sex of a child is an important aspect of birth registration which provides demographic trends on population structure. Figure 4.3 shows that in the period 2019–2023, most of the registered live births in the country were for males at about 51 percent.

Figure 4.3: Registered live births by sex of child, 2019–2023

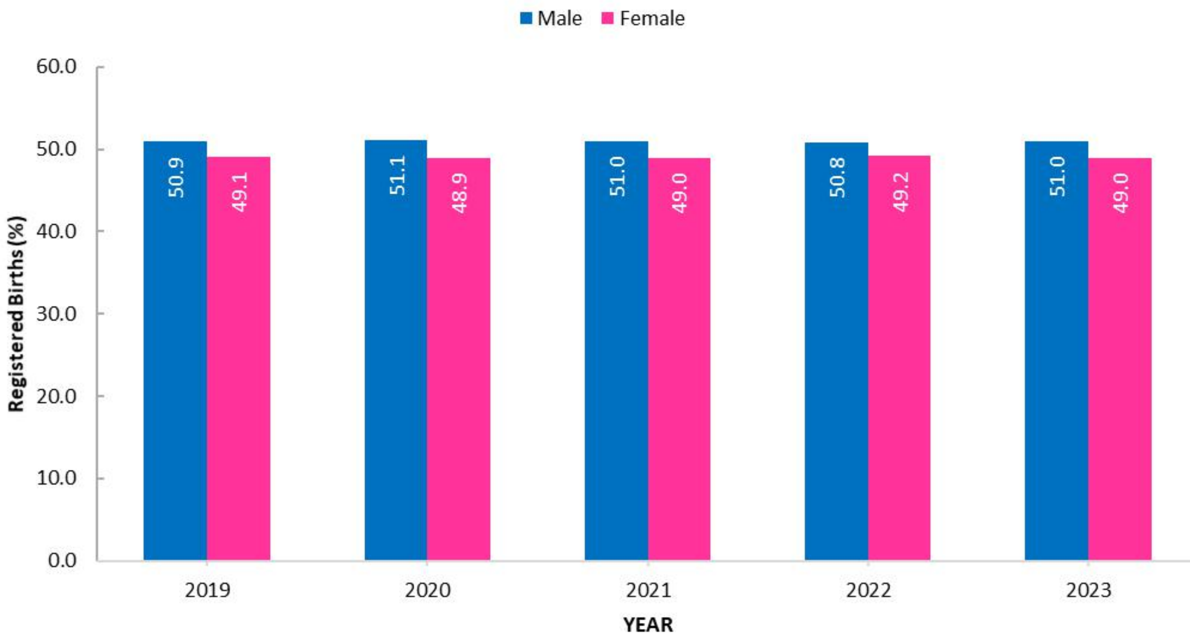
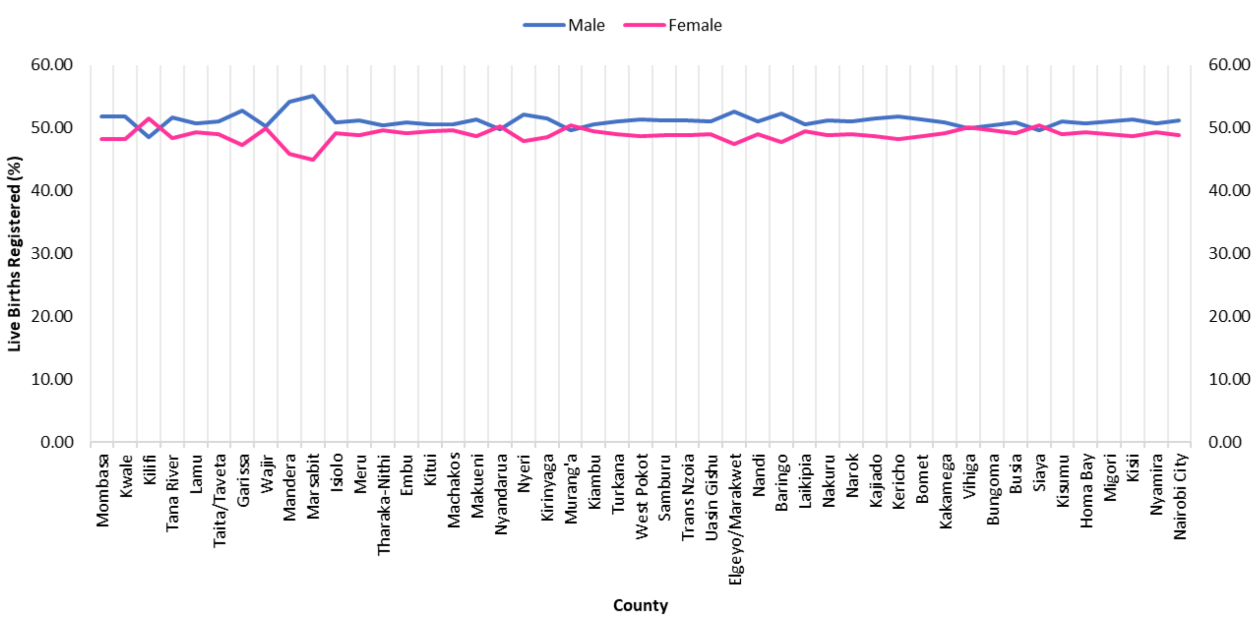


Figure 4.4 shows in 2023, all the counties except Kilifi registered more male than female live births. In Mandera and Marsabit, there is a huge disparity in registration of live births between males and females which could be an indication of over-reporting of male births.

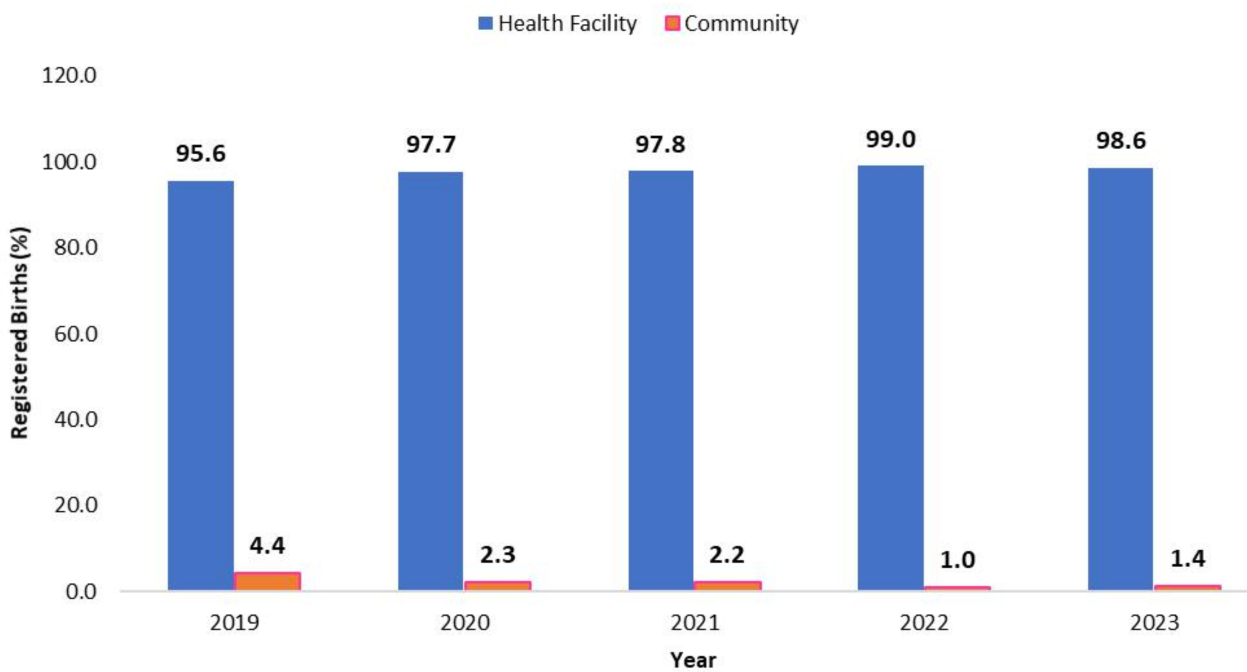
Figure 4.4: Registered live births by sex of child and by county of registration, 2023



4.5.2 Registered live births by place of occurrence

The Government advocates for mothers to deliver in health facilities. This aims at reducing both maternal and neonatal mortality in the country. Figure 4.5 shows that the proportion of registered births that occurred in health facilities increased progressively from about 96 percent in 2019 to 99 percent in 2023. Over the same period, the proportion of registered live births occurring in the community reduced from 4 to 1 percent.

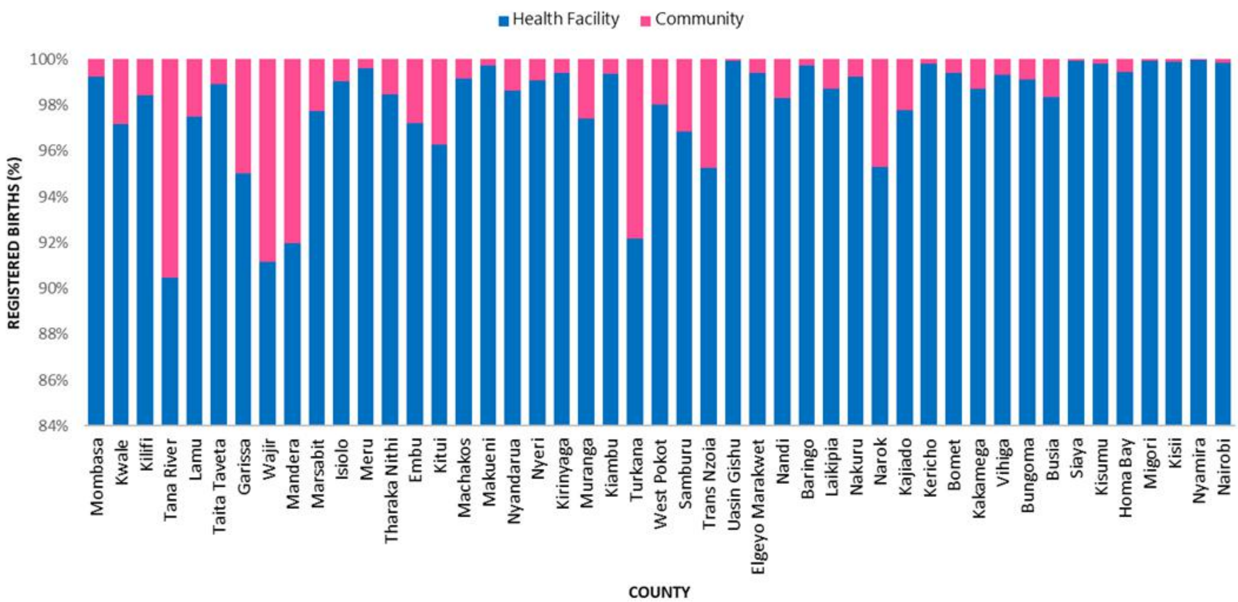
Figure 4.5: Registered live births by place of occurrence, 2019–2023



In each of the forty-seven counties, over 90 percent of the registered live births occurred in health facilities as shown in Figure 4.6. Nyamira County had the highest proportion of registered births that occurred in health facilities at 100 percent while Wajir and Tana River counties had the lowest at about 91 percent.

Early childbearing is associated with higher risk of maternal and child morbidity and mortality. It is therefore the government's policy to eliminate pregnancies among adolescents (ICPD 25, 2019)

***Figure 4.6:** Registered live births by place of occurrence and by county of registration, 2023*



The scale starts at 84 percent since all the counties have registration coverage from the health facility of over 90 percent.

4.5.3. Registered live births by age of the women

Early childbearing is associated with higher risk of maternal and child morbidity and mortality. It is therefore the government's policy to eliminate pregnancies among adolescents (icpd 25, 2019). Data on registered live births provide information about the mother's age which can be used to monitor the progress toward elimination of pregnancies among adolescents.

Table 4.4 Shows that from 2019 to 2023, the highest proportion of registered births were consistently by women aged 20-24, who contributed to a third (30%) of total registered births while twelve percent of births were from women below 20 years. It is worth noting that 298 registered births were from women aged 50 years and above. However, women below age 20 in Wajir, Nairobi city and mandera counties accounted for less than six (6) percent of registered live births.

This contrasts with migori and nyamira counties where women below age 20 years accounted for 19 percent of the registered live births, which is the highest in the country. In seventeen (17) counties, at least 15 percent of the registered births were by mothers below age 20 years. (Appendix b3).

***Table 4.4:* Registered Live Births by the age of the women, 2019-2023**

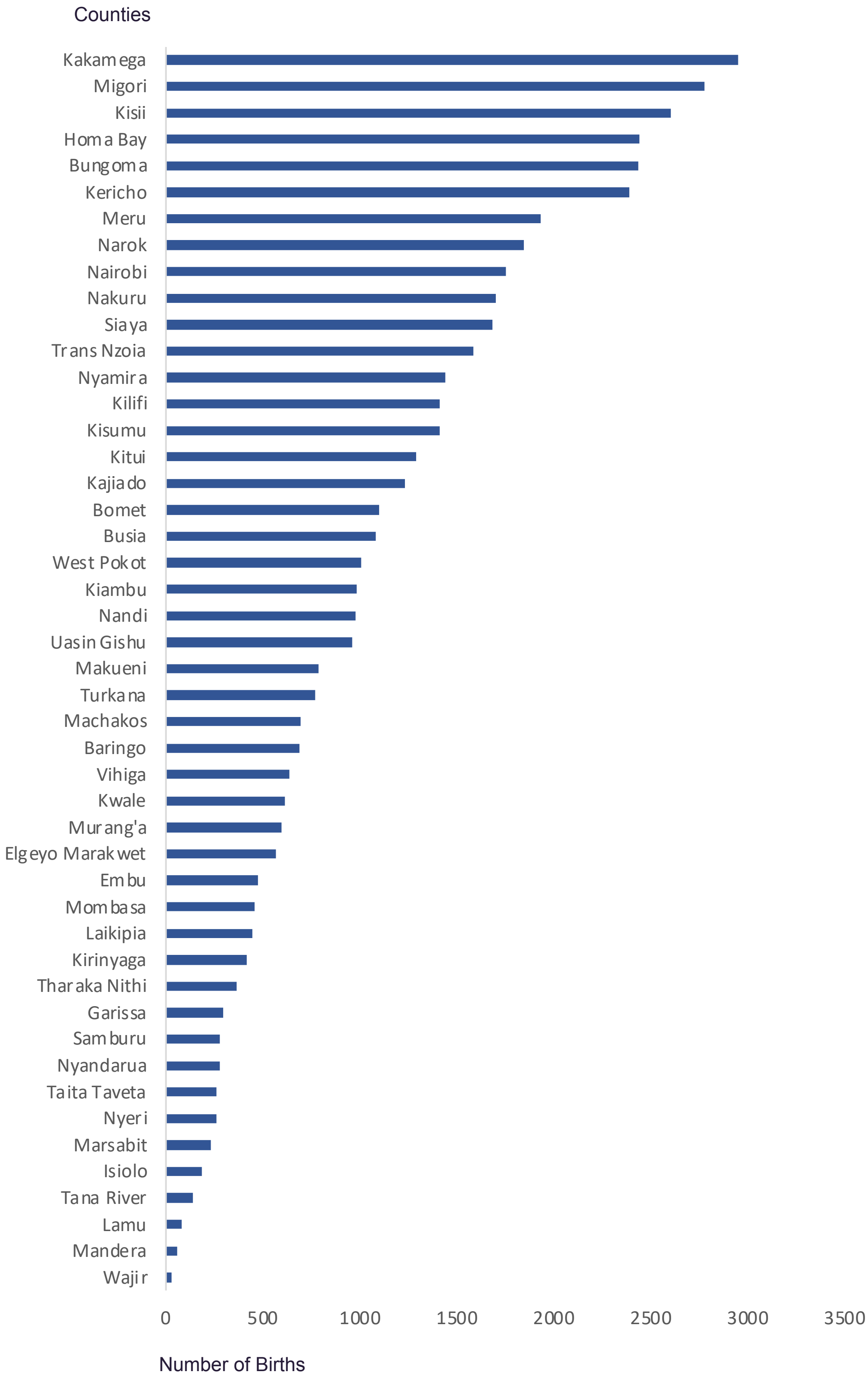
	2019	%	2020	%	2021	%	2022	%	2023	%
Under 15	2510	0.2	2116	0.2	3130	0.3	2390	0.2	2049	0.2
15-19	140468	11.8	123881	11.0	147812	12.3	137383	11.2	140774	11.8
20-24	354193	29.9	342807	30.4	352955	29.4	363493	29.8	361838	30.3
25-29	301563	25.4	285282	25.3	301393	25.1	315983	25.9	301184	25.2
30-34	215480	18.2	211212	18.7	210459	17.5	216766	17.7	206661	17.3
35-39	97771	8.2	97190	8.6	103083	8.6	112614	9.2	113363	9.5
40-44	27903	2.4	25821	2.3	25165	2.1	26207	2.1	26698	2.2
45-49	3112	0.3	2373	0.2	2333	0.2	2342	0.2	2739	0.2
50+	299	0.0	156	0.0	150	0.0	182	0.0	298	0.0
Not Stated	42845	3.6	35924	3.2	53710	4.5	44084	3.6	37280	3.1
Grand Total	**1186144**	**100.0**	**1126762**	**100.0**	**1200190**	**100**	**1221444**	**100**	**1192884**	**100.0**

4.5.4 Adolescent pregnancy

During the period under review, 48,633 registered births were from adolescent girls aged below 18 years. Six counties (kakamega, migori kisii, homabay, bungoma, and kericho) accounted for 32 percent of the total births registered among adolescents as shown in fig. 4.8.

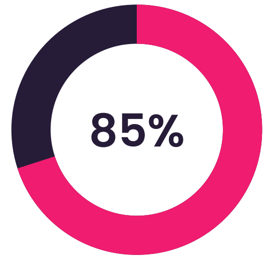
Data on registered live births provide information about the mother's age which can be used to monitor the progress toward elimination of pregnancies among adolescents

Figure 4.7: ***Registered adolescence deliveries by county, 2023***



4.5.5 Registered live births by mother's marital Status

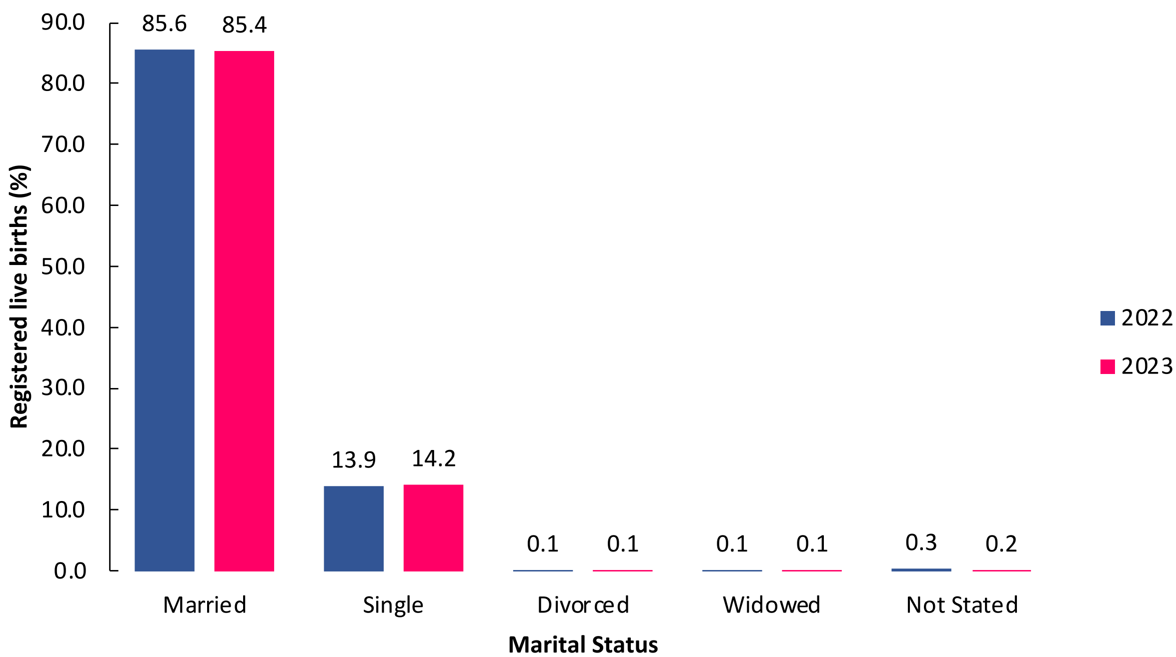
The marital status of a mother can significantly impact various aspects of maternal and child health, including birth outcomes (Prakesh et al., 2010). Figure 4.9 shows that 85 percent of the live births registered in 2023 were among married women.



Live births registered in 2023 which were among married women

Single women accounted for about 14 percent while the divorced or widowed women accounted for less than one (1) percent of the registered births.

Figure 4.8: ***Registered live births by women's marital status, 2022-2023***



In 2023, all the registered live births in Marsabit, Garissa, Wajir and Mandera counties were from married women. Counties with the lowest proportion of registered live births by married women were Kitui, Nandi, Makueni, Siaya, Elgeyo/ Marakwet, Vihiga, Kakamega, Nyamira, Kisumu, Kericho and Machakos. (Appendix B8)

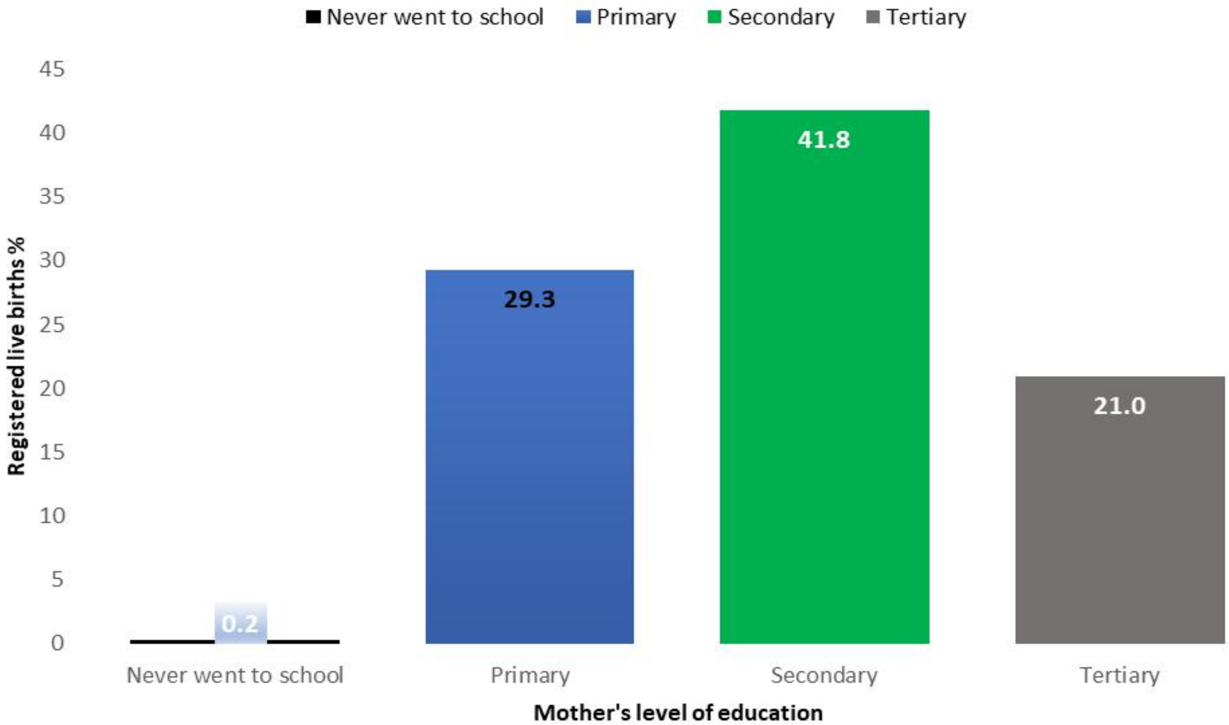
4.5.6 Registered live births by women's levelof education

Education is an important developmental factor that contributes to population management and empowerment of women (Yue and Yang, 2023). Women with secondary level of education accounted for 42 percent of the live births that were registered in 2023 as shown in Figure 4.8. This was followed by those with primary and tertiary level of education at 29 and 21 percent of the registered live births respectively. Those who never went to school accounted for less than one (1) percent of these live births. About 8 percent did not indicate the women's level of education

Turkana and Kwale County had the highest percentage of mothers who never went to school at 17.7 percent followed by Tana River (14.7), Narok (9.5) and Marsabit (8.2). (Appendix B9)

Those who never went to school accounted for less than one (1) percent of these live births. About 8 percent did not indicate the women's level of education

Figure 4.9: ***Registered live births by women's education level, 2023***



4.6 Registration of births of kenyans occurring abroad

Foreign registration of births refers to registration of children born outside the country by a Kenyan citizen upon request. In this case, one or both of the parents should have Kenyan citizenship.

Table 4.5 presents information on foreign births registered by sex in 2023. The total number of foreign births registered in the year 2023 was 4,954. Males constituted the highest proportion of these births compared to females, at 52 and 48 percent respectively. The three leading Countries in foreign births registration were United States of America at 28 percent, United Kingdom at 19 percent and United Arab Emirates at 6 percent.

Foreign registration of births refers to registration of children born outside the country by a Kenyan citizen upon request. In this case, one or both of the parents should have Kenyan citizenship

Table 4.5: Foreign Births Registration By Sex, 2022-2023

2022				2023			
Country Of Birth	**Male**	**Female**	**Both Sexes**	**Country Of Birth**	**Male**	**Female**	**Both Sexes**
	N=2144	**N=2047**	**N=4191**		**N=2585**	**N=2369**	**N=4954**
United States Of America	584	558	1142	United States Of America	725	670	1395
United Kingdom	372	354	726	United Kingdom	465	469	934
United Arab Emirates	107	115	222	United Arab Emirates	156	155	311
Uganda	96	85	181	Saudi Arabia	134	117	251
Canada	79	74	153	Australia	91	86	177
Saudi Arabia	74	79	153	Canada	87	76	163
Tanzania	74	77	151	Uganda	81	76	157
South Africa	65	65	130	Tanzania	87	69	156
Australia	59	58	117	South Africa	52	63	115
Botswana	56	48	104	Germany	63	47	110
Sweden	52	37	89	Sweden	48	40	88
Germany	42	45	87	Yemen	57	24	81
Yemen	36	28	64	Switzerland	36	36	72
India	33	30	63	Qatar	28	39	67
Switzerland	33	25	58	Botswana	35	30	65
Other Countries	382	369	751	Other Countries	440	372	812

4.7 Fertility Measures

This section highlights various fertility indicators derived from birth registration in 2023.These include; Crude Birth Rate (CBR), General Fertility Rate (GFR), Age Specific Fertility Rate (ASFR) and Total Fertility Rate (TFR).

The results presented in Table 4.6 show that the CBR was 23.2 per 1000 population which is lower than 27.7 reported in the 2022 KDHS. GFR was 88.3 per 1000 women compared with 122 per 1000 women reported in the 2022 KDHS. The ASFR is highest for women of age 20-24 after which it starts to decline. ASFR for women within age (20-24) is 139per thousand female population while it was 179 per 1000 in 2022 KDHS report. Fertility among adolescents (15-19) was 50 live births per 1000 compared with 73 births per 1000 women reported in 2022 KDHS. TFR was 2.6 births per woman compared to3.4 in 2022 KDHS.

Generally, fertility indicators generated from CRS data are lower than those computed in 2022 KDHS and 2019 KPHC. The differences could be attributed to incompleteness in birth registration.

Generally, fertility indicators generated from CRS data are lower than those computed in 2022 KDHS and 2019 KPHC. The differences could be attributed to incompleteness in birth registration

***Table 4.6:* Fertility measures, 2023**

Age group	ASFR-2019 KPHC	ASFR-2022 KDHS	ASFR- 2022 CRS	ASFR- 2023 CRS
15-19	53	73	51	50
20-24	169	179	147	139
25-29	175	172	141	128
30-34	141	137	115	102
35-39	98	87	74	70
40-44	41	35	21	20
45-49	8	5	2	3
TFR	3.4	3.4	2.8	2.6
GFR	112	122	98	88.3
CBR	27.9	27.7	24	23.2

Source KPHC,KDHS and CRS

CHAPTER FIVE

Key Findings

2022 2023

Death registration completeness declined from **47.6 percent** in 2022 to **45.1 percent** in 2023.

2022 2023

The Proportion of deaths registered in Health Facilities increased from **53 percent** in 2022 to **54.9 percent** in 2023.

Counties with the highest proportion of community death registration were Mandera (88.8%), Wajir **(85.2%)** and Vihiga (76.3%), while counties with the lowest proportion of community registered death were Uasin Gishu **(19.9%**), Kericho **(22.0%)** and Nairobi **(23.3%).**

There were more male than female registered deaths in all the years from 2019 to 2023.

Among adolescents aged 15-19, 329 deaths were registered among the married, 137 among the divorced and 20 among the widowed category.

The ASALS recorded low registration of neonatal deaths.

Death records provide the basis for compilation of mortality statistics, which are primary inputs for health policy and planning, monitoring and evaluation of health programs, and for identifying and prioritizing health research

5.1 Introduction

Death registration is an important legal and administrative function and is essential for accurate, complete, and timely vital statistics. Death and causes of death records provide the basis for the compilation of mortality statistics, which are primary inputs for health policy and planning, monitoring and evaluation of health programs, and for identifying and prioritizing health research.

This chapter highlights the death registration completeness, sex ratio, age and sex, registration by background characteristics such as marital status and place of occurrence. It also looks at adult and neonatal deaths, crude death rate and foreign death registration.

Routine measurement of death registration completeness provides timely and relevant feedback for intervention to strengthen and improve system performance

***Table 5.1:* Summary Statistics on deaths 2019-2023**

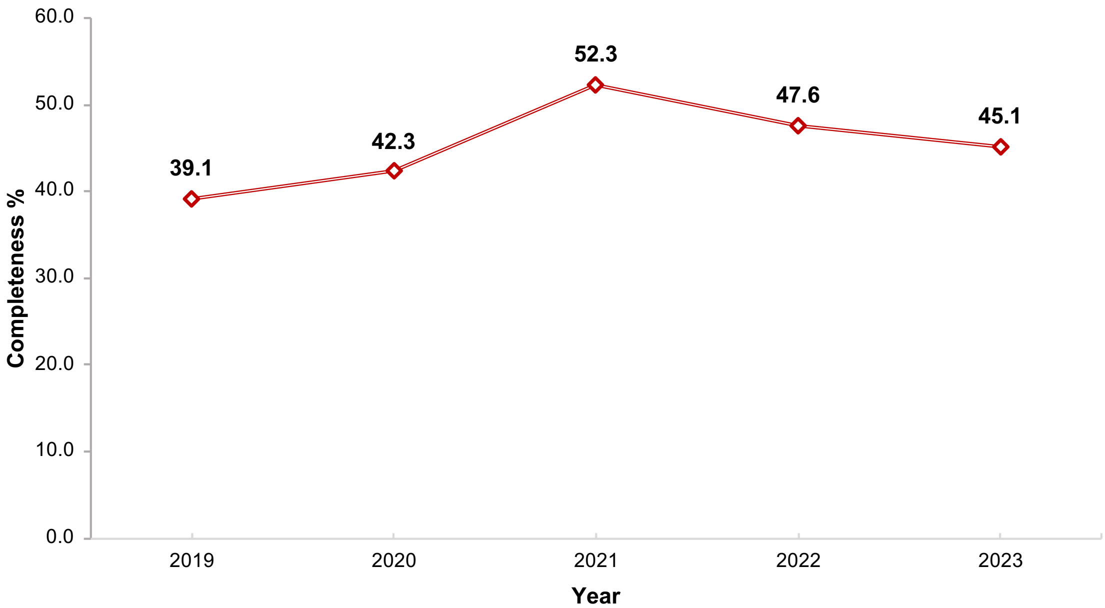
Indicator	2019	2020	2021	2022	2023
Expected	489,492	438,095	443,252	448,250	455,814
Registered	191,495	185,385	231,944	213,210	205,731
Completeness (%)	39.1	42	52.3	47.6	45.1
Male	106,215	104,832	131,599	120,357	115,507
Female	85,280	80,553	100,345	92,853	90,224
Sex Ratio	124.5	130.1	131.1	129.6	128.0
Community Deaths	81,960	86,019	110,174	100,209	92,880
Health Institution Deaths	109,535	99,366	121,770	113,001	112,851

5.2 Death registration completeness

Death registration completeness is computed using the number of deaths registered out of the total deaths expected to have occurred in the same period. Routine measurement of death registration completeness provides timely and relevant feedback for intervention to strengthen and improve system performance. Such interventions lead to strengthened and improved CRVS performance over time. Incomplete death registration results in underestimation of the number of deaths, hence the information being inadequate for planning, policy interventions, programming, and research.

Figure 5.1 shows death registration completeness from 2019 to 2023. There was a decline in death completeness from 52.3 percent in 2021 to 45.1 percent in 2023.

***Figure 5.1:* Trend in death registration completeness, 2019-2023**



Registration completeness among ASAL counties; Mandera (7.0%), Wajir (13.9%), Garissa (14.1%) was the lowest largely affected by geographical vastness, insecurity, and cultural beliefs where the deceased are buried almost immediately and are likely to go without notification (Table 5.2).

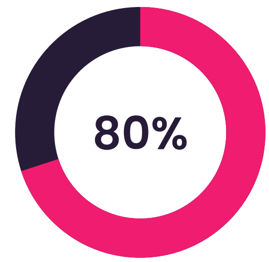
Table 5.2: ***Expected deaths, registered deaths, and completeness of death registration by counties, 2019-2023***

Code	Region/ County	Expected					Registered					Completeness				
		2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
	Kenya	489,492	438,095	443,252	448,250	455,814	191,495	185,385	231,944	213,210	205,731	39.1	42.3	52.3	47.6	45.1
001	Mombasa	11,733	12,007	12,435	6,898	7,173	6,158	5,819	6,636	6,081	5,961	52.5	48.5	53.4	88.2	83.1
002	Kwale	9,498	9,719	8,953	8,874	9,179	2,980	2,965	3,491	3,393	2,931	31.4	30.5	39.0	38.2	31.9
003	Kilifi	14,226	14,555	15,713	19,553	20,279	5,341	5,180	6,202	6,651	5,687	37.5	35.6	39.5	34.0	28.0
004	Tana River	3,509	3,674	3,418	3,556	3,667	502	528	606	548	687	14.3	14.4	17.7	15.4	18.7
005	Lamu	1,620	1,686	1,128	1,215	1,732	444	478	627	561	573	27.4	28.3	55.6	46.2	33.1
006	Taita/ Taveta	5,969	6,107	3,609	4,108	4,121	1,743	1,666	2,337	2,063	1,888	29.2	27.3	64.7	50.2	45.8
007	Garissa	7,038	7,203	6,820	8,091	8,335	717	626	637	753	1,175	10.2	8.7	9.3	9.3	14.1
008	Wajir	8,534	8,734	6,022	6,313	6,495	720	333	567	613	906	8.4	3.8	9.4	9.7	13.9
009	Mandera	12,389	12,677	6,641	6,716	6,896	438	315	495	387	482	3.5	2.5	7.5	5.8	7.0
010	Marsabit	3,411	3,489	4,286	4,236	4,300	799	679	791	925	1,817	23.4	19.5	18.5	21.8	42.3
011	Isiolo	1,754	1,795	2,589	2,846	2,883	570	581	715	801	795	32.5	32.4	27.6	28.1	27.6
012	Meru	13,848	14,250	15,815	18,137	17,938	6,565	6,243	7,782	8,046	7,584	47.4	43.8	49.2	44.4	42.3
013	Tharaka-Nithi	3,736	3,821	4,620	4,733	4,714	1,535	2,072	2,669	2,368	2,071	41.1	54.2	57.8	50.0	43.9
014	Embu	5,458	5,583	7,605	8,078	8,021	3,608	3,438	3,860	3,832	3,684	66.1	61.6	50.8	47.4	45.9
015	Kitui	12,904	13,199	14,592	14,016	13,953	4,177	4,900	5,970	6,070	5,419	32.4	37.1	40.9	43.3	38.8
016	Machakos	18,346	18,764	18,898	18,118	18,194	10,200	6,533	9,306	7,969	7,811	55.6	34.8	49.2	44.0	42.9
017	Makueni	13,533	13,841	14,361	13,961	13,948	4,272	4,276	5,865	5,541	5,420	31.6	30.9	40.8	39.7	38.9
018	Nyandarua	7,804	7,984	8,376	8,428	8,611	2,553	2,332	2,950	2,646	2,499	32.7	29.2	35.2	31.4	29.0
019	Nyeri	11,450	11,713	7,744	9,359	9,204	4,774	5,318	6,662	5,814	5,130	41.7	45.4	86.0	62.1	55.7
020	Kirinyaga	6,501	6,651	7,473	8,800	8,532	2,970	3,457	4,370	3,872	3,761	45.7	52.0	58.5	44.0	44.1
021	Muranga	13,332	13,638	17,342	17,934	17,879	7,652	6,197	8,169	6,884	6,515	57.4	45.4	47.1	38.4	36.4
022	Kiambu	20,760	21,240	19,601	21,418	21,456	10,373	10,281	12,702	11,915	10,793	50.0	48.4	64.8	55.6	50.3

***Table 4.2:* Births Registration by County, 2019-2023 (Cont'd)**

023	Turkana	11,610	11,882	8,762	9,019	9,229	2,041	1,923	2,041	2,134	2,509	17.6	16.2	23.3	23.7	27.2
024	West Pokot	6,857	7,017	5,618	6,276	6,307	789	1,171	1,356	1,179	1,452	11.5	16.7	24.1	18.8	23.0
025	Samburu	2,862	2,929	2,516	2,608	2,665	328	320	440	556	579	11.5	10.9	17.5	21.3	21.7
026	Trans Nzoia	10,735	10,985	7,374	7,386	7,514	4,378	3,957	4,819	4,753	4,239	40.8	36.0	65.3	64.4	56.4
027	Uasin Gishu	13,560	13,874	7,960	8,598	8,630	7,005	6,493	8,155	6,866	7,579	51.7	46.8	102.4	79.9	87.8
028	Elgeyo/ Marakwet	4,906	5,019	4,800	5,198	5,194	1,132	1,186	1,600	1,310	1,375	23.1	23.6	33.3	25.2	26.5
029	Nandi	11,152	11,409	7,949	7,852	7,908	2,691	2,365	3,403	2,682	2,596	24.1	20.7	42.8	34.2	32.8
030	Baringo	7,843	8,024	5,012	4,922	4,989	1,224	1,105	1,533	1,363	1,371	15.6	13.8	30.6	27.7	27.5
031	Laikipia	7,130	7,295	5,011	5,001	5,090	2,315	2,301	3,167	2,718	2,481	32.5	31.5	63.2	54.4	48.7
032	Nakuru	27,613	28,254	19,164	19,407	19,804	9,009	9,697	12,476	10,668	10,754	32.6	34.3	65.1	55.0	54.3
033	Narok	8,175	8,365	10,371	10,001	10,233	1,557	1,499	2,081	1,936	1,907	19.0	17.9	20.1	19.4	18.6
034	Kajiado	8,836	9,042	9,755	10,067	10,383	1,692	2,213	3,026	2,829	2,714	19.1	24.5	31.0	28.1	26.1
035	Kericho	10,427	10,669	9,082	9,655	9,715	3,494	3,441	4,233	3,888	3,952	33.5	32.3	46.6	40.3	40.7
036	Bomet	9,153	9,365	8,599	9,815	9,799	2,729	2,545	3,206	2,854	2,758	29.8	27.2	37.3	29.1	28.1
037	Kakamega	24,136	24,696	16,302	15,780	16,103	9,720	8,900	11,265	10,671	9,694	40.3	36.0	69.1	67.6	60.2
038	Vihiga	11,703	11,973	7,905	9,015	9,013	4,024	3,911	5,038	4,650	4,340	34.4	32.7	63.7	51.6	48.2
039	Bungoma	18,164	18,586	11,914	11,733	11,940	7,265	6,446	8,398	8,242	7,649	40.0	34.7	70.5	70.2	64.1
040	Busia	11,960	12,238	7,937	7,757	7,880	4,498	3,837	4,476	4,426	3,906	37.6	31.4	56.4	57.1	49.6
041	Siaya	20,281	20,752	13,333	13,197	13,337	6,028	5,627	7,180	6,278	6,231	29.7	27.1	53.9	47.6	46.7
042	Kisumu	16,787	17,178	12,600	12,580	12,853	6,431	6,567	7,579	6,362	6,638	38.3	38.2	60.1	50.6	51.6
043	Homa Bay	15,584	15,947	14,565	14,910	15,041	3,077	3,154	3,861	3,615	3,345	19.7	19.8	26.5	24.2	22.2
044	Migori	14,485	14,823	13,378	13,463	13,746	2,800	2,820	3,548	3,207	3,669	19.3	19.0	26.5	23.8	26.7
045	Kisii	13,804	14,123	13,229	14,728	14,725	7,065	6,283	8,118	7,388	7,218	51.2	44.5	61.4	50.2	49.0
046	Nyamira	7,153	7,318	6,948	9,406	9,229	1,417	1,740	2,439	2,447	2,500	19.8	23.8	35.1	26.0	27.1
047	Nairobi City	31,357	32,091	28,484	30,173	31,030	19,695	21,667	25,097	22,455	20,686	62.8	67.5	88.1	74.4	66.7

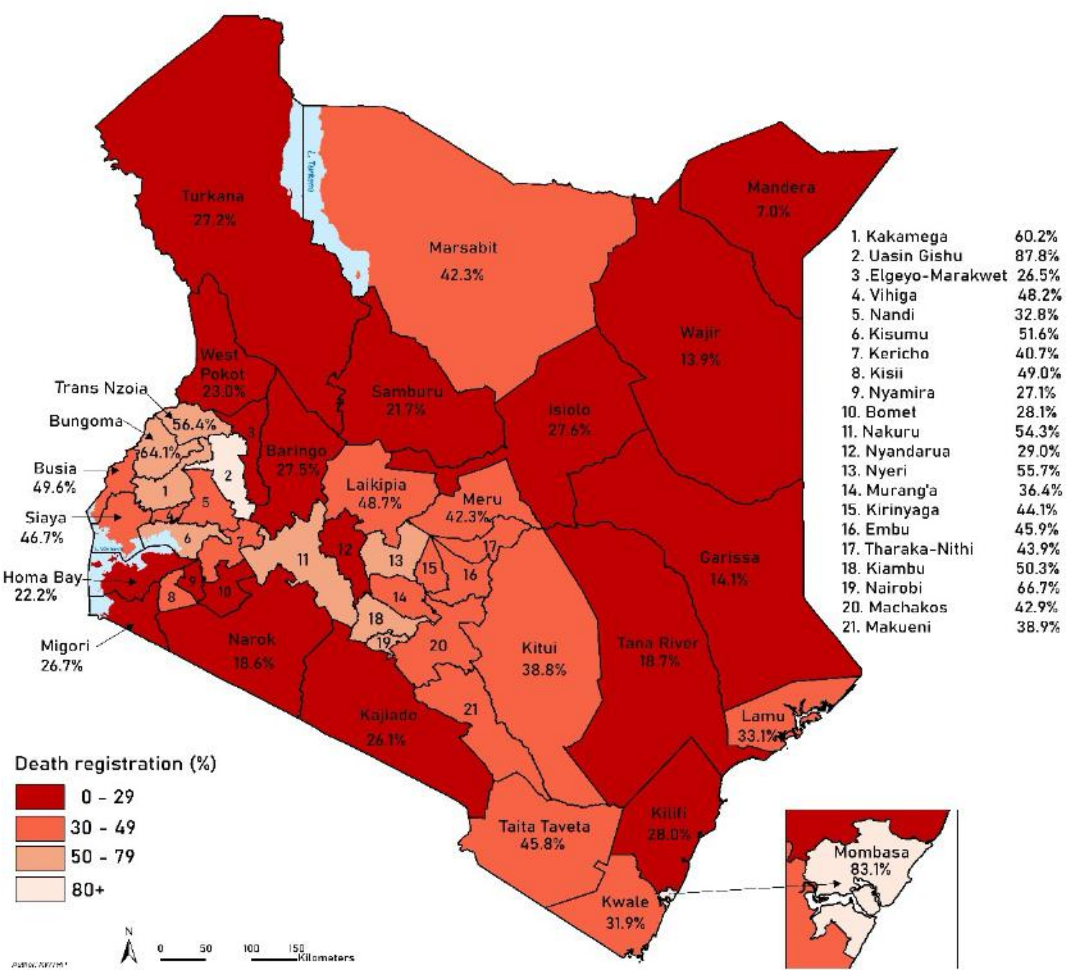
Only two counties (Mombasa and Uasin Gishu) registered over 80 percent of deaths while 30 counties had registration below the national average of 45.1 percent. Ten counties had registration coverage of over 50 percent in 2023 (Map 5.1).



Death registration in Mombasa and Uasin Gishu, while 30 counties had registration below the national average of 45.1%

The death registration completeness in Mombasa could be attributed to its urban nature and the predominance of the Muslim community which has designated communal burial sites where regulations are enforced requiring a burial permit for disposal of the dead. The high coverage recorded in Uasin Gishu County can be attributed to patient inflows from neighboring counties (in the North Rift and Western Regions) to the comparatively better referral facilities and modern private facilities in Eldoret.

Map 5.1: ***Death registration completeness in Kenya, 2023***

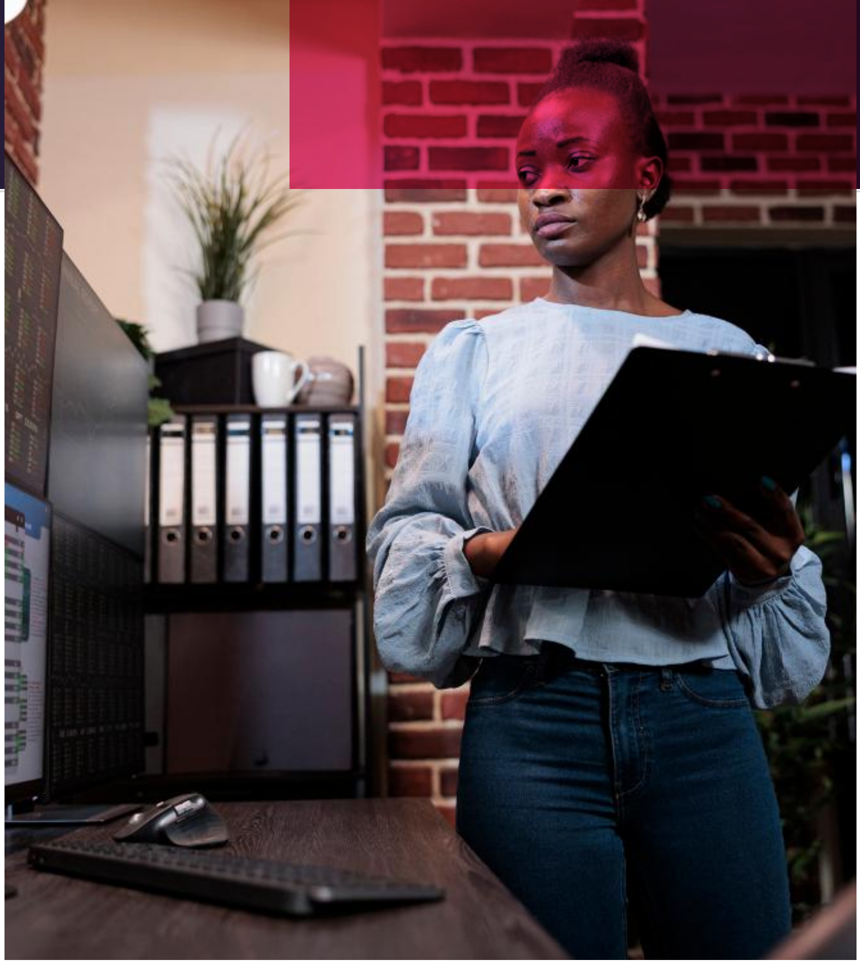


5.3 Sex Ratios for registered deaths

In 2023, the national sex ratio at death was 128, a slight decline from 129.6 in 2022, showing that there were more registered deaths among males than females. Age-specific sex ratios for death registrations were above 100 with exception of the 80+ age group, which had a sex ratio of 78.9.

In 2023, the national sex ratio at death was 128, a slight decline from 129.6 in 2022, showing that there were more registered deaths among males than females.

In 2023, the highest sex ratios were recorded in age groups 40-44 (185.8), 25-29 (184.6), and 20-24 (181.7) and the lowest sex ratios in age groups above 80+ years (78.9), under 1 (102.6), and 1-4 (118.4). It will be important to link this results with the causes of death particularly among males age group 25-29 and 40-44 for policy interventions.



Among the counties, Mandera County (223.5) had the highest registered death sex ratio

Table 5.3: Death registration by Age group and sex, 2023

Age	Female	Male	Sex Ratio
Under 1	10341	10614	102.6
1-4	3491	4132	118.4
5-9	1442	1899	131.7
10-14	1261	1689	133.9
15-19	1678	2674	159.4
20-24	2123	3858	181.7
25-29	2665	4919	184.6
30-34	3541	5586	157.8
35-39	4612	6812	147.7
40-44	3447	6406	185.8
45-49	4375	6966	159.2
50-54	4174	6542	156.7
55-59	3405	5809	170.6
60-64	5033	7238	143.8
65-69	5020	7161	142.6
70-74	6396	8281	129.5
75-79	6001	7373	122.9
80+	19550	15431	78.9
Not Stated	1666	2116	127.0
Total	**90221**	**115506**	**128.0**

In 2023, the highest sex ratios were recorded in age groups 40-44 (185.8), 25-29 (184.6), and 20-24 (181.7) and the lowest sex ratios in age groups above 80+ years (78.9), under 1 (102.6), and 1-4 (118.4).

Among the counties, Mandera County (223.5) had the highest registered death sex ratio. Other Counties with high registered death sex ratios were Wajir (177.9), Isiolo (167.7), Garissa (160.0) and Marsabit (159.2) all of from the ASAL areas, an indication that female deaths are likely to be underreported in these areas.

The counties that had the lowest registered death sex ratio include Nandi (115.6), Busia (115.6), Kericho (115.1), Siaya (111.2) and Turkana (110.1) as Shown in Table 5.4.

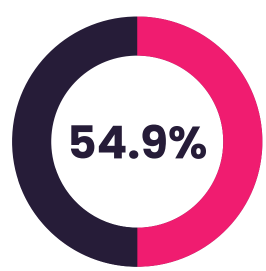
Table 5.4: Death Registration by Sex Ratio, National and County, 2021-2023

Code	National/County	2021	2022	2023
	National	131.1	129.6	128.0
001	Mombasa	134.3	123.9	126.3
002	Kwale	133.2	127.4	147.6
003	Kilifi	118.0	118.8	121.2
004	Tana River	144.4	170.0	150.7
005	Lamu	173.8	164.6	144.9
006	Taita/Taveta	125.4	139.3	126.1
007	Garissa	220.1	178.9	160.0
008	Wajir	186.4	187.8	177.9
009	Mandera	184.5	214.6	223.5
010	Marsabit	153.5	154.1	159.2
011	Isiolo	168.8	167.0	167.7
012	Meru	154.1	150.7	151.3
013	Tharaka-Nithi	153.0	149.0	125.8
014	Embu	130.6	136.3	135.4
015	Kitui	128.0	126.2	120.5
016	Machakos	144.0	135.3	118.9
017	Makueni	128.1	123.0	126.9
018	Nyandarua	125.5	136.9	136.9
019	Nyeri	130.8	121.1	131.5
020	Kirinyaga	133.7	122.4	133.4
021	Muranga	136.9	141.3	130.1
022	Kiambu	131.0	129.9	127.1
023	Turkana	105.1	105.4	110.1
024	West Pokot	127.1	131.6	138.8
025	Samburu	168.3	130.7	151.7
026	Trans Nzoia	121.5	122.8	121.2
027	Uasin Gishu	129.7	129.5	129.7
028	Elgeyo/Marakwet	124.4	130.2	134.2
029	Nandi	124.0	132.8	115.6
030	Baringo	142.6	143.4	145.3
031	Laikipia	124.1	140.5	126.8
032	Nakuru	133.0	125.5	129.2
033	Narok	144.8	140.2	141.7
034	Kajiado	131.5	124.3	136.4
035	Kericho	131.1	125.7	115.1
036	Bomet	121.7	126.7	131.0
037	Kakamega	127.1	127.3	120.4
038	Vihiga	145.5	146.6	138.9
039	Bungoma	125.1	125.7	116.1
040	Busia	111.8	119.5	115.6
041	Siaya	113.9	109.0	111.2
042	Kisumu	119.7	123.1	117.3
043	Homa Bay	112.3	113.3	117.5
044	Migori	128.5	140.2	134.1
045	Kisii	123.3	130.9	125.8
046	Nyamira	134.3	140.4	137.6
047	Nairobi City	140.3	130.5	132.2

5.4 Deaths by background characteristics

5.4.1 Registered deaths by place of occurrence

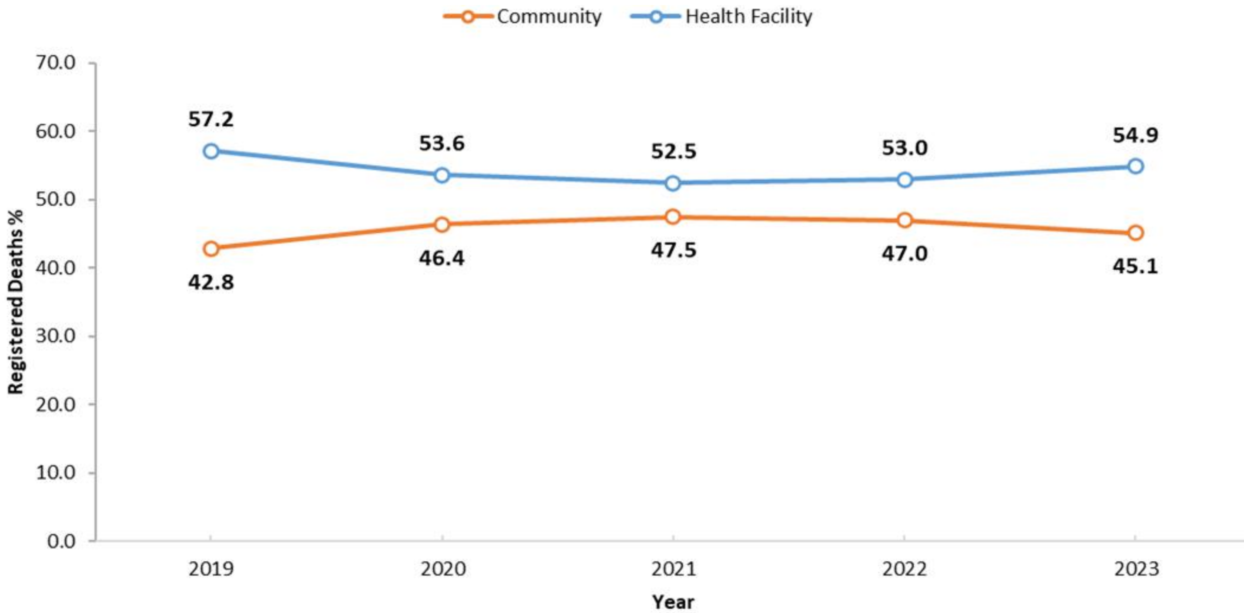
Figure 5.2 presents the proportion of registered deaths by place of occurrence. The proportion of registered deaths in health facilities increased from 53.0 percent in 2022 to 54.9 percent in 2023.



Proportion of registered deaths in health facilities in 2023, up from 53.0 percent in 2022

Conversely, the proportion of registered deaths occurring in the community declined from 47.0 percent in 2022 to 45.1 percent in 2023.This decline could be attributed to operation challenges such as prolonged lack of registration materials' that was witnessed across the country during the period under review.

Figure 5.2: Proportion of Registered Deaths by Place of Occurrence, 2019-2023



The counties with highest proportion of deaths registered in health facilities in 2023 were Uasin Gishu (80.1%), Kericho (78.0%) and Nairobi City (76.7%) while those with highest proportion of community death registration were Mandera (88.8%), Wajir (85.2%) and Vihiga (76.3%) as shown in Appendix C1.

5.4.2 Registered deaths by age and sex

Figure 5.3 presents the trends of registered deaths for males and females from 2019 to 2023. It is noted that the number of registered deaths has been decreasing since the year 2021. During the year under review, the number of male deaths registered decreased by 4.0 percent from 120,357 in 2022 to 115,506 in 2023 while female deaths registered decreased from 92,853 in 2022 to 90,221 in 2023. More male than female deaths were registered in all the years.

During the year under review, the number of male deaths registered decreased by 4.0 percent from 120,357 in 2022 to 115,506 in 2023 while female deaths registered decreased from 92,853 in 2022 to 90,221 in 2023

Figure 5.3: ***Trends in registered deaths by sex, 2019-2023***

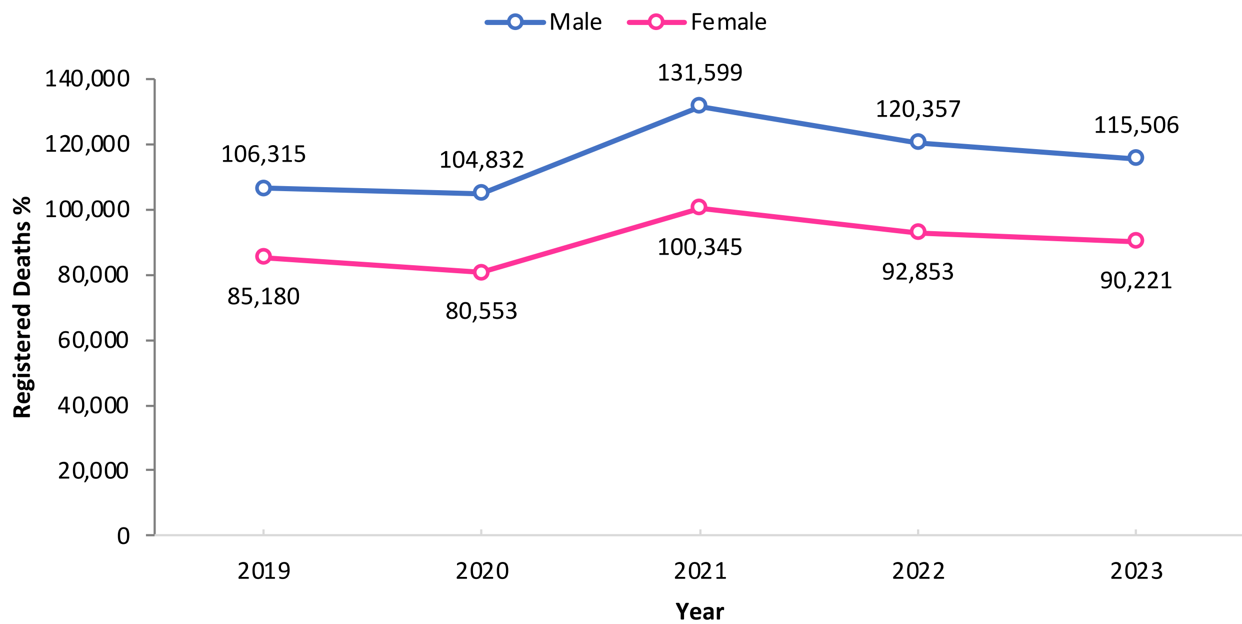
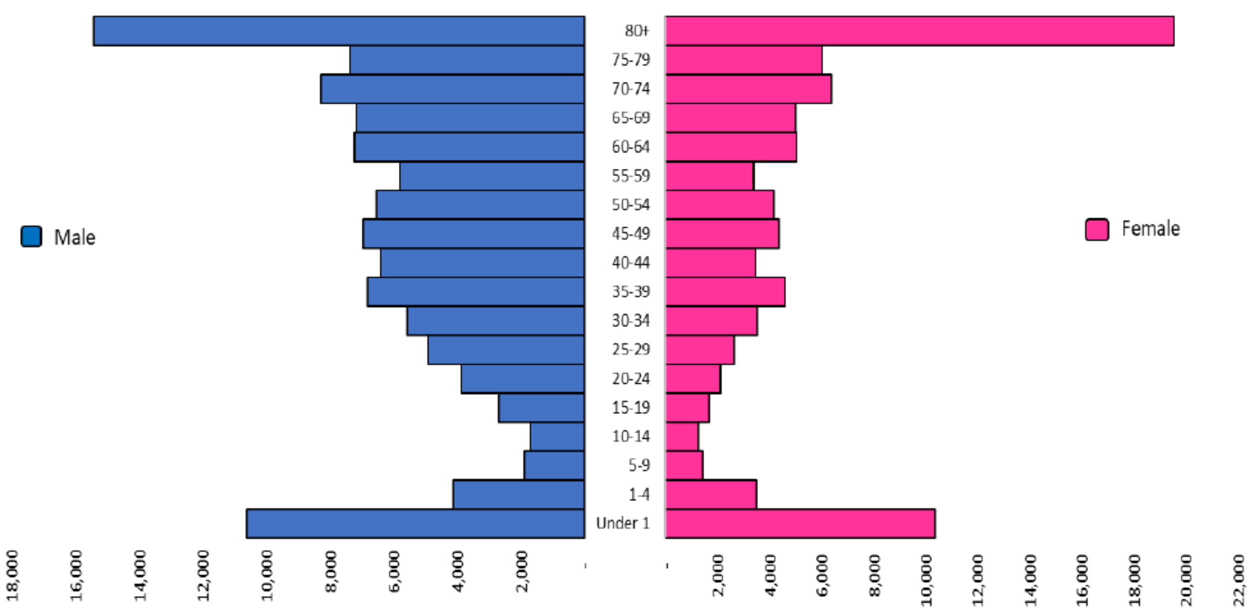


Figure 5.4 shows the age and sex distribution of registered deaths in 2023. Notably, more deaths occurred in the age group 80+ and under 1 year. This could be attributed to the high risk of death at an early and old age. A low percentage of registered deaths is observed in the age group of 5-9 Years and 10-14 years after which registered deaths start to increase.

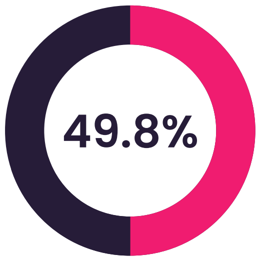
Figure 5.4: ***Age-Sex structure, 2023***



5.4.3 Registered deaths by marital status

Figure 5.5 presents mortality by marital status for deaths registered in 2023. Almost half (49.8%) of all registered deaths were married persons while 43.3 percent were people who were single, widowed, or divorced. This pattern of registered death by marital status for 2023 is similar to that recorded in 2022. The registered deaths across the counties shows that 20 counties were below the national average of 49.8 percent of registered deaths among those who had been married. The following counties had the highest proportion of deaths registered among those who had been married (Wajir 95.9%, Mandera 92.0% , and Marsabit 84.8 % of deaths .

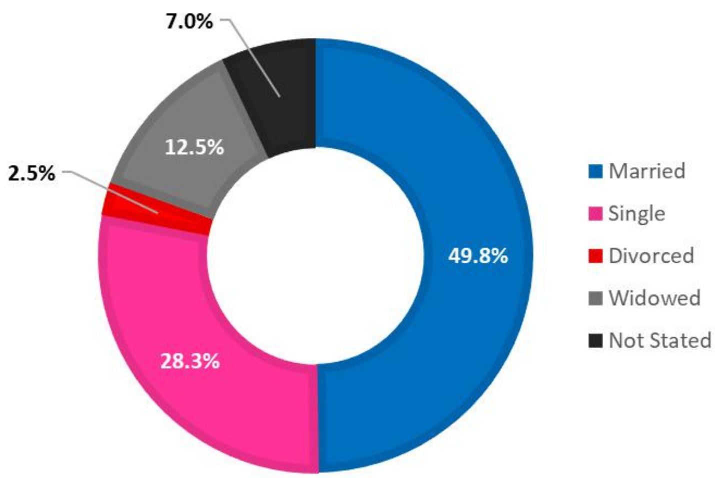
The analysis shows a sizeable number (7 percent) of registered deaths for which marital status was not stated. More than 1 in every 3 registered deaths in ten counties was from a person who was single with Turkana at (47.2 percent), West Pokot (43.6 percent) and Uasin gishu (37.2 percent). On the other hand Mandera (1.2 percent), Wajir (3.3 percent) and Marsabit (3.8 percent) registered the lowest percentage of registered deaths among single persons as shown in appendix C2.



Registered deaths that were married persons, while 43.3 percent were single, widowed, or divorced

The registered deaths across the counties shows that 20 counties were below the national average of 49.8 percent of registered deaths among those who had been married

Figure 5.5: ***Registered deaths by marital status, 2023***

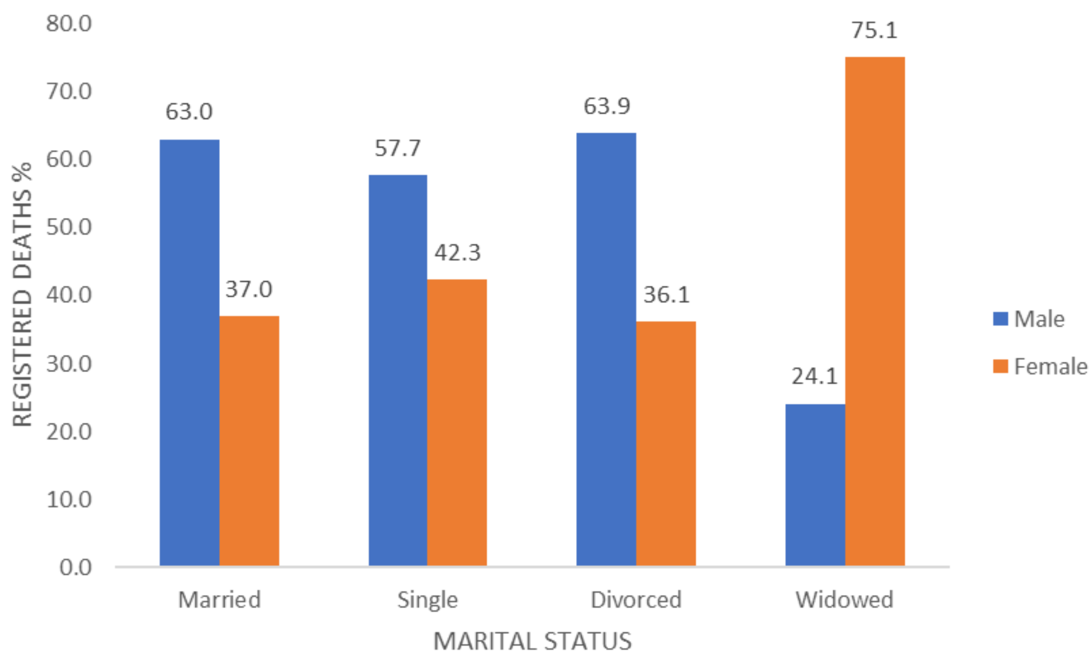


Mandera, Wajir and Marsabit had the lowest percentage of registered deaths among persons who were single

5.4.3.1 Registered deaths by marital status and sex, 15 years and above.

Males comprised the highest proportion of registered deaths across all marital status categories except among the widowed where the proportion registered deaths among females was higher (75.9 percent) compared to males (24.1 percent) (Figure 5.6).

Figure 5.6: ***Registered Deaths by Marital Status and Sex, 15 Years and above***



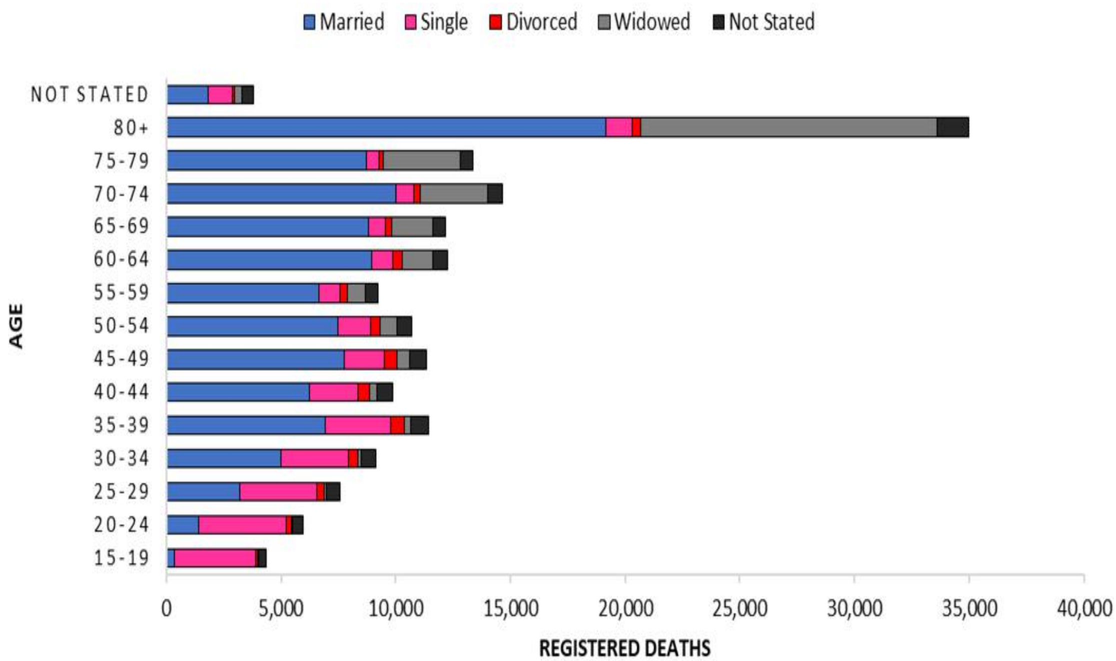
5.4.3.2 Registered deaths by marital status and age group

In the reference period, 205,731 deaths were registered. Among adolescents aged 15-19, 329 deaths were registered among the married and one hundred and thirty-seven deaths (137) in the divorced and twenty (20) among the widowed category.

This may be an indication of child marriage despite the existence of policies that prohibit child marriage

Males comprised the highest proportion of registered deaths across all marital status categories except among the widowed where the proportion registered deaths among females was higher (75.9 percent) compared to males

Figure 5.7: Registered Deaths by Marital Status and Age Group



5.4.4 Neonatal Deaths

Neonatal death is defined as deaths among live births during the first 28 completed days of life. It is usually subdivided into early neonatal deaths (deaths between 0 and 7 completed days of birth) and late neonatal deaths (deaths after 7 days to 28 completed days of birth). It is a common measure of healthcare quality and the safety of maternity services. It is expected that by 2030, end preventable deaths of newborns, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births.

5.4.4.1 Registered neonatal deaths by sex

Table 5.5 presents the number of neonatal deaths registered by sex. There was a slight decrease in the number of neonatal deaths registered from 12,219 in 2022 to 12,175 in 2023. In 2023, the number of neonatal deaths registered for females was higher compared to the number of neonatal deaths registered for females in 2022. Conversely, the number of neonatal deaths registered for males declined marginally in 2023 compared to the number of neonatal deaths registered for males in 2022. These results resonate with the results from Kenya Health Information system (11979). This excludes community registered neonatal deaths captured by CRS.

Table 5.5: ***Registered neonatal deaths by sex, 2019 - 2023***

Sex	2019	2020	2021	2022	2023
Female	4971	5785	6069	5919	6050
Male	5044	6123	6329	6300	6125
Total	**10015**	**11908**	**12398**	**12219**	**12175**

**There were three cases of intersex and one case not stated under neonatal deaths in 2023*

5.4.4.2 Registered neonatal deaths by place of occurrence

The proportion of registered neonatal deaths in health facilities increased slightly from 83.7 percent in 2022 to 84.4 percent in 2023. Community neonatal deaths registration declined slightly from 16.3 percent in 2022 to 15.6 percent in 2023 as shown in Figure 5.8.

Figure 5.8: ***Registered Neonatal Deaths by Place of Occurrence, 2019-2023***

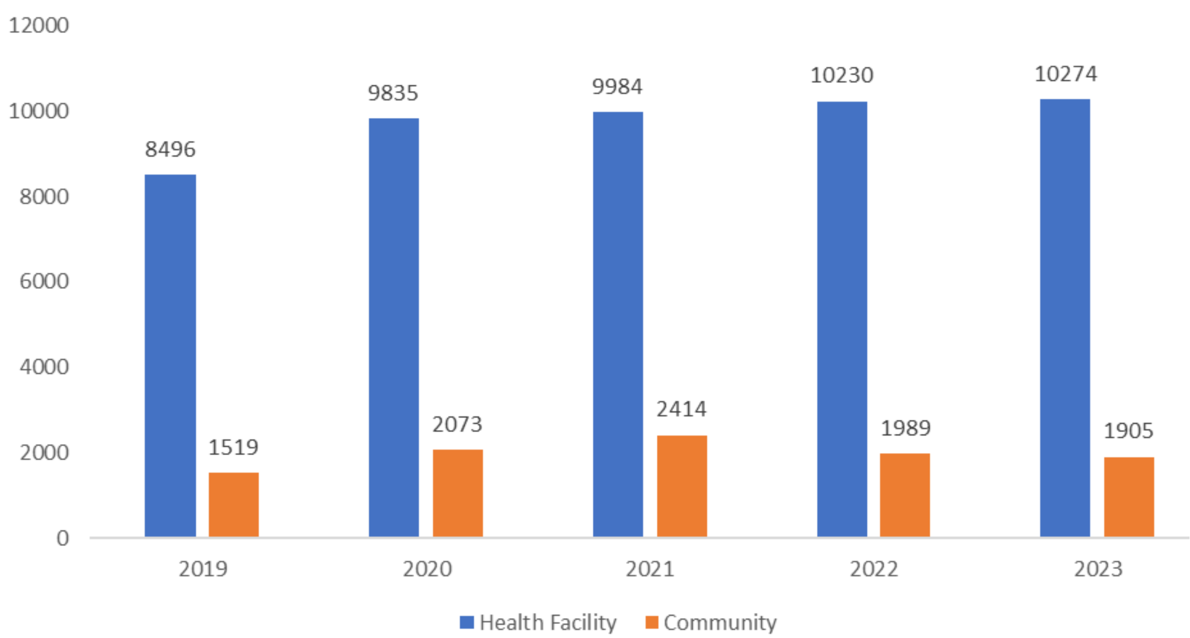


Table 5.6 shows the distribution of registered neonatal deaths by county in 2023. Eight counties, namely; Nairobi City, Nakuru, Kiambu, Mombasa, Kakamega, Bungoma, Kilifi, and Machakos accounted for over half (51.7%) of the registered neonatal deaths in the country. Twenty counties each accounted for less than one percent of the registered neonatal deaths, with Wajir, Samburu, and Mandera counties only registering 7, 4, and 2 neonatal deaths, respectively.

Table 5. 6 Registered Neonatal Deaths by County, 2023

Code	National/ County	Registered Neonatal Deaths	Proportion %	Code	National/ County	Registered Neonatal Deaths	Proportion %
	National	12,179	100.00	024	West Pokot	255	2.09
001	Mombasa	665	5.46	025	Samburu	4	0.03
002	Kwale	243	2.00	026	Trans Nzoia	389	3.19
003	Kilifi	546	4.48	027	Uasin Gishu	271	2.23
004	Tana River	32	0.26	028	Elgeyo/Marakwet	83	0.68
005	Lamu	53	0.44	029	Nandi	206	1.69
006	Taita/Taveta	103	0.85	030	Baringo	77	0.63
007	Garissa	31	0.25	031	Laikipia	77	0.63
008	Wajir	7	0.06	032	Nakuru	1,095	8.99
009	Mandera	2	0.02	033	Narok	112	0.92
010	Marsabit	15	0.12	034	Kajiado	275	2.26
011	Isiolo	37	0.30	035	Kericho	395	3.24
012	Meru	94	0.77	036	Bomet	88	0.72
013	Tharaka-Nithi	35	0.29	037	Kakamega	561	4.61
014	Embu	236	1.94	038	Vihiga	40	0.33
015	Kitui	410	3.37	039	Bungoma	565	4.64
016	Machakos	505	4.15	040	Busia	229	1.88
017	Makueni	391	3.21	041	Siaya	153	1.26
018	Nyandarua	148	1.22	042	Kisumu	131	1.08
019	Nyeri	159	1.31	043	Homa Bay	25	0.21
020	Kirinyaga	112	0.92	044	Migori	227	1.86
021	Murang'a	135	1.11	045	Kisii	382	3.14
022	Kiambu	827	6.79	046	Nyamira	27	0.22
023	Turkana	190	1.56	047	Nairobi City	1,536	12.61

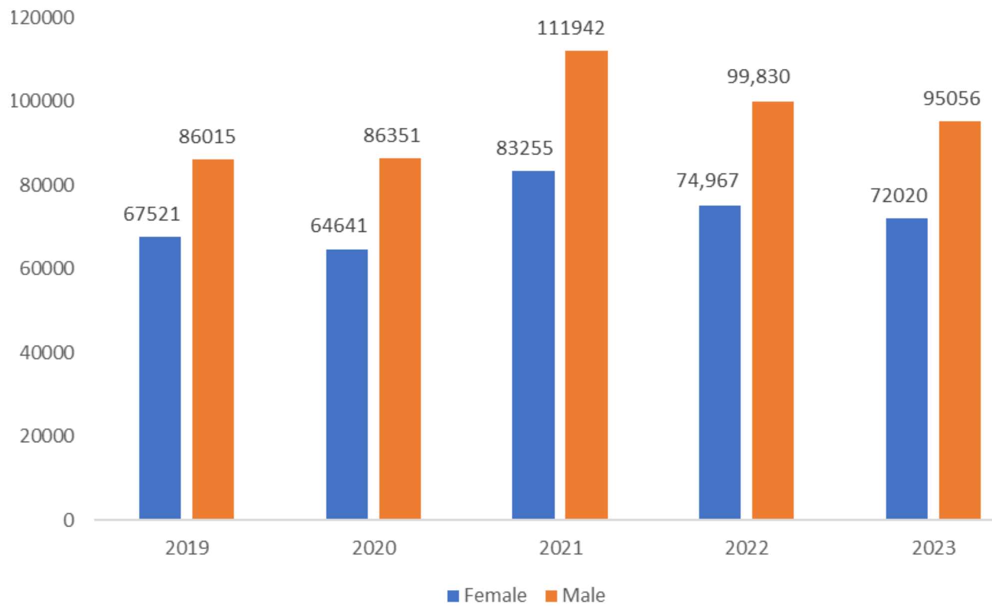
5.4.5 Registered adult deaths 18 years and above

Sustainable Development Goal 3 aims at ensuring healthy lives and promotion of wellbeing for all at all ages. Adult deaths threaten the livelihood of entire families and seriously affect the children's development, limit support on elderly people and economic activities of households. Adult mortality is associated with different demographic and behavioral risks. Adult mortality rate significantly reflects the effectiveness of public health-related programs and interventions (Yamin et al., 2015). There was a general decline in the number of registered adult deaths in Kenya from 172,187 in 2022 to 167,072 in 2023.

5.4.5.1 Registered adult deaths by sex

There was a decline of registered adult deaths for both males and females from 98,271 in 2022 to 95,056 in 2023 among males and 73,916 to 72,020 among females in the same period.

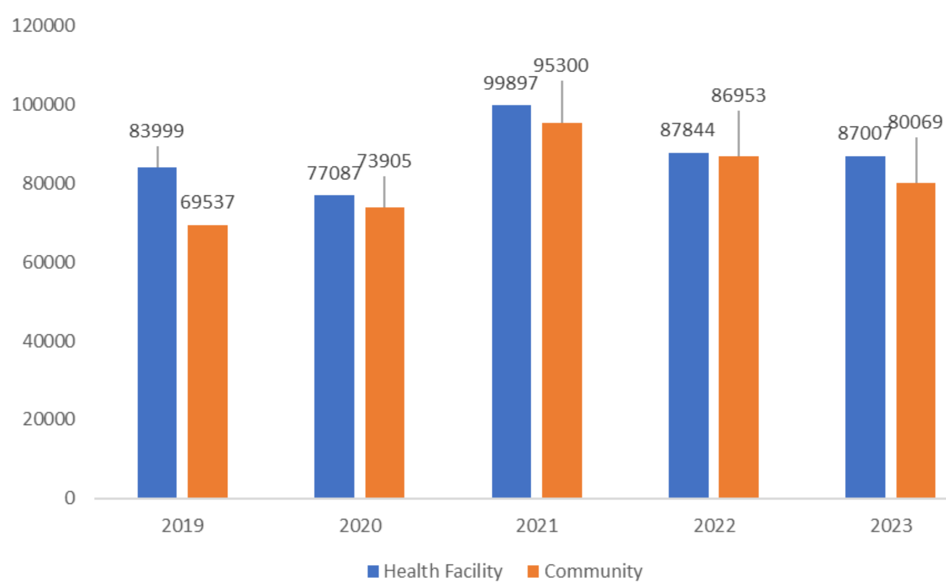
Figure 5.9: ***Registered Adult Deaths by Sex, 2019 and 2023***



5.4.5.2 Registered adult deaths by place of occurrence

The proportion of deaths registered in health facilities increased slightly from 50.1 percent in 2022 to 52.1 percent in 2023 while community deaths declined from 49.7 percent to 47.9 Percent in 2023 as shown in Figure 5.10.

Figure 5.10: ***Registered adult deaths by place of occurrence, 2019-2023***



5.5 Crude death rate

Crude Death Rate (CDR) is the number of registered deaths within the population per 1,000 mid-year population in a given year.

$$CDR = \frac{Number\ of\ registered\ deaths}{Total\ midyear\ population} \times 1{,}000$$

There was a decline in the CDR based on the registered deaths from 4.2 per 1,000 population in 2022 to 4.0 deaths per 1,000 population in 2023.

The proportion of deaths registered in health facilities increased slightly from 50.1 percent in 2022 to 52.1 percent in 2023 while community deaths declined from 49.7 percent to 47.9 Percent in 2023

5.6 Registered deaths of kenyans occuring abroad

Registration of deaths occurring abroad refers to the registration of Kenyan citizen who die and are registered abroad, and whose foreign death certificates were presented to CRS for registration in order to get Kenyan death certificates. There was a 10.3 percent decrease in the number of registered deaths of Kenyans occurring abroad from 301 in 2022 to 270 in 2023 as shown in Table 5.7.

The United States, India and Saudi Arabia accounted for most 52.2 percent of the registered deaths of Kenyans occurring abroad at 65, 47 and 29 respectively, equivalent to the total. In the East African region, 20 registered deaths of Kenyans occurred in Tanzania while 13 occurred in Uganda.

The United States, India and Saudi Arabia accounted for most 52.2 percent of the registered deaths of Kenyans occurring abroad at 65, 47 and 29 respectively, equivalent to the total. In the East African region, 20 registered deaths of Kenyans occurred in Tanzania while 13 occurred in Uganda

Registered deaths of Kenyans in Saudi Arabia more than doubled from 13 in 2022 to 29 in 2023 while those registered deaths of Kenyans from Tanzania increased from 8 in 2022 to 20 in 2023. Registered deaths of Kenyans from the USA increased by 12.1 percent from 58 in 2022 to 65 in 2023.

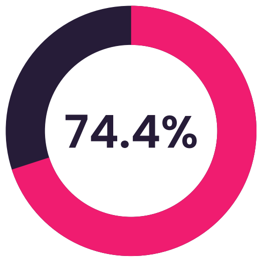
Table 5.7: Registered foreign deaths, 2022-2023

2022				2023			
Country Of Death	Male	Female	Both Sexes	Country Of Death	Male	Female	Both Sexes
	N=182	N=89	N=271		N=168	N=102	N=270
United State of America	34	24	58	United State of America	32	33	65
India	23	25	48	India	33	14	47
United Kingdom	19	7	26	Saudi Arabia	12	17	29
Somalia	22	0	22	Tanzania	17	3	20
Qatar	11	3	14	Qatar	12	6	18
Saudi Arabia	7	6	13	United Kingdom	10	8	18
Uganda	12	1	13	Uganda	9	4	13
Tanzania	9	3	12	South Sudan	6	2	8
South Africa	5	3	8	United Arab Emirates	6	2	8
United Arab Emirates	5	3	8	Somalia	5	0	5
South Sudan	4	1	5	South Africa	5	0	5
Australia	2	2	4	Rwanda	3	1	4
Canada	3	1	4	Kuwait	3	0	3
Rwanda	4	0	4	Congo	2	0	2
Botswana	1	1	2	Egypt	0	2	2
Ethiopia	1	1	2	Greece	1	1	2
Yemen	1	1	2	Italy	0	2	2
Other Countries	19	7	26	Other Countries	12	7	19

5.7 Registered deaths of kenyans occuring abroad by age and sex

Table 5.8 shows the registered deaths of Kenyans occurring abroad by age group and sex. Most of the registered foreign deaths were from the age group 25-64 years which accounted for 74.4 percent.

It was also notable that there was no death of Kenyans under 5 years of age that was registered by CRS in 2023. During the same period, more male deaths (168) compared to female deaths (102) were registered.



Proportion of most of the registered foreign deaths were from the age group 25-64 years

Table 5.8: ***Registered deaths of Kenyans occurring abroad by age group and sex, 2023***

National/Age	Male	Female	Total
Kenya	168	102	270
5-9	1	1	2
15-19	0	1	1
20-24	2	0	2
25-29	13	6	19
30-34	15	7	22
35-39	21	12	33
40-44	14	10	24
45-49	14	9	23
50-54	13	9	22
55-59	17	9	26
60-64	17	15	32
65-69	8	4	12
70-74	14	7	21
Over 75	18	12	30
Not Stated	1	0	1

There was no death of Kenyans under 5 years of age that was registered by CRS in 2023. During the same period, more male deaths (168) compared to female deaths (102) were registered

CHAPTER SIX

Key Findings

- Pneumonia was the leading cause of death for the medically certified causes of death in 2019, 2021, 2022 and 2023. It was also the leading cause of death in age group 5-14 years from 2021 to 2023.
- Sudden death, was the leading cause of registered deaths among males and females in the community.
- Cancer has been on the rise from fifth position in 2021 to the second leading cause of death in 2023 for the medically certified causes.
- The leading causes of death for persons aged 15-49 years, 50-59 years and 60+ were injuries, cancer and cardiovascular respectively for the medically certified causes.
- Prematurity and birth asphyxia were the leading cause of death for the neonates.
- Pneumonia was the leading cause of death in twenty-seven (27) counties followed by Cancer in six (6) counties, Sepsis in four (4) counties and cardiovascular diseases in four (4) counties.

In order to understand the mortality patterns of any nation, it is critical that a comprehensive analysis is done on the causes of death.

Introduction

In order to understand the mortality patterns of any nation, it is critical that a comprehensive analysis is done on the causes of death. The quality of evidence-based decision-making in health surveillance structure depends on how well the mortality patterns are understood in a country and how these patterns are applied in formulating targeted interventions. This chapter presents the mortality patterns disaggregated by age and place of occurrence, the medically certified causes of death and those within communities and causes of death from foreign registration.

The quality of evidence-based decision-making in health surveillance structure depends on how well the mortality patterns are understood in a country

During the period under review, Pneumonia was the leading cause of death in twenty-seven (27) counties followed by Cancer in six (6) counties, Sepsis in four (4) counties and cardiovascular diseases in four (4) counties. This was followed by Anemia in three (3) counties, prematurity and asphyxia in two (2) counties and Injuries in one (1) county.

Refer to table C18 in the appendix

6.2 Medically certified causes of registered deaths

6.2.1 Ten leading medically certified causes of registered deaths, 2019-2023

Table 6.1 presents the trend analysis of ten leading medically certified causes of deaths from 2019 to 2023. The four major leading causes of death within the reporting period 2019-2023 are pneumonia, cardiopulmonary and cardiorespiratory arrest, respiratory infections and cancer.

Table 6.1: Ten leading causes of medically certified registered deaths, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=109535**	**Cause of Death**	**N=99355**	**Cause of Death**	**N=121727**	**Cause of Death**	**N =112,967**	**Cause of Death**	**N=112845**
1	Pneumonia	8090	Cardiorespiratory failure/Cardio-pulmonary arrest	9332	Pneumonia	15,468	Pneumonia	11,453	Pneumonia	9966
2	Cancer	5869	Pneumonia	9061	Cardiopulmonary and Cardiorespiratory Arrest	9,862	Cardiopulmonary and Cardiorespiratory Arrest	11,176	Cancer	7699
3	Cardio Pulmonary and Respiratory diseases	5127	Cancer	6078	Respiratory Infections	7,434	Respiratory Infections	7,340	Cardiovascular Diseases	7494
4	Respiratory Infections	5104	Respiratory infections	5749	Covid 19	5,987	Cancer	5,653	Sepsis	6171
5	Hypertension	4486	Hypertension	5456	Cancer	5,743	Injuries	4,296	Hypertension	4842
6	Prematurity and Birth Asphxia	3582	Prematurity &birth asphyxia	4368	Heart Diseases	4,869	Hypertension	4,212	Injuries	4559
7	Anaemia	3286	Anaemia	3557	Hypertension	4,734	Anaemia	4,108	Prematurity and Asphyxia	4134
8	Tuberculosis	2716	Diabetes	3040	Prematurity & Birth asphyxia	4,239	Prematurity & Birth Asphyxia	3,641	Anaemia	3939
9	Injuries	2661	Kidney and urinary tract infections	2585	Anaemia	3,766	Sepsis	3,158	Renal Diseases	3322
10	Traffic Accidents	2646	Road traffic accidents	2453	Diabetes	3,692	Diarrhea	2,997	Tuberculosis	2798

6.2.2 Leading causes of medically certified registered death by sex

Results from table 6.2 and 6.3 indicate that Pneumonia is the leading cause of death for both sexes for 2019, 2021 and 2023. In addition, Cancer has remained among the leading causes of death for both sexes from 2019 to 2023. While injuries is among the ten leading causes of death for males, it is not among the ten leading causes of death for females.HIV/AIDS is among the top leading causes of death for females, but not among males.

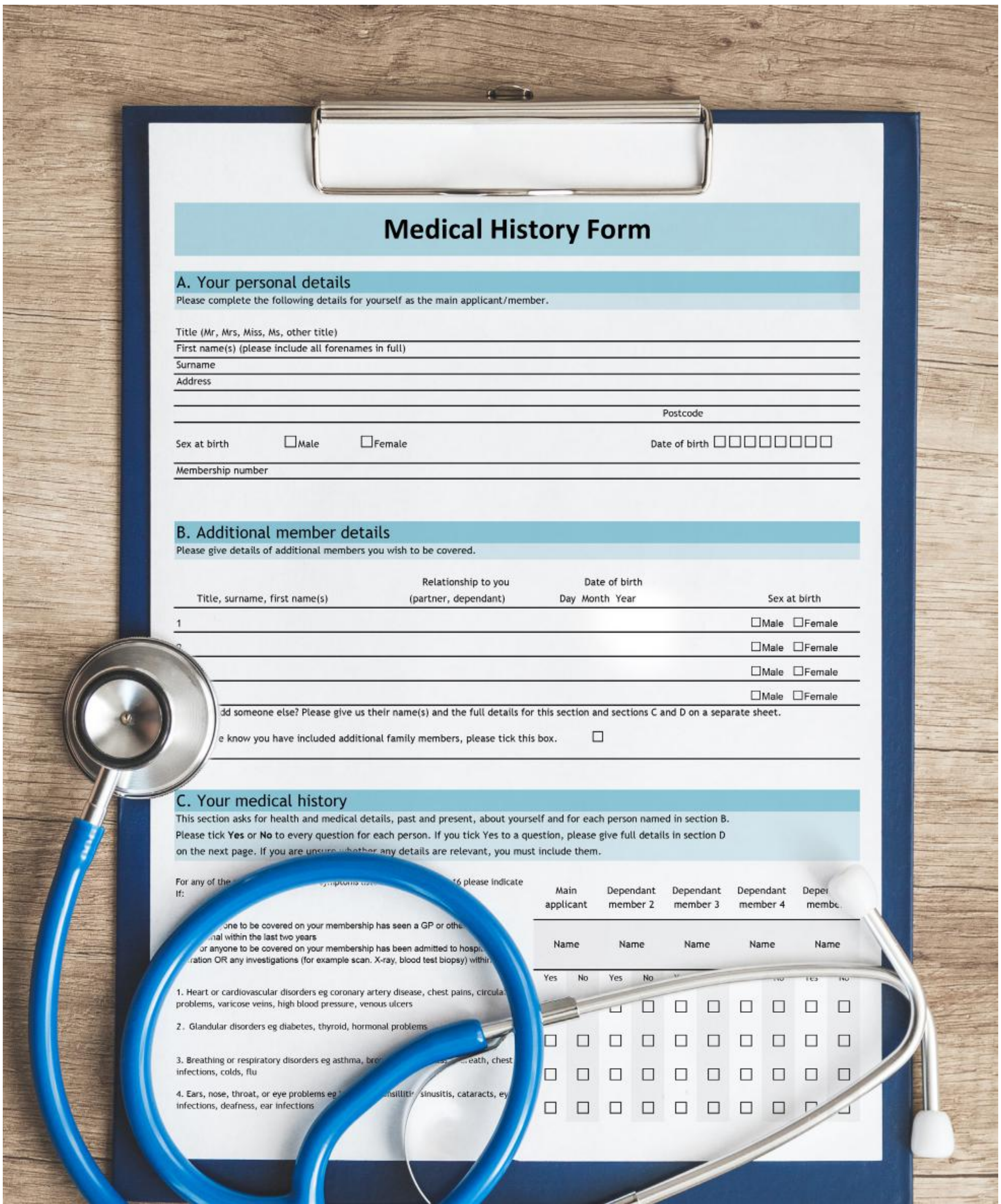


Table 6.2: Ten leading causes of medically certified registered deaths for males, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=60225**	**Cause of Death**	**N=55484**	**Cause of Death**	**N=68400**	**Cause of Death**	**N =62,679**	**Cause of Death**	**N=62221**
1	Pneumonia	4346	Cardiorespiratory failure/Cardio-pulmonary arrest	5045	Pneumonia	8,643	Pneumonia	6,294	Pneumonia	5404
2	Cancer	3094	Pneumonia	5019	Cardiopulmonary and Cardiorespiratory Arrest	5,367	Cardiopulmonary and Cardiorespiratory Arrest	5,907	Cancer	3758
3	Respiratory Infections	2724	Respiratory infections	3053	Respiratory Infections	4,148	Respiratory Infections	3,905	Injuries	3728
4	Cardio Pulmonary and Respiratory diseases	2711	Cancer	3049	Covid 19	3,544	Injuries	3,278	Cardiovascular Diseases	3656
5	Hypertension	2235	Hypertension	2738	Cancer	2,899	Cancer	2,679	Sepsis	3170
6	Injuries	2001	Prematurity & birth asphyxia	2283	Heart Diseases	2,479	Prematurity & Birth Asphyxia	2,102	Hypertension	2309
7	Traffic Accidents	1955	Road traffic accidents	2028	Hypertension	2,281	Anaemia	1,995	Anaemia	2109
8	Prematurity and Birth Asphyxia	1738	Anaemia	1741	Injuries	2,223	Hypertension	1,892	Prematurity and Asphyxia	1962
9	Tuberculosis	1655	Injuries	1733	Prematurity & Birth asphyxia	2,116	Road Traffic Accident	1,786	Renal Diseases	1875
10	Anaemia	1619.0	Diabetes	1598	Road Traffic Accidents	2,036	Diarrhea	1,625	Tuberculosis	1757

Table 6.3: Ten leading causes of medically certified registered deaths for females, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=49310**	**Cause of Death**	**43871**	**Cause of Death**	**N=53327**	**Cause of Death**	**N = 50,286**	**Cause of Death**	**N=50617**
1	Pneumonia	3744	Cardiorespiratory failure/Cardiopulmonary arrest	4287	Pneumonia	6,825	Cardiopulmonary and Cardiorespiratory Arrest	5,269	Pneumonia	4562
2	Cancer	2775	Pneumonia	4042	Cardiopulmonary and Cardiorespiratory Arrest	4,495	Pneumonia	5,159	Cancer	3940
3	Cardio Pulmonary and Respiratory diseases	2416	Cancer	3029	Respiratory Infections	3,286	Respiratory Infections	3,435	Cardiovascular Diseases	3838
4	Respiratory Infections	2380	Hypertension	2718	Cancer	2,844	Cancer	2,974	Sepsis	3001
5	Hypertension	2251	Respiratory infections	2696	Hypertension	2,453	Hypertension	2,217	Hypertension	2533
6	Prematurity and Birth ASPHYXIA	1844	Prematurity & birth asphyxia	2085	Covid 19	2,443	Anaemia	2,006	Prematurity and Asphyxia	2025
7	Anaemia	1667	Anaemia	1816	Heart Diseases	2,390	Prematurity & Birth Asphyxia	1,749	Anaemia	1974
8	HIV	1430	Diabetes	1442	Prematurity & Birth asphyxia	2,123	Sepsis	1,575	Diabetes	1525
9	Meningitis	1253	HIV/AIDS	1227	Anaemia	1,855	Diabetes	1,436	Renal Diseases	1447
10	Diabetes	1200	Meningitis	1105	Diabetes	1,854	Diarrhea	1,372	HIV/AIDS	1118

6.2.3 Leading causes of medically certified registered deaths for neonates

The first 28 days of life are the most delicate period of life for the newborn child. Globally, neonatal mortality constitutes about 47 percent of child mortality. Most neonatal deaths occur during the first week of life.

Children who die within the first 28 days of birth suffer from conditions and diseases associated with a lack of quality care at or immediately after birth and in the first days of life (UNICEF, 2014).

Preterm birth, childbirth-related complications (birth asphyxia or lack of breathing at birth), infections, and birth defects cause most neonatal deaths. This section presents the top 10 causes of death for neonates disaggregated by sex. Table 6.4 shows Prematurity birth asphyxia and respiratory infections remain the leading cause of death among neonates during the reporting period. However, in 2023 neonatal sepsis was in the second position.

Table 6.4: Leading causes medically certified causes of registered deaths for neonates, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=8496**	**Cause of Death**	**N=9456**	**Cause of Death**	**N=9984**	**Disease**	**N = 10,230**	**Cause of Death**	**N=10273**
1	Prematurity and Birth Asphyxia	3294	Prematurity & birth asphyxia	3920	Prematurity & Birth asphyxia	3,922	Prematurity & Birth Asphyxia	3,489	Prematurity and Asphyxia	4225
2	Respiratory Infections	950	Respiratory infections	1427	Respiratory Infections	1,447	Respiratory Infections	1,918	Neonatal Sepsis	1141
3	Cardio Pulmonary and Respiratory diseases	467	Cardiorespiratory failure/Cardio-pulmonary arrest	871	Cardiopulmonary and Cardiorespiratory Arrest	773	Sepsis	1,014	Pneumonia	431
4	Neonatal Conditions	341	Neonatal Conditions	599	Neonatal Conditions	695	Cardiopulmonary and Cardiorespiratory Arrest	634	Cardiovascular Diseases	215
5	Sepsis	325	Pneumonia	313	Pneumonia	496	Pneumonia	581	Respiratory Infections	174
6	Pneumonia	316	Asphyxia	202	Sepsis	217	Diarrhea	280	Renal Diseases	131
7	Heart Diseases	99	Sepsis	185	Heart Diseases	194	Jaundice	133	Complications Leading to Hypoxia	81
8	Meningitis	50	Maternal conditions	121	Kidney & urinary tract infections	102	Injuries	120	Anaemia	77
9	Anaemia	46	Heart diseases	107	Neonatal Sepsis	80	Heart Disease	84	Diarrhoea	76
10	Malaria	44.0	Kidney and urinary tract infections	91	Meningitis	67	Meningitis	81	Meningitis	74

From table 6.5 and 6.6 prematurity and birth asphyxia were the leading cause of death for both male and female neonates from 2019 to 2023.

Table 6.5: Leading causes medically certified causes of registered neonatal deaths for males, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=4277**	**Cause of Death**	**N=4813**	**Cause of Death**	**N=5045**	**Disease**	**N =5,267**	**Cause of Death**	**N=5091**
1	Prematurity and Birth Asphyxia	1622	Prematurity & birth asphyxia	2068	Prematurity & Birth asphyxia	1,950	Prematurity & Birth Asphyxia	1,832	Prematurity and Asphyxia	2087
2	Respiratory Infections	490	Respiratory infections	651	Respiratory Infections	740	Respiratory Infections	942	Neonatal Sepsis	604
3	Cardio Pulmonary and Respiratory diseases	241	Cardiorespiratory failure/Cardiopulmonary arrest	439	Cardiopulmonary and Cardiorespiratory Arrest	400	Sepsis	482	Pneumonia	225
4	Neonatal Conditions	181	Neonatal Conditions	300	Neonatal Conditions	363	Cardiopulmonary and Cardiorespiratory Arrest	326	Cardiovascular Diseases	83
5	Pneumonia	177	Pneumonia	170	Pneumonia	247	Pneumonia	310	Respiratory Infections	75
6	Sepsis	163	Asphyxia	104	Sepsis	110	Diarrhea	125	Renal Diseases	65
7	Heart Diseases	44	Sepsis	89	Heart Diseases	104	Jaundice	81	Anaemia	42
8	Meningitis	23	Maternal conditions	59	Kidney & urinary tract infections	53	Injuries	66	Diarrhoea	39
9	Anaemia	20	Heart diseases	57	Cerebral Vascular Diseases	39	Heart Disease	56	Complications Leading to Hypoxia	37
10	Jaundice	19.0	Kidney and urinary tract infections	57	Neonatal Sepsis	38	Meningitis	43	Meningitis	37

Table 6.6: Leading causes medically certified causes of registered neonatal deaths for females, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	N=4219	Cause of Death	N=4643	Cause of Death	N=4939	Disease	N = 4,962	Cause of Death	N=5178
1	Birth AsphyxiA	1672	Prematurity & birth asphyxia	1852	Prematurity & Birth asphyxia	1,972	Prematurity & Birth Asphyxia	1,657	Prematurity and Asphyxia	2136
2	Respiratory Infections	460	Respiratory infections	776	Respiratory Infections	707	Pneumonia	976	Neonatal Sepsis	537
3	Cardio Pulmonary and Respiratory diseases	226	Cardiorespiratory failure/Cardiopulmonary arrest	432	Cardiopulmonary and Cardiorespiratory Arrest	373	Respiratory Infections	532	Pneumonia	206
4	Sepsis	162	Neonatal Conditions	299	Neonatal Conditions	332	Sepsis	308	Cardiovascular Diseases	132
5	Neonatal Conditions	160	Pneumonia	143	Pneumonia	249	Cardiopulmonary and Cardiorespiratory Arrest	271	Respiratory Infections	99
6	Pneumonia	139	Asphyxia	98	Sepsis	107	Diarrhea	155	Renal Diseases	66
7	Heart Diseases	55	Sepsis	96	Heart Diseases	90	Gastroenteritis	54	Complications Leading to Hypoxia	44
8	Malaria	28	Maternal conditions	62	Kidney & urinary tract infections	49	Anaemia	52	Diarrhoea	37
9	Meningitis	27	Heart diseases	50	Neonatal Sepsis	42	Meningitis	38	Meningitis	37
10	Anaemia	26.0	Anaemia	38	Anaemia	32	Malaria	28	Anaemia	35

6.2.4 Leading Causes Of Registered Deaths Among Children Under 1 Year

This section, analyses the leading causes of death for children aged below one year (Infant mortality). Prematurity and birth asphyxia was the leading cause of death from 2019 to 2023. Respiratory infections and Pneumonia, were the second leading cause of death in the same period as presented in Table 6.7.

Table 6.7: Ten Leading causes of medically certified causes of registered deaths for under 1 year, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cuase of death	N=14985	Cause of Death	N=13601	Cause of Death	N=14735	Cause of Death	N = 15,204	Cause of Death	N=15847
1	Prematurity and Birth Asyphxia	3481	Prematurity &birth asphyxia	4047	Prematurity & Birth asphyxia	4,239	Prematurity & Birth Asphyxia	3,641	Prematurity and Asphyxia	3827
2	Pneumonia	1905	Respiratory infections	1661	Pneumonia	1,963	Respiratory Infections	2,211	Pneumonia	1937
3	Respiratory Infections	1347	Pneumonia	1589	Respiratory Infections	1,703	Pneumonia	2,039	Sepsis	964
4	Cardio Pul-monary and Respiratory diseases	805	Cardiorespirato-ry failure/Cardio-pulmonary arrest	1244	Cardiopulmo-nary and Car-diorespiratory Arrest	1,121	Sepsis	1,194	Neonatal Sepsis	704
5	Sepsis	458	Neonatal Condi-tions	663	Neonatal Con-ditions	762	Cardiopulmo-nary and Car-diorespiratory Arrest	995	Diarrhoea	530
6	Neonatal Conditions	353	Sepsis	287	Heart Diseases	330	Diarrhea	481	Asphyxia	438
7	Meningitis	263	Asphyxia	222	Sepsis	328	Gastroenteritis	320	Cardio Vascular Diseases	281
8	Malaria	259	Meningitis	214	Meningitis	231	Meningitis	246	Meningitis	255
9	Anaemia	226	Anaemia	209	Anaemia	205	Anaemia	225	Anaemia	228
10	Gastro-enteritis	220	Heart diseases	200	Gastroenteritis	201	Heart Disease	166	Respiratory Infections	210

Results from table 6.8 and 6.9 shows that prematurity and birth asphyxia was the leading cause of death for both males and females followed by pneumonia for the period 2019, 2021and 2023 whereas respiratory infection was the second leading cause of death in 2020 and 2022.

Table 6.8: Ten Leading causes of medically certified causes of registered deaths for under 1-year males, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=7714**	**Cause of Death**	**N=6935**	**Cause of Death**	**N=7476**	**Cause of Death**	**N =7,765**	**Cause of Death**	**N=7892**
1	Prematurity and Birth Asphyxia	1689	Prematurity & birth asphyxia	2126	Prematurity & Birth asphyxia	2,116	Prematurity & Birth Asphyxia	1,892	Prematurity and Asphyxia	1902
2	Pneumonia	995	Pneumonia	826	Pneumonia	979	Respiratory Infections	1,092	Pneumonia	933
3	Respiratory Infections	699	Respiratory infections	764	Respiratory Infections	875	Pneumonia	1,047	Sepsis	502
4	Cardio Pul-monary and Respiratory diseases	415	Cardiorespirato-ry failure/Cardio-pulmonary arrest	647	Cardiopulmo-nary and Car-diorespiratory Arrest	584	Sepsis	564	Neonatal Sepsis	378
5	Sepsis	223	Neonatal Condi-tions	327	Neonatal Con-ditions	397	Cardiopulmo-nary and Car-diorespiratory Arrest	519	Diarrhoea	258
6	Neonatal Conditions	196	Sepsis	140	Heart Diseases	173	Diarrhea	218	Asphyxia	208
7	Malaria	137	Asphyxia	116	Sepsis	167	Gastroenteritis	159	Meningitis	143
8	Meningitis	127	Meningitis	116	Meningitis	120	Meningitis	124	Anaemia	124
9	Anaemia	121	Heart diseases	110	Anaemia	95	Anaemia	119	Cardiovascular Diseases	120
10	Gastro-enteritis	103	Anaemia	107	Malaria	92	Heart Disease	92	Malaria	95

Table 6.9: Ten Leading causes of medically certified causes of registered deaths for under 1-year females, 2019-2023

Rank	2019		2020		2021		2022		2023	
	N=7271		Cause of Death	N=6666	Cause of Death	N=7259	Disease	N = 7,439	Cause of Death	N=7951
1	Prematurity and Birth Asphyxia	1792	Prematurity & birth asphyxia	1921	Prematurity & Birth asphyxia	2,123	Prematurity & Birth Asphyxia	1,749	Prematurity and Asphyxia	1923
2	Pneumonia	910	Respiratory infections	897	Pneumonia	984	Pneumonia	1,119	Pneumonia	1004
3	Respiratory Infections	648	Pneumonia	763	Respiratory Infections	828	Respiratory Infections	992	Sepsis	462
4	Cardio Pulmonary and Respiratory diseases	390	Cardiorespiratory failure/Cardiopulmonary arrest	597	Cardiopulmonary and Cardiorespiratory Arrest	537	Sepsis	630	Neonatal Sepsis	326
5	Sepsis	235	Neonatal Conditions	336	Neonatal Conditions	365	Cardiopulmonary and Cardiorespiratory Arrest	476	Diarrhoea	272
6	Neonatal Conditions	157	Sepsis	147	Sepsis	161	Diarrhea	263	Asphyxia	230
7	Meningitis	136	Asphyxia	106	Heart Diseases	157	Gastroenteritis	161	Cardiovascular Diseases	161
8	Malaria	122	Anaemia	102	Gastroenteritis	115	Anaemia	122	Respiratory Infections	119
9	Gastro-enteritis	117	Meningitis	98	Meningitis	111	Meningitis	106	Meningitis	112
10	Anaemia	105	Gastroentritis	94	Anaemia	110	Malaria	75	Anaemia	104

6.2.5 Ten Leading Medically Certified Causes Of Registered Deaths Among Children Under 5 Years

Mortality in children under five years is an important indicator for SDG 3.2.1 which aims at promoting healthy lives and well-being for all children by ending preventable deaths of children Under 5 by 2030. Table 6.10 shows that prematurity and birth asphyxia, Pneumonia and respiratory infections were the top leading causes of death for the period under review apart from sepsis which was the third leading cause of death in 2023.

Table 6.10: ***Ten Leading causes of medically certified causes of registered deaths for under 5 years, 2019-2023***

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=20438**	**Cause of Death**	**N=17124**	**Cause of Death**	**N=18432**	**Disease**	**N = 19688**	**Cause of Death**	**N=20321**
1	Prematurity & Birth asphyxia	3481	Prematurity & birth asphyxia	4148	Prematurity & Birth asphyxia	4,239	Prematurity & Birth Asphyxia	3,641	Prematurity and Asphyxia	3827
2	Pneumonia	2604	Pneumonia	2250	Pneumonia	2,778	Pneumonia	2,897	Pneumonia	2710
3	Respiratory Infections	1710	Respiratory infections	1837	Respiratory Infections	1,903	Respiratory Infections	2,475	Sepsis	1276
4	Cardio Pulmonary and Respiratory diseases	1043	Cardiorespiratory failure/Cardiopulmonary arrest	1515	Cardiopulmonary and Cardiorespiratory Arrest	1,408	Sepsis	1,310	Diarrhoea	808
5	Malaria	637	Neonatal Conditions	683	Neonatal Conditions	762	Cardiopulmonary and Cardiorespiratory Arrest	1,287	Neonatal Sepsis	704
6	Sepsis	526	Malaria	490	Sepsis	421	Diarrhea	634	Asphyxia	481
7	Anaemia	467	Anaemia	440	Heart Diseases	417	Anaemia	508	Anaemia	472
8	Neonatal Conditions	410	Meningitis	360	Anaemia	415	Gastroenteritis	468	Malaria	423
9	Meningitis	401	Sepsis	341	Malaria	412	Malaria	406	Cardiovascular Diseases	398
10	Gastroenteritis	347.0	Gastroenteritis	267	Meningitis	338	Meningitis	401	Meningitis	387

Table 6.11 and 6.12 indicate that prematurity and birth asphyxia and pneumonia remained the leading cause of death for both male and female in the period 2019 to 2023

Table 6.11: Ten Leading causes of medically certified causes of registered deaths for under 5 years males, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	N=10700	Cause of Death	N=8795	Cause of Death	N=9486	Disease	N =10,199	Cause of Death	N=10324
1	Prematurity & Birth asphyxia	1689	Prematurity & birth asphyxia	2173	Prematurity & Birth asphyxia	2,116	Prematurity & Birth Asphyxia	1,892	Prematurity and Asphyxia	1902
2	Pneumonia	1358	Pneumonia	1170	Pneumonia	1,410	Pneumonia	1,520	Pneumonia	1319
3	Respiratory Infections	907	Respiratory infections	851	Respiratory Infections	982	Respiratory Infections	1,240	Sepsis	683
4	Cardio Pulmonary and Respiratory diseases	539	Cardiorespiratory failure/Cardiopulmonary arrest	805	Cardiopulmonary and Cardiorespiratory Arrest	734	Cardiopulmonary and Cardiorespiratory Arrest	687	Diarrhoea	401
5	Malaria	342	Neonatal Conditions	339	Neonatal Conditions	397	Sepsis	626	Neonatal Sepsis	378
6	Anaemia	255	Malaria	238	Malaria	220	Diarrhea	304	Anaemia	244
7	Sepsis	254	Anaemia	235	Anaemia	219	Anaemia	279	Malaria	233
8	Neonatal Conditions	233	Meningitis	190	Heart Diseases	215	Gastroenteritis	238	Asphyxia	229
9	Meningitis	196	Sepsis	173	Sepsis	205	Malaria	233	Meningitis	224
10	Gastro-enteritis	172	Asphyxia	133	Meningitis	167	Meningitis	215	Cardiovascular Diseases	185

Table 6.12: Ten Leading causes of medically certified causes of registered deaths for under 5 years females, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=9738**	**Cause of Death**	**N=8329**	**Cause of Death**	**N=8946**	**Disease**	**N =9489**	**Cause of Death**	**N=9993**
1	Prematurity & Birth asphyxia	1792	Prematurity & birth asphyxia	1975	Prematurity & Birth asphyxia	2,123	Prematurity & Birth Asphyxia	1,749	Prematurity and Asphyxia	1923
2	Pneumonia	1246	Pneumonia	1080	Pneumonia	1,368	Pneumonia	1,377	Pneumonia	1391
3	Respiratory Infections	803	Respiratory infections	986	Respiratory Infections	921	Respiratory Infections	1,235	Sepsis	593
4	Cardio Pulmonary and Respiratory diseases	504	Cardiorespiratory failure/Cardiopulmonary arrest	710	Cardiopulmonary and Cardiorespiratory Arrest	674	Sepsis	684	Diarrhoea	407
5	Malaria	295	Neonatal Conditions	344	Neonatal Conditions	365	Cardiopulmonary and Cardiorespiratory Arrest	600	Neonatal Sepsis	326
6	Sepsis	272	Malaria	252	Sepsis	216	Diarrhea	330	Asphyxia	252
7	Anaemia	212	Anaemia	205	Heart Diseases	202	Gastroenteritis	230	Anaemia	228
8	Meningitis	205	Meningitis	170	Anaemia	196	Anaemia	229	Cardiovascular Diseases	213
9	Neonatal Conditions	177	Sepsis	168	Malaria	192	Meningitis	186	Malaria	190
10	Gastro-enteritis	175	Gastroenteritis	138	Meningitis	171	Malaria	173	Meningitis	163

6.2.6 Ten leading causes of registered deaths among children age 5-14 years

The leading causes of death for ages 5-14 shows a mixed pattern from 2019 to 2023. Malaria, pneumonia, anaemia and cardiopulmonary and cardio respiratory arrest was among the leading causes of death as presented in table 6.13.

Table 6.13: Ten Leading causes of medically certified causes of registered deaths for 5-14 years, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N = 4033**	**Cause of Death**	**N=3247**	**Cause of Death**	**N=3398**	**Disease**	**N = 3447**	**Cause of Death**	**N=3459**
1	Malaria	355	Anaemia	339	Pneumonia	362	Pneumonia	355	Pneumonia	306
2	Pneumonia	308	Malaria	329	Anaemia	311	Anaemia	321	Anaemia	297
3	Anaemia	284	Pneumonia	275	Cardiopulmonary and Cardiorespiratory Arrest	233	Cardiopulmonary and Cardiorespiratory Arrest	286	Malaria	212
4	Cardio Pulmonary and Respiratory diseases	209	Cardiorespiratory failure/Cardiopulmonary arrest	248	Malaria	195	Malaria	200	Cardiovascular Diseases	197
5	Respiratory Infections	195	Respiratory infections	150	Heart Diseases	142	Respiratory Infections	161	Sepsis	178
6	Meningitis	152	Road traffic accidents	125	Respiratory Infections	141	Injuries	132	Injuries	177
7	Cancer	99	Cancer	117	Meningitis	129	Diarrhea	116	Cancer	128
8	Injuries	98	Meningitis	114	Kidney & urinary tract infections	103	Meningitis	113	Meningitis	96
9	Heart Diseases	83	Injuries	96	Injuries	97	Road Traffic Accident	89	Road Traffic Accidents	72
10	Traffic Accidents	79.0	Heart diseases	78	Cancer	87	Cancer	81	Diarrhoea	67

From table 6.14 and 6.15, Malaria, Anemia and Pneumonia were the leading causes of death for this age group for both male and female with an interchanging pattern. However, Cardiopulmonary and cardiorespiratory arrest was the third leading cause of death in 2021 and 2022. Although road traffic accident was among the ten leading causes of death for males, in 2021 to 2023, it did not feature among the females

Table 6.14: Ten Leading causes of medically certified causes of registered deaths for 5-14 years males, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	N = 2218	Cause of Death	N=1815	Cause of Death	N=1871	Disease	N =1923	Cause of Death	N=1970
1	Malaria	190	Anaemia	184	Pneumonia	193	Pneumonia	188	Pneumonia	172
2	Anaemia	165	Malaria	172	Anaemia	182	Anaemia	177	Anaemia	167
3	Pneumonia	164	Pneumonia	142	Cardiopulmonary and Cardiorespiratory Arrest	132	Cardiopulmonary and Cardiorespiratory Arrest	145	Malaria	117
4	Cardio Pulmonary and Respiratory diseases	115	Cardiorespiratory failure/Cardiopulmonary arrest	135	Malaria	100	Malaria	113	Injuries	111
5	Respiratory Infections	115	Respiratory infections	75	Respiratory Infections	80	Respiratory Infections	86	Cardiovascular Diseases	105
6	Meningitis	90	Road traffic accidents	73	Heart Diseases	72	Injuries	79	Sepsis	100
7	Injuries	61	Cancer	72	Meningitis	66	Diarrhea	68	Cancer	80
8	Cancer	50	Injuries	66	Injuries	60	Meningitis	57	Meningitis	64
9	Traffic Accidents	46	Meningitis	64	Kidney & urinary tract infections	57	Road Traffic Accident	51	Road Traffic Accidents	42
10	Heart Diseases	37.0	Kidney and urinary tract infections	47	Road Traffic Accidents	53	Cancer	43	Tuberculosis	37

Table 6.15: ***Ten Leading causes of medically certified causes of registered deaths for 5-14 years females, 2019-2023***

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N = 1815**	**Cause of Death**	**N=1432**	**Cause of Death**	**N=1527**	**Disease**	**N = 1524**	**Cause of Death**	**N=1849**
1	Malaria	165	Malaria	157	Pneumonia	169	Anaemia	144	Pneumonia	134
2	Pneumonia	144	Anaemia	155	Anaemia	129	Pneumonia	167	Anaemia	130
3	Anaemia	119	Pneumonia	133	Cardiopulmonary and Cardiorespiratory Arrest	101	Cardiopulmonary and Cardiorespiratory Arrest	141	Malaria	95
4	Cardio Pulmonary and Respiratory diseases	94	Cardiorespiratory failure/Cardiopulmonary arrest	113	Malaria	95	Malaria	87	Cardiovascular Diseases	92
5	Respiratory Infections	80	Respiratory infections	75	Heart Diseases	70	Respiratory Infections	75	Sepsis	78
6	Meningitis	62	Road traffic accidents	52	Meningitis	63	Meningitis	56	Injuries	66
7	Cancer	49	Meningitis	50	Respiratory Infections	61	Injuries	53	Cancer	48
8	Heart Diseases	46	Cancer	45	Kidney & urinary tract infections	46	Diarrhea	48	Meningitis	32
9	Injuries	37	Heart diseases	39	Injuries	37	Heart Disease	40	Diarrhoea	31
10	Traffic Accidents	33.0	Injuries	30	Cancer	35	Sepsis	40	Liver Diseases	31

6.2.7 Ten leading causes of medically registered deaths among Age 15-49 Years

Age 15-49 years is the most productive age group in the human cycle. Analyzing the causes of death in this age group is therefore critical for specific interventions so as to improve their health, thereby reducing premature mortality. Men in this age group are more exposed to injuries and accidents due to the nature of their occupations hence more likely to die as a result of complications associated with such incidents. On the other hand, this being the childbearing age, women are more likely to die as a result of maternal and reproductive health-related complications. The information derived from such analysis is important in informing various interventions for programming for this population age set. Table 6.16 shows deaths from injuries and cancer has been on a rising trend from 2021 where they ranked position three (3) to position one (1) and position six (6) to position two (2) in 2023 respectively.

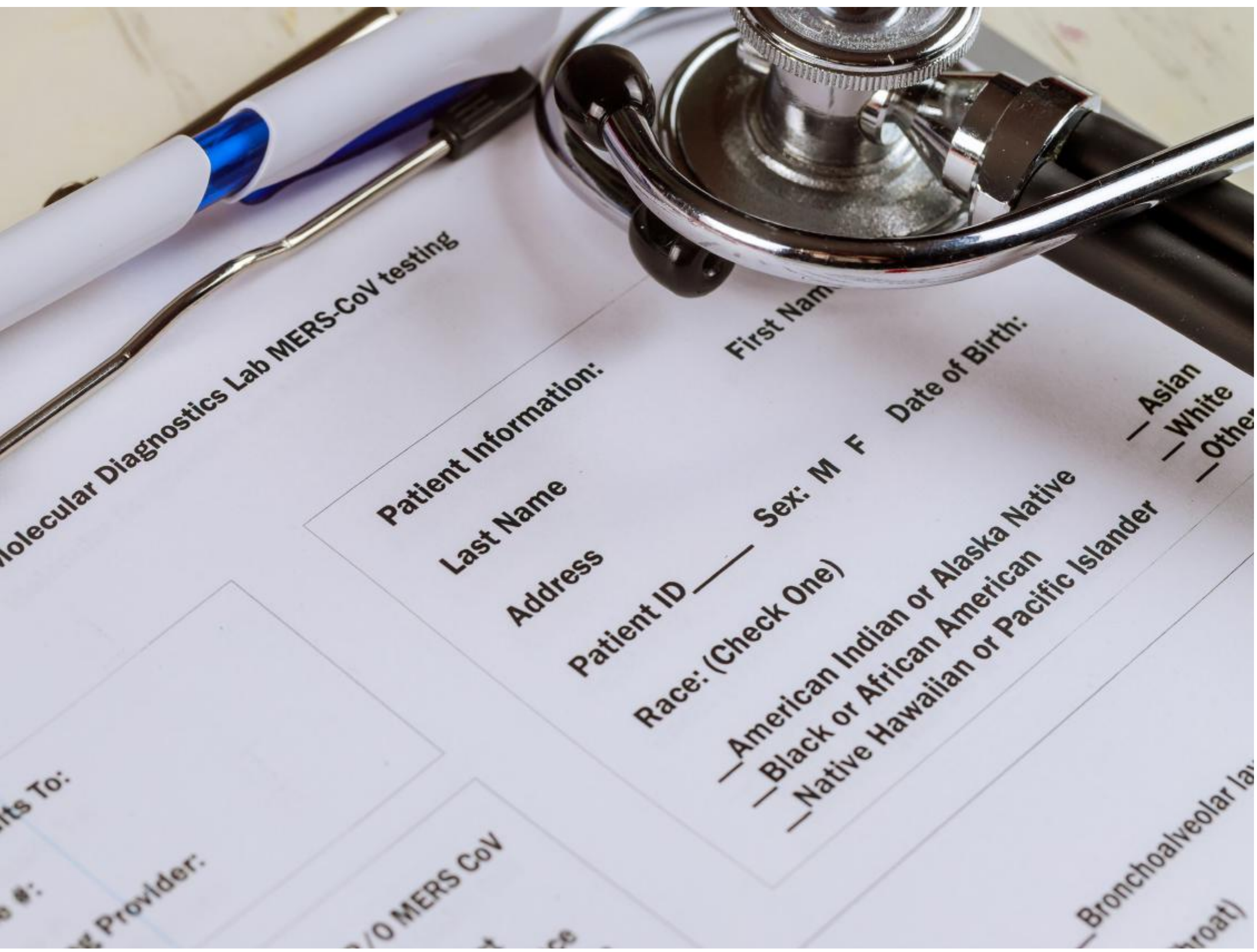


Table 6.16: Top leading causes of medically certified registered deaths for 15-49 years, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N = 35586**	**Cause of Death**	**N=32037**	**Cause of Death**	**N=35980**	**Cause of Death**	**N = 35263**	**Cause of Death**	**N=34317**
1	HIV/AIDS	1822	Cardiorespiratory failure/Cardiopulmonary arrest	2672	Pneumonia	3,043	Cardiopulmonary and Cardiorespiratory Arrest	3,109	Injuries	3039
2	Pneumonia	1738	Pneumonia	2118	Cardiopulmonary and Cardiorespiratory Arrest	2,639	Injuries	2,466	Cancer	2090
3	Injuries	1677	Cancer	1668	Injuries	1,841	Pneumonia	2,404	Pneumonia	2059
4	Tuberculosis	1573	Road traffic accidents	1661	Road Traffic Accidents	1,736	Respiratory Infections	1,595	Cardiovascular Diseases	1831
5	Traffic Accidents	1526	HIV/AIDS	1571	Respiratory Infections	1,597	Cancer	1,581	Sepsis	1460
6	Cancer	1451	Injuries	1406	Cancer	1,514	Road Traffic Accident	1,499	Tuberculosis	1454
7	Cardio Pulmonary and Respiratory diseases	1445	Respiratory infections	1335	Anaemia	1,397	Tuberculosis	1,457	Anaemia	1453
8	Meningitis	1406	Anaemia	1328	HIV/AIDS	1,281	Anaemia	1,421	Road Traffic Accidents	1364
9	Respiratory Infections	1236	Tuberculosis	1288	Heart Diseases	1,128	Meningitis	1,236	HIV/AIDS	1320
10	Anaemia	1198.0	Meningitis	1225	Meningitis	1,123	HIV/AIDS	1,147	Meningitis	938

Tables 6.17 and 6.18 show that deaths among males 15-49 years for the period under review are majorly caused by injuries, road traffic accidents, pneumonia and cardiopulmonary and cardiorespiratory arrest., Similarly the causes of death among females of the same age group are cardiopulmonary and cardiorespiratory arrest, pneumonia and cancer.

Table 6.17: ***Top leading causes of medically certified registered deaths for 15-49 years males, 2019-2023***

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N = 20442**	**Cause of Death**	**N=18618**	**Cause of Death**	**N=21283**	**Cause of Death**	**N =20804**	**Cause of Death**	**N=20326**
1	Injuries	1339	Road traffic accidents	1469	Pneumonia	1,745	Injuries	2,055	Injuries	2673
2	Traffic Accidents	1274	Cardiorespiratory failure/Cardiopulmonary arrest	1430	Injuries	1,629	Cardiopulmonary and Cardiorespiratory Arrest	1,636	Pneumonia	1209
3	Pneumonia	968	Injuries	1228	Road Traffic Accidents	1,496	Pneumonia	1,373	Road Traffic Accidents	1151
4	Tuberculosis	935	Pneumonia	1158	Cardiopulmonary and Cardiorespiratory Arrest	1,414	Road Traffic Accident	1,265	Cardiovascular Diseases	941
5	HIV	773	Tuberculosis	793	Respiratory Infections	905	Respiratory Infections	882	Tuberculosis	874
6	Cardio Pulmonary and Respiratory diseases	754	Respiratory infections	725	Tuberculosis	696	Tuberculosis	880	Cancer	821
7	Meningitis	688	HIV/AIDS	707	Anaemia	612	Meningitis	636	Sepsis	747
8	Respiratory Infections	662	Cancer	648	Covid 19	597	Anaemia	619	Anaemia	662
9	Cancer	601	Meningitis	575	Heart Diseases	592	Cancer	562	Liver Diseases	594
10	Anaemia	512.0	Anaemia	562	Cancer	588	HIV/AIDS	462	HIV/AIDS	579

Table 6.18: ***Top leading causes of medically certified registered deaths for 15-49 years females, 2019-2023***

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N = 15144**	**Cause of Death**	**N=13419**	**Cause of Death**	**N=14697**	**Cause of Death**	**N = 14459**	**Cause of Death**	**13991**
1	HIV	1049	Cardiorespiratory failure/Cardio-pulmonary arrest	1242	Pneumonia	1,298	Cardiopulmonary and Cardiorespiratory Arrest	1,473	Cancer	1269
2	Cancer	850	Cancer	1020	Cardiopulmonary and Cardiorespiratory Arrest	1,225	Pneumonia	1,031	Cardiovascular Diseases	890
3	Pneumonia	770	Pneumonia	960	Cancer	926	Cancer	1,019	Pneumonia	850
4	Meningitis	718	HIV/AIDS	864	Anaemia	785	Anaemia	802	Anaemia	791
5	Cardio Pulmonary and Respiratory diseases	691	Anaemia	766	HIV/AIDS	708	Respiratory Infections	713	HIV/AIDS	741
6	Anaemia	686	Meningitis	650	Respiratory Infections	692	HIV/AIDS	685	Sepsis	713
7	Tuberculosis	638	Respiratory infections	610	Meningitis	552	Meningitis	600	Tuberculosis	580
8	Respiratory Infections	574	Tuberculosis	495	Heart Diseases	536	Tuberculosis	577	Renal Diseases	437
9	Hypertension	426	Hypertension	481	Covid 19	471	Injuries	411	Meningitis	430
10	Injuries	338.0	Kidney and urinary tract infections	319	Tuberculosis	404	Hypertension	374	Hypertension	407

6.2.8 Ten leading medically certified causes of registered deaths among 50-59 Years

Table 6.19 shows that majority of the top ten causes of death in this age group are due to non-communicable causes: cancer, Hypertension, Diabetes, Cardiovascular diseases, and Kidney failure. Cancer was the leading cause of death in 2019 and 2023, while it was second in 2020 and 2022 and the third in 2021.Pneumonia has for the last four years maintained the top three position within the same age group for the period under review.

Table 6.19: Ten leading medically certified causes of registered deaths for 50-59 years

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N = 10668**	**Cause of Death**	**N=10406**	**Cause of Death**	**N=12698**	**Disease**	**N =11024**	**Cause of Death**	**N=11384**
1	Cancer	978	Cardiorespiratory failure/Cardiopulmonary arrest	1093	Pneumonia	1,407	Cardiopulmonary and Cardiorespiratory Arrest	1,210	Cancer	1278
2	Hypertension	591	Cancer	1040	Cardiopulmonary and Cardiorespiratory Arrest	1,143	Cancer	1,008	Cardiovascular Diseases	770
3	Cardio Pulmonary and Respiratory diseases	568	Pneumonia	810	Cancer	922	Pneumonia	781	Pneumonia	709
4	Pneumonia	556	Hypertension	631	Covid 19	898	Respiratory Infections	560	Hypertension	614
5	Respiratory Infections	413	Respiratory infections	482	Respiratory Infections	751	Hypertension	484	Sepsis	542
6	Tuberculosis	354	Diabetes	456	Hypertension	574	Injuries	400	Tuberculosis	420
7	Diabetes	353	Kidney and urinary tract infections	358	Diabetes	502	Anaemia	360	Anaemia	406
8	HIV	341	Anaemia	357	Heart Diseases	497	Tuberculosis	360	Renal Diseases	405
9	Anaemia	333	HIV/AIDS	355	Kidney & urinary tract infections	386	Diabetes	340	Injuries	395
10	Traffic Accidents	256.0	Tuberculosis	328	Anaemia	357	Diarrhea	339	Diabetes	351

Cancer was the leading cause of death in 2019, 2020, 2022 and 2023 among females, while for the males it was leading in 2019 and 2023. Pneumonia remained the top five cause of death among both sexes during the period under review.

Table 6.20: Ten leading medically certified causes of registered deaths for 50-59 years males 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	N = 6228	Cause of Death		Cause of Death	N=7539	Disease	N =6539	Cause of Death	N=6703
1	Cancer	484	Cardiorespiratory failure/Cardiopulmonary arrest	601	Pneumonia	870	Cardiopulmonary and Cardiorespiratory Arrest	726	Cancer	570
2	Pneumonia	345	Pneumonia	529	Cardiopulmonary and Cardiorespiratory Arrest	658	Pneumonia	499	Pneumonia	457
3	Hypertension	337	Cancer	459	Covid 19	562	Cancer	451	Cardiovascular Diseases	428
4	Cardio Pulmonary and Respiratory diseases	303	Hypertension	361	Respiratory Infections	457	Injuries	319	Hypertension	338
5	Tuberculosis	242	Respiratory infections	291	Cancer	419	Respiratory Infections	314	Sepsis	318
6	Respiratory Infections	199	Diabetes	274	Hypertension	299	Hypertension	249	Injuries	313
7	HIV	193	Tuberculosis	231	Heart Diseases	273	Tuberculosis	246	Tuberculosis	278
8	Traffic Accidents	190	Kidney and urinary tract infections	212	Diabetes	264	Diarrhea	200	Renal Diseases	248
9	Diabetes	177	HIV/AIDS	184	Kidney & urinary tract infections	235	Diabetes	186	Liver Diseases	228
10	Injuries	168.0	Covid 19	182	Tuberculosis	211	Anaemia	179	Anaemia	218
11			Road traffic accidents	182						

Table 6.21: Ten leading medically certified causes of registered deaths for 50-59 years females, 2019-2023

Rank	2019		2020		2021		2022		2023	
	Cause of Death	N = 4440	Cause of Death	N=4194	Cause of Death	N=5159	Disease	N =4485	Cause of Death	N=4680
1	Cancer	494	Cancer	581	Pneumonia	537	Cancer	557	Cancer	708
2	Cardio Pulmonary and Respiratory diseases	265	Cardiorespiratory failure/Cardiopulmonary arrest	492	Cancer	503	Cardiopulmonary and Cardiorespiratory Arrest	484	Cardiovascular Diseases	342
3	Hypertension	254	Pneumonia	281	Cardiopulmonary and Cardiorespiratory Arrest	485	Pneumonia	282	Hypertension	276
4	Respiratory Infections	214	Hypertension	270	Covid 19	336	Respiratory Infections	246	Pneumonia	252
5	Pneumonia	211	Respiratory infections	191	Respiratory Infections	294	Hypertension	235	Sepsis	224
6	Diabetes	176	Anaemia	185	Hypertension	275	Anaemia	181	Diabetes	189
7	Anaemia	169	Diabetes	182	Diabetes	238	Diabetes	154	Anaemia	188
8	HIV	148	HIV/AIDS	171	Heart Diseases	224	HIV/AIDS	151	HIV/AIDS	163
9	Tuberculosis	112	Kidney and urinary tract infections	146	Anaemia	169	Diarrhea	139	Renal Diseases	157
10	Meningitis	101.0	Tuberculosis	97	HIV/AIDS	155	Tuberculosis	114	Tuberculosis	142

6.2.9 Ten Leading Medically Certified Causes Of Registered Deaths Among 60 Years And Above

This section represents the leading causes of death for people aged 60 years and above. This age group is prone to non-communicable diseases and there is need to strengthen the health system to cater for their health needs. Cancer, Hypertension and Cardiovascular disease take prominence interchangeably as the leading cause of death for this age group during the reference period. Communicable diseases, Pneumonia, Tuberculosis, Respiratory infections also feature among the top ten causes of death within this age group as shown in Table 6.22.

Table 6.22: Ten leading medically certified causes of registered deaths for 60 years and above

Rank	2019		2020		2021		2022		2023	
	Cause of Death	N=37745	Cause of Death	N=34644	Cause of Death	N=51219	Cause of Death	N = 41557	Cause of Death	N=41306
1	Cancer	3203	Hypertension	3615	Pneumonia	7,878	Cardiopulmonary and Cardiorespiratory Arrest	5,087	Cardiovascular Diseases	4054
2	Pneumonia	2871	Cardiorespiratory failure/Cardiopulmonary arrest	3575	Cardiopulmonary and Cardiorespiratory Arrest	4,439	Pneumonia	4,807	Cancer	4051
3	Hypertension	2861	Pneumonia	3452	Covid 19	3,957	Cancer	2,867	Pneumonia	4022
4	Cardio Pulmonary and Respiratory diseases	1810	Cancer	3081	Hypertension	3,420	Hypertension	2,826	Hypertension	3321
5	Diabetes	1517	Diabetes	1849	Cancer	3,125	Respiratory Infections	2,409	Sepsis	2613
6	Respiratory Infections	1503	Respiratory infections	1800	Respiratory Infections	3,042	Diabetes	1,796	Diabetes	1698
7	Anaemia	1162	Kidney and urinary tract infections	1246	Heart Diseases	2,685	Anaemia	1,418	Renal Diseases	1657
8	Heart Diseases	1091	Heart diseases	1114	Diabetes	2,376	Heart Disease	1,125	Anaemia	1451
9	Stroke	684	Anaemia	1038	Kidney & urinary tract infections	1,492	Diarrhea	1,068	Tuberculosis	715
10	Traffic Accidents	674	Cerebrovascular diseases	775	Anaemia	1,286	Sepsis	993	Injuries	679

Table 6.23 and 6.24 shows that, Cancer, pneumonia and cardiopulmonary and cardiorespiratory arrest remained among the leading causes of death among both females and males. Hypertension is prominent among females under the reference period. While injuries feature among the top ten causes in 2022 and 2023 for males.

Table 6.23: Ten leading medically certified causes of registered deaths for 60+ years males

Rank	2019		2020		2021		2022		2023	
	Cause of Death	**N=20146**	**Cause of Death**	**N=18955**	**Cause of Death**	**N=28221**	**Cause of Death**	**N =22067**	**Cause of Death**	**21779**
1	Cancer	1883	Cardiorespiratory failure/Cardiopulmonary arrest	1942	Pneumonia	4,425	Cardiopulmonary and Cardiorespiratory Arrest	2,606	Cancer	2204
2	Pneumonia	1502	Pneumonia	1931	Cardiopulmonary and Cardiorespiratory Arrest	2,429	Pneumonia	2,597	Pneumonia	2152
3	Hypertension	1368	Cancer	1789	Covid 19	2,352	Cancer	1,572	Cardiovascular Diseases	1884
4	Cardio Pulmonary and Respiratory diseases	987	Hypertension	1754	Cancer	1,795	Respiratory Infections	1,309	Hypertension	1505
5	Respiratory Infections	825	Respiratory infections	1036	Respiratory Infections	1,724	Hypertension	1,283	Sepsis	1275
6	Diabetes	743	Diabetes	946	Hypertension	1,608	Diabetes	862	Renal Diseases	956
7	Anaemia	614	Kidney and urinary tract infections	811	Heart Diseases	1,327	Anaemia	804	Anaemia	789
8	Heart Diseases	542	Anaemia	558	Diabetes	1,175	Injuries	633	Diabetes	775
9	Traffic Accidents	385	Heart diseases	546	Kidney & urinary tract infections	915	Diarrhea	585	Tuberculosis	486
10	Tuberculosis	378	Tuberculosis	356	Anaemia	710	Kidney Diseases	525	Injuries	461

Table 6.24: Ten leading medically certified causes of registered deaths for 60+ years females

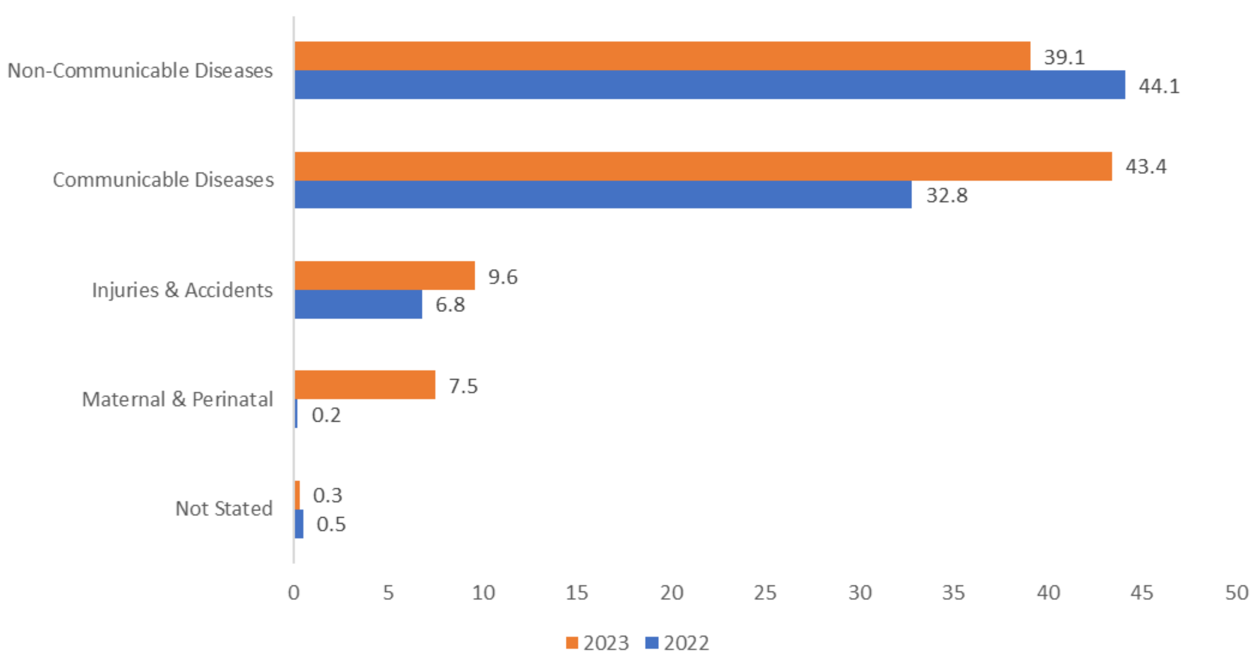
Rank	2019		2020		2021		2022		2023	
	Cause of Death	N=17599	Cause of Death	N=15689	Cause of Death	N=22998	Cause of Death	N =19490	Cause of Death	N=19527
1	Hyperten-sion	1493	Hypertension	1861	Pneumonia	3,453	Cardiopulmo-nary and Car-diorespiratory Arrest	2,481	Cardiovascular Diseases	2170
2	Pneumonia	1369	Cardiorespirato-ry failure/Cardio-pulmonary arrest	1633	Cardiopulmo-nary and Car-diorespiratory Arrest	2,010	Pneumonia	2,210	Pneumonia	1870
3	Cancer	1320	Pneumonia	1521	Hypertension	1,812	Hypertension	1,543	Cancer	1846
4	Cardio Pul-monary and Respiratory diseases	823	Cancer	1292	Covid 19	1,605	Cancer	1,295	Hypertension	1816
5	Diabetes	774	Diabetes	903	Heart Diseases	1,358	Respiratory Infections	1,100	Sepsis	1338
6	Respiratory Infections	678	Respiratory infections	764	Cancer	1,330	Diabetes	934	Diabetes	923
7	Heart Dis-eases	549	Heart diseases	568	Respiratory Infections	1,318	Heart Disease	618	Renal Diseases	701
8	Anaemia	548	Anaemia	480	Diabetes	1,201	Anaemia	614	Anaemia	662
9	Stroke	391	Kidney and urinary tract infections	435	Kidney & urinary tract infections	577	Diarrhea	483	Diarrhoea	275
10	Traffic Acci-dents	289	Cerebrovascular diseases	427	Anaemia	576	Sepsis	474	Liver Diseases	234

6.3 Causes Of Death According To Global Burden Of Disease Groups, All Ages 2022-2023

The Global Burden of Disease (GBD) study provides comprehensive data on the causes of death worldwide. GBD provides a comprehensive picture of mortality and disability across countries, time, age, and sex. The causes of death are categorized as communicable, non-communicable, maternal/perinatal, external injuries and nutritional deficiencies. The causes of death vary over time due to various factors such as advancements in healthcare, changes in lifestyle, and the emergence of new diseases. Figure 6.1 shows non-communicable diseases dropped to 39.1% from 44.1% in 2022. On the other hand, communicable diseases increased to 43.4% in 2023 from 32.8% in 2022. Injuries and accidents increased from 6.8% in 2022 to 9.6% in 2023.In addition, maternal and perinatal causes increased from 0.2% in 2022 to 7.5% in 2023.

The causes of death are categorized as communicable, non-communicable, maternal/perinatal, external injuries and nutritional deficiencies. The causes of death vary over time due to various factors such as advancements in healthcare, changes in lifestyle, and the emergence of new diseases.

***Figure 6.1:* Global burden of disease groups, 2022 - 2023**



6.4 Causes Of Registered Death With Special Programmes By Age, 2022 and 2023

The section presents causes of death under special programs in Kenya. These include Pneumonia, Asthma, Malaria, Tuberculosis, HIV/AIDS, Cancer, and Road traffic accidents (RTA).

Table 6.25 shows that causes of death due to HIV/AIDS and malaria increased among all the age groups while pneumonia, tuberculosis and RTAdeclined among all the age groups over the reference period.

Table 6.25: ***Causes of registered deaths with special programs by age and sex, 2022 and 2023***

Cause of Death	Asthma		HIV/AIDS		Malaria		Pneumonia		Tuberculosis		Road Traffic Accident	
Age	**2022**	**2023**	**2022**	**2023**	**2022**	**2023**	**2022**	**2023**	**2022**	**2023**	**2022**	**2023**
Neonatal	11	11	15	18	45	46	556	431	27	0	10	5
Under 1	6	7	7	7	142	144	1535	1506	69	44	8	8
Under 5	10	8	18	19	229	233	803	773	87	66	54	44
5-14	7	8	20	21	206	212	329	306	75	59	83	72
15-49	103	103	1223	1320	425	442	2291	2059	1730	1454	1610	1364
50-59	60	56	324	341	87	90	807	709	502	420	314	185
60+	212	217	325	351	335	339	4294	4022	916	715	949	251
Not Stated	7	7	24	25	27	30	170	160	45	40	43	31
Total	**416**	**417**	**1956**	**2102**	**1496**	**1536**	**10785**	**9966**	**3451**	**2798**	**3071**	**1960**

6.5 Causes Of Death From Foreign Deaths Registration

Table 6.26 presents registration of causes of death of Kenyan nationals who died abroad. In 2023, cancer, Pneumonia, Injuries, Respiratory infections, and Road Traffic Accidents were the leading top five causes of death, accounting for more than a quarter of the all deaths. Out of 13 deaths occurring from Road Traffic accidents, 12 were among males. This pattern is also reflected in injuries, respiratory infections and hypertension where more male deaths were registered. However, more cancer deaths were registered among females than in males.

Out of 13 deaths occurring from Road Traffic accidents, 12 were among males. This pattern is also reflected in injuries, respiratory infections and hypertension where more male deaths were registered

***Table 6.26:** Leading causes of foreign registered deaths, 2023*

Rank	Cause of Death	Male		Female		Both Sexes	
		N = 168	%	N = 102	%	N = 270	%
1	Cancer	8	42.1	11	57.9	19	7.0
2	Pneumonia	8	57.1	6	42.9	14	5.2
3	Injuries	10	76.9	3	23.1	13	4.8
4	Respiratory Infections	9	69.2	4	30.8	13	4.8
5	Road Traffic Accident	12	92.3	1	7.7	13	4.8
6	Heart Disease	8	66.7	4	33.3	12	4.4
7	Hypertension	7	70.0	3	30.0	10	3.7
8	Tuberculosis	4	57.1	3	42.9	7	2.6
9	Hemorrhage	4	66.7	2	33.3	6	2.2
10	Sepsis	2	33.3	4	66.7	6	2.2
11	Diabetes	2	50.0	2	50.0	4	1.5
12	Kidney Diseases	1	25.0	3	75.0	4	1.5
13	Stroke	3	75.0	1	25.0	4	1.5
14	Other Causes	90	62	55	37.9	145.0	53.7

6.6 Causes Of Registered Deaths In The Community

This section presents analysis of causes of death registered within the community by background characteristics. The data on community deaths are mainly sourced from lay reporting by Assistant Chiefs who are required to register deaths occurring within their communities. In this section, data regarding the ten leading causes of death by age and sex which occur outside medical facilities are presented.

The data on community deaths are mainly sourced from lay reporting by Assistant Chiefs who are required to register deaths occurring within their communities.

6.5.1 Ten leading causes of registered deaths from the community, 2023

Table 6.27 shows that the three leading causes of death were sudden death at 17.2 percent, pneumonia 15 percent and cancer 10.2 percent accounting for over 40 percent. among both males and females.

Table 6.27: Ten Leading causes of registered deaths in the community, 2023

	Male			Female			Both Sexes		
Rank	Cause of Death	N = 53,280	%	Cause of death	N = 39,600	%	Cause of Death	N = 92,880	%
1	Sudden Death	9,141	17.2	Sudden Death	6,813	17.2	Sudden Death	15,954	17.2
2	Pneumonia	7,703	14.5	Pneumonia	6,206	15.7	Pneumonia	13,909	15.0
3	Cancer	4,961	9.3	Cancer	4,540	11.5	Cancer	9,501	10.2
4	Malaria	4,666	8.8	Malaria	4,067	10.3	Malaria	8,733	9.4
5	Tuberculosis	2,711	5.1	Hypertension	2,841	7.2	Hypertension	4,705	5.1
6	Injuries	2,039	3.8	Anaemia	1,283	3.2	Tuberculosis	3,809	4.1
7	Hyperten-sion	1,864	3.5	Diabetes	1,229	3.1	Asthma	2,771	3.0
8	Asthma	1,552	2.9	Asthma	1,219	3.1	Anaemia	2,626	2.8
9	Anaemia	1,343	2.5	Tuberculosis	1,098	2.8	Diabetes*	2,424	2.6
10	Suicide	1,333	2.5	Stroke	1,025	2.6	Injuries *	2385	2.6

** Cause of death identified among top ten (10) in both sexes but not appearing as top 10 in one of the individual sex*

6.5.2 Leading Causes Of Registered Deaths For Neonates In The Community

Table 6.28 shows the leading causes of death among neonates was pneumonia at 45.2 percent, sudden death at 20.1 percent and malaria at 11.7 percent

Table 6.28: Ten leading causes of registered deaths in the community for neonates, 2023

	Male			Female			Both Sexes		
Rank	Cause of death	N = 1,033	%	Cause of death	N = 872	%	Cause of death	N = 1,905	%
1	Pneumonia	469	45.4	Sudden Death	6,813	17.2	Sudden Death	15,954	17.2
2	Sudden Death	207	20.0	Pneumonia	6,206	15.7	Pneumonia	13,909	15.0
3	Malaria	127	12.3	Cancer	4,540	11.5	Cancer	9,501	10.2
4	Prematurity and Asphyxia	42	4.1	Malaria	4,067	10.3	Malaria	8,733	9.4
5	Pregnancy/ Birth Complications	17	1.6	Pregnancy/ Birth Complications	15	1.7	Pregnancy/ Birth Complica-tions	32	1.7
6	Anaemia	14	1.4	Anaemia	14	1.6	Anaemia	28	1.5
7	Jaundice	14	1.4	Neonatal Sepsis	11	1.3	Jaundice	22	1.2
8	Asthma	14	1.4	Jaundice	8	0.9	Neonatal Sepsis	21	1.1
9	Neonatal Sepsis	10	1.0	Sepsis	7	0.8	Asthma	18	0.9
10	Tetanus	5	0.5	Asthma	4	0.5	Sepsis*	10	0.5

** Cause of death identified among top ten (10) in both sexes but not appearing as top 10 in one of the individual sex.*

6.5.3 Leading causes of registered deaths for under 1 year in the community

Table 6.29 shows the leading causes of death for under 1 year was Pneumonia (43.9%), Malaria (17.5%), and Sudden Death (15.7%).

Table 6.29: ***Ten leading causes of registered deaths for under 1 in the community, 2023***

	Male			Female			Both Sexes		
Rank	Cause of death	N=2722	%	Cause of death	N=2390	%	Cause of death	N=5112	%
1	Pneumonia	1,208	44.4	Pneumonia	1,037	43.4	Pneumonia	2,245	43.9
2	Malaria	493	18.1	Malaria	402	16.8	Malaria	895	17.5
3	Sudden Death	408	15.0	Sudden Death	396	16.6	Sudden Death	804	15.7
4	Anaemia	56	2.1	Anaemia	46	1.9	Anaemia	102	2.0
5	Prematurity and Asphyxia	42	1.5	Prematurity and Asphyxia	32	1.3	Prematurity and Asphyxia	74	1.4
6	Diarrhoea	33	1.2	Asthma	27	1.1	Diarrhoea	58	1.1
7	Asthma	31	1.1	Diarrhoea	25	1.0	Asthma	58	1.1
8	Jaundice	26	1.0	Jaundice	21	0.9	Jaundice	47	0.9
9	Heart Disease	22	0.8	Sepsis	21	0.9	Sepsis	41	0.8
10	Sepsis	20	0.7	Pregnancy Birth Complications	19	0.8	Pregnancy/ Birth Complica-tions	36	0.7

** Cause of death identified among top ten (10) in both sexes but not appearing as top 10 in one of the individual sex.*

6.5.4 Ten Leading causes of registered deaths in the community for under 5 Years

Pneumonia (37.9%), Malaria (20.6%), sudden death (14.8%), are the top leading causes of death among under 5 years in the community and accounts for more than 70% of registered deaths in this age group as presented in Table 6.30.

Table 6.30: Ten leading causes of registered deaths in the community for under 5 years, 2023

	Male			Female			Both Sexes		
Rank	Cause of death	N=4431	%	Cause of death	N=3847	%	Cause of death	N=8278	%
1	Pneumonia	1,691	38.2	Pneumonia	1,445	37.6	Pneumonia	3,136	37.9
2	Malaria	930	21.0	Malaria	778	20.2	Malaria	1,708	20.6
3	Sudden Death	634	14.3	Sudden Death	589	15.3	Sudden Death	1,223	14.8
4	Anaemia	119	2.7	Anaemia	121	3.1	Anaemia	240	2.9
5	Drowning	68	1.5	Drowning	43	1.1	Drowning	111	1.3
6	Asthma	52	1.2	Asthma	43	1.1	Asthma	95	1.1
7	Diarrhoea	50	1.1	Diarrhoea	35	0.9	Diarrhoea	85	1.0
8	Injuries	45	1.0	Prematurity and Asphyxia	32	0.8	Prematurity and Asphyxia	74	0.9
9	Prematurity and Asphyxia	42	0.9	Jaundice	30	0.8	Injuries	71	0.9
10	Jaundice	35	0.8	Sepsis	27	0.7	Jaundice	65	0.8

6.5.5 Ten Leading causes of registered deaths in the community for age 5-14 Years

Table 6.31 presents the top three leading causes of death among age 5-14 years were Malaria (19,7%), Pneumonia (17.1%) and Sudden Death (14.0%) accounting for more than 50% of registered deaths in this age group. Additionally, asthma was among top ten leading cause in males and not among females while tuberculosis was among the top leading cause of death among females and not among males.

Table 6.31: Ten leading causes of registered deaths in the community for 5-14 years, 2023

	Male			Female			Both Sexes		
Rank	Cause of death	N = 1,609	%	Cause of death	N = 1,206	%	Cause of death	N = 2,815	%
1	Malaria	312	19.4	Malaria	242	20.1	Malaria	554	19.7
2	Pneumonia	243	15.1	Pneumonia	238	19.7	Pneumonia	481	17.1
3	Sudden Death	235	14.6	Sudden Death	158	13.1	Sudden Death	393	14.0
4	Anaemia	109	6.8	Anaemia	92	7.6	Anaemia	201	7.1
5	Drowning	77	4.8	Cancer	36	3.0	Drowning	110	3.9
6	Injuries	56	3.5	Drowning	33	2.7	Injuries	78	2.8
7	Suicide	48	3.0	Tuberculosis	26	2.2	Cancer	73	2.6
8	Cancer	37	2.3	Epilepsy	23	1.9	Suicide	66	2.3
9	Epilepsy	27	1.7	Injuries	22	1.8	Epilepsy	50	1.8
10	Asthma	25	1.6	Suicide	18	1.5	Tuberculosis*	48	1.7

**The total includes both sexes although it doesn't appear among males as top 10.*

6.5.6 Ten leading causes of registered deaths in the community for age 15-49 years

Table 6.32 shows sudden death (16.3%), Pneumonia (10.5%), Malaria (8.0%) Cancer (7.7%) accounts for more than 40% of all deaths registered in the community among this age group. Suicide, Road traffic accidents and alcoholism are among the top ten causes of death among males but not among the females in this age category. On the other hand, HIV/AIDS, Hypertension and Asthma are among the top ten causes of death among females, but not among males in this age group.

Sudden death, Pneumonia, Malaria and Cancer account for more than 40% of all deaths registered in the community among the 15-49 Years age group

***Table 6.32:** Ten leading causes of registered deaths in the community for age 15-49 years, 2023*

Male				Female			Both Sexes		
Rank	**Cause of death**	**N = 16,894**	**%**	**Cause of death**	**N = 8,449**	**%**	**Cause of death**	**N = 25,343**	**%**
1	Sudden Death	2,790	16.5	Sudden Death	1,329	15.7	Sudden Death	4,119	16.3
2	Pneumonia	1,716	10.2	Cancer	1,075	12.7	Pneumonia	2,668	10.5
3	Injuries	1,568	9.3	Pneumonia	952	11.3	Malaria	2,026	8.0
4	Malaria	1,227	7.3	Malaria	799	9.5	Cancer	1,949	7.7
5	Tuberculosis	1,150	6.8	Tuberculosis	429	5.1	Injuries	1,751	6.9
6	Suicide	971	5.7	Anaemia	348	4.1	Tuberculosis	1,579	6.2
7	Cancer	874	5.2	Hypertension	326	3.9	Suicide *	1,127	4.4
8	Road Traffic Accidents	565	3.3	Asthma	255	3.0	Anaemia	726	2.9
9	Anaemia	378	2.2	HIV/AIDS	238	2.8	Road Traffic Accidents*	659	2.6
10	Alcoholism	339	2.0	Injuries	183	2.2	Asthma*	589	2.3

** Causes of death identified among top ten in both sexes but not appearing as top ten 10 in one of the individual sex*

6.5.7 Ten leading causes of registered deaths in the community among 50-59 Years

Table 6.33 shows Sudden Death (17.6%), Cancer (15.6%), Pneumonia (11.2%) accounts for more than 40% of the total deaths in this age category.

Table 6.33: ***Ten leading causes of registered deaths in the community for age 50-59 years, 2023***

	Male			Female			Both Sexes		
Rank	**Cause of death**	**N = 5,647**	**%**	**Cause of death**	**N = 2,899**	**%**	**Cause of death**	**N = 8,546**	**%**
1	Sudden Death	1,060	18.8	Cancer	634	21.9	Sudden Death	1,505	17.6
2	Cancer	696	12.3	Sudden Death	445	15.4	Cancer	1,330	15.6
3	Pneumonia	675	12.0	Pneumonia	286	9.9	Pneumonia	961	11.2
4	Tuberculosis	465	8.2	Hypertension	228	7.9	Malaria	587	6.9
5	Malaria	403	7.1	Malaria	184	6.3	Tuberculosis	574	6.7
6	Hypertension	222	3.9	Tuberculosis	109	3.8	Hypertension	450	5.3
7	Asthma	194	3.4	Diabetes	107	3.7	Asthma	285	3.3
8	Injuries	155	2.7	Asthma	91	3.1	Diabetes	240	2.8
9	Diabetes	133	2.4	Anaemia	81	2.8	Injuries*	184	2.2
10	Suicide	122	2.2	HIV/AIDS	70	2.4	Anaemia*	177	2.1

** Causes of death identified among top ten in both sexes but not appearing as top ten 10 in one of the individual sex*

6.5.8 Ten Leading causes of registered deaths in the community among 60 years and above

Table 6.34 presents the ten leading causes of registered death in the community for age 60 years and above. Sudden Death (18.1%), Pneumonia (14.0%), Cancer (12.9%), account for 45% of all the deaths registered in this age category for both sexes

Table 6.34: ***Ten leading causes of registered deaths in the community for age 60+ years, 2023***

Male				Female			Both Sexes		
Rank	Cause of death	N = 23,705	%	Cause of death	N = 22,473	%	Cause of death	N = 46,178	%
1	Sudden Death	4,199	17.7	Sudden Death	4,154	18.5	Sudden Death	8,353	18.1
2	Pneumonia	3,257	13.7	Pneumonia	3,188	14.2	Pneumonia	6,445	14.0
3	Cancer	3,252	13.7	Cancer	2,706	12.0	Cancer	5,958	12.9
4	Malaria	1,693	7.1	Hypertension	2,245	10.0	Malaria	3,661	7.9
5	Hypertension	1,398	5.9	Malaria	1,968	8.8	Hypertension	3,643	7.9
6	Tuberculosis	1,008	4.3	Diabetes	981	4.4	Diabetes	1,810	3.9
7	Asthma	925	3.9	Stroke	887	3.9	Asthma	1,712	3.7
8	Urinary Ob-struction	887	3.7	Asthma	787	3.5	Stroke	1,558	3.4
9	Diabetes	829	3.5	Anaemia	618	2.7	Tuberculosis*	1,505	3.3
10	Stroke	671	2.8	Complications of Old Age	555	2.5	Anaemia*	1,232	2.7

** Causes of death identified among top ten in both sexes but not appearing as top ten 10 in one of the individual sex*


Medical History
A. Your personal details
Please complete the following details for yourself as the main applicant/member.
Ms, other title)
include all forenames in full)
Male
Female
B. Additional member details
Please give details of additional members you wish to be covered.
Title, surname, first name(s)
Relationship to you
(partner, dependant)
Day
1
2
3
give us their name(s) and the full details for this section
have included additional family members, please tick this box.
FOR IN VITRO DIAGNOSTIC USE
LOT
Name/Nom/Nome
Date/Data
C. Your medical history
This section asks for health and medical details, past and present, about yourself and for each
Please tick Yes or No to every question for each person. If you tick Yes to a question, please
on the next page. If you are unsure whether any details are relevant, you must include them.
For any of the medical conditions or symptoms listed in questions 1 to 16 please indicate if:
Main applicant
~ you or anyone to be covered on your membership has seen a GP or other healthcare professional within the last two years
~ you or anyone to be covered on your membership has been admitted to hospital, had an operation OR any investigations (for example scan. X-ray, blood test biopsy) within the last
Name
Yes
No
1. Heart or cardiovascular disorders eg coronary artery disease, chest pains, circulation problems, varicose veins, high blood pressure, venous ulcers
2. Glandular disorders eg diabetes, thyroid, hormonal problems

CHAPTER SEVEN

Conclusion and Recommendations

7.1 Introduction

This chapter presents conclusion and recommendations on the findings on civil registration and vital statistics based on KVSR 2023. The findings are useful for planning and improving the civil registration and vital statistics systems in the country.

7.2 Conclusion

7.2.1 Birth Registration

Kenya has made a lot of efforts to increase Birth registration coverage in the country through various strategies. Despite these efforts, in 2023 the national birth registration completeness declined to 77.1 percent from 83.1 and 80.6 percent in 2021 and 2022 respectively. County disparities in birth registration were also evident in 2023 with only 12 counties attaining a registration completeness above 90 percent while twenty-three (23) counties attained completeness above the national registration completeness (77.1 percent).

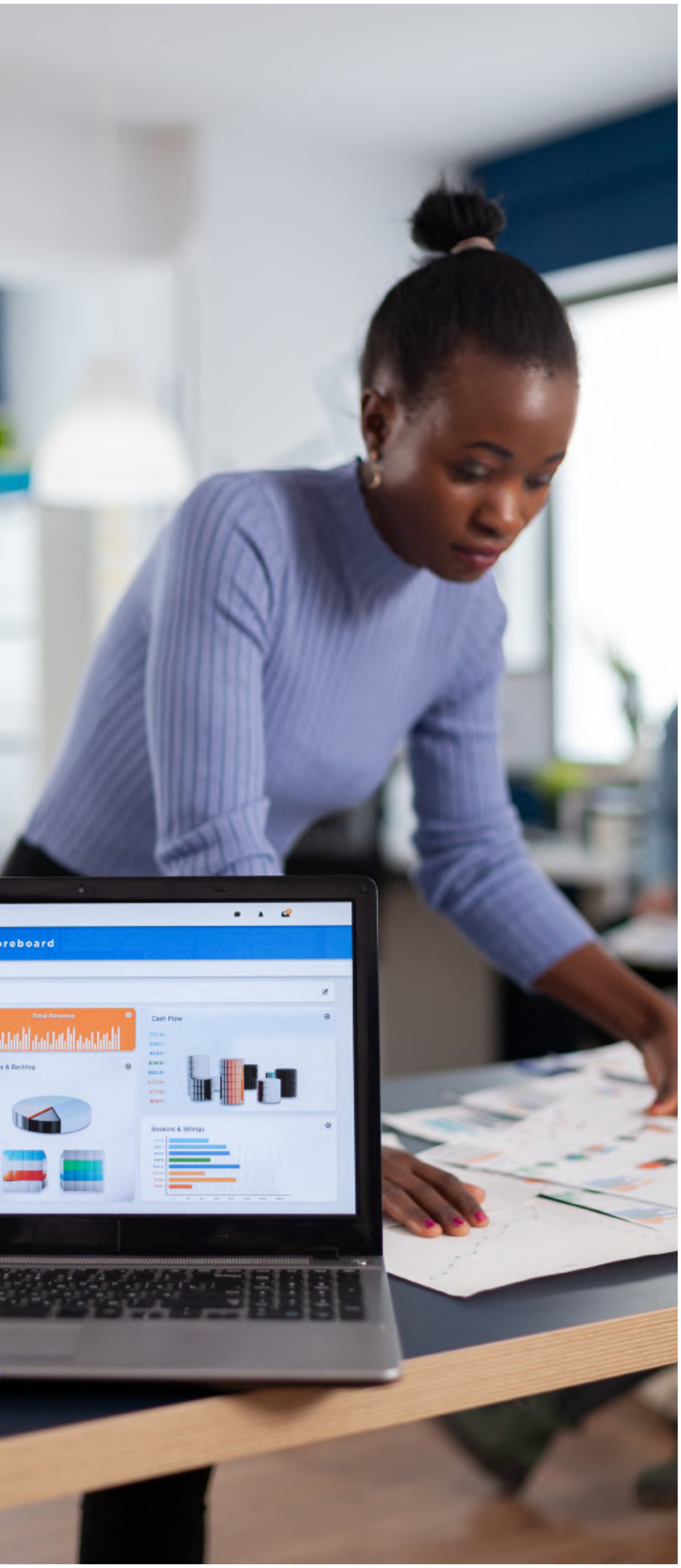
The report shows a national sex ratio of 104 where 29 counties are in the expected normal sex ratio levels. However, some counties have lower or higher than the

Some counties have lower or higher than the normal range which is an indication of over-reporting or under-reporting of male births

normal range which is an indication of over-reporting or under-reporting of male births. Registration of Health facility Births have continued to increase while community births have been on a decline which can be attributed to government policy in ensuring that women access skilled delivery in the health facilities.

Majority of registered births were from women aged 20-24 which resonates to KDHS and KPHC. Women with secondary level of education contributed the largest number of registered births at 42%.

Registration of Health facility Births have continued to increase while community births have been on a decline which can be attributed to government policy in ensuring that women access skilled delivery in the health facilities



7.2.2 Death Registration

Death registration completeness declined from 47.6 in 2022 to 45.1 in 2023. Most of the counties recorded a decline in death registration completeness. Only Mombasa and Uasin Gishu counties recorded completeness above 80 percent at 83.1 and 87.8 percent respectively. Deaths occurring at health facilities increased from 53.0 percent in 2022 to 54.9 percent in 2023. Counties with relatively high deaths from the community were Mandera (88.8%), Wajir (85.2%) and Vihiga (76.3%). Death registration across the counties indicates that more male than female deaths were registered, with an average national sex ratio of 128 at death.

7.2.3 Causes Of Death

Pneumonia was the leading cause of death for the medically certified causes of death while Sudden death was the leading cause of registered deaths in the community in the year 2022 and 2023. Cancer and cardiovascular diseases contributed to the highest percentage of non- communicable diseases. Causes of death according to the global burden of diseases accounted for the highest proportion of deaths, with communicable diseases contributing 43.4% and non-communicable diseases accounting for 39.1%.

7.3 Recommendations

Based on the issues observed in the process of developing the 2023 KVSR as well as the results from the analysis of the 2023 data, the following recommendations are made;

1. Automation of CRS business process;
2. Provide a continuous capacity building to all the relevant personnel involved in the registration process (data capture, reporting, analysis and ICD 11 coding)
3. Migrate from the current MS Excel data entry software to an advanced software such as CSPro or Survey Solution.
4. Build capacity of CRS staff at the field and national levels on data management using SPSS, R or Stata;
5. Increase budgetary allocation to the department (development and recurrent)
6. CRS to make provision for compilation of marriage statistics in the annual summary and report (KVSR)
7. Undertake further analysis or studies using the 2023 KVSR report in order to interrogate the trends on counties with extreme disparities in completeness and various characteristics.
8. There is a need for Community engagement and sensitization on the importance of registration.
9. The 2023 KVSR report, informational products (Factsheets, policy briefs) to be disseminated to policy makers and other stakeholders at National and counties to promote evidence-based decision making.
10. Implement verbal autopsy to improve the quality of community causes of death.
11. Conduct quarterly data reviews and harmonization forums between CRS, NGA, KNBS and MOH at National and counties
12. Conduct supportive monitoring on implementation of the newly introduced data collection software (CSpro).

Death registration across the counties indicates that more male than female deaths were registered, with an average national sex ratio of 128 at death

Pneumonia was the leading cause of death for the medically certified causes of death while Sudden death was the leading cause of registered deaths in the community in the year 2022 and 2023

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Appendices

A. Birth And Death Registration Forms

Appendix A1: Form B1

FORM B1

REPUBLIC OF KENYA
THE BIRTHS AND DEATHS REGISTRATION ACT
(Cap. 149)

ORIGINAL

ACKNOWLEDGEMENT OF BIRTH NOTIFICATION (FOR PARENTS)

Serial

1. NAME OF CHILD: ……………………………………………………………………………
First name Other name Father's *(surname or tribal) name*

2. DATE OF BIRTH : .... 3. SEX:* Male □ Female □
Day month year

5. NATURE OF BIRTH: Born alive □ Born dead □

7. NAME OF MOTHER ……………………………………………………………………………
First name Maiden name Father's *(surname or tribal) name*

I certify that the above information has been notified and recorded.

17. DATE .... 18. REGISTRATION ASSISTANT FOR: 19. NAME AND SIGNATURE
Day month year (state sub-location or health institution)

…………………………………………………… ……………………………………

See Instruction III (b) on the cover.
Note.-To obtain a birth certificate, present this notification to the District Registrar of Births where this birth occurred.

FORM B1

REPUBLIC OF KENYA
3E BIRTHS AND DEATHS REGISTRATION ACT
(Cap. 149)
REGISTER OF BIRTH

ORIGINAL

SAMPLE

Serial

CHILD

1. NAME ……………………………………………………………… 2. DATE OF BIRTH ……………………………………
First name Other name Father's (surname or tribal) name Day Month Year

3. SEX: 1 Male □ 2 Female □ 4. TYPE OF BIRTH: 1 Single □ 2 Twin □ Other, specify ………………… 5. NATURE OF BIRTH 1 Born alive □ 2 Born dead □

6. PLACE OF BIRTH ……………………………………………………………/……………………………
Sub-location or Estate and town or health institution District

MOTHER

7. NAME ……………………………………………………………………… 8. AGE ... ……………………
First name Maiden name Father's *(surname or tribal) name*

9. IS MOTHER MARRIED TO FATHER?* Yes □ No □ 10. RESIDENCE ……………………………… ……………...
Sub-location or Estate or town District

11. PREVIOUS BIRTHS TO MOTHER: (excluding current one) No. born alive .... No. born dead ……………………...

FATHER

12. NAME ……………………………………………………………………………………………
First name Other name Father's *(surname or tribal) name*

INFORMANT

13. NAME ……………………………………………………………………………………………
First name Other name Father's *(surname or tribal) name*

14. CAPACITY OF INFORMANT'
1 Parent □ 2 T.B.A. □ 3 Midwife □ 4 Medical Attendant □ Other, specify ……………………………….□ 5

REGISTRATION ASSISTANT

I certify that to the best of my knowledge the information given above is correct. 15. DATE .... 16. SIGNATURE
Day month year ………………………………………..

REGISTRAR

17. DATE .... 18. REGISTRATION ASSISTANT FOR 19. NAME AND SIGNATURE
Day month year (state sub-location or health institution)
…………………………………………………………… ……………………………………

20. DISTRICT .... 21 REGISTRATION NO. ……………………………………

22. DATE .... 23. NAME .... 24. SIGNATURE ……………………………

* Cross the appropriate box, thus (x).
If mother is not married to father, do not insert the name of father

GPK(L)

Pg 1 of 2

Appendix A2: Form D1

FORM D1

REPUBLIC OF KENYA

THE BIRTHS AND DEATHS REGISTRATION ACT
(*Cap.* 149)

PERMIT FOR BURIAL

IP Number ....

1. NAME OF DECEASED ....
First Name   Middle Name   Father's or husband's name

2. IDENTIFICATION /PASSPORT NUMBER ....

4. SEX: Male ☐ Female ☐ 5. AGE .... 6. DATE OF DEATH ....
Years /Months/ Days   Day /Month /Year

9. USUAL RESIDENCE ....
Sub-location or estate and town   Sub-county

After making due inquiry as to cause of the death of the above named deceased person, I hereby authorize the interment of the body.

18. DATE..   19. REGISTRATION ASSISTANT FOR: 20. SIGNATURE
Day /Month/ Year
....

PERMIT ISSUED TO (NAME): .... ID No. .... SIGNATURE ....

Note.— To obtain death certificate, present this permit to the Sub-county Registrar of Deaths in the Sub-county where this death occurred

FORM DI

REGISTER OF DEATH
(for use in health institutions and by Medical Practitioners)

Serial No. DA 0958801   **IP Number** ....

SAMPLE

1. NAME OF DECEASED ....
First Name   Middle Name   Father's or husband's name

2. IDENTIFICATION /PASSPORT NUMBER .... 3. NATIONALITY ....

4. †SEX: Male ☐   Female ☐ .... 5. AGE .... 6. DATE OF DEATH
Years /Months /Days   Day /Month /Year

7. MARITAL STATUS: (a) Married ☐ (b) Divorced ☐ (c) Single ☐ (d) Widowed ☐

8. PLACE OF DEATH../ ....
Health Institution/Sub-location or estate and town.   Sub-county

9. USUAL RESIDENCE ..../ ....
Sub-location or estate and town   Sub-county

10. LEVEL OF EDUCATION .... 11. OCCUPATION ....

MEDICAL CERTIFICATION

12. CAUSE OF DEATH (PRINT IN BLOCK LETTERS, DO NOT ABBREVIATE) ....
IMMEDIATE CAUSE: disease or condition directly leading to death (a) ....
Due to
ANTECEDENT CAUSES: Morbid conditions, if any, which gave rise to immediate cause (a)
(b) ....
Due to (stating the underlying condition last)
(c) ....
OTHER SIGNIFICANT CONDITIONS: Contributing to death but not related to (a) ....

13. CERTIFICATE: I certify that:

Tick as Appropriate
- (a) I attended the deceased before death or
- (b) I examined the body after death; or
- (c) I conducted a post-mortem examination of the body, and that the above information is correct to the best of my knowledge.

14. NAME .... 15. TITLE ....
16. DATE .... 17. SIGNATURE ....

REGISTRATION ASSISTANT

18. DATE .... 19. REGISTRATION ASSISTANT FOR: 20. SIGNATURE.......................
Day/ Month/Year   (Name of health institution)
....

REGISTRAR

21. SUB-COUNTY .... 22. REGISTRATION No. ....
23. DATE .... 24. NAME .... 25. SIGNATURE ....

*If the deceased was a married woman, husband's name can be written, †cross the appropriate box, thus ☒

GPK (SP) 7106—80m Bks. —8/14

Appendix A3: Form D2:

FORM D2

REPUBLIC OF KENYA

THE BIRTHS AND DEATHS REGISTRATION ACT

(*Cap*. 149)

PERMIT FOR BURIAL

Serial No.

1. NAME OF DECEASED ....
First Name Middle Name *Father's or husband's name

2. IDENTIFICATION /PASSPORT NUMBER ....

4. SEX: Male ☐ Female ☐ 5. AGE ....6. DATE OF DEATH ....
Years/Months/Days Day Month Year

9. USUAL RESIDENCE ....
Sub-location or estate and town Sub-county

After making due inquiry as to cause of the death of the above named deceased person, I hereby authorize the interment of the body

17. DATE.. 18. REGISTRATION ASSISTANT FOR: 18. SIGNATURE
Day/Month/ Year (Name of Sub-location)

....

PERMIT ISSUED TO (NAME): .... ID No. .... SIGNATURE ....

Note.— To obtain death certificate, present this permit to the Sub-county Registrar of Deaths in the Sub-county where this death occurred

---

FORM D2

REPUBLIC OF KENYA

THE BIRTHS AND DEATHS REGISTRATION ACT

(*Cap*. 149)

REGISTER OF DEATH

(for use by Registration Assistants for home death)

Serial No. 0798926

SAMPLE

1. NAME OF DECEASED ....
First Name Middle Name *Father's or husband's name

2. IDENTIFICATION /PASSPORT NO. .... 3. NATIONALITY ....
(ID to be surrendered)

4. †SEX: Male ☐ Female ☐ 5. AGE.........../........./........ 6. DATE OF DEATH.........../............../..................
Years Months Days Day Month Year

7. MARITAL STATUS: (*a*) Married ☐ (*b*) Divorced ☐ (*c*) Single ☐ (*d*) Widowed ☐

8. PLACE OF DEATH. ..../..
Sub-location or estate and town. Sub-county

9. USUAL RESIDENCE ..../..
Sub-location or estate and town Sub-county

10. LEVEL OF EDUCATION.. 11. OCCUPATION ....

12A. NATURAL CAUSES*

Malaria	☐	Anaemia	☐	Cancer	☐
Pneumonia	☐	Jaundice	☐	Urinary Obstruction	☐
Measles	☐	Child/pregnancy/birth	☐	AIDS	☐
Tetanus	☐	Sudden death	☐	Malnutrition	☐
Tuberculosis	☐	Alcoholism	☐	Asthma	☐

Other known cause, specify ....

I am satisfied after the above-mentioned death is not one to which section 386 or 387 of the Criminal Procedure Code (*Cap*.75) apply. An external examination of the body has/has not been made by a medical practitioner.

CAUSE OF DEATH

12B. UNNATURAL CAUSES*

Accident	☐	Motor Vehicle	☐	House fire	☐
Poisoning	☐	Attacked by animal or snake	☐		
Suicide	☐	Drowning	☐	Other known cause, specify	

I certify that provisions of *Cap*. 75 have been observed.

Name .... Date .... Signature ....
(Police Officer or Magistrate)

INFORMANT

13. NAME ....
First Name Middle Name *Father's or husband's name

14. CAPACITY OF INFORMANT
RELATIVE ☐ VILLAGE ELDER ☐ Other, specify ....

15. DATE .... 16. SIGNATURE OF INFORMANT ....

REGISTRATION ASSISTANT

17. DATE .... 18. REGISTRATION ASSISTANT FOR: 19. SIGNATURE
Day/Month/Year *(Name of Sub-location)*

....

REGISTRAR

20. SUB-COUNTY .... 21. REGISTRATION No. ....

22. DATE .... 23. NAME .... 24. SIGNATURE ....

*If the deceased was a married woman, husband's name can be written, +cross the appropriate box, thus ☒

GPK (SP) 7105—80m Bks.—8/14

Appendix A4: Form BDA1 - Application For Registration Of Birth Of A Citizen Of Kenya Occurring Abroad

FORM BDA 1

REPUBLIC OF KENYA

THE REGISTRATION OF BIRTHS AND DEATHS ACT

(*Cap.* 149)

APPLICATION FOR REGISTRATION OF BIRTH OF A CITIZEN OF KENYA OCCURRING ABROAD

SAMPLE

The following information concerning the birth must be supplied:-

1. FULL NAME OF CHILD	Baptismal or given Name (s)	Middle or tribal Surname Name	Son Of Daughter of	Surname or Tribal Name of Father of Child
2. DATE OF BIRTH	Date of Month :	Month :	Year	3. SEX OF CHILD Male .. I Female .. 2
4. FULL NAME FATHER OF CHILD	Baptismal or given Name (s)	Middle or tribal name	Son of	Surname or Tribal Name of his Father
5. FULL NAME MOTHER OF CHILD	Baptismal or given Name (s)	Middle or tribal name	Daughter of	Maiden Surname or Tribal Name of her Father
6. EXACT PLACE AND COUNTRY OF BIRTH				
7. NORMAL RESIDENCE IN KENYA OF MOTHER				

08. CERTIFICATES

A—*Informant*

I certify that I am (State relationship to child or capacity in which information given) ....

....

and that the above information is correct to the best of my knowledge.

Signature ....Full Name...

Address ....Date ……………………………………….

B.-By member of Kenya Mission abroad.

I am satisfied from evidence produced to me and inquiries which I have made that the above information is correct to the best of my knowledge.

Signature ....

Designation and Address………………………………………………….

……………………………………………………………………………

……………………………………………………………………………..

Appendix A5: Form Bda2 - Application For Registration Of A Death Of A Citizen Of Kenya Occurring Abroad

REPUBLIC OF KENYA

FORM BDA 2

APPLICATION FOR REGISTRATION OF DEATH OF A CITIZEN OF KENYA OCCURRING ABROAD

THE FOLLOWING INFORMATION CONCERNING THE DECEASED MUST BE SUPPLIED		
1.Full Name of Deceased	Baptismal or Given Name(s) Middle or Tribal Name	Surname, or Tribal Name Son of of Father Daughter of
2. Date of Death	Date of Month Month Year	3. Sex of Deceased Male 1 ☐ Female 2 ☐
4. Age of Deceased	Years (If under one year state in Months ...………………….... or Days)…………………...)	5. Occupation of Deceased
6. Exact Place and Country of Death		
7. Deceased's Normal Residence in Kenya		

8. If Death certified by Medical Practitioner
A. Cause of Death-Enter one cause per line

		Interval between onset and death.
1. Immediate cause	(a)………………………………………....	………………………………………...………
Due to	(b) ……………………………………………..	………………………………………………...…
Due to	(c) ……………………………………………..	…………………………………………………….

II. Other significant conditions.

B. Name and Address of certifying Doctor ……………………………………………………………………………………

…….

9. If death not certified by Medical Practitioner state apparent cause of death ....

………..

………..

………..

10. CERTIFICATES

(a) Informant.

I certify that I am *(State relationship to deceased or capacity in which information given)*………………………………......

…….

and that the above information is correct to the best of my knowledge.

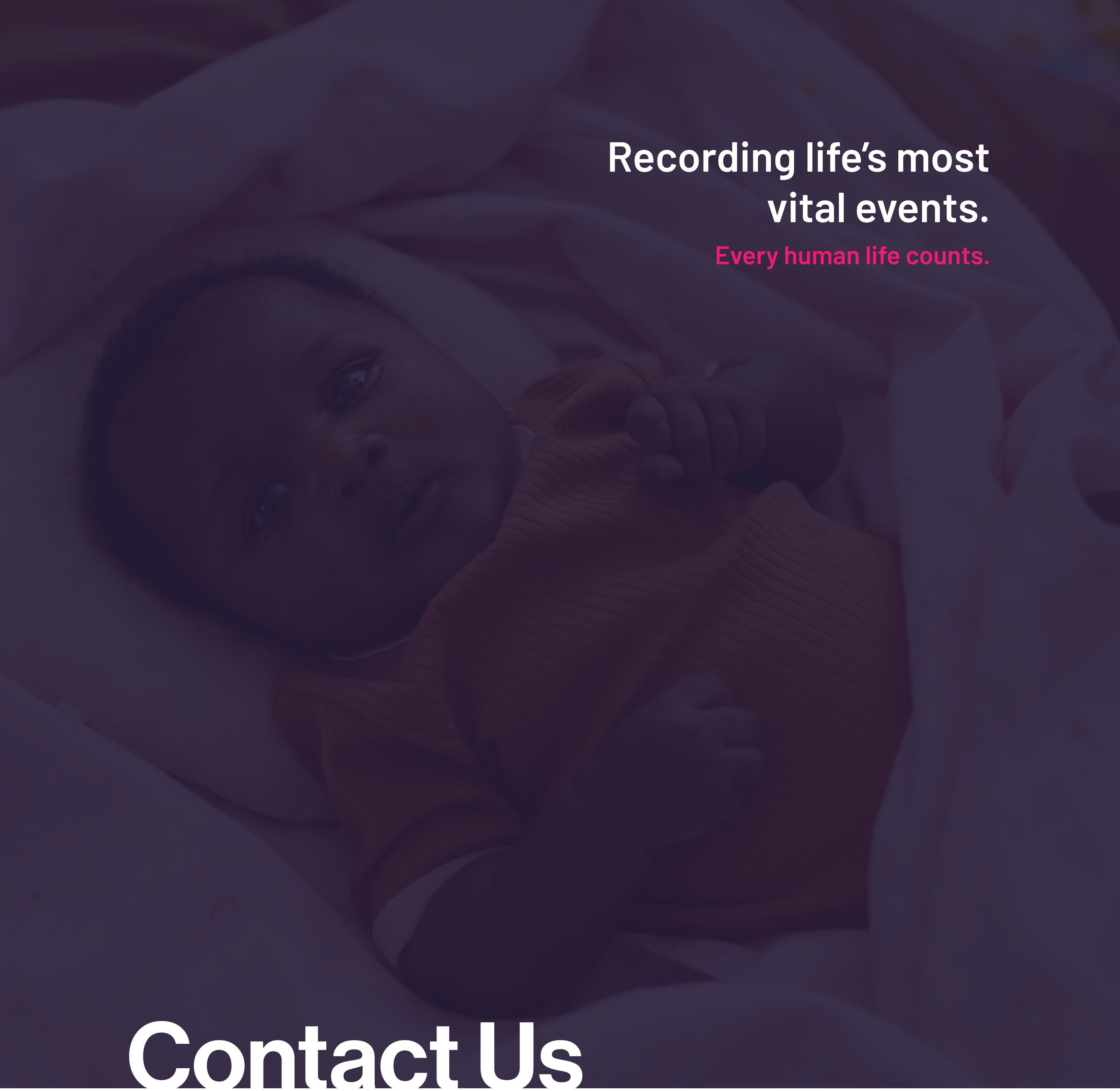
Signature ....Full Name …………………... ………………………………..............

Address ....Date …………………………………………………..

(b) By member of Kenya Mission abroad.
I am satified from evidence produced to me and inquiries which I have made that the above information is correct 'to the best of my knowledge

SAMPLE

Partners



Contact Us

REPUBLIC OF KENYA

Department of Civil Registration
Hass Plaza 4th Floor,
Lower Hill Road
P.O Box 49179- 00100 Nairobi

SCAN ME

ISBN 978-9914-9650-0-1

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NORTHERN CORRIDOR
TRANSIT AND TRANSPORT
COORDINATION AUTHORITY

SURVEY REPORT ON PRIORITY BLACK SPOTS
ALONG THE NORTHERN CORRIDOR ROUTE IN KENYA

February 2020

NORTHERN CORRIDOR TRANSIT AND
TRANSPORT COORDINATION AUTHORITY

SURVEY REPORT ON PRIORITY BLACK SPOTS ALONG THE NORTHERN CORRIDOR ROUTE IN KENYA

February 2020

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FOREWORD

On behalf of the Permanent Secretariat of the ACTTC-CN I am pleased to present the report on the ten (10) priority black spots along the Northern Corridor route in the member state of Kenya. This report is in line with the NCTTCA 2017-2021 Strategic Plan especially under its strategic objective # 2 related to improving safety in all modes of transport. In addition it meets one of the recommendations of NCTTCA Executive Committee which considers road safety as a major concern within the Northern Corridor member states, thus relaying the charter on road safety adopted at the African Union level during its Summit held in Addis Ababa, Ethiopia, 31 January, 2016.

Data from National Transportation Safety Authority (NTSA) indicates that in Kenya, traffic accidents cause more than 3,000 deaths yearly with a huge impact on health and development. Conducting a survey to identify black spots is therefore a crucial step in discovering the real causes of accidents, with a view of proposing adequate measures to mitigate the risks and damage observed along the Northern Corridor route.

Surveys in Kenya have shown that the factors at the origin of accidents come either from the careless driving, or from vehicles condition, or from road infrastructure conditions, and finally from pedestrians behavior. Based on the findings at each black spot surveyed, this report suggests specific recommendations for improvement of the situation observed.

For better management of black spots Guidelines will also be developed. They will reflect our conviction that most issues related to road safety can be resolved if the Government, in collaboration with the development partners and the NCTTCA join their efforts and work to educate road users on road safety by enforcing the regulations in our member states.

I would be remiss if I did not mention that this report is the result of close collaboration between the Permanent Secretariat of NCTTCA, Kenya National Highways Authority of (KeNHA), National Transport Safety Authority (NTSA), Kenya National Police and Kenya Transporters Association (KTA) whom I would like to thank in particular for their active participation in the surveys conducted in Kenya from March 4 to 8, 2019 but also, for their inputs to this report.

I finally renew NCTTCA commitment to work with our member states and development partners towards improvement of road safety along the Northern Corridor.

Omae NYARANDI
Executive Secretary.

EXECUTIVE SUMMARY

The Northern Corridor Transit and Transport Coordination Authority Permanent Secretariat in collaboration with Kenya National Highways Authority (KeNHA), National Transport and Safety Authority (NTSA), Kenya Transporters Association (KTA) and the Kenya Traffic Police conducted a survey on priority black spots along the Northern Corridor route in Kenya, from 4th to 8th March, 2019.

Prior to the survey, a joint study conducted by Safe Way Right Way (SWRW), National Transport and Safety Authority (NTSA), Kenya National Highways Authority (KeNHA), Kenya Urban Roads Authority (KURA) and Kenya Traffic Police mapped out a total of one hundred and ninety nine (199) hazardous (black) spots along the Kenyan Northern Corridor and around Nairobi County.
The ten (10) priority black spots along the Northern Corridor were identified on the basis of crash frequency, crash rate, crash severity and intensity (Equivalent Property Damage Only (EPDO) index), in a study carried out by KeNHA in September 2016.

The objectives of the Survey were to; confirmation of priority Hazardous (Black) spots; diagnosis of crashes to establish likely cause of accidents; propose appropriate remedial measures to address safety concerns; prepare country guidelines on Hazardous (Black) Spots Management (BSM) along the Northern Corridor route in Kenya; and advocate for funds mobilization in order to address safety concerns at priority black spots identified in Kenya.

The methodology of the survey involved; review of existing Road Safety Studies and Audit Reports (Reports by KeNHA and NTSA); collection and analysis of collision data; site inspections and identification of safety deficiencies; and recommendation of appropriate remedial measures. The survey team adopted simplified checklist which was used to record features of the road environment, that is, geometric alignment, junction configuration, road furniture etc; traffic conditions and general road user behavior; interaction between vehicles and non-motorized traffic including pedestrian crossing habits; and previous site conditions that have since been rectified.

The Survey team made stops and assessed all the earmarked locations in a bid to further assess and diagnose the spots for possible remedial actions. At each stage, detailed observations were made by all participating experts. For every location, a discussion on likely causes of accidents ensued to consensually agree on factors might be contributing to crash occurrences.

The survey established that the main factors which contribute to most fatal accidents at identified spots are insufficient or absence of road signs and markings, insufficient designation of pedestrian crossings and Non-Motorized Traffic (NMT) facilities, reckless use of roadway and road facilities by motorists and failure of geometric and traffic design provisions. The team upon analysis of accident cases at the priority hazardous (black) spots observed that some of the interventions require engineering methods while others call for public awareness.

The study recommends that KeNHA in collaboration with NTSA endeavour to carry out routine inspection and maintenance of road furniture, that is, safety guardrails, road signs, road markings, traffic rumble strips and bumps to ensure their serviceability.

The survey also recommends that KeNHA will provide sufficient Non-Motorized Traffic facilities like footbridges, central barriers, road underpasses and sidewalks to safeguard pedestrians where appropriate.

Finally, KeNHA is urged to redesign and correct sections where horizontal and vertical alignments have failed to meet the traffic utility needs.

NTSA and Kenya Traffic Police are urged to work together to keep public informed on safe use of roads and to ensure effective enforcement of road safety regulations to safeguard proper utilization of the roads.

CHAPTER ONE

1. INTRODUCTION

1.1 Background Information

The Northern Corridor is the busiest and most important transport route in the region as it provides a gateway to the landlocked economies of Uganda, Rwanda, Burundi, South Sudan as well as Eastern DR Congo from the Kenyan sea port in Mombasa.

The multi-modal trade route consists of the rail network from Mombasa to Kampala, the oil pipeline from Mombasa to Nairobi, Eldoret and Kisumu, the inland waterway system on Lake Victoria and most importantly, the road network from Mombasa through Nairobi to Kampala, Kigali, Bujumbura, Juba, Goma, Beni and Kisangani in the Democratic Republic of the Congo.

Road Safety has posed one of the major challenges along the Northern Corridor with numerous studies showing that road traffic accidents along the route constitute a significant loss of human lives and property within the region. Road fatalities present a significant impediment to the achievement of some of the key development goals of the East African Community (EAC) such as expansion of health capacities owing to big drain on national resources allocated to health. It is this severity that led the 4th EAC Development Strategy to target reduction of road related fatalities by 20% by the year 2015 in line with the African road safety performance target which aims to reduce road related fatalities by 50% by the year 2020.

In Kenya for instance, road crash statistics from the National Transport and Safety Authority (NTSA) show that an average of 3,000 lives are lost annually with thousands more injured from road accidents. The Northern Corridor alone contributes up to 22% of all fatal injuries sustained in the entire country.

According to data from the World Health Organization (WHO), approximately 1.35 million people die every year on the world's roads as a result of road traffic crashes, with between 20 to 50 million more sustaining non-fatal injuries as a result of the crashes. Further, it approximates that about 93% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have approximately 60% of the world's vehicles.

The crashes are mainly attributed to human error as well as other factors such as unsafe road designs, poor condition of vehicles, unsafe road user behavior, inadequate infrastructure for non-motorized traffic and missing or ineffective road signage. In view of the above, one of the targeted objectives of the NCTTCA is 'to improve Transport Infrastructure and Facilities' along the Northern Corridor.

It is in this line that the NCTTCA Executive Committee during its 45th meeting held from 30th July to 3rd August, 2018 in Mombasa directed the Permanent Secretariat 'To improve safety in all transport modes' in furtherance of the NCTTCA Strategic Plan 2017-2021.

Following this directive, the NCTTCA Permanent Secretariat in collaboration with Kenya National Highways Authority (KeNHA), National Transport and Safety Authority (NTSA), Kenya Transporters Association (KTA) and the Kenya Traffic Police conducted a survey on priority black spots along the Northern Corridor route in Kenya from 4th to 8th March, 2019, with an aim of extending the activity to the remaining member states.

1.2 Objectives of the Survey

The objectives of the Survey were as outlined below:

i. Identification of priority Hazardous (Black) spots;

ii. Diagnosis of crashes to establish likely cause of accidents;

iii. Propose appropriate remedial measures to address safety concerns;

iv. Prepare country guidelines on Hazardous (Black) Spots Management (BSM) along the Northern Corridor route in Kenya;

v. Advocate for funds mobilization in order to address safety concerns at priority black spots identified in Kenya.

1.3 Methodology of the Survey

The scope of the survey covered top Ten Black Spots on the Kenyan section of the Northern Corridor from Mombasa through Nairobi, Mau Summit to Kisumu with stops and detailed assessments of the spots listed in ***Table 2*** below.

For purposes of this survey, the team adopted the Black Spot definition given in KeNHA's Black Spot Management Report, 2018, as *"any location that has a higher number of crashes than other similar locations because of local risk factors which are based on observed or recorded number of crashes in an area and not the expected number of accidents"*. This definition was fortified by the Kenya Traffic Police Department which identified a black spot as *"any location that experiences at least five crashes in a given calendar year."*

The principal purpose of the survey was to conduct a comprehensive diagnosis and analysis of the selected priority spots to identify safety concerns, diagnose them and propose appropriate remedial measures to address them.

The methodology of the survey entailed the following activities;

i. Review of existing Road Safety Studies and Audit Reports (Reports by KeNHA and NTSA);
ii. Collection and analysis of collision data;
iii. Site inspections and identification of safety deficiencies;
iv. Recommendation of appropriate remedial measures.

1.4 Survey Team

The Priority Black Spots survey team consisted of the following members:

Table 1: Survey team assessing the priority black spots

S/No.	Name	Institution	Designation
1.	Prof. Liêvin Chirhalwirwa	NCTTCA	Director - Infrastructure Development and Management (Team Leader)
2.	Fred Tumwebaze Hunter	NCTTCA	Director - Private Sector
3.	Eng. John Deng Diar Diing	NCTTCA	Deputy Director - Infrastructure Development and Management (Secretary of the Survey Team)
4.	Eng. Christine A. Ogut	NTSA	Deputy Director - Safety Audit and Inspection
5.	Doris Sabaya	NTSA	Road Safety Officer
6.	Eng. Monica A. Abonyo	KeNHA	Deputy Director - Highway Safety and Planning
7.	Peter Wanyoike	KeNHA	Engineer - Highway Safety and Planning
8.	Gilbert Njeru	Traffic Police	Chief Inspector
9.	Boniface Andai	Traffic Police	Inspector
10.	Walter Misama	Kenya Transporters Association	Technical Support Officer - Simulation Services

1.5. Scope of the Survey

In September, 2016, KeNHA commissioned a consultancy study on Technical Assistance on Road Safety for which a Black Spot Management & Crash Data Collection, Analysis and Management Reports were developed. The study identified a list of thirty (30) high crash locations in Kenya based on collision statistics over a six-year period (2011 – 2016).

Based on three (3) high crash location identification criteria including crash frequency, crash rate as well as crash severity and intensity (Equivalent Property Damage Only (EPDO) index), the top ten (10) crash locations were identified and ranked; incidentally all being along the Northern Corridor. The Ten (10) priority black spots assessed by the survey team are listed in Table 2 below.

Table 2: Ten priority black spots assessed by the Survey team

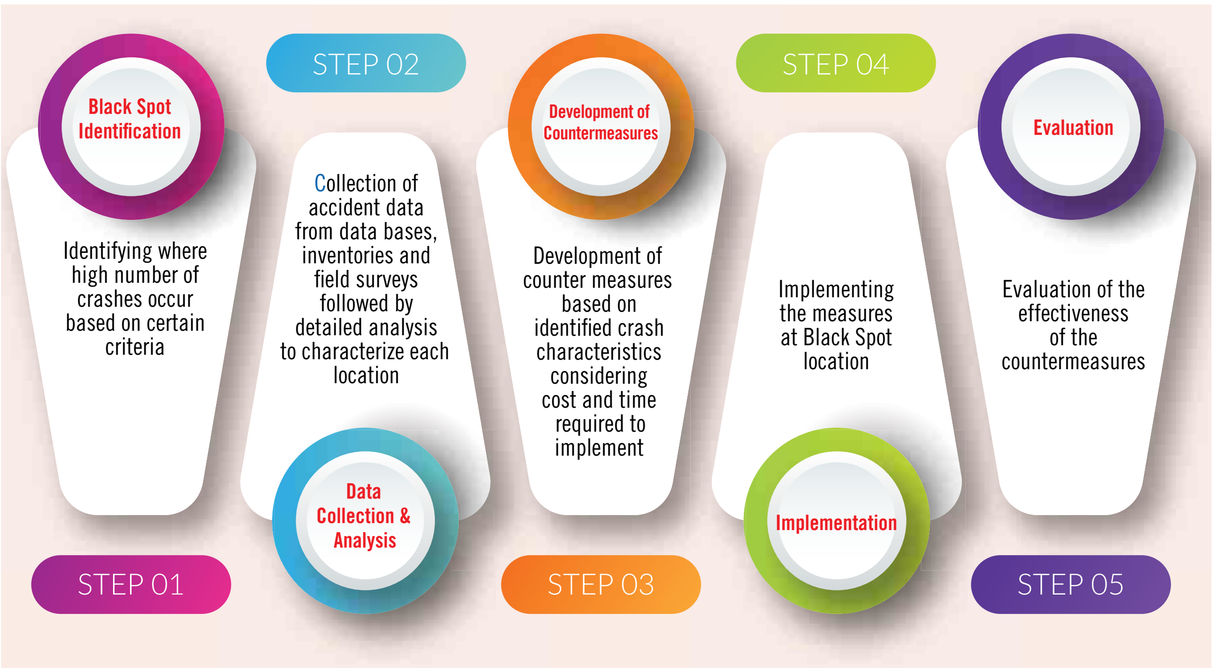
Rank	Region	Black Spot Location	Length (Km)	No. of Crashes (Frequency)	Crashes per Km (Rate)	Crash Severity (EPDO Index)
1.	Rift Valley	Mukinya – Migaa – Sobea – Salgaa – Sachangwan	20.7	152	7.34	1330
2.	Central	Gitaru – Rungiri	2.7	117	43.33	1094
3.	Coast	Kibarani – Makupa Causeway	5.5	107	19.45	921
4.	Nyanza	Molem – Namba Okana – Nyamasaria – Kasagam	9.4	100	10.64	932
5.	Eastern	Emali – Pipeline	3.0	89	29.67	806
6.	Coast	Bonje	5.0	85	17.00	700
7.	Coast	Maji ya Chumvi	6.8	75	11.03	641
8.	Eastern	Konza – Malili	10.3	69	6.70	572
9.	Eastern	Ngokomi – Kalimbini	0.9	68	75.56	640
10.	Eastern	Mlolongo	4.0	65	16.25	559

CHAPTER TWO

2. CRASH DATA ANALYSIS & CONFIRMATION OF PRIORITY BLACK SPOTS

2.1 Crash Data Analysis

The process of Black Spot Management is a crucial process in the mitigation of frequency and severity of crashes on a road network. It involves identification, analysis and development of countermeasures in the remedying of the hazardous locations. Black Spot Management can be summarized in the following series of steps;



Source: KeNHA Black Spot Management Report, 2018

The categorization of a hazardous spot encompasses three major aspects: -

2.1.1. Collision Frequency

A road section is categorized as a hazardous/black spot if the number of collisions recorded exceeds a threshold number over a specified period. Collision frequency can hence be defined as the number of crashes occurring at a site, facility or network within a one-year period.

2.1.2. Collision Rate

A road section is considered a hazardous/black spot if the collision rate exceeds a set threshold. By definition, collision rate can be described as the number of crashes that occur at a given site during a certain period in relation to a measure of exposure (for instance, per billion vehicle kilometres of travel for a roadway segment). It is thus the probability of a crash occurring per instance of exposure based on past events.

Where AADT – Annual Average Daily Traffic

2.1.3. Collision Severity and Intensity

This criterion attaches a weightage factor that is a function of the worst injury sustained by one of the crash victims. In this regard, for example, a fatal or serious injury crash has a higher weightage factor as compared to a slight injury or a Property Damage Only (PDO) crash. If the number and frequency of fatalities or severe injury crashes at a spot exceeds the threshold, then the location can be considered a hazardous/black spot.

2.2 Black Spot Identification

This process involves determination of the most hazardous locations within a road network and forms the basis for road safety analysis. Prior to the survey, a joint study conducted by Safe Way Right Way (SWRW), National Transport and Safety Authority (NTSA), Kenya National Highways Authority (KeNHA), Kenya Urban Roads Authority (KURA) and Kenya Traffic Police mapped out a total of one hundred and ninety nine (199) hazardous (black) spots along the Kenyan Northern Corridor and Nairobi County Route in 2017.

Following a detailed review of collision data for the entire country for the period between 2011 and 2016, the study conducted by KeNHA ranked the top thirty (30) high crash locations on roads under their mandate based on collision frequency with each of the locations recording at least five (5) collisions in a calendar year. Amongst the top thirty high ranking locations, the survey team prioritized on the top ten locations for the purpose of this exercise.

2.3. Data Collection and Analysis

Collection and analysis of available crash data is an essential procedure as it provides a better insight on the general issues surrounding and experienced by road users at the time of the crash. Parameters such as general trends, crash severity, causal factors and distribution of parties involved can therefore be deduced from the analysis.

It is however important to note that such analysis procedures need to be initiated and concluded before the field visit and site inspection as they may influence the observations made. The crash data analysis, nonetheless, should be carried to site for reference purposes and to inform discussions between the team members.

The following tools are important for the analysis of collision data:

2.3.1. P41 Forms

These are standardized data collection forms that should be filled by the Traffic Police department as and when collisions occur. The date, time and location of the collision is captured in the document. The details of the vehicles, particulars of the drivers involved including their age, sex and if suspected intoxicated are also filled in the form. The severity of injury sustained as well as the position in the vehicle and whether safety belts had been in use at the time of the collision are also recorded. The officer is also expected to capture a pictorial representation of the site of the accident through a sketch plan. Furthermore, the prevailing conditions of the site including the weather, condition of the road surface and other road features should also be filled in the form.

A sample P41 form from the Kenya Traffic Police department is attached as ***Appendix 1*** to the Report.

Accident data analyzed by National Transport and Safety Authority (NTSA) from P41 forms provided by the Traffic Police department between 2016 and 2018 indicate an alarming number of fatalities along the Northern Corridor route as shown in ***Table 3*** below. In spite of the decline in fatal injuries over the duration, the number of fatal crashes still remains a concern and it is paramount that mitigation measures be instituted.

Table 3: Fatal injuries along the Northern Corridor route in Kenya

Year	2016	2017	2018
Fatalities	828	790	606

The nature of crashes over the period following crash data characterization show speeding-related factors as the major cause of collisions along the Northern Corridor route in Kenya. Head-on collisions, vehicle-pedestrian collisions, loss of control, rear-end collisions as well as motorists ramming into stationary vehicles account for a significant number of crashes as well.

2.3.2. Stick Diagram

This is a Road Safety Engineering tool that provides an even more detailed and comprehensive analysis approach to collisions. It consists of two sets of forms which are complementary to each other and are best stored in Microsoft Excel database format. The first form captures on site collision characteristics more or less like the P41 form only that the causation factors and manoeuvre of the parties involved are filled using a scientific methodological approach that assigns different number codes and pictorial representations respectively. Following data collection over a given period of time, the statistics are then translated into a summary form. At this point, it is easier to determine the years, months, days of the week and hours when collisions are most prevalent. Accident patterns and trends for a location over a given duration including severity of the crashes, lighting conditions during their occurrence, road surface characteristics, and distribution of the parties involved and the manoeuvres of the vehicles can therefore be inferred. Ranking of the high-risk locations and the necessary intervention measures can hence be informed from such analysis procedures.

A sample stick diagram is annexed to the Report as ***Appendix 2.***

Note: *This analysis approach should only be used by persons with appropriate Road Safety Engineering training.*

2.4. Statistical Tests and Analysis

Additionally, the following Statistical Tests may be used to determine risk rating and probability of collision recurring:

$$\text{Collision Rate, } x = \frac{\text{Average Collisions per year} \times 10^9}{365 \text{ days} \times \text{AADT} \times \text{Length of Scheme under consideration (Km)}}$$

2.4.1. Collision Rate per billion vehicle kilometres

The collision rate for a given roadway segment can be determined using the formula below;

2.4.2. Poisson's Test

This Poisson distribution is used to check a sudden increase or decrease in collision data based on comparison with the long-term average. It is carried out to determine the probability of collisions recurring in a given year by use of the Poisson tables.

2.4.3. Chi-Squared Comparative Test

This test is used to compare characteristics at a particular problem site against the local control data. It is typically used to compare data, for instance, wet and dry, before and after, dark and light; whereby the formula below is used to calculate the chi-squared value:

$$x^2 = \frac{\left\{[ad-bc]-\frac{N}{2}\right\}^2 N}{efgh} = \frac{\left\{[ad-bc]-\frac{N}{2}\right\}^2 N}{efgh}$$

Where **a** and **b** - site data for the two instances
c and **d** - control data for the two instances
e - sum of the site data
f - sum of the control data
g - sum of data for the first instance
h - sum of data for the second instance
N - sum total of the site and control data for the two instances.

Following calculation of the chi-squared value, chi-squared distribution tables are then used to determine the probability level.

Note: *Statistical tests and analysis methods, like the stick diagram analysis, require specialized training in Road Safety Engineering for effective use.*

CHAPTER THREE

3. METHODOLOGY

3.1. Field Review of the Hazardous/Black Spots

A field visit and site inspection were carried out on all the ten-priority hazardous (black) spots for the purpose of identifying the safety concerns with a view of diagnosing the likely cause of collisions and hence propose appropriate remedial measures. The survey incorporated representatives from the major stakeholders in road safety in Kenya. It was important to harness the initiatives from the different organizations and integrate their various viewpoints in a bid to develop more effective solutions.

A simplified checklist was adopted for recording of site characteristics and conditions (refer to ***Appendix 3***). It was thus possible to conduct a comprehensive assessment of the hazardous spots with the survey team members taking the following factors into consideration;

- Features of the road environment, for instance, geometric alignment, junction configuration, road furniture etc;
- Traffic conditions and general road user behaviour;
- Interaction between vehicles and non-motorized traffic including pedestrian crossing habits;
- Previous site conditions that have since been rectified.

Records of the same were thereafter used to generate the survey findings and recommendations. Photographs were also taken during the site visit to act as reference during reporting and also provide any information that might have been overlooked during the actual inspection.

3.2. Development of Corrective Measures

Countermeasures can be described as strategies adopted to mitigate or reduce the collision frequency and/or severity for a given location. This procedure is preceded by analysis of crash data and the field visit as the characteristics of each site and crash patterns are clear at this stage. Subsequent development of the countermeasures should however be evaluated from an economic point of view.

In view of budgetary constraints, prioritization of remedial measures is done through application of the Benefit Cost Ratio (BCR) analysis method. The intervention with the highest First Year Rate of Return (FYRR) is preferred:

$$\text{First Year rate of Return (FYRR)} = \frac{\text{Annual Collisions saved x Average collision Cost X 100}}{\text{Scheme Cost}}$$

Benefit Cost Ratio, in principle, assumes that the sum of all positive effects (benefits) of an investment is set against all negative effects (costs). Quantification of the benefits is carried out by converting the estimated change in crash frequency to a monetary value by basing it on societal cost of crashes.

Kenya, however, is yet to establish a basis for determining the societal cost of crashes. Nevertheless, International Road Association Programme (iRAP) proposes two (2) methods that countries should generally apply in estimating the Value of Statistical Life (VSL) namely: -

i. **Human Capital Approach (Lost Output) - Ex post approach**: The value of a fatality or serious injury emanating from the crash is attached to the loss in economic value incurred.

ii. **Willingness to Pay - Ex-ante approach**: This approach estimates the value that individuals attach to safety improvement by approximating the amount of money that individuals would be prepared to pay to reduce the risk of loss of life.

While causes of road crashes are attributable to human factors, roadway characteristics and vehicle conditions, it is important to note that only the roadway characteristics can be sufficiently addressed by this procedure in mitigating occurrence of crashes at a given location. To guide the implementation framework, countermeasures can further be categorized into three tiers namely; short-term (immediate), intermediate and long-term measures.

3.3. Implementation of Corrective Interventions

After the development of suitable countermeasures for a given hazardous/black spot, the subsequent step involves execution of appropriate remedial works. It light of budgetary constraints occasioned by limited financial resources, interventions with the highest Benefit Cost Ratio should be prioritized on, followed by the other measures identified to address the safety concerns.

3.4. Monitoring and Evaluation

This phase entails periodic assessment of implemented works to evaluate their effectiveness. It requires sound data collection and analysis techniques as well as synergies between key stakeholders in road safety. In addition, regular road safety audits need to be carried out to identify emerging safety concerns. To this end, timely reports should be prepared and submitted to relevant agencies for any further action that might be necessitated.

3.5. Confirmation of top ten priority Black Spots

The Survey team made stops and assessed all the earmarked locations in a bid to further assess and diagnose the spots for possible remedial actions. At each stage, detailed observations were made by all the stakeholders present. A diagnosis of likely causes was done for every location to identify influential factors which might be contributing to crash occurrence.

Non-conformity to best practices and standards was flagged and the degree of their consequences evaluated. Finally, appropriate countermeasures and recommendations for improving the spots were proposed as captured in the *Survey Findings and Recommendations.* For all the locations surveyed, significant gaps were identified taking into consideration the general behavior, capabilities and limitations of all the road users. By implication, these gaps predisposed the locations to occurrence of crashes thus affirming them as priority black spots.

CHAPTER FOUR

4. FINDINGS AND ANALYSIS

4.1. Survey Findings

The Survey on the hazardous/black spots was carried out between 4th and 8th March, 2019, during daytime hours. The weather throughout the site inspection was sunny and dry with temperatures ranging from moderate to high. The road surface was therefore dry for the entirety of the exercise. The existing road condition from Mombasa to Mau Summit (A8) and Mau Summit to Kisumu (A12) can generally be classified as good to fair. However, pavement condition varies from section to section. Makupa roundabout – Miritini, Maungu – Voi and a section through Tsavo National park were all observed to have deteriorated with potholes, cracks and ruts, amongst other pavement distress signs.

At the time of the survey, upgrading of Mombasa – Kwa Jomvu section which forms part of the greater Mombasa – Mariakani project and capacity enhancement and rehabilitation of the James Gichuru – Rironi section were ongoing. Road safety enhancement works including pavement widening and separation of lanes into a dual carriageway and provision of road furniture at the notorious Salgaa area hazardous/black spot area from Molo River bridge through Sachang'wan to Kibunja was also in progress to address some of the safety concerns at the Mukinya – Migaa – Sobea – Salgaa – Sachang'wan stretch.

Except for sections under construction/rehabilitation, the existing road has been put on Performance Based Maintenance Contracting to attend to both routine and periodic maintenance needs.

The specific survey findings, analysis as well as suggested recommendations for improvement for each of the ten priority hazardous spots have been attached as ***Appendix 4*** to the Report. However, the following general road safety concerns were identified as common to the hazardous/black spots under assessment;

- Faded road markings;
- Inadequate/missing road signs;
- Damaged/missing safety fences;
- Deteriorated road pavement/surface;
- Insufficient visibility splays;

- Unsafe junction layouts;
- Numerous accesses and illegal turnings;
- Inadequate/Lack of NMT facilities;
- Reckless driving and overtaking;
- Excessive speeding;
- Obstruction by Trucks and Public Service Vehicles (PSVs);
- Encroachment into the road reserve and invasion of the same by vendors;
- Picking and dropping of passengers at undesignated bus stops;
- Blatant violation of traffic rules.

Selected site photographs taken during the activity have also been attached as ***Appendix 5*** to this Report.

As part of the exercise, the survey team also conducted interviews with various stakeholders along the Corridor including truck drivers and transporters with the view of establishing challenges encountered in daily operations from a road safety point of view. This would form a basis for appropriate areas of improvement from a road user standpoint. A record of the discussions and suggested recommendations for improvement from the stakeholders in annexed to this Report as ***Appendix 6***.

4.2. Interview with Trucking Companies

4.2.1. Interview with the Director of One 2 One Logistics , Newton Wang'óo

Date of Interview: 4th March, 2019:

The company has a fleet of 115 trucks which operate along Northern Corridor routes in the region.

Challenges encountered by drivers

- Lack of proper signage along the Corridor
- Harassment by traffic officers
- Unroadworthy trucks on the roads (could be blamed on corruption to a large extent)
- Some of the trucks operating along the Corridor lack the necessary twist locks to fasten containers. This poses a huge safety hazard to other motorists and truck drivers plying the route.
- Fatigue: This was explained to be the main cause of accidents. As a remedial measure, roadside stations equipped with amenities would go a long way to alleviate the problem according to the Director.

Measures taken by the Company

The director reported that up to the year 2016, the company was recording an average of two serious accidents monthly involving their fleet. The following measures have since been taken:

- The company made it a policy to only employ drivers whose age was at least thirty-five (35) years. Drivers above the age of 35 were deemed to be more cautious on the roads as compared to their younger counterparts. The eldest driver is approximately sixty (60) years of age.
- Change of driving hours: As a company policy, driving hours start from 6.00 a.m to 10.00 p.m. In the festive season, no driver is expected to be on the roads past 8.00 p.m. as a safety precautionary measure.
- Monitoring of speed using a 24-hour tracking system. Drivers have also been discouraged from freewheeling as the practice has been established to be a major causal factor for crashes along the roads. Truck drivers running out of gear run the risk of losing control of their vehicles.
- Driver training: The Company has invested in training for their drivers in liaison with Kenya Transporters Association (KTA).
- Withdrawal of 'turn boys' (driver assistants): This was found to translate to reduced accidents on the roads. It was observed that during transit, drivers would hand over to the relatively less skilled 'turn boys' who were more prone to causing accidents due to lack of necessary experience and qualifications.

Further proposals

- The Director noted that driving has no academic qualifications meaning that anyone who has acquired a driving license is eligible. He further highlighted that the literacy gap might pose a challenge, for instance in interpretation of road signs as well as influencing driver behavior. In this regard, he proposed the introduction of an education threshold and more so for truck drivers to the effect that only persons with a specific academic qualification can undergo training for truck driving.
- In addition, he recommended the introduction of health tests for truck drivers. It was explained that this would go a long way in curbing road carnage.

4.2.2. Interview with Seven Stars:

Date of Interview: 4th March, 2019

Interview with the General Manger

Background

Logistics entity incepted in June, 2017 following acquisition of Coast Couriers. It was explained that the objective of the interview was to establish the challenges encountered in daily operations from a safety perspective and hence propose potential improvements.

Challenges encountered by drivers

- Vertical obstructions to the trucks by flyovers, advertisement banners, signage gantries etc. According to the Transporter, the ideal clearance was 6.3 m. It was however clarified that a clearance of 5.5 m is allowable and is usually factored in the design of gantries and overhead structures. In this regard, low base trailers would be an ideal option to mitigate the challenge.
- Delays in acquiring bookings for inspection.
- Difficulties in load reconstitution where axle load limits had been exceeded but within the allowable Gross Vehicle Weight (GVW). It was however explained that in such an instance, the transporter would have to incur fines for exceeding the limits.

4.2.3. Interview with Drivers at Masimba

Date of Interview: 5th March, 2019

This interview presented a forum for drivers to raise their concerns and issues in regard to road safety along the Northern Corridor.

Issues/Challenges encountered by drivers

- Lack of necessary warning signage especially when approaching speed humps. Vandalism of road signs was explained to be a challenge too as the drivers are not forewarned or notified early enough as they approach safety hazards.
- Poor quality of the road especially along the Mtito Andei to Voi section.
- Dangerous overtaking by buses and matatus. In some cases, the drivers reported that they had to veer of the carriageway at the expense of their safety to avert head on collisions.
- Frustration due to low pay and meagre allowances.
- Erection of road blocks along descents in contravention of the Traffic Act Cap 403.
- Lack of clarity on rules and regulations by the Kenya Revenue Authority (KRA) Customs Department.
- Difference in road and traffic standards amongst the member states, for instance, lack of climbing lanes in some countries.

Recommendations proposed by the drivers to address the challenges

- Installation of appropriate signs along the corridor and sustained maintenance of the same. This includes prompt repair/replacement of damaged/vandalized road signage especially where safety hazards exist. It was also suggested that relevant authorities endeavour to install non-metallic signs as a measure to curb vandalism.
- Rehabilitation of deteriorated pavement sections along the Corridor especially between Mtito Andei and Voi.
- In the long term, dualling of the Corridor should be prioritized according to the drivers. This would go a long way in reducing transit time as well as minimize accidents caused by dangerous overtaking.
- Pay increment to the drivers taking into consideration the exigencies of their job.
- Erection of road blocks at suitable locations as provided for in the Traffic Act. This includes sections where the gradient is favourable and sight distance sufficient.
- Clear and concise rules and regulations by the KRA Customs department.
- Harmonization of design and operational standards between the member states.

Further recommendations/requests by the Survey team

In light of the proposals made by the drivers, the Survey team members also noted that drivers had a role to play to safeguard their safety and that of other motorists along the roads. The drivers were urged to take the following issues into consideration:

- Refrain from using mobile phones or other electronic gadgets while driving; It was noted that accidents occur in split seconds and simple lapses in concentration would possibly result in serious and fatal crashes.
- Drivers were advised against parking on shoulders or carriageway as this would compromise the safety of other motorists.
- Reckless overtaking by the truck drivers was also discouraged albeit being associated with untrained drivers. As much as possible, the truck drivers were impressed upon to refrain from overtaking dangerously as the risk factor is higher when trucks are doing so.
- Freewheeling by truck drivers was earmarked as a major cause of accidents. Drivers were urged to avoid the practice to avoid losing control of their vehicles.

4.2.4. Interview with Comtrade Hauliers

Date of Interview: 6th March, 2019

Background

15 No. fleet.

Challenges encountered by drivers

Hazardous spots along the corridor pose a huge safety concern to the Transporter's drivers. Amongst the most notorious black spots highlighted were the Mombasa-bound descent at Salama area and along the Mai Mahiu road where the carriageway was deemed to be too narrow.

Recommendations/requests by the Company

- Better management of traffic at accident scenes.
- Traffic officers to avoid flagging off/stopping vehicles on the carriageway.
- More courtesy from the traffic officers. As compared to their region's counterparts, officers from Kenya were deemed to be less courteous.

Measures taken by the Company

It was reported that the transporter had not recorded a major accident involving its fleet. This was attributable to:

- Constant communication with the drivers and promptly addressing issues they might face while in transit. In this regard, the transporter had managed to foster a healthy relationship with its drivers
- Monitoring of driver behaviour during transit by use of a tracking system.
- Training of drivers to equip them with necessary skills. It was reported that training is done approximately twice a year.
- Allowing adequate leave days for the drivers. The drivers were allowed up to thirty (30) working days leave.

4.2.5. Interview with Drivers at Salgaa

Date of Interview: 7th March, 2019

The main objective of the interview was to establish challenges encountered along the Northern Corridor in regard to road safety and to propose recommendations to address some of the challenges.

Issues/Challenges encountered by drivers

- Missing speed limit signs along sections where certain speed limits should not be exceeded. Some have been pulled down or vandalized creating conflict between the drivers and traffic police.
- Delays in withdrawing vehicles that have stalled along the carriageway. It was proposed that such vehicles be towed away in good time since they act as safety hazards and more so to truck drivers.
- Narrow carriageway along some bridges. A case in point of the bridge at Chemoi area was cited. The drivers proposed that speed calming measures or necessary warning signs be installed at the approaches to such bridges to forewarn all motorists.
- Frivolous charges by traffic police. They contested that some traffic officers were harassing truck drivers by preferring non-existent charges only to extort money from them.
- Deteriorated pavement structure in some sections of the Corridor. It was reported that potholes in particular presented a huge safety concern especially when drivers try to evade them.
- Inappropriate parking by large trucks on the shoulders effectively narrowing the carriageway.
- Vandalism of vehicle parts and spares.
- Levies by the County Government at Malaba as trucks await to cross the border towards Uganda.
- Lack of roadside facilities. In this regard, roadside stations with amenities and parking for the trucks was a welcome idea by the drivers.

4.2.6. Interview with Rongai Workshop and Transport Ltd.

Date of Interview: 7th March, 2019

As with the other transporters, it was explained that the objective of the interview was to establish challenges they face from a safety perspective and hence propose areas of improvement with an aim of achieving optimum road safety conditions.

Issues raised

- Absence of a road safety culture in the country. It was however acknowledged that cultivation of such a culture was a multi-faceted work in progress that needs to be nurtured and sustained by all the parties involved.
- Slow flow of traffic which is commonly associated with driver frustration and fatigue.
- Missing/faded road markings to delineate the traffic lanes. Missing central road marking to separate the directions of traffic for instance poses a challenge to the truck drivers as the extent of the lanes is not defined.
- Non-standard and non-retroreflective road signage making it difficult to view the signs from a distance especially at night.
- Dumping of garbage/litter by the roadside
- The carriageway at Salgaa centre has been constricted by bodaboda riders.
- Abrupt transition of the dual carriageway into a single carriageway as you approach the Molo River Bridge from the Eldoret direction. No warning signs are in place to forewarn the drivers accordingly.
- High number of road blocks and harassment by traffic officers.

Recommendations/requests by the Company

- Sensitization and enforcement in regulating behavior of motorists and other road users. Where, regulations and policy framework are in place, implementation should be emphasized on.
- Request for review of regulations governing the lift axle mechanism.
- Installation of retro-reflective road marking throughout the Corridor to delineate traffic lanes accordingly.
- Replacement of non-standard and non-retroreflective road signage with high intensity signs for easier visibility especially at night. The Transporter in particular also requested for installation of necessary warning signs at the transition from dual to single carriageway near the Molo River Bridge further noting that it lies at the end of the Sachang'wan – Salgaa descent; a confirmed notorious hazardous spot.
- Better traffic management for all forms of traffic at Salgaa centre.
- Reduction of the number of road blocks.

Measures taken by the Company

The Transporter has cultivated a culture of courtesy and respect amongst its drivers. For instance, in case of incidents and accidents, the drivers have been encouraged to be polite to traffic officers translating to better service.

4.2.7. Interview with Swan Carriers Ltd. at the Kisumu Yatch Club

Date of Interview: 8th March, 2019

Issues raised

- Delays by traffic officers when checking the heavy commercial vehicles resulting into longer transit times.
- Extortion/harassment by traffic officers. A proposal was fronted to have an instant fine system for minor traffic offences such as a non-functional brake light.

4.3. Analysis

The survey at all the ten (10) top priority hazardous (black) spots along the Northern Corridor route in Kenya registered interesting trends on what could be the most frequent cause of accidents.

The most common feature at observed dangerous sites was insufficient or absence of road signs and markings. It was observed that most of the dangerous spots either are not sufficiently marked with no signs to forewarn motorists of the danger ahead or the marks had faded with signs vandalized or uprooted. This was found to contribute to most head-on, rear-end and skidding off accidents along the Corridor.

Another trending observation which is a leading cause of fatal accidents along the Northern Corridor route was absence of designated areas for pedestrian crossings and Non-Motorized Traffic (NMT) facilities. Absence of footbridges and/or speed calming measures like speed humps and rumble strips was observed to contribute to most accidents that involve pedestrians and NMT. This was found to be very common at black spots closer to busy urban centers and along straight stretches where vehicles overspeed.

Additionally, reckless use of the roadway and road facilities by motorists was also attributable to a significant number of collisions. It was observed that most motorists and especially Public Service Vehicles (PSVs) pick and drop passengers at areas that are not designated for stopping. The irregular picking and dropping off of passengers consequentially leads to unregulated crossing at dangerous points leading to frequent vehicle-pedestrian collisions. Long-distance truck drivers were also found culpable of parking at the carriageway leading to obstruction of other road users, insufficient visibility splays for both motorists and pedestrians and throttling of the carriageway making it insufficient for other road users.

Among other road sundries that contribute to frequent accidents is failure of geometric and traffic design provisions. There were cases of unsuitable junctions for splitting traffic, for example in Emali and Sobea which often contribute to head-on, rear-end and side impact accidents. Dangerous combination of both horizontal and vertical curves was also deemed a significant causation of skidding off and head-on collisions at some hazardous spots including the Kibunja – Sachangwan – Salgaa stretch, Salama and Bonje area.

CHAPTER FIVE

5. RECOMMENDATIONS, INTERVENTIONS AND MONITORING AND EVALUATION

5.1. Recommendations

The team upon analysis of accident cases at the priority hazardous (black) spots observed that some of the interventions require engineering methods while others call for public awareness.

It is recommended that KeNHA in collaboration with NTSA endeavour to carry out routine inspection and maintenance of road furniture like safety guardrails, road signs, road markings, traffic rumble strips and bumps to ensure their serviceability.

KeNHA should also undertake to provide engineering facilities like footbridges, central barriers, road underpasses and sidewalks to safeguard pedestrians and NMT. Moreover, KeNHA needs to realign sections where dangerous horizontal and vertical curves are found.

NTSA and Kenya Traffic Police should work together to ensure effective enforcement of road safety regulations to safeguard proper utilization of the roads. Other measures that the survey team deemed necessary to sustain road safety at the hazardous spots and along the entire Corridor include:

i. Development of collision data repository. Collaboration between NTSA and the Kenya Traffic Police is required to achieve this milestone;

ii. Continuous collision investigation and analysis by the Traffic Police department to ensure safety decisions are evidence based;

iii. Regular Road Safety Audits by KeNHA in collaboration with NTSA to ensure a proactive approach in the management of black spots;

iv. Mobilization of finances from development partners to address identified hazardous (black) spots;

v. Routine Monitoring and Evaluation of effectiveness of interventions by KeNHA and NTSA;

vi. Sustained road safety sensitization and awareness campaigns by government agencies;

vii. Development and implementation of Road Safety Strategies and Action Plans;

viii. Development and mainstreaming of Hazardous (Black) Spot Management Guidelines;

ix. Research and development;

x. Stakeholder collaboration and increased synergies between organizations;

xi. Capacity building for all the stakeholders in the road safety sector including development of skills, technology transfer between organizations and departments as well as general institutional development.

5.2. Implementation of Recommendations

The survey team noted that at the time of the exercise, various interventions were being undertaken by KeNHA in a bid to enhance the capacity at some sections of the Corridor through pavement widening as well instituting emergency road safety measures at some of the hazardous spots. The following works were ongoing:

- Upgrading of the Mombasa – Kwa Jomvu section (Lot 1) which forms part of the greater Mombasa – Mariakani project. Ongoing works entailed strengthening and construction of additional lanes to a 6-lane dual carriageway separated by a raised median to remove capacity constraints and enhance smooth and uninterrupted flow of traffic. Interchanges, grade separators, underpasses and overpasses were also being constructed to facilitate safe movement of cross road traffic. To facilitate access, service roads on either side of the road were to be constructed with footpaths along the outer edge of the carriageway in addition to footbridges at critical road crossing locations. The procurement process to undertake similar works for Lot 2 (Kwa Jomvu – Mariakani section) was ongoing at the time of the survey.

  It is expected that the road safety concerns at Kibarani – Makupa Causeway and Bonje area will be addressed following completion of the above project.

- Rehabilitation and Capacity Enhancement of James Gichuru Road Junction to Rironi Highway. Works that were being executed under the Contract included pavement widening and dualling of the section, construction of interchanges, underpasses and overpasses as well as provision of pedestrian facilities and footbridges at critical crossing locations.

  The safety hazards identified at the Gitaru – Rungiri hazardous spot mostly involving pedestrians are expected to mitigated once the works are completed.

- Emergency Road Safety Enhancement along Kabarak Juction to Kibunja (A8) Road. The intervention had been necessitated by the high number of crashes, mostly fatal, previously recorded at the Salgaa – Sachangwan section especially during the festive seasons. The scope of the works being carried out entailed widening of the carriageway and separation of traffic directions using New Jersey crash barriers for the approximately 10 Km long climbing lane section, construction of truck run away ramps and installation of speed humps and rumble strips across the descending lanes as a speed calming measure.

The emergency safety works were almost substantially complete at the time of the survey. Following installation of the pending road furniture including road signage and application of road marking, road condition factors that were identified by the team as having contributed to frequent occurrence of road crashes at the location were expected to be addressed.

Further to the above ongoing works at four of the surveyed priority hazardous spots, the civil works below (both short and long term) have been proposed to sufficiently address road safety at the remaining six hazardous locations:

Table 4: Proposed civil works at the priority hazardous (black) spots

Rank (in terms of Collision Frequency)	Hazardous (Black spot) Location	Proposed Short-Term Intervention	Proposed Long-term intervention	Cost Estimate (USD)
4.	Molem - Namba Okana - Nyamasaria - Kasagam	Road markings, signs, safety fences, NMT facilities	Dualling of the section, Construction of Grade separated junctions	30,000,000
5.	Emali – Pipeline	Road markings, signs, safety fences, NMT facilities	Construction of Grade separated Junction at Emali - Oloitoktok Junction	15,000,000
7.	Maji ya Chumvi	Road markings, signs, safety fences, NMT facilities	Construction of a second carriageway	Expected to be addressed under the proposed Nairobi - Mombasa Expressway
8.	Konza – Malili	Road markings, signs, safety fences, NMT facilities		
9.	Ngokomi – Kalimbini	Road markings, signs, safety fences, NMT facilities		
10.	Mlolongo	Construction of NMT facilities/service lanes, road markings, signs, safety fences	Capacity enhancement, service lanes, NMT facilities	50,000,000

Note: *The cost estimates for the long-term interventions are mere estimates and are not based on actual studies.*

It is recommended that KeNHA continues to liaise with relevant agencies to secure funding for implementation of corrective works as well as sustain Performance Based Contracting (PBC) road maintenance to attend to both the routine and maintenance needs of the Corridor.

It is also instructive to note that the hazardous spots along the Northern Corridor extend beyond the ten (10) locations surveyed. In particular, regular application of road marking and installation/ replacement of road signage should be prioritized throughout the Corridor as a measure to guide and forewarn motorists and other road users accordingly. Moreover, where pavement distress symptoms are observed or capacity constraints encountered with time, KeNHA should undertake to institute upgrading and rehabilitation programmes based on a need basis to continually enhance road safety in the future.

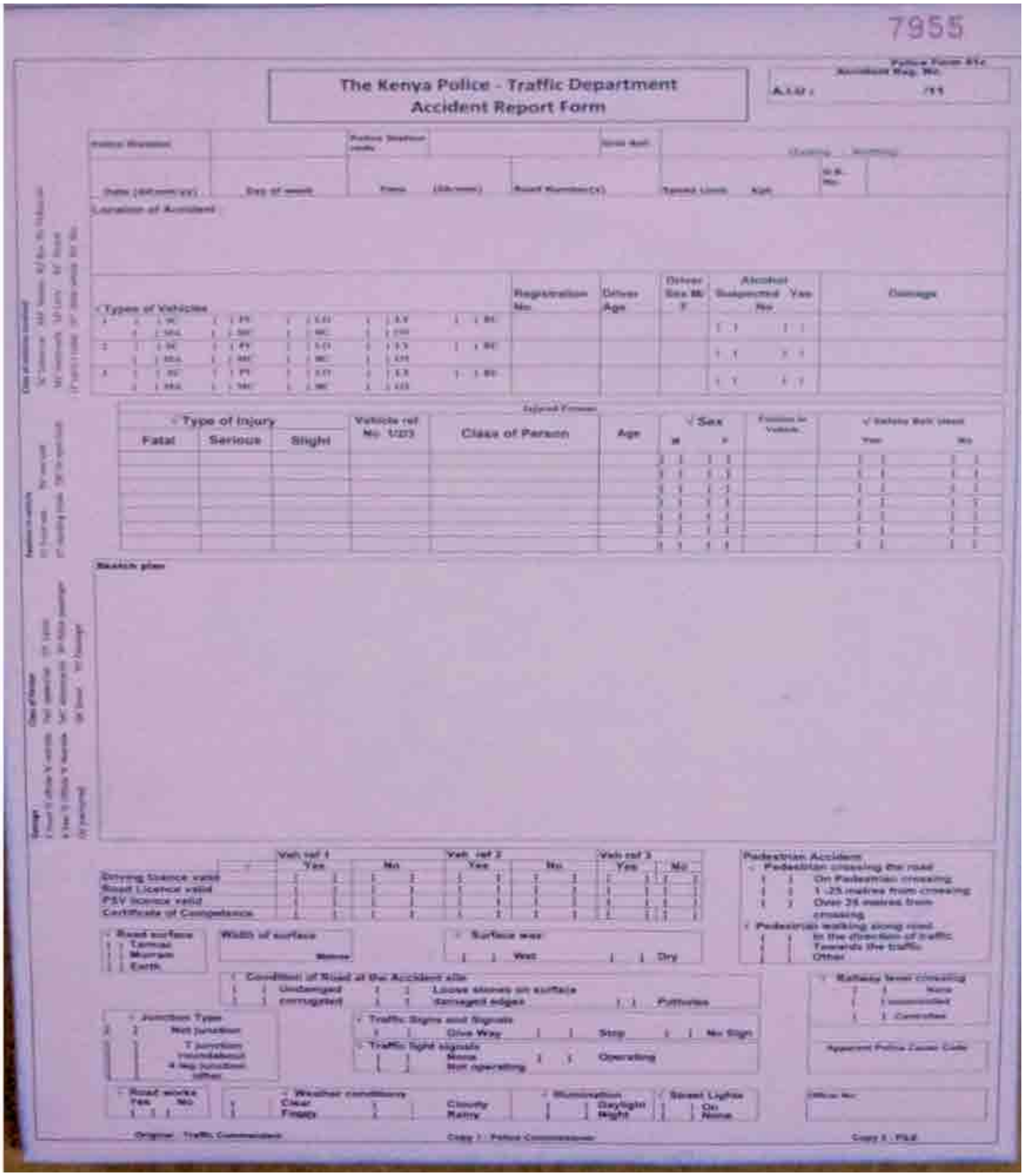
5.3. Monitoring and Evaluation Framework

As a measure to continually assess road safety along the Northern Corridor, it is recommended that KeNHA in partnership with NTSA conducts periodic road safety audits and assessments. The findings should be compiled into reports for easy monitoring of the implementation status. Inspection exercises should also be carried out routinely by KeNHA and quick wins acted upon to prevent minor safety hazards from aggravating.

Partnership and collaborative efforts between government agencies such as NTSA and KeNHA as well as other stakeholders are critical in order to address road safety concerns along the Corridor. Finally, it is also recommended that relevant agencies continually engage and participate in road awareness campaigns to sensitize all road users in order to realize a safe road network in line with the recommendations of the UN Decade of Action for Road Safety.

6 APPENDICES

6.1 Appendix 1: Sample P41 Form from Traffic Police Department


7955

Police Form 41

The Kenya Police - Traffic Department
Accident Report Form

Location of Accident

Types of Vehicles

Registration No.

Driver Age

Driver Sex

Alcohol Suspected Yes No

Damage

Type of Injury

Fatal

Serious

Slight

Vehicle ref No. 1/2/3

Class of Person

Age

Sex

Sketch plan

Veh ref 1

Veh ref 2

Veh ref 3

Yes

No

Driving licence valid

Road Licence valid

PSV licence valid

Certificate of Competence

Pedestrian Accident

Pedestrian crossing the road

On Pedestrian crossing

Over 25 metres from crossing

Pedestrian walking along road

In the direction of traffic

Towards the traffic

Other

Road surface

Tarmac

Murram

Earth

Width of surface

Metres

Surface was

Wet

Dry

Condition of Road at the Accident site

Undamaged

corrugated

Loose stones on surface

damaged edges

Potholes

Railway level crossing

Junction Type

Not junction

T junction

roundabout

4 leg junction

other

Traffic Signs and Signals

Give Way

Stop

No Sign

Traffic light signals

None

Not operating

Operating

Road works

Yes

No

Weather conditions

Clear

Foggy

Cloudy

Rainy

Illumination

Daylight

Night

Street Lights

On

None

Original - Traffic Commandant

Copy 1 - Police Commissioner

Copy 2 - FILE

6.2 Appendix 2: Sample Stick Diagram

SURVEY/ROAD SAFETY AUDIT OF 10 NO. PRIORITY HAZARDOUS/BLACK SPOTS ALONG THE NORTHERN CORRIDOR ROUTE

Location: ....

Road collisions between .... and .... sheet .... of ....

Collision No.	1	2	3	4	5	6	7	8	9	10
Reference No.										
Date										
Day										
Time										
Severity										
Dark/light										
Weather										
Road Surface										
No. vehicles										
Vehicle 1										
Vehicle 2										
Vehicle 3										
No. casualties										
Casualty 1										
Casualty 2										
Casualty 3										
Causation										
Manoeuvre										
Location										

SURVEY/ROAD SAFETY AUDIT OF 10 NO. PRIORITY HAZARDOUS/BLACK SPOTS ALONG THE NORTHERN CORRIDOR ROUTE

Sumary of collisions

Location: ....

Road collisions between .... and ....

Years

Total	

Months

Jan	
Feb	
March	
April	
May	
June	
July	
Aug	
Sep	
Oct	
Nov	
Dec	
Total	

Days

Mon	
Tue	
Wed	
Thu	
Fri	
Sat	
Sun	
Total	

Hours

0:00	
1:00	
2:00	
3:00	
4:00	
5:00	
6:00	
7:00	
8:00	
9:00	
10:00	
11:00	
12:00	
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	
19:00	
20:00	
21:00	
22:00	
23:00	
Total	

Severity

Light conditions

Road surface conditions

VRU collisions

Collision manoeuvres founded

Other factos

Collision problem(s)

6.3 Appendix 3: Simplified Checklist

SIMPLIFIED CHECKLIST

Site location: ____

Date of site inspection [DD/MM/YYYY]: ____

SNo.	Observed Location	Time	Observations (please give details)	Related sketches (please specify)

6.4 Appendix 4: Specific Survey Findings and Recommendations

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Kibarani – Makupa Causeway			
1	Non-existent Road marking(faded)	Traffic lanes have not been delineated for both carriageways. It is difficult to ascertain errant motorists in the event of conflict.	• Application of retroreflective road marking • Installation of delineator retroreflective road studs to improve on visibility at night • Sustained maintenance of the same	To be addressed under the ongoing construction of Mombasa – Kwa Jomvu project (Lot 1)
2	Missing/ineffective road signs	Critical road signs at the junction and along the causeway are lacking. Temporary signage warning motorists of ongoing construction works are inappropriately placed in some sections.	• Installation of appropriate retroreflective signs • Sustained maintenance	,,
3	Deteriorated road surface especially at the Makande/ Shimanzi junction coupled with pavement edge concerns	The existing pavement is characterized by a deteriorated surface with some sections being pothole ridden. The shoulders are absent and edges highly run-down.	• Repair of deteriorated roads section • Routine maintenance	,,
4	Unsafe junction layout at Makande	The junction has no speed changing lanes with the weaving length into the main highway being too short for heavy goods vehicles.	• Channelization of traffic • Provision of road marking to clearly demarcate and separate lanes and direct safe flow of traffic through the junction • Installation of adequate road signs • Routine maintenance of all road signs • In the long-term, a grade separated junction should be considered	,,

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
5	Narrowed carriageway occasioned by accumulation of silt on the road edges as well as the ongoing construction works	The road width along the causeway ranges from 5.5m to 6.3m mainly due to the accumulation of silt deposits on the edges. In effect, the 2-lane carriageway has been reduced to 1-lane translating to traffic snarl ups.	• De-siltation and cleaning of the carriageway edges • Widening of the existing carriageway	,,
6	Lack of designated pedestrian crossing points and NMT facilities	Lack of marked pedestrian crossings and walkways have forced pedestrians to cross at arbitrary locations and walk on road edge oblivious of their safety.	• Provision of safe marked pedestrian crossings at appropriate locations. • Provision of adequate appropriate signs to guide all road users • Separation of NMT from motorized transport (provide footpath, cycle tracks, footbridges etc)	,,
7	Poor Traffic Management plan on an active/live construction area. (Lack of temporary traffic signs/ barriers to safeguard road users from construction area)	The site is characterized by deep excavations which pose a safety hazard especially to school going children using the causeway. Site management operations are lacking.	• Reflective tapes to cordon off the excavations. • Provision of temporary road signs to appropriately inform, caution and guide all road users around live construction zones. • Traffic marshals and flagmen should be put in place to guide traffic	,,
8	Unsafe picking up and dropping off of passengers	Matatus are observed to pick up and drop off passengers at none designated zones especially at the Makande junction. In effect, the passengers will tend to cross the road at these locations.	• Provision of well designated bus bays preferably adjacent to the footbridge or pedestrian crossing zones.	,,

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
9	Close proximity between the causeway and the railway line; both running parallel to each other	Absence of safety barriers between the two modes of transport presents a safety hazard to both motorists plying the causeway and pedestrians walking on or adjacent to the railway line	• Installation of appropriate retroreflective speed control and warning signs • Realigning the railway line and/or the road as a long-term measure.	,,
10	Presence of pipe outcrops, hazardous debris and overgrown vegetation	The pipe outcrops pose a safety concern to motorists that might veer of the road. Uncollected litter/garbage creates a safety concern to pedestrians with overgrown vegetation reducing visibility for the motorists using the route.	• Liaison with the Government agency responsible for relocation of damaged and protruding pipe outcrops and with the County Government of Mombasa to collect garbage within the road reserve. • Overgrown vegetation should be cleared and the hazardous debris removed.	,,
11	Lack of traffic safety barriers/fences on the high embankment separating the two carriageways	Along the causeway, there is a significant height difference between the two carriageways separated by a high embankment with no safety barriers. Motorists from the island side who veer of the road might easily collide with oncoming traffic from the mainland as no barriers are in place.	• In the interim, crash barriers marked with hazard marker paint should be installed both at the median and at the edges.	,,

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Bonje Area			
1	Successive combination of horizontal and vertical curves	Vehicles might encounter difficulties negotiating the tight curves and ultimately lose control.	• Run-away ramps should be installed at strategic locations in the interim to cater for motorists that might veer of the road. • Re-alignment of the section (as a long-term measure) to eliminate the dangerous succession of horizontal and vertical curves	To be addressed under the planned construction of Kwa Jomvu – Mariakani road project (Lot 2)
2	Non-existent/faded road markings	The lanes are not delineated to guide motorists with existing markings faded and invisible.	• Application of retroreflective road marking. • Installation of delineator retroreflective road studs to improve on visibility at night. • Sustained maintenance of the same.	,,
3	Inadequate/lack of road signs	Warning/speed control signs are absent increasing the likelihood of accidents happening. Matatus also pick up and drop off passengers at non-designated zones further exacerbating the safety problem.	• Installation of appropriate retroreflective signs at appropriate locations with priority given to warning and speed control signs • Provision of bus bays to allow for safe picking up and dropping off of passengers • Sustained maintenance	,,
4	Speeding, careless and dangerous overtaking and freewheeling	Vehicles on both directions tend to overspeed and overtake dangerously. Further, disregard of lane discipline is also common especially by slow moving vehicles who fail to drive on the left lane and on the climbing lane.	• Installation of speed calming measures i.e. rumble strips on steep descent sections • Installation of appropriate warning and informatory signs, for instance, 'Kept Left Unless Overtaking' and 'Observe Lane Discipline' sign boards • Collaboration with law enforcement agencies • Construction of off-road safe runway truck ramps/emergency escapes ramp/clear zones at strategic locations • Realignment of road section to improve on the geometric alignment	,,

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
5	Absence of a central median barrier at some sections to separate the opposite directions of traffic	The median is too narrow creating a threat of vehicles that lose control crossing to the opposite carriageway and ramming onto oncoming traffic. Presence of a barrier at the median would negate the threat of traffic crossing over to the opposite direction.	• Consider installation of rigid central crash barriers painted with retroreflective paint/ tapes to enhance visibility at night.	,,
6	Damaged central median barrier The two carriageways are separated by a narrow central median. Flex beam guardrails that were installed in the central median to act as a crash barrier and safeguard traffic in the opposing carriageways have all since been knocked down or are damaged.	Risk of vehicle losing control, veering off into the opposite carriageway and crashing into oncoming traffic. Head-on, side-impact, side-swipe and multi-vehicle pile-ups collisions are all possible.	• Repair/replacement of damaged guardrails • Installation of hazard marker signs on guardrails in the central median.	,,
7	Lack of/damaged safety fences The Survey team observed that guardrails in the entire stretch have either been damaged beyond repair or are completely missing. Further, the damaged guardrails have been left exposed with no end pieces and protruding sharply against the direction of traffic posing great danger to all road users.	Risk of vehicles rolling over high embankment. Risk of vehicles ramming into protruding guardrails which might in turn piercing through the vehicle. The following collisions are therefore probable: head-on, side-impact, side-swipe and roll-over	• Repair/replacement of broken guardrails complete with end pieces and delineators. • Sustained maintenance of the same	,,

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
8	Poor transition from single to dual carriageway The team observed that transition from single to dual carriageway at Mazeras is on both a horizontal and vertical curve just at the beginning of busy Mazeras centre. This has compromised visibility of Nairobi bound traffic. Further, there are no signs to mark the beginning and end of dual carriageway.	Risk of head-on, side-impact, side-swipe and multi-vehicle pile-ups collisions are all possible due to the road condition factor.	• Installation and sustained maintenance of appropriate retroreflective signs to mark beginning and end of dual carriageway • Re-design of the dual carriageway section to improve on the geometric alignment of the section	,,
	Maji ya Chumvi			
1	At the time of mapping of black spots in 2016/2017 (refer to NTSA report on mapping of black spots along the Northern Corridor), the section was under reconstruction. The works have since been completed and road condition factors that were identified then as to having contributed to frequent occurrence of road crashes at the location were addressed. For example, the road was realigned at Maji ya Chumvi bridge greatly improving the geometric alignment. However, some safety concerns and hazards still remain including:			
2	Over speeding traffic with no speed calming measures in place	The section is characterized by sloping approaches on either side of the bridge. Vehicles tend to overspeed and heavy trucks freewheel as they approach the bridge posing a threat of head-on as well as roll-over collisions.	• Installation of speed calming measures; rumble strips for instance would reduce the likelihood of motorists over speeding • Installation of retroreflective speed control signs and hazard marker signs at the bridge abutments to guide safe movement of traffic at night.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Reduced skid resistance due to bleeding of the road surface	Bleeding is a phenomenon characterized by a shiny black film on the road caused by upward movement of asphalt in the pavement surface. Coupled with the prevalent high temperatures at the area, the surface tends to be slippery thereby provides low skid resistance.	• Repair of affected sections	
4	Damaged guard rails/safety fences	The guard rails on the LHS of the Nairobi bound traffic are damaged ostensibly due to previous crashes. This poses a risk of vehicles rolling over the embankment as the rails are not structurally sound.	• Replacement of damaged/warped guard rails complete with fishtail end pieces	
5	Missing/inadequate road signage	Critical road signs are lacking at the location (hazard signs at bridge abutments/ approaches). This presents a threat of motorists ramming onto the bridge abutments especially due to reduced visibility at night.	• Installation of appropriate retroreflective signs at the approaches to the bridge with priority given to warning and speed control signs • Sustained maintenance	
6	Deep open lined drains too close to the edge of the road (near Road-over-rail Bridge)	Motorists who veer off the road are highly likely to roll over into the drains	• Installation of vehicle restraints i.e guardrails to prevent motorists from plunging into the drains.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Emali - Pipeline			
	Emali/Oloitoktok Junction			
1	Unsuitable Junction configuration/layout	The junction is located on a combination of horizontal and vertical curves and on the crest of the Standard Gauge Railway (SGR) road over rail bridge. Mombasa bound traffic descending on the vertical curve tends to accelerate creating a risk of rear-end, side-impact, side-swipe, roll-over and multiple vehicle pileup collisions with vehicles queuing and waiting to turn right towards Oloitoktok. The junction is characterized by skid marks apparently due to the difficulty encountered by motorists exiting to the road towards Oloitoktok	As a long-term measure, consider: • Re-aligning the junction to a safer location (relatively flat area especially towards the Mombasa side) • Provision of a grade separated junction to enhance separation and safe passage of traffic.	
2	Confusing/ambiguous road marking and multiple lanes	The road is widened (has multiple lanes in addition to old carriageway which is still in use) at the junction and there exists elaborate and visible road marking to separate, channelize and guide flow of traffic at the junction.	• The road markings should be rectified to enhance safe flow and movement of traffic through the junction • Provision of appropriate road signs to guide on usage of old realigned road that is adjacent to the new carriageway • Sensitization and enforcement by the relevant agencies to prevent over speeding and overtaking at the junction.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
		However, the Survey team observed that: • There are too many confusing road markings some which cross each another; • Road making on old realigned Mombasa road has not been merged with those on newly constructed carriageway. They cross each other, some terminating abruptly and right turning arrows leading to nowhere; • Old road making leading to unused temporary road and which crosses markings on main road still exists and confuses motorists; • Section of old realigned road is still in use and Mombasa bound traffic uses this to overlap and overtake. These existing and ambiguous road markings create confusion and complicate safe movement and flow of traffic at the already complicated junction.		

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Ineffective informatory (directional) road signs	The directional signs are too close to the junction and hence do not serve the intended purpose	• Installation of appropriate retroreflective signs at a safe distance before the junction restricting speed and notifying motorists of the junction ahead. • Sustained maintenance	
4	Numerous roads/accesses (access to SGR station and Curio shop) joining main A8 Road at the junction at the location Existence of several roads/ accesses encourages unsafe and dangerous turnings in and out of the main road. The survey team observed vehicles making the following unsafe and illegal turns: • Vehicles from Nairobi branching into the curio shop and SGR station cut across traffic from Oloitoktok heading towards Nairobi thereby forcing them to apply emergency brakes • Vehicles from Curio shop cut across traffic from Oloitoktok heading towards Nairobi to join Emali-Oloitoktok road and to join main A8 road towards Mombasa.	Risk of head-on, side-impact, side-swipe collisions as well as rear-end and multi-vehicle pile-ups as vehicles from Oloitoktok side make emergency braking to avoid hitting vehicles cutting across	• Consider completely blocking paved access road to curio shop and provide alternative entry point at safer location. • Installation of appropriate warning and prohibitory signs • Collaboration with law enforcement agencies to impound vehicles making illegal and unsafe turnings. • Relocation of the junction to a relatively flat area especially towards the Mombasa side • In the long-term, a grade separate junction at a safe distance from the road over rail bridge should be considered.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	• Entry point to Curio shop access is located on a crest thereby limiting visibility as one joins the main road. It is also important to note that convergence of this access with A8 road is located on a combination of both on a vertical and horizontal curve, is on high embankment and very close to road over SGR rail bridge.			
5	Damaged safety fences, handrails and crash barrier. Several lines of guardrails on turning towards Oloitoktok from Mombasa and to Nairobi from Mombasa were knocked down, damaged with some pieces completely missing. Turning into A8 road from Oloitoktok is on high embankment.	Risk of vehicles rolling over high embankment Risk of vehicle ramming into protruding guardrails and piecing through the vehicle	• Repair/replacement of broken guardrails complete with end pieces and delineators • Painting with retro-reflective paints, old guardrails to enhance visibility at night. • Sustained maintenance of the same	
6	Exposed pedestrian footpath cum shoulders on Road over rail bridge Wider shoulders that also serve as footpaths are provided on both sides. However, this is not separated to shield pedestrians from errant motorist	Risk of pedestrians being knocked down by errant or overlapping vehicles	• Consider installing barriers to shield pedestrians and bar motorist from driving on the shoulders.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Pipeline Area			
1	Over speeding and dangerous overtaking	The section is long, straight and on a generally level terrain prompting motorists to overspeed and overtake dangerously. Most crashes recorded at the area are head on.	• Installation of speed calming measures; rumble strips for instance would reduce the likelihood of motorists over speeding • Installation of retroreflective speed control signs preferably in form of overhead sign gantries. • Enforcement of speed limits by relevant agencies • Improve crash data gathering and management for comparative analysis	
2	Faded road markings	Road markings at the edges and median have faded. Delineation of the lanes should be done afresh to guide the motorists.	• Application of retroreflective road markings • Installation of delineator retroreflective road studs to improve on visibility at night • Sustained maintenance of the same	
3	Non-existent/inadequate road signs	Speed limit signs are conspicuously absent along this stretch. Over speeding and reckless overtaking should be highly discouraged to avert crashes in the area.	• Installation and sustained maintenance of appropriate retroreflective signs along the section; speed control and warning signs should be prioritized.	
	Ngokomi - Kalimbini			
	Kalimbini			
1	Over speeding and dangerous overtaking	The section is long and straight with a gentle descent from the Nairobi side. Vehicles and especially heavy trucks from the Nairobi side tend to overspeed and overtake dangerously at the area.	• Installation of speed calming measures; rumble strips for instance would reduce the likelihood of motorists overspeeding • Installation of retroreflective speed control signs • Reinforce police road patrols in hot spots of pedestrian crashes • Enforcement of speed limits by relevant agencies	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
2	Lack of a designated pedestrian crossing	A small market centre exists along the stretch. Speeding traffic tends to pose difficulties to pedestrians crossing the road.	• Provision of a safe and marked pedestrian crossing at an appropriate location near the market • Provision of appropriate signs to notify motorists of an existing pedestrian crossing.	
3	Faded road markings Road markings on the main carriageway and designated pedestrian crossings are completely faded in most of the sections	Application of fresh road marking needs to be done to delineate the lanes.	• Application of retroreflective road markings • Installation of delineator retroreflective road studs to improve on visibility at night • Sustained maintenance of the same	
4	Lack of/Inadequate road signs	Speed limit signs are absent along this stretch. Over speeding and reckless overtaking should be highly discouraged to avert crashes in the area.	• Installation and sustained maintenance of appropriate retroreflective signs along the section; speed control and warning signs should be prioritized.	
5	Smooth road surface	The road surface is generally in good condition and as such prompts motorists to overspeed. However, in the event of an emergency, the smooth surface provides low skid resistance meaning that emergency brakes might fail.	• Application of surface dressing to provide better skid resistance.	
6	Hanging road shoulders	There is a significant height difference between the existing shoulders and the ground level. In the long run, the edges tend to erode and wear away effectively reducing the carriageway width.	• Perform routine maintenance checks along the Corridor as a mitigating measure	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Ngokomi			
1	Lack of a designated pedestrian crossing at Ngokomi market center	The stretch is long and straight with two sloping approaches on either side of the shopping centre prompting pedestrian fatalities.	• Provision of a safe and marked pedestrian crossing at an appropriate location within the centre. • Provision of appropriate signs to notify motorists of an existing pedestrian crossing.	
2	Over speeding and dangerous overtaking	The section is characterized by gentle vertical curves with the horizontal curves being minimal. This might prompt motorists to overspeed and overtake recklessly posing a safety hazard.	• Installation of speed calming measures; rumble strips for instance would reduce the likelihood of motorists over speeding • Installation of retroreflective speed control signs • Enforcement of speed limits by relevant agencies	
3	Faded road markings	The traffic lanes have not been delineated with the median marking in particular appearing faded.	• Application of retroreflective road markings • Installation of delineator retroreflective road studs to improve on visibility at night • Sustained maintenance of the same	
4	Missing road signage	Speed limit signs are lacking along this stretch. Over speeding and reckless overtaking should be highly discouraged to avert crashes in the area.	• Installation and sustained maintenance of appropriate retroreflective signs along the section; speed control and warning signs should be prioritized.	
5	Damaged safety fences Several lines of guardrails at box culverts crossings are knocked down, damaged and some pieces missing. Some section of road along Ngokomi stretch is on high embankment but have guardrails completely missing.	Risk of vehicles rolling over high embankment Risk of vehicle ramming into protruding guardrails and piecing through the vehicle	• Repair/replacement of broken /missing guardrails complete with end pieces and delineators and sustained maintenance of the same	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
6	Aging road pavement and hanging road shoulders Isolated potholes in addition to rutting, cracks, rutting (low skid resistance) raveling were observed to be developing along the wheel paths on Nairobi bound carriageway especially along Pipeline and Ngokomi stretches	The shoulders are high as compared to the surrounding ground level. Speeding vehicles are likely to roll over after veering off the road. Moreover, in the event of an emergency, motorists are less likely to move to the road side for fear of rolling over increasing the propensity of crashes.	• Repair of deteriorated road section and sustained maintenance	
	Konza - Malili			
1	Over speeding and dangerous overtaking	Generally long straight stretch which encourages reckless over speeding and overtaking	• Installation of speed calming measures; rumble strips for instance would reduce the likelihood of motorists over speeding • Installation of retroreflective speed control signs preferably in the form of overhead sign gantries. • Enforcement of speed limits by relevant agencies	
2	Faded road markings Road markings at the edges and median have faded. Delineation of the lanes should be done afresh to guide the motorists.	Risk of vehicles involved in head-on, rear-end, side-impact, side-swipe collisions and pedestrians being knocked down as they cross the road	• Application of retroreflective road markings • Sustained maintenance of the same • Installation of delineator retroreflective road studs to improve on visibility at night	
3	Inadequate road signage	Speed limit signs are absent along this section. Over speeding and reckless overtaking should be highly discouraged to avert crashes in the area.	• Installation and sustained maintenance of appropriate retroreflective signs along the section; speed control and warning signs should be prioritized.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
4	Damaged/missing safety fences Most lines of guardrails in the entire stretch have either been damaged beyond repair or are completely missing. Further, the damaged guardrails have been left exposed with no end pieces and protruding sharply against the direction of traffic.	Risk of vehicles rolling over high embankment Risk of vehicle ramming into protruding guardrails and piecing through the vehicle The following collisions are therefore probable: head-on, side-impact, side-swipe and roll-over.	• Repair/replacement of broken guardrails complete with end pieces and delineators • Repainting of non-reflective old guardrails to enhance visibility at night	
5	Deteriorated pavement and worn out road shoulders	Team observed pavement is already showing signs of distress and failure. Failures observed along the wheel path on Nairobi bound lane included: emerging potholes, cracks, raveling, rutting, eroded/warn out & hanging shoulders Risk of Head-on, Side-impact, Side-swipe, Rear-end, Multi-vehicle pile-ups collisions exist as vehicles swerve to avoid damaged sections	• Repair of deteriorated roads section and sustained regular maintenance	
6	Silted/inadequate drainage capacity Poor drainage resulting in water ponding within the road cross section and reducing effective width of the road.	Reduced road width greatly increases risk of Head-on (water splashing and blocking view of motorist), Rear-end, Side-impact, Side-swipe, Multi-vehicle pile-ups collisions and Roll-over collisions	• Clean/enhance capacity of existing drainage structures • Sustained maintenance of the drainage system	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
7	Obstruction by Heavy trucks and PSV Trucks parking on the roadside and PSV pick and drop commuters on the road thereby reducing visibility of motorists and obstructing road signs	Rear End, Side-swap, side impact collisions and vehicle-pedestrian accidents	• Collaboration with law enforcement agencies	
8	Steep vertical curves with limited sight distances	Kapiti plains sections is on a relatively straight alignment with gentle terrain. However, there exists some steep vertical curves with limited sight distances Risk of Head-on, Side-swipe, Side- impact, Rear-end, Multi-vehicle pile-ups collisions exists.	• Redesign of sections with limited sign distances as a long-term measure • Provision of adequate requisite warning signs • Collaboration with law enforcement offices to monitor and regulate speed along the stretch.	
	Mlolongo			
1	At the time of the Survey, 1No. foot bridge was under construction at Olympic petrol crossing in Mlolongo. In addition, the service lane was also under construction between Mlolongo and Sabaki area on Mombasa bound carriageway side and within Mlolongo centre on Nairobi bound carriageway)			
2	Missing/non-existent road signs	A considerable number of road signs have been knocked down and those remaining are often blocked by parking trucks and cannot therefore relay intended messages No signs to direct traffic through service lanes Vehicles make dangerous and illegal turns at undesignated places Risk of Head-on, Rear-end, Side-impact, Side swipe collisions is imminent along the area	• Installation and sustained maintenance of appropriate and requisite retroreflective signs along the road section • Install barriers to deter illegal turnings.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Faded road marking	Existing road marking is completely faded. Markings on few provided raised pedestrian crossings/ speed humps are also faded. Risk of Pedestrians collision, Head-on, Side-impact, Side-swap Roll-over and Multi-vehicle pile-ups	• Application of retroreflective road markings on carriageway and designated pedestrian crossings and sustained maintenance of the same to guide movement of vehicles and pedestrians at market centres • Installation of delineator retroreflective road studs to improve on visibility at night on both carriageways.	
4	Confusing U-turn on Nairobi bound carriageway near Syokimau railway station stage	Even though a gantry sign has been provided to show existence of a U-turn near Syokimau railway station stage on Nairobi bound carriageway, design of the U-turn lane is confusing. The U-turn lane is long and confuses motorists as it terminates abruptly. Risk of Roll-over, Head-on with Mombasa bound traffic, Side-impact, Side-swipe, Roll-over and Multi-vehicle pile-ups exists as result.	• Remarking of the road to direct road users through the U-turn • As an addition to the gantry sign already provided, consider providing additional road signs to caution on abrupt termination of the lane • Need to redesign the U turn as a long-term measure • Application of road markings on the carriageway and designated pedestrian crossings and sustained maintenance of the same to guide movement of vehicles and pedestrians at market centres • Installation of delineator retroreflective road studs to improve on visibility at night	
5	Insufficient/lack of pedestrian crossings (Mlolongo, Kapa/Gateway Mall and Syokimau railway station stage)	Provided designated pedestrian crossing are not enough to cover the whole of Mlolongo This has further been aggravated by PSVs that pick/ drop at multiple points across the centre. Risk of Pedestrians collision; Rear-end, Side-impact, Side-swipe collisions as vehicle swerve to avoid hitting pedestrians	• Provision of safe and marked pedestrian crossings at appropriate locations complete with pedestrian crossing signs and road studs to enhance visibility at night. • Installation of rumble strips on either side of raised pedestrian crossings where they have been provided. • Consider providing foot bridges at Mlolongo, Syokimau and crossing to SGR station as a more sustainable solution	Currently being addressed. 1 No. footbridge under construction at Olympic Petrol crossing. Additional 3 footbridges to be constructed at Mlolongo, Syokimau-Katani and Gateway Mall crossings

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
6	Lack of bus bays (Mlolongo, Kapa/Gateway Mall)	Mlolongo is a populous trading centre with heavy settlement on both sides. It is also a popular picking and dropping point for commuters There are no bus bays provided along the road within Mlolongo on the Nairobi bound carriageway at Kapa/Gateway Mall. Most PSVs don't use the provided (though small) off road bus park on Mombasa bound carriageway. In the absence of designated bus bays at suitable strategic locations, vehicles therefore pick and drop at any point, thereby aggravating road safety problems that abound the centre. In addition, Nairobi bound PSV pick/drop passengers on the inner median on the Nairobi bound carriageway since trucks diverting into the Weighbridge always use the outer lane. Risk of Pedestrians collision; Rear-end, Side-impact and Side-swipe collisions	• Collaboration with law enforcement agencies to compel PSV to use a bus park provided on Mombasa bound carriageway. • Provision of an off-road bus park	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
7	Encroachment by vendors at Mlolongo	Vendors selling wares on the road carriageway Others standing in the middle of the carriageway to sell their goods to moving traffic oblivious of the danger this pose to them and to other road users Risk of pedestrians being knocked down and vehicles involved in Rear-end, Side-impact, Side-swipe, Multi-vehicle pile-ups collisions as they try to avoid knocking the vendors and other vehicles	• Reclamation of RoW by clearing of any encroachment within road reserve. • Sustained maintenance and management of RoW Collaboration with law enforcement agencies • Collaboration with relevant agencies on Road Safety awareness campaigns and sensitization of vendors and other road users	
8	Obstruction by trucks and PSV vehicles at Mlolongo.	Trucks and PSVs park on the shoulders and edge of carriageway Service lanes have been converted into garages and truck stopping points/parking Risk of Rear end, Side-swipe, side impact collisions and vehicle-pedestrian accidents	• Collaboration with law enforcement agencies • As a long-term measure, consider construction of service lanes to separate through traffic from local and reduce congestion • Provision of a road side station at a suitable location	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
9	Damaged kerbstone/barriers to Weighbridge and hanging shoulders	Several kerbs separating auxiliary lane to static weighbridge station on Nairobi bound carriageway are damaged dangerously exposing steel reinforcement. Some of the barriers have also been knocked down and left dangerously lying beside the narrow auxiliary lane Markings on the kerbs/ barriers are covered in soot and are not clearly visible. Vehicles run the risk of ramming into them Worn out shoulders have left the road edge hanging Risk of vehicles ramming into non reflective kerbs, Rear-end, Multi-vehicle pile-ups and Roll-over collisions	• Repair of damaged and knocked down kerbs/separators/barriers on auxiliary lane • Repaint the kerbs/barriers and ensure sustained maintenance of the same. • Repair of damaged pavement and shoulders and sustained regular maintenance of the same	
	Gitaru – Rungiri (Southern Bypass/A8 Junction)			
1	At the time of the survey, a construction contract covering the section was ongoing (James Gichuru – Rironi project). The scope of works entails capacity enhancement (construction of additional lanes, service lanes, grade separated junctions, elevated pedestrian crossings in addition to other NMT facilities)			
2	Lack of a provision for a designated pedestrian crossing	There is no provision of a safe pedestrian crossing at the location. Instead, pedestrians use a narrow gap between the New Jersey crash barriers notwithstanding the crossing is on a curvy slope.	• Provision of a footbridge at an appropriate location (a marked pedestrian crossing might not be effective taking the location and volume of traffic into account).	To be addressed under the ongoing rehabilitation and capacity enhancement of the James Gichuru Junction to Rironi road project.

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Unsafe location of Bus stop on Nairobi bound carriageway	Location of Bus stop on Nairobi bound carriageway is sited on a curve with limited visibility. Section also descends downhill hence speeding motorist are likely to knockdown pedestrians crossing the road at this location and collide with vehicles accelerating from bus bay into main carriageway. Risk of rear-end, side swipe, side impact collision and pedestrian knock down	• Providing rumble strips to warn motorists descending downhill to slow down speed in the meantime as the section is under construction • As a long-term measure, improve on visibility at the curve to make the bus bay more visible	,,
4	Absent/faded road markings	There are no road markings or reflective road studs to delineate the traffic lanes. In addition, the transition lane from the Southern Bypass should be well marked for easy movement of the motorists joining the A8 Highway	• Application of retroreflective road markings • Sustained maintenance of the same • Installation of delineator retroreflective road studs to improve on visibility at night	,,
5	Lack of road signs	Road signage informing the road users of the presence of bus bays and pedestrian crossings are absent. Appropriate signage should be installed to inform all road users accordingly.	• Installation and sustained maintenance of appropriate retroreflective signs.	,,
6	Non-reflective central concrete barriers	The central concrete barriers are not reflective especially during the night. Consequently, they have been constantly hit against as evidenced by the cracks and marks.	• The central crash barriers should be painted with retroreflective paint or fitted with retroreflective tapes to enhance visibility at night.	,,

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
7	Encroachment into the road reserve by vendors	Makeshift/temporary kiosks/ sheds have cropped up especially adjacent to the Nakuru bound bus bay as vendors display and sell their wares.	• Clearing of any encroachment within the road reserve and especially near the carriageway.	,,
8	Deteriorating road surface	The surface on the A8 Highway has deteriorated and is characterized by an uneven surface. The shoulders have also eroded over time.	• Repair of deteriorated roads section. For a more wholistic solution, construction of a new pavement structure would be ideal. • Sustained maintenance	,,
9	Blocked/silted gully pots at the foot of the New Jersey crash barriers	The gully pots at the foot of the crash barriers have been blocked by litter/silt. In essence, this implies that storm water that would be otherwise channeled by the gully pots flows over the carriageway causing substantial erosion and deterioration.	• Regular cleaning/de-siltation of the existing drainage facilities and structures • Sustained maintenance of the drainage system.	,,
	Mukinya – Migaa – Sobea – Salgaa - Sachangwan			
	Sobea Junction			
1	No provision of speed change lanes	There is no provision for accelerating lanes for Nakuru bound traffic joining the Highway from Njoro and Eldoret bound traffic from Menengai	• Construction of speed change lanes for accesses and junctions to allow for gradual entry of vehicles to the highway.	
2	Inadequate turning radius for heavy trucks	Turning radii from the feeder roads and especially from the Njoro bound road are too narrow for heavy trucks.	• Geometric design for trucks requires much more generous design in regard to turning radius because of wider and longer wheelbases	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Missing/non-existent road signs	The team noted that except for gantry sign there are no warning motorists on dangers of over-speeding, there are no adequate signs as well advance directional/ informatory signs to inform motorists of major junction at Sobea or presence of pedestrian crossing on this section which has generally gentle horizontal and vertical curves to. Motorists tend to speed in this stretch Risk of pedestrians being knocked Roll-over, Head-on, Rear-end, Side-impact, Side-swipe, Multi-vehicle pile-ups collisions	• Installation of appropriate retro-reflective signs along the road section • Sustained maintenance of the same.	
4	Lack of a designated pedestrian crossing zone	Despite the provision of bus bays at the Sobea junction, no designated crossing points have been marked out. The section has commercial and residential establishments that generate significant pedestrian traffic at this section of road. Risk of Pedestrians collisions, Head on, Rear-end, Side-impact, Side-swipe collisions as vehicle swerve to avoid hitting pedestrians	• Provision of safe and marked pedestrian crossings at appropriate locations. • Provision of adequate and appropriate signs to guide all road users to and through these designated crossings	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
5	Dangerous location of the bus bays	The two bus bays are situated on what ideally should be the accelerating lanes from the feeder roads joining the Highway. Rear-end collisions are likely to occur as a result.	• Relocation of the bus bays to a safe distance from the junction • Installation of appropriate retroreflective signage showing the location of the bus bays	
	Sobea – Salgaa Stretch			
1	This section of road forms one of the most notorious black spots in the country's road network. Arising from numerous catastrophic crashes that have occurred in this area, KeNHA recently installed speed calming measures (speed limit and warning signs, rumble strips, road marking etc) aimed at controlling speeds in this long and straight stretch of the road thereby reducing on number and severity of crashes. The road surface is fairly in good condition.			
2	Speeding and dangerous overtaking	Section between Sobea – Salgaa is fairly in good condition and traverses a fairly level terrain. The road has a long straight section with two and three lanes at the climbing section. As such, vehicles were observed to be over-speeding and overtaking dangerously. Several speed calming measures have been employed though adherence to speed limits by motorists still remains a challenge. Risk of Head-on, Rear-end, Side-impact, Side-swipe, roll-over, Multi-vehicle pile-ups collisions	• Repair of smoothened rumble trips as speed calming measures • Collaboration with law enforcement agencies to enforce the speed limits • Provision of audible/vibratory edge road marking at carriageway edges to keep motorists alert • Provision of speed limit signs	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Long and straight horizontal alignment	The stretch through Margaret Kenyatta farm is on a long straight with gentle vertical curve. This long and straight alignment generally entices motorist to overspeed and overtake dangerously. Roll-over, Head-on, Rear-end, Side-impact, Side-swipe, Multi-vehicle pile-ups collisions are all likely at this location.	• In addition to the speed calming measures and signs already installed, as a long-term measure, reconsider realigning the stretch or modifying the cross section into a dual carriageway by separating traffic in opposite directions	
4	Worn out & hanging road shoulders edges	Whereas the carriageway is in good condition, RSA team observed existing road shoulders have been eroded by overlapping motorists and are hanging in some sections Risk of vehicles being involved in Roll-over, Rear-end, Side-impact, Side-swipe, Multi-vehicle pile-ups collisions as vehicles manoeuvre over hanging shoulders	• Repair of deteriorated roads section • Sustained maintenance	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Salgaa centre			
1	The town section is considerably busy with trucks stopping and parking along the road for large parts of the day. Considerable pedestrian and NMT movements can be observed throughout the town.			
2	Unsafe parking of heavy trucks on the shoulders	The heavy trucks park on the shoulders thereby reducing the effective width of the carriageway. Most of the accidents are associated to the roadside parking which causes reduced visibility for both motorists and pedestrians crossing the road	• Provision of off-road heavy truck parking facility complete with amenities (Road Side Station) as a long-term measure	
3	Lack of safe designated pedestrian crossings	There is no provision for designated crossing zones for pedestrians in the town.	• Provision of marked raised pedestrian crossings at appropriate locations in the town. • Provision of appropriate signs to notify motorists of existing pedestrian crossings. • In the long term, construction of a footbridge(s) should be considered to safeguard the safety of pedestrians.	
4	Fading/non-existent road markings	Road marking through the town section of road is faded. Additionally, some of the speed humps along the section may not be clearly visible to motorists. Markings for pedestrian crossing are not visible and therefore motorists are unable to establish the existence of designated pedestrian crossing points.	• Application of retro-reflective road markings • Provision of audible/vibratory edge road marking at carriageway edges to keep motorists alert • Provision of retro-reflective delineator road studs to enhance visibility at night • Sustained maintenance of the same	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
		Risks of pedestrians being knocked by vehicles as they cross the road. Risk of vehicles involved in Head-on, Side-impact, Side-swipe, Rear-end, Multi-vehicle pile-ups collisions		
5	Inadequate provision of NMT facilities and safe pedestrian crossing points	Despite the heavy presence of pedestrian and NMT movements along the town section, no designated crossing points have been marked out. There is also no separation of lanes for NMT and motorised transport modes, making it dangerous for both road users. Risk of Pedestrians collision; Head on, Rear-end, Side-impact, Side-swipe collisions as vehicle swerve to avoid hitting pedestrians	• Provision of safe and marked pedestrian crossings and NMT features at appropriate locations. • Provision of adequate and appropriate signs to guide all road users to and through these designated crossings	
6	Unsafe junction layout at Salgaa town	The town section is riddled with numerous accesses and minor road junctions that have no speed change lanes. Additionally, there is a major staggered junction at the town section with stagger less than the minimum 50m requirement.	• Channelization of traffic at the junction • Installation of adequate and appropriate signs • Sustained maintenance of the signs • Redesign of access to meet design requirements.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
		The junction is not channelized and has no provision for speed change lanes on Nairobi bound side. Risk of vehicles being involved in Head-on, Side-impact, Side-swipe, Rear-end, Multi-vehicle pile-ups collisions are all probable.		
7	Worn out & hanging road shoulders edges	Whereas the carriageway is in good condition, the Survey team observed existing road shoulders have been eroded by overlapping motorists and are hanging in some sections Risk of vehicles being involved in Roll-over, Rear-end, Side-impact, Side-swipe, Multi-vehicle pile-ups collisions as vehicles manoeuvre over hanging shoulders	• Repair of deteriorated roads section • Sustained maintenance	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Molo River Bridge			
1	Dangerous transition from a dual to a single carriageway and vice versa. The bridge is located on a both vertical (sag) and horizontal curve.	There is an abrupt end of the dual carriageway into a single carriageway when approaching Molo River bridge from the Eldoret side. Vehicles on both sides tend to over speed as they descend towards on the bridge. With this constriction/ abrupt termination of the dual carriageway, there is high risk of conflict as 2 lanes of traffic merge into a single lane. Risk of Roll-over, Head on, Rear-end, Side-impact and Side-swipe collisions.	• Installation of appropriate retroreflective signs notifying motorists of the transition from a dual to a single carriageway and vice versa and at a safe distance • Provide requisite warning signs to warn motorists of existence of bridge (narrow road) • Extend extending the climbing lane past the bridge towards Salgaa side as a long-term measure	
2	Missing hazard marker signs on the bridge abutments	Hazard signs on the abutments are missing. This presents a hazard especially to motorists using the bridge at night.	• Installation of retroreflective hazard marker signs on the bridge abutments on either side.	
	Molo River Bridge – Sachang'wan			
1	The section was under construction (carriageway widening and separation of lanes using New Jersey Crash barriers into a dual carriageway)			
2	Non-reflective median New Jersey crash barriers	The two directions of traffic are separated using New Jersey crash barriers. However, they might be barely visible at night especially to motorists using the inner lanes.	• Painting of the New Jersey crash barriers with retroreflective paint/fitting them with retroreflective tapes to enhance visibility at night.	To be addressed under the ongoing Emergency Safety Enhancement works from Kibunja to Kabarak Junction.

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Encroachment by vendors	Some venders have taken advantage of the speed calming measures to sell their wares and products to motorists oblivious of the dangers they expose themselves to.	• Sensitization on the dangers accompanied with enforcement by the relevant authorities	
	GSU Camp – Kibunja Section			
1	This section of the highway is treacherous and known for successive combination of windy horizontal and vertical curves. The road surface is fairly good with little rutting observed near the road hump sections			
2	Missing/damaged and wrongly connected safety fences	The survey team observed several locations and especially on bridge crossings with: • Missing and knocked down guardrails with missing end pieces • Missing guardrails on high embankment sections • Wrongly connected and terminated guardrails • Weak guardrail support, rails covered in soot. • Wrong guardrail connection/ termination and damaged guardrails have left critical areas including drainage structures crossings exposed and sharp edges protruding towards direction of traffic. • Risk of vehicle rolling over on high embankment • Risk of vehicle ramming into protruding guardrails and piecing through the vehicle	• Repair/replacement of broken and weak guardrails complete with end pieces and delineators • Painting of the same with retro reflective paint to enhance visibility at night	To be addressed under the ongoing Emergency Safety Enhancement works from Kibunja to Kabarak Junction

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Fading and non-reflective road markings	The Survey team observed that existing road marking is fading and require repair. Additionally, section has no retro-reflective delineator road studs to hence visibility at night. Completed sections under constructed have also not been marked. Risks of pedestrians being knocked by vehicles as they cross the road. Risk of vehicles involved in Head-on, Side-impact, Side-swipe, Rear-end, Multi-vehicle pile-ups collisions	• Application of retro-reflective road markings and tapes • Provision of audible/vibratory edge road marking at carriageway edges to keep motorists alert • Provision of retro-reflective delineator road studs to enhance visibility at night • Sustained maintenance of the same	
4	Speeding, careless and dangerous overtaking and freewheeling	Between Sachangwan and Chepsion Vehicles on both directions tend to: • Over speed • Overtake carelessly and dangerously, They also barely observe lane disciple (double overlap on climbing lane and opposite lane as well) Risk of Head-on, Rear-end, Side-impact, Side-swipe, roll-over, Multi-vehicle pile-ups collisions	• Installation of speed calming measures i.e. rumble strips on Nakuru bound carriageway • Installation of 'No Overtaking' and other warning signs • Collaboration with law enforcement agencies • Construction of off-road safe runway truck ramp/emergency escape ramp/clear zones at strategic locations on Nakuru bound carriageway along the accident-prone section– currently being implemented • Dualling to separation of traffic in opposite directions as a long-term measure – currently being implemented	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
5	Encroachment of vendors onto the carriageway	Where speed humps have been provided, vendors have invaded the road and are selling wares to moving motorists while standing in the middle of the road, thereby posing a danger to themselves and other road users. Risks of vendors being knocked by vehicles. Risk of vehicles involved in Head-on, Side-impact, Side-swipe, Rear-end, Multi-vehicle pile-ups collisions.	• Liaison with law enforcement authorities to ensure that the vendors are moved from the main carriageway	
	Molem – Namba Okana – Nyamasaria – Kasagam			
	Namba-Okana			
1	Faded road markings	The road markings especially at the edges are almost completely faded. The lanes should be delineated accordingly to guide the road users. Risk of vehicles being involved in Head-on, Side-impact, Side-swipe, Rear-end, Multi-vehicle pile-ups collisions Risks of pedestrians being knocked by vehicles as they cross the road.	• Application of road retro-reflective road markings to guide the movement of through and diverting traffic • Provision of audible/vibratory edge road marking at carriageway edges to keep motorists alert • Installation of delineator retro reflective road studs to enhance night vision • Sustained maintenance of the same	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
2	Inadequate road signs	A speed limit sign of 50 Kph has been provided for the section. Road signage showing the speed humps, pedestrian crossings and other requisite signs have however not been provided Pedestrian-vehicle conflict exists. Risk of vehicles being involved in Head-on, Roll – over, Side-impact, Side-swipe, Rear-end, Multi-vehicle pile-ups collisions	• Installation and sustained maintenance of appropriate retroreflective signs. • Enforcement of the speed limits by the relevant agencies	
3	Lack of designated pedestrian crossings	A provision for raised pedestrian crossings near the local bus bay has only been made for the on one side (towards Kisumu side). For higher effectiveness, pedestrian crossings should be provided on both fronts of the bus bays.	• Provision of marked pedestrian crossings (raised) on either side of the bus bays. • Installation of delineator retro reflective road studs at pedestrian crossing points to enhance night vision • Provision of rumble strips between the speed calming humps and the pedestrian crossings to prevent motorists from accelerating as they approach the crossing zones.	
4	Lack of safety fences/guard rails on high embankment	The road has been constructed on a high embankment with steep slopes on the LHS of the Kisumu bound lane especially at the left turning horizontal curve.	• Provision of safety fences/guard rails on the steep sloped embankment	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
		However, no provision for safety fences/guard rails has been made posing a risk of vehicles that might lose control rolling down the high embankment.		
5	Dangerous overtaking especially by *bodaboda* riders	The shoulders along the stretch have been widened to provide stability to heavy trucks plying the route. It has however been observed that some *bodaboda* riders take advantage and overtake on the wrong side subjecting themselves and other motorists to risk.	• Enforcement of traffic rules by the relevant agencies	
6	Hanging road shoulders	The road pavement structure has been constructed on a fill. Resultingly, there is a sharp drop from the road edges. With time, the edges are likely to erode eventually reducing the effective carriageway. More so, vehicles that might veer off the road are likely to roll over.	• Repair or damaged/deteriorated road sections	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Rabuor			
1	Faded road markings	The median road markings are faded where the edge road markings are non-existent. Delineation of the lanes needs to be done to guide road users. Additionally, markings on the speed humps and pedestrian crossings have faded over time	• Application of road retro-reflective road markings to guide the movement of through and diverting traffic • Provision of audible/vibratory edge road marking at carriageway edges to keep motorists alert • Installation of delineator retro reflective road studs to enhance night vision • Sustained maintenance of the same	
2	Inadequate road signage	Road signs showing the presence of speed calming humps and pedestrian crossings are missing. In addition, marker posts at the culvert edges are not adequately reflective.	• Installation and sustained maintenance of appropriate retroreflective signs • Painting of marker posts at the culvert edges with retroreflective paint/fitting them with retroreflective tapes.	
3	Picking up and dropping off of passengers at non-designated locations	Matatus along the stretch tend to pick up and drop off passengers at non designated zones despite bus bays being provided	• Enforcement by the relevant agencies	
4	Silted drainage structures	The terrain is generally flat with cross and access culverts having no clearly defined outfalls. Most of them have been further clogged by plastics reducing their effective capacity.	• Regular cleaning and de-siltation of the culverts • Regular clearing of vegetation around the drainage structures	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
5	Non provision of speed changing lanes at the junctions	The centre is generally busy with a significant movement of both vehicles and pedestrians. Accesses joining the main highway do not have speed changing lanes as required posing a safety hazard to both motorists joining the highway and exiting into the accesses.	• Providing speed change lanes to the accesses • This being an international trunk road serving both through and local traffic, provision of access should be controlled and proper development to be supervised by the Authority • Provision of service lanes to the highway to serve local traffic as a long-term measure	
6	Hanging road shoulders	There is a significant height difference between the road edges and the normal ground level. As time progresses, they are likely to erode creating rugged road edges	• Repair or damaged/deteriorated road sections	
7	Significant spacings between speed calming humps and pedestrian crossings	Siting of raised pedestrian crossings/speed humps are far off from provided Bus stops, are far apart and from the market center central point where many people cross the road at. (are widely stationed apart. Motorists might tend to over speed when approaching the subsequent hump).	• Provision of rumble strips between the speed humps and the pedestrian crossings • Provision of rumble strips in between to caution motorists to slow down • Provision of pedestrian crossing at strategic and best locations. • Provide additional safe crossing points at safe locations.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
	Alendu			
1	Unsafe pedestrian crossings	Siting of raised pedestrian crossings/speed humps are far off from provided Bus stops, are far apart and from the market center central point where many people cross the road at. (are widely stationed apart. Motorists might tend to over speed when approaching the subsequent hump).	• Provision of rumble strips between the speed humps and the pedestrian crossings • Provision of rumble strips in between to caution motorists to slow down • Provision of pedestrian crossing at strategic and best locations. • Provide additional safe crossing points at safe locations.	
2	Faded road markings	The road markings especially at the edges are almost completely faded. The lanes should be delineated accordingly to guide the road users.	• Application of road retro-reflective road markings to guide movement of through and diverting traffic • Provision of audible/vibratory edge road marking at carriageway edges to keep motorists alert •Installation of delineator retro reflective road studs to enhance night vision • Sustained maintenance of the same	
3	Inadequate road signage	Road signs showing the presence of speed calming humps and pedestrian crossings are missing. Hazard marker signs at the bridge/box culverts	• Installation and sustained maintenance of appropriate retroreflective signs • Installation of retroreflective hazard marker signs at the bridge	
4	Hanging road shoulders	There is a significant height difference between the road edges and the normal ground level. As time progresses, they are likely to erode creating rugged road edges.	• Repair or damaged/deteriorated road sections	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
5	Speeding motorists and dangerous overtaking	Speeding motorists pose a risk to pedestrians as well as fellow motorists noting that the traffic volume in the area is quite significant. Dangerous overtaking by both motorists and *bodaboda* riders also presents a risk to the road users.	• Provision of rumble strips between the speed calming humps • Collaboration with law enforcement officers	
	Nyamasaria			
1	Unsafe crossing of pedestrians albeit the presence of a footbridge	A steel footbridge has recently been completed but has been rendered redundant by the locals; who instead opt to arbitrarily cross the road at grade below the bridge.	• Provision of pedestrian safety fences/barriers at Nyamasaria town to prevent pedestrians from crossing the road at grade • Sensitization on the need to use the footbridge and enforcement by the relevant agencies.	
2	Ramps touching the ground are extremely steep making them highly inconvenient for Persons with Disabilities (PWDs)	Entry and exit Ramps touching the ground are extremely steep making them impractical for use by Persons with Disabilities (PWDs) Whereas a footbridge has been provided, pedestrians do not use the provided footbridge and instead cross at grade Pedestrian/PWD tripping and falling over, Foot bridge being abandoned and instead people cross the road at grade	• Re-design of the ramps to a lower gradient.	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
3	Safety concerns on the bridge rails	The vertical spacing between the bridge rails is significantly large such that open spaces are left between. In addition, there are concerns that the bridge rails are too low.	• Provision of rails with narrow spacing and sufficient safety provisions	
4	Encroachment of the service lanes and walkways by vendors	Vendors display and sell their wares on what should otherwise be used as service lanes/walk ways risking their safety and effectively inhibiting vehicular movement within the town Pedestrian-Cyclist/vehicle conflict Rear-end, Side-impact, Side-swipe collisions as vehicle swerve to avoid hitting pedestrians	• Reclamation of RoW • Collaboration with law enforcement agencies to deter vendors from using the road	
5	Faded road marking	Road markings delineating the lanes has faded. The raised speed humps are not also clearly marked.	• Application of road retro-reflective road markings to guide movement of through and diverting traffic • Provision of audible/vibratory edge road marking at carriageway edges to keep motorists alert • Installation of delineator retro reflective road studs to enhance night vision • Sustained maintenance of the same	

S/No	Survey Observations and Findings	Analysis/Diagnosis	Suggested Recommendation for improvement	Remarks/ Approximate Remedial Cost
1	Wrongly placed road signage	Some road signs have been placed on the street lighting poles. These might not be visible to all road users.	• Installation of appropriate retroreflective signs at appropriate heights for visibility to all motorists • Sustained maintenance of the same	
2	Damaged storm water drains on the cycle tracks/ foot paths	The concrete covering on the storm water drainage has been damaged at a section within the town. This poses a safety hazard since pedestrians might trip and fall into the drains if they are not repaired early enough.	• Repair of the storm water drain by replacing the damaged section using a suitable concrete slab.	

6.5 Appendix 5: Selected Site Observation Photographs

1. Kibarani – Makupa Causeway

__Figure 2:__ Missing road markings at Makupa Causeway

__Figure 5:__ Site management concerns at the ongoing footbridge construction (Unsecured excavation)

__Figure 3:__ Deteriorated road surface at Makande Junction

__Figure 6:__ Dangerous pipe outcrops along Makupa causeway. Note the close proximity between the carriageway and railway line

__Figure 4:__ Insufficient turning radius for heavy trucks at Makande Junction

__Figure 7:__ Absence of a barrier between the road and railway line posing a safety hazard to pedestrians.

2. Bonje Area

Figure 8: Faded road markings

Figure 9: Successive combination of horizontal and vertical curves

Figure 10: Picking up/dropping off of passengers at non-designated locations (no provision for a bus bay)

3. Maji ya Chumvi

Figure 11: Bleeding road surface

Figure 12: Deep open drains too close to the carriageway

Figure 13: Damaged safety fences/guard rails

4. Emali – Pipeline

Figure 14: Unsafe configuration at Emali/Oloitoktok Junction

Figure 15: Lorry exiting towards Oloitoktok from the A8 Highway (note the skid marks indicating difficulties when making the turn)

Figure 16: Long and straight stretch along Pipeline area. Faded road markings at the stretch also observed

5. Ngokomi - Kalimbini

Figure 17: Kalimbini area (Long and straight stretch with a slight descent from the Nairobi side prompting motorists to overspeed and overtake recklessly)

Figure 18: Ngokomi shopping centre (Long and straight stretch with gently sloping approaches on either side)

6. Gitaru - Rungiri

Figure 19: *Dangerous location of the Nairobi bound bus bay*

Figure 20: *Encroachment of the road reserve by vendors/hawkers*

Figure 21: *Rushing pedestrian crossing at a non-designated location*

7. Mukinya – Migaa – Sobea – Salgaa – Sachangwan

Sobea Junction

Figure 22: *Heavy truck joining the A8 Highway from Njoro (note the narrow turning radius).*

Figure 23: *Matatu joining Eldoret bound traffic from Menengai*

Figure 24: *Lack of a provision for an accelerating lane for Eldoret bound traffic from Njoro*

Salgaa centre

Figure 25: Heavy trucks parked on the shoulders effectively narrowing the carriageway and impairing visibility for other road users

Figure 26: Hawkers/vendors selling their products on the carriageway around Sachangwan area oblivious of the safety hazards

8. Molem – Namba Okana – Nyamasaria – Kasagam

(Namba Okana area)

Figure 27: Faded road markings at a pedestrian crossing

Figure 28: Hanging road shoulders

Figure 29: Missing safety fences on a high steep-sloped embankment

Rabuor Area

__Figure 30:__ Dropping off/picking up of passengers at non-designated locations despite provision for a bus bay a few metres away

__Figure 31:__ Silted/blocked access culvert

Nyamasaria town

__Figure 32:__ Damaged slab over a covered storm water drain

__Figure 33:__ Pedestrian dangerously crossing the highway at grade despite provision of a footbridge

__Figure 34:__ An abnormally steep ramp on the footbridge

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Kofi Annan Road Safety Award

Concept Note

Happy Valley Hotel, Ezulwini, Kingdom of Eswatini, 14 – 15 April 2025

1. Background

1.1. Road Safety Situation in Africa

Road crashes are disproportionately high in Africa compared to other regions of the world. The continent loses annually over 300,000 people through road crashes, even though its countries are witnessing the lowest levels of motorization in the world. Africa is the most affected by road crashes, with a traffic fatality rate of 19.5 deaths per 100,000 people compared to 16 deaths per 100,000 in Southeast Asia, and 6.5 deaths per 100,000 in Europe. Thirty-eight percent of all African road traffic fatalities occur among pedestrians while 43 percent occur among car occupants. These average figures mask the wide variation among countries on the continent with many of them recording a higher share of pedestrian deaths as a percentage of total deaths. For instance, up to 46 percent of road traffic deaths in Kenya occur among pedestrians. Motorized 2-3 wheelers and cyclists account for 7 percent and 5 percent of Africa's traffic deaths respectively. A significant proportion of road fatalities on the continent occur in urban areas.

It is expected that the ongoing improvement of the quality and coverage of Africa's roads will increase crashes on the continent if it is not accompanied by appropriate road safety measures. This has a huge financial implication as Africa may be losing all its investment in road infrastructure through crashes that are estimated to cost 1-2 percent of the GDP of countries. Indeed, this may be as high as 5 percent in countries such as Uganda. From another perspective, savings through improved road safety could significantly close Africa's infrastructure financing gap, estimated to be between $137 billion–$177 billion a year.

1.2. Kofi Annan and Road Safety

The UN made great strides in the early 2000s, under the leadership of Kofi Annan, in raising awareness on the enormity of the global road safety challenge. It also garnered political will across the world to address the scourge of road crashes. This is reflected by the adoption of resolutions to improve road safety by the UN General Assembly during this period as well as the regular presentation by the Secretary General of reports on the global road safety situation to the General Assembly. It was also during Kofi Annan's tenure as the Secretary-General of the UN that the UN Road Safety Collaboration was established.

Leadership and political will are the hallmarks of Kofi Annan's legacy. This is epitomized by the mission of the Kofi Annan Foundation to help build peaceful, democratic and resilient societies. The Foundation mobilizes those who are in a position to influence and bring leadership to the world's most pressing problems. This is relevant for road safety in Africa where management challenges, notably weak leadership and political will, contribute significantly to the slow-moving implementation of initiatives.

1.3. Eswatini's Designation as Host Country for the 2025 Edition

Eswatini is uniquely positioned to host the 2025 Kofi Annan Road Safety Award, thanks to its unwavering commitment to improving road safety and its substantial progress in this vital area. At the highest levels of government, there is a clear and visible dedication to transforming the country's road safety landscape. In 2023, Eswatini adopted its National Road Safety Strategy, marking a significant milestone in its efforts to address the alarming rates of road traffic accidents and fatalities. This feat lead to Eswatini wining the Road Safety Management category of the 2nd Edition of the Kofi Annan Road Safety Award in 2023 presented in Marrakech, Morocco. This strategic framework is paired with ongoing legislative reforms designed to create a more robust and responsive road safety governance system.

Eswatini has established a Centre of Excellence in Road Safety, underscoring its commitment to becoming a regional leader in this domain. This centre plays a crucial role in fostering research, policy innovation, and capacity building, while also serving as a hub for collaboration between government bodies, the private sector, and academic institutions. By aligning its efforts with international standards and leveraging South-South cooperation with other African countries, Eswatini is positioning itself as a model for road safety in Africa. Eswatini has made significant strides in infrastructure development, investing in road safety awareness campaigns and training programs. These initiatives are aimed at changing behaviours and equipping individuals with the knowledge they need to contribute to safer roads.

The Ministry of Public Works and Transport has been at the forefront of reforming the Road Safety Council, enhancing its mandate and ensuring better coordination across various sectors. This restructuring is designed to streamline decision-making, improve resource allocation, and ensure a more integrated and effective approach to road safety. The Ministry has also worked closely with the private sector, encouraging collaboration on key initiatives and policies to ensure a comprehensive and sustainable approach to road safety.

In collaboration with the United Nations Economic Commission for Africa (ECA), Eswatini is aligning its national road safety functions and legal frameworks with global best practices, ensuring that its policies are in harmony with international road safety standards. This comprehensive, multi-faceted approach highlights why Eswatini is an ideal host for the 2025 Kofi Annan Road Safety Award, as it demonstrates the political will, innovation, and regional leadership necessary to drive meaningful change in road safety across the continent.

1.4. Sponsoring Entities

i. Eswatini Ministry of Public Works and Transport

The Ministry of Public Works and Transport (MPWT) plays a crucial role in Eswatini's infrastructural development and transportation governance. As a key government entity, the Ministry is responsible for planning, constructing, and maintaining the country's road networks and public infrastructure. It also regulates and oversees transportation policies to ensure efficiency, sustainability, and safety in the sector. The Ministry is led by Minister Chief Ndlaluhlaza Ndwandwe, who is committed to advancing road safety and transportation reforms in Eswatini.

Beyond road safety, the MPWT is a key player in broader transportation sector reforms. The Ministry has partnered with the United Nations Economic Commission for Africa (ECA) and the African Civil Aviation Commission (AFCAC) to advance regional air transport liberalization under the Yamoussoukro Decision (YD). Through this initiative, the Ministry is overseeing the alignment of Eswatini's Bilateral Air Service Agreements (BASAs) with the Single African Air Transport Market (SAATM) framework, promoting greater connectivity and economic integration in the region.

As a sponsoring entity, the Ministry of Public Works and Transport, under the leadership of Minister Chief Ndlaluhlaza Ndwandwe, remains dedicated to fostering a safer, more efficient, and sustainable transport system, ensuring that Eswatini's infrastructure supports national development goals while meeting international standards.

ii. Office of the Special Envoy for Road Safety

The Office of the Special Envoy for Road Safety was established by the United Nations Secretary-General to advance global road safety efforts and address the growing crisis of traffic-related deaths and injuries. The Special Envoy works to raise awareness, promote international cooperation, and support governments in implementing effective road safety policies aligned with the UN Sustainable Development Goals (SDGs), particularly SDG 3.6, which aims to halve global road traffic deaths by 2030. The office collaborates with stakeholders such as governments, NGOs, and private sector partners to improve road safety infrastructure, encourage the adoption of safer vehicles, and enhance road user behaviour. Additionally, it plays a key role in mobilizing financial and technical resources to support road safety initiatives worldwide.

The former United Nations Secretary-General, Ban Ki-moon, appointed in 2015 Mr Jean Todt as his Special Envoy for Road Safety. He was reconfirmed in this role by United Nations Secretary-General António Guterres, in 2017 and in 2021. In 2018, together with 14 UN organizations, the Special Envoy launched the UN Road Safety Fund (UNRSF). The Special Envoy contributes, among other things, to mobilize sustained political commitment to make road safety a priority; to advocate and raise awareness of UN legal instruments on road safety; to share established good practices in this area; to striving to generate adequate funding through strategic partnerships between the public, private and non-governmental sectors. Special Envoy brochure and Twitter account.

iii. United Nations Economic Commission for Africa (ECA)

United Nations Economic Commission for Africa (ECA) contributes to road safety in Africa through its three core functions – think-tank, convening, and operational functions. As a think-tank, the Commission has developed a methodology to measure the performance of African countries in road safety and used it to rank countries on the continent. ECA has also undertaken road safety performance reviews in African countries, including Uganda, Cameroon, Ethiopia and Zimbabwe in collaboration with the Secretariat of the United Nations Secretary-General's Special Envoy for Road Safety and the governments of these countries.

With an implementing consortium led by the International Road Forum (IRF), ECA also completed successively the "Ten Step Plan for Safer Road Infrastructure," project in Tanzania. In addition, ECA led the development of the African Road Safety Action Plan (2011-2020) in the context of the UN Decade of Action for Road Safety for the same period in collaboration with the African Union Commission (AUC) and the African Transport Policy Programme (SSATP). Furthermore, ECA collaborated with AUC to formulate the African Road Safety Charter and to ensure its alignment with the African Road Safety Action Plan (2011-2020). ECA also collaborated with AUC in formulating the Intergovernmental Agreement on the Trans-African Highways (TAH) adopted by African Ministers of Transport and endorsed by Heads of State of the continent, ensuring that it had an annex on road safety. In 2019, ECA and AUC jointly articulated Africa's post-2020 Strategic Directions for Road Safety as well as the continent's Road Safety Action Plan for the period 2021-2030. ECA is also part of the Task Force that is currently developing the Global Plan of Action for the second UN Decade of Action for Road Safety (2021-2030).

1.5.United Nations System and Road Safety

Over the years, the UN has been a key player in efforts to improve road safety around the world. The UN General Assembly adopted resolution 64/255 that proclaimed 2011-2020 as the Decade of Action for Road Safety in March 2010. The global goal of the Decade was to stabilize and then reduce the forecasted level of global road fatalities, by increasing activities conducted at the national, regional and global levels. The UN General Assembly has also adopted resolution 74/299 that proclaims the period 2021-2030 as the second Decade of Action for Road Safety, with a goal of reducing road traffic deaths and injuries by at least 50 percent from 2021 to 2030.

The UN recognizes road safety as a development issue and includes it explicitly in 2 of the 17 Sustainable Development Goals (SDGs). Target 3.6 of SDG 3 is to halve global deaths and injuries from road traffic crashes by 2020. Target 11.2 of SDG 11, for its part, is to "provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons" by 2030.

The appointment of the UN Secretary-General's Special Envoy for Road Safety in 2015 and the launch of the United Nations Road Safety Fund (UNRSF) in 2018 are additional steps taken by the UN to save lives on the world's roads.

2. Objective of the Kofi Annan Road Safety Award

The mid-term review of the African Road Safety Action Plan (2011-2020) undertaken by ECA, in collaboration with AUC and SSATP, in 2015 showed that most African countries performed poorly in the safety of rural roads and had taken insignificant action to implement the recommended activities in that area.

They also performed poorly in road safety management and in providing post-crash response. That was confirmed by another review undertaken in 2018. The latter showed that in several countries, the fundamentals of road safety are almost absent: national road safety strategy and action plan, well-funded lead agency, updated road safety laws, reliable car inspection system, etc. The work of the

international academic group, that preceded the ministerial conference of Stockholm in February 2020, identified the non-existence or insufficiency of road safety actions in countries as one of the main weaknesses of the first Decade of Action for Road Safety.

This weak performance calls for innovative solutions – through initiatives and products - from governments, private sector/businesses, civil society and other organizations as well as individuals to reduce deaths on the continent's roads. ECA, the UN Special Envoy for Road Safety and the Kofi Annan Foundation seek to motivate outstanding contribution (excellence in thinking and action) by recognizing achievements or innovation which will reduce fatalities and injuries from road crashes in Africa. It is foreseen that giving public recognition to those who have improved road safety in Africa through outstanding initiatives would raise awareness on the scale of the challenge and motivate others to take action to save lives on the continent's roads.

The primary objective of the Kofi Annan Road Safety Award is to motivate key stakeholders – governments, private sector, and civil society organizations – to develop and implement innovative and outstanding ideas/initiatives to save lives on Africa's roads.

The award also aims to recognize the contribution of Kofi Annan to Road Safety.

3. Modalities

3.1 Type of award and selection criteria

The award will be in the form of certificates and physical symbolic prize of recognition delivered to governments, private sector, civil society and other organizations as well as individuals who have made outstanding contributions to road safety in Africa. The third edition of the award will be given to governments that are taking serious measures and actions to achieve the objective of the second UN Decade of Action for Road Safety 2021-2030, to halve road deaths by 2030. The selection of award winners is based on a methodology that takes into consideration elements of the global and African regional action plans on road safety, which include but are not limited to:

1. Innovation, particularly in digitalization
2. Road safety financing
3. Road safety management

4. Safer vehicles
5. Public transportation/Modal shift and
6. Post-crash care.

In addition to countries, awards could be given to cities – that have made outstanding contributions to road safety. Considerations will include:

- Demonstrated strong partnerships with government.
- Formally registered organizations.
- Plan of work that contributes directly to achieving existing national, regional and international frameworks (national road safety action plans, African Road Safety Plan, SDGs)

3.2 Nominations

- Call for nomination will be published online from 27 January-15 February 2025;
- Nominations will be judged in February 2025 by a dedicated committee composed of ECA and the Office of the UN Secretary General's Special Envoy for Road Safety;
- Notifications will be sent to winners by 25 February 2025;
- The Kofi Annan Awards will be presented to the winners on April, 15, 2025 during the Award ceremony in Ezulwini, Kingdom of Eswatini.

ECA will also publish judging criteria; as well as all the useful information concerning the whole process.

3.3 Participants and format of award ceremony

High-level political leaders of the host country (the Kingdom of Eswatini), the UN Secretary-General's Special Envoy for Road Safety, the Executive Secretary of ECA, the Executive Secretary of the Kofi Annan Foundation and a senior official of the World Bank will attend the ceremony. The award-winning countries will be represented at the level of ministers.

The event will consist of a hybrid of physical and virtual participation. It is envisaged that the following groups of participants will attend the meeting physically:

- High-level political leaders and senior Road Safety officials and experts of the host country (Kingdom of Eswatini);
- Ministers of recipient countries and their delegations;
- The UN Secretary-General's Special Envoy for Road Safety and the Executive Secretary of ECA and their delegations;
- Representatives of UN Agencies;
- Representative of the African Union Commission;
- Representative of the World Bank/SSATP;
- Representative of the African Development Bank;
- Senior Leadership of the Kofi Annan Foundation;
- The Director of the Africa CDC; and
- Celebrities (football; music; etc).

Road safety officials from other African countries, other stakeholders and the public will join the event (physically or online). The award ceremony will provide an opportunity to present concrete actions that have started in countries within the framework of the implementation of the African Road Safety Action Plan for the period 2021-2030.

The award ceremony will be on 15 April. It will be preceded by a high-level seminar to be organised by the United Nations Eswatini on 14 April and a hybrid Road Safety Seminar also on 14 April. Topics to be covered in the UN Eswatini seminar shall be shared in due course and those of the Road Safety seminar shall include Road Management (legislation, finance, monitoring and evaluation, research, promotion, etc.), UN Road Safety Conventions, and safety standards for used vehicles in Africa.

4. The Technical Workshop On The 14th April 2024: Mobilizing Domestic Financing To Accelerate Road Safety Agenda In Africa

Road safety is a critical issue in Africa due to the significant economic and social repercussions of road traffic injuries and fatalities. Even though the continent is home to 15% of the global population and only 3% of the global vehicle fleet, road fatalities were estimated to be 225,482 in 2021, accounting for 19% of the global road traffic mortality. Since 2010, the mortality rate in Africa has increased by 17%, according to WHO. Even though mortality rates in certain countries have decreased by as much as 49%, the region continues to have the highest fatality rate in the world, at 19.4 per 100,000. As acknowledged by the WHO, these figures could still underrepresent reality, given the limited monitoring and evaluation capacities of many African countries. This sobering reality underscores the urgent necessity of enhancing road safety throughout Africa to save lives and social and economic development.

Nevertheless, it is a widely recognized fact that the smooth implementation of the African Road Safety Action Plan for the Decade 2021-2030 and the ambitious goal of halving the number of road accidents, fatalities, and severe injuries by 2030 are being impeded by road safety financing. Various financing mechanisms have been proposed and tested over the years, with varied results.

Some governments prioritize road safety by integrating it into national budgets and infrastructure projects, leveraging international loans and grants, and exploring innovative financing mechanisms like taxation, tolling, licensing, etc. Public-private partnerships offer additional opportunities by allowing governments to interact with markets to generate funding through monetization of road-related transactions, such as licensing of garages and advertising on roads. Private sector investments are increasingly recognized as essential for achieving sustainable improvements in road safety as public funding alone is insufficient to meet road safety related SDG targets, according to The World Bank's Saving Lives Through Private Investment in Road Safety 2022 Report.

It is now timely to explore and highlight various avenues for Road Safety financing tailored to the needs and adapted to the context of local and national stakeholders.

The technical workshop will serve as platform that showcases success stories, initiatives, and opportunities for road safety financing in general and domestic financing in particular.
More specifically, the meeting will:

- Articulate the safe system approach and frame its links with road safety financing.
- Identify opportunities for action and funding by stakeholders, especially the private sector.
- Emulate interest and commitment from African private sector to invest and commit to road safety.
- Identify constraints for private sector and other categories of investors to invest in road safety
- Raise policy recommendations for road safety financing.

5. Contact

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PROGRAMMES

APRIL 14th, 2025: MOBILISING DOMESTIC FINANCING TO ACCELERATE ROAD SAFETY AGENDA IN AFRICA – TECHNICAL WORKSHOP
DRAFT AGENDA: (In SAST-Southern Africa Standard Time)

April 14th, 2025	
Technical Workshop Facilitator ; Dr. Fortunate Shabalala, Chairman Road Safety Council of Eswatini	
08 :30 – 09:30	**Registration and accreditation**
09:30 - 10:30	**Opening Session** **Moderator: Mr. Thulani MKHALIPHI: Principal Secretary, Ministry of Public Works and Transport, Eswatini** Opening: 1- Mr. George WACHIRA; United Nations Eswatini Resident Coordinator 2- Hon. Chief Ndlaluhlaza NDWANDWE; Minister for Public Works and Transport, Kingdom of Eswatini 3- Mr. Antonio PEDRO; Deputy Executive Secretary of the United Nations Economic Commission for Africa (ECA) 4- Mr. Jean TODT, UN Secretary-General's Special Envoy for Road Safety
10:30 – 11:00	**Coffee Break** **Group Photo and withdrawal of the HL Delegation**
11:00 – 12:00	**Session 1: Financing Road Safety: Strategical Considerations** **Moderator: Robert LISINGE, Director, ECA** Setting the scene: Mainstreaming Road Safety in National Development Strategies: Placid BADJI, ECA 1. Mr. Ariel SACRAMENTO: Director General CNSR, Benin 2. Mr. Atoumane SY: Director General ANASER, Senegal 3. Mr. Mandla P. NTSHALINTSHALI: Director Road Transport, Eswatini 4. Dr. Velephi OKELLO: Director Health Services; Ministry of Health, Eswatini 5. Mr Katushabe Winstone FCILT: Commissioner, Transport Regulation and Safety/Chief Licensing Officer, Min. of Works and Transport, Uganda **Discussions**
12:00 – 13:00	**Session 2: Contribution of the Private Sector and Innovative financing options** **Moderator: Benacer BOULAAJOUL, Director General, NARSA, Morocco** 1. Mr. Ngae Nkinime JOCELYN: Director General: Prooftag Catis 2. Mr. Mbuso GAMEDZE: Manager Consumer Education & Financial Inclusion; Financial Services Regulatory Authority (FRSA); Eswatini 3. Dr. Essaie Moussa AUBIN: President of African Road Maintenance Funds Association (ARMFA) 4. Mr. David Osafo ADONTENG: Director General, National Road Safety Authority, Accra, Ghana 5. Mr. Philip WIJERS: Director Government Affairs – Sensys Gatso Group and Chair - IRF Road Safety Committee (online) 6. Mr. David MYENI: Chief Executive; Sincephetelo Motor Vehicle Accidents Fund (SMVAF); Eswatini **Discussions**
13:00 – 14:00	**Lunch @Happy Valley Hotel**

14:05 – 14:30	**Exhibition Tour by Special Envoy: Led by Minister of Public Works and Transport and accompanied by Deputy Executive Secretary and UNRC**
14:35 – 15:35	**Session 3: Experience Sharing** **Moderator: David NIYOSENGA: Head of Secretariat; African Road Safety Observatory (ARSO), AUC** 1- Mr. Divine MBAMBOME NKEDONG: Director of Transport: Cameroon 2- Mr. Benaceur BOULAAJOUL: Director General; National Road Safety Agency (NARSA); Kingdom of Morocco 3- CORPS Marshall Shenu Usman MOHAMED; Federal Road Safety Corps; Nigeria 4- Mr. Georges NJAO; National Transport and Safety Authority; Kenya 5- Mr. Thierno Mamagou SIRE; Director General AGUISIER; Guinee 6- Mr. Eugene TENDEKULE; National Road Safety Council; Namibia **Discussions**
15:35 – 16:00	**Coffee Break**
16:00 – 17:00	**Session 4: Launch of the ARCOS guidelines on Domestic Financing of Sustainable Urban Mobility; financed by the United Nations Road Safety Fund** **Moderator: Jordi Pla BOSCH: UN HABITAT** 1- Ms. Helena TITO, Municipal Counsel of Maputo 2- Ms. Gciniwe FAKUDZE; Chief Executive Officer: Municipal Council of Mbabane 3- Mr. MUHAMMAD; Deputy Director Ethiopia Road Safety Agency: Ethiopia 4- Dr. Nomthandazo LUKHELE: Noncommunicable Diseases Technical Officer; WHO, Eswatini **Discussions**
17:00 – 17:20	• Wrap up and take away: David NIYONSENGA, Head of Secretariat, African Road Safety Observatory (ARSO). • Closing: Robert LISINGE: United Nations Economic Commission for Africa (ECA) • Closing: Thulani MKHALIPHI: Principal Secretary; Ministry of Public Works and Transport, Eswatini
17 :20	**End of Day 1**
18:00 – 20:00	**Meeting of the Transitional Steering Committee of the African Road Safety Observatory (ARSO) – Closed session** • Opening: Benaceur Boulaajoul, Chair ARSO Transitional Steering Committee • Presentation of the draft ARSO workplan: David Niyonsenga, Head of the Secretariat, ARSO • Discussion: Members of the Transitional Steering Committee • Closing

APRIL 15th, 2025: KOFI ANNAN ROAD SAFETY AWARD CEREMONY
DRAFT AGENDA: (In SAST-Southern Africa Standard Time)

15th April 2025	
Kofi Annan Award Ceremony Facilitator **Mr. Thulani MKHALIPHI: Principal Secretary; Ministry of Public Works and Transport, Eswatini**	
09:00 – 12 :00	**Organised Excursion for Technical Delegates**
13:00 – 14:30	**Lunch @Happy Valley Hotel**
15:00 – 15:40	**Official Opening of Kofi Annan Road Safety Award Ceremony** 1. Mr. George WACHIRA; United Nations Resident Coordinator in the Kingdom of Eswatini; Welcome Statement and Introduction of ECA Executive Secretary, 2. Mr. Antonio PEDRO; Deputy Executive Secretary of the Economic Commission for Africa; Statement, 3. Mrs. Nane Maria ANNAN; Message [Pre-recorded], 4. Mr. Jean TODT; United Nations Secretary-General's Special Envoy for Road Safety; Statement, 5. Hon. Chief Ndlaluhlaza NDWANDWE; Minister for Public Works and Transport Eswatini; Statement and Introduction of H.E. The Right Honourable Prime Minister, 6. H. E. the Right Honourable Prime Minister Russel Mmiso DLAMINI; Kingdom of Eswatini; Keynote Address
15:40 – 16:00	**Presentation of an Alcohol Evidence Centre by Eswatini Beverages Limited in partnership with the Ministry of Public Works and Transport as well as Royal Eswatini Police Services**
16:00 – 17:30	**Presentation of Awards** 1. ECA: **Overview of road safety in Africa and award criteria** 2. Professional moderator: **Presentation of Awards in categories of:** ***(Ministers to present Acceptance Statement upon receipt of Award)*** • Innovation, particularly in Digitalisation: S.E M. Jean Ernest Masséna NGALLE BIBEHE: Minister of Transport; Republic of Cameroon • Road Safety Management: Hon. Senator Sa'idu Ahmed ALKALI; Minister of Transportation; Federal Republic of Nigeria • Public Transportation/Modal Shift; H.E. Bareo HASSEN, State Minister of the Ministry of Transport and Logistics; Democratic and Federal Republic of Ethiopia • Safer Vehicles: H.E. Hon. Davis CHIRCHIR: Cabinet Secretary for the Ministry of Roads and Transport; Republic of Kenya • Road Safety Financing; S.E M. Yankoba DIÉMÉ: Minister of Infrastructure and Land and Air Transport; Republic of Senegal • Post-Crash Care; H.E Hon. Barbara CREECY: Minister of Transport; Republic of South Africa
17:30 – 17:45	**Closing** Family photo
19h00 +	**Gala Dinner @Mantenga Nature Reserve & Cultural Village**

SSATP Africa Transport Policy Program

African Union

World Health Organization African Region

World Health Organization Eastern Mediterranean Region

Africa Status Report on Road Safety

2025

Africa Status Report on Road Safety

2025

The SSATP is an international partnership to facilitate policy development and related capacity building in the transport sector in Africa.

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8 Regional Economic Communities (RECs);

2 African institutions: African Union Commission (AUC) and United Nations Economic Commission for Africa (UNECA);

Financing partners for the Fourth Development Plan: European Commission (main donor), Swiss State Secretariat for Economic Affairs (SECO), African Development Bank (AfDB), and World Bank (host);

Many public and private national and regional organizations.

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The SSATP gratefully acknowledges the contributions and support of member countries and its partners.

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Contents

Foreword

Road traffic crashes and injuries are a significant cause of death and disability worldwide, and Africa bears an increasingly heavy burden from crashes and disproportionately high costs for essential mobility. The continent accounts for 24 percent of global road fatalities despite hosting less than 4 percent of the world's vehicles. This alarming situation demands an urgent and comprehensive response. The *Africa Status Report on Road Safety 2025* is essential to inform that response. It provides an overall picture of the current state of road safety in Africa, progress made in addressing road safety challenges, and promising initiatives being carried out across the continent to inspire and motivate key stakeholders to collaborate in continued efforts to implement the United Nations (UN) Decade of Action for Road Safety 2021–2030 at the country level and scale up interventions to ensure safe mobility.

Road safety is the core of UN Sustainable Developmental Goal targets 3.6 and 11.2 and Goals and Priority Areas of the African Union's Agenda 2063. In 2020, the Decade of Action for Road Safety and the African Road Safety Action Plan 2021–2030 called for reducing road traffic deaths and injuries by 50 percent. But we are far off target. The current report marks a milestone in our collective efforts to address the road safety crisis while underscoring the importance of a coordinated, multisectoral, and comprehensive approach using data-driven decisions to improve road safety across the continent.

Since the release of the *Africa Status Report on Road Safety 2020*, significant progress has been made on many fronts to improve road safety on the continent, including signature and ratification of the *African Road Safety Charter* by 13 countries. The charter serves as a policy framework for road safety improvement in Africa and as an advocacy tool for road safety improvement with the goal of facilitating the creation of an enabling environment to drastically reduce road traffic crashes.

This 2025 edition of the Africa Status Report on Road Safety highlights some examples of key initiatives in Africa's journey toward improved road safety through case studies, national and regional milestones, and success stories. These include the establishment and operationalization of the African Road Safety Observatory (ARSO), which serves as a regional forum enabling African countries to generate robust road safety data and analysis to positively impact policies and actions for road safety in the region.

While ARSO has shortcomings, it is one of the major achievements of the African road safety agenda during the decade 2011–2020, providing a platform for managers of road safety and road safety national data coordinators to regularly exchange data and information, particularly best practices in policy formulation, planning, road safety strategies, and data management.

But much more needs to be done to reach the ambitious goal of the Decade of Action for Road Safety, and thus one of the key objectives of this report is to provide the continent with a comprehensive picture of the current situation and to monitor road safety progress made in the first five years of the Decade of Action.

The report demonstrates the importance of establishing and strengthening road safety lead agencies, implementing key policy and investment decisions, and enhancing data management systems. It also emphasizes the need for a balanced approach that includes data-driven strategies, engineering, and enforcement to effectively reduce road traffic injuries and fatalities.

Now, past the halfway point to the 2030 deadline, the government of Morocco, in partnership with the World Health Organization, will host the first Ministerial Conference on Road Safety on African soil (Marrakech, February 2025). This historic event will bring together key stakeholders across the world, including government officials, industry leaders, and international organizations, to discuss and generate support for the new vision of safe and sustainable mobility. The conference provides an international high-level platform for sharing knowledge and best practices and fostering collaboration to tackle the formidable road safety challenges still facing countries. It should also help the continent secure a step-change in support for proven prevention solutions and reset collective ambitions to realize the 2030 Agenda for Sustainable Development target of halving the number of deaths and injuries from road traffic crashes globally.

The core solutions to address road safety at the continental level fall under the Safe System approach, which includes improved management, safer roads, vehicles, and road users, as well as better postcrash response, and involves applying the UN road safety conventions and domesticating the African Road Safety Charter. As we move forward, it is imperative to maintain political commitment and allocate adequate funding to road safety initiatives and identified solutions. By doing so, we can create safer roads, save lives, and contribute to the overall development and prosperity of the African continent.

We hope this report will serve as a catalyst for action for rest of the decade and inspire all stakeholders to work together to improve road safety across Africa.

Nicolas Peltier
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Vice-Presidency, World Bank

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Eastern Mediterranean Region

Acknowledgments

The Africa Status Report on Road Safety 2025 was prepared by the Africa Transport Policy Program (SSATP) in collaboration with the World Health Organization (WHO) African and Eastern Mediterranean Regional Offices (AFRO and EMRO) and the African Union Commission (AUC). The report is based on the data collected by the World Health Organization (WHO) for the Global Status Report on Road Safety 2023, funded by Bloomberg Philanthropies.

The report was developed under the overall guidance of Mustapha Benmaamar (SSATP Program Manager), Jean-Francois Marteau (Transport Practice Manager, World Bank), and Eric Ntagengerwa (Head of Transport and Mobility Division, African Union Commission). The task team leader of this assignment was Marisela Ponce de Leon Valdes (SSATP Road Safety Pillar Lead).

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Case studies for this report were provided by Duncan Kibogong, Janene Tuniz, Karin Steinecke, the Tunisia National Road Safety Council, Jean-Christophe Rusatira, Nzeyimana N. Innocent, Nadine Niwemfura, Divine Nkendong, and Loubna Maazouzi. We also acknowledge Wouter Van den Berghe (AUC ARSO) for the write-up of the case studies and Kacem Iaych (WHO) for providing the estimated fatalities trend analysis.

Finally, we thank the peer reviewers for their guidance to further enrich the report: Dipan Bose (Senior Transport Specialist, World Bank), Ndeye Anna Ba (Transport Specialist, World Bank), and Tawia Addo-Ashong (Senior Transport Specialist, World Bank).

Acronyms

AfDB	African Development Bank
AFRO	WHO Regional Office for Africa
ARSO	African Road Safety Observatory
ASE	Automated Speed Enforcement
AU	African Union
AUC	African Union Commission
BAC	blood alcohol concentration
BrAC	breath alcohol concentration
CRVS	civil registration and vital statistics
EMRO	WHO Regional Office for the Eastern Mediterranean
GSRF	World Bank Global Road Safety Facility
GSRRS	Global Status Report on Road Safety
iRAP	International Road Assessment Programme
NARSA	National Road Safety Agency (Morocco)
NRSAP	National Road Safety Action Plan 2024–2028 (Kenya)
NTSA	National Transport and Safety Authority (Kenya)
PAAPAM	Pan African Action Plan for Active Mobility
RSLA	road safety lead agency
RSM	road safety management
SDG	Sustainable Development Goal
SSATP	Africa Transport Policy Program
UN	United Nations
UNECA	United Nations Economic Commission for Africa
WHO	World Health Organization

Executive Summary

Road traffic crashes and injuries in Africa pose a significant public health and developmental challenge. According to the most recent World Health Organization (WHO) estimates, 259,601 fatalities occurred in Africa in 2021, accounting for 24 percent of global road traffic deaths. Since 2000, fatalities have generally risen, although there was a slight decrease during the COVID-19 pandemic. Since 2010, there has been a gradual decline in number of fatalities in 22 countries. Despite these improvements, the African continent still has the highest road traffic fatality rate, 19.6 per 100,000 population, with wide variations among countries.

The burden disproportionately affects males, individuals ages 18 to 59 years, and vulnerable road users, with pedestrians accounting for 31 percent of all deaths, motorized two- and three-wheelers 17.5 percent, and cyclists 4.4 percent—together accounting for more than half of the continent's fatalities.

Reporting on road traffic fatalities remains a challenge in Africa, with significant discrepancies between the country reported and WHO estimated figures. In 2021, estimated fatalities were three times higher than reported fatalities. Gaps in data systems, including single-source data reliance, and incomplete reporting on the distribution of road traffic fatalities among the different population groups, serious injuries, and road safety key performance indicators continue to undermine efforts to monitor road safety effectively and implement evidence-based interventions. It is encouraging to note that, despite these gaps, the discrepancy between reported and estimated fatalities has decreased since the previous Global Status Report on Road Safety (2018), demonstrating that data collection systems can improve when countries take measures to strengthen them.

Over the past decade, the African Union Commission (AUC) has demonstrated a strong commitment to improving road safety across the continent, aligning its efforts with global and regional road safety goals. Through key initiatives such as the Intergovernmental Agreement on Trans-African Highways, and the African Road Safety Charter, the AUC has actively worked to enhance road safety management, policies, and infrastructure. The establishment of the African Road Safety Observatory (ARSO), with the vision to create a data-driven approach to road safety and contribute to Africa's broader development goals under AU Agenda 2063, supports the AUC's efforts.

In line with the Sustainable Development Goals (SDG 3.6 and 11.2) and the UN Decade of Action for Road Safety 2021–2030, the AUC has led the development of the African Road Safety Action Plan 2021–2030, a framework guiding regional and national interventions.

To realize this vision for road safety in Africa, countries must address the multiple factors contributing to the continent's significant road traffic burden, guided by the Safe System approach and the five key pillars of road safety: road safety management, safer roads and mobility, vehicle safety, safe road user behavior, and postcrash response.

Effective road safety management, anchored by the establishment of road safety lead agencies (RSLAs), is essential for integrating institutional management functions, scaling up targeted interventions, and achieving measurable outcomes. Forty-nine countries have reported having national road safety lead agencies, with only 29 of them receiving allocated budget support. Good progress has been made through the creation of

RSLAs and the development of national strategies. Further enhancements in institutional management are essential to expand these functions and boost their effectiveness. Further analysis of the management capacity of RSLAs is needed to assess key factors such as institutional ownership, financial and human resources, as well as core institutional functions. The SSATP study on RSLAs in Africa provides valuable insights, and available tools such as the road safety management capacity reviews from the Global Road Safety Facility (GRSF) are useful for this in-depth evaluation.

Global and regional support for African countries must now be focused on assisting executive leaders and specialists to address the practical realities and priorities of country strategy delivery and the strengthening of country management processes necessary to mobilize scaled-up road safety financing. Limited and inconsistent funding, inadequate budgetary allocations, and weak data systems hinder the ability of RSLAs to perform their roles effectively. Strengthening road safety management in Africa requires sustained investment, robust data systems, and alignment with international frameworks to ensure comprehensive and impactful interventions.

Africa's road and transport infrastructure is designed and built with insufficient consideration of motorized two- and three-wheelers, cyclists, and pedestrians, who account for most fatalities. Only nine countries mandate formal road safety assessments, using methodologies like iRAP star rating. Further, only a few countries promote the use of safer, alternative modes of transport. Therefore, designing and maintaining road infrastructure to meet the safety and accessibility needs of vulnerable road users while supporting other more sustainable modes of transport should be a key focus area in Africa.

Vehicle regulation faces challenges because of weak registration systems and inadequate safety legislation. Less than a third of the countries have laws that include safety features for four-wheeled vehicles and none of the laws include safety features for motorized two- and three-wheelers. Strengthening vehicle safety laws, aligning them with United Nations road safety conventions, rigorously enforcing laws, and restricting the import and export of unsafe used vehicles are critical steps toward improving road safety across the continent.

Ensuring the safety of all road users requires addressing behavioral risk factors (speeding, driving under the influence of alcohol or drugs, distracted driving, and nonuse of helmets, seat belts, and child restraints) that significantly contribute to road traffic injuries and fatalities. While many African countries have laws addressing these risk factors, none fully meet WHO-recommended best practices, in that they include the recommended requirements to ensure the safety of road users. To improve safety, countries should refine their laws to align with international standards, strengthen enforcement mechanisms, and establish reliable data collection systems to monitor compliance and evaluate the impact of interventions.

Postcrash response and care remains a crucial yet underdeveloped area in Africa's road safety landscape. Systems for emergency prehospital care, such as emergency care numbers and coordinating agencies, are available in most countries. Countries have also taken steps to ensure the availability of emergency care specialists, with training programs for trauma surgeons, emergency care physicians, and trauma nurses. Half of the countries have trauma registries, but less a third have national level data. Efforts to improve postcrash response and care should prioritize expanding access to prehospital and emergency care, ensuring quality of emergency care systems, and strengthening data collection systems for effective monitoring and planning. Additionally, strengthening postcrash legislation and implementing financial protection mechanisms will provide the necessary guarantees of access to quality care and support for victims and their families.

Addressing Africa's road safety challenges calls for a comprehensive strengthening of institutional management frameworks, to ensure the sustainable funding of effective and efficient interventions, guided by enhanced data collection systems that accurately assess and monitor the burden of road traffic injuries. Meeting these needs will require considerably higher levels of road safety financing than currently evident. To address these challenges comprehensively, concerted efforts are needed to strengthen national road safety strategies embedded in regional transportation policies. This entails enhancing coordination mechanisms, allocating adequate resources, and improving data collection systems.

This report is intended for policy makers, government agencies, development agencies, regional and international organizations, road safety practitioners, law enforcement authorities, researchers, private sector stakeholders, and civil society groups involved in road safety governance and policy implementation in Africa. It aims to provide decision-makers with a snapshot of the status of road safety in the African continent as well as the governance structures, regulations, standards, legislation, and the systems in place to improve road safety outcomes.

Introduction

The Decade of Action for Road Safety 2011–2020 marked significant efforts globally and has given new impetus to Africa's initiatives to address road safety challenges. Following a review of the decade of action, the United Nations (UN) General Assembly proclaimed a second decade of action in 2020, aiming to halve road traffic deaths by 2030 (UN 2020). Building on these efforts, the World Health Organization (WHO) plays a central role in global road safety, coordinating with UN regional commissions to develop the Global Action Plans for Road Safety, publish Global Status Reports on Road Safety, and provide technical guidance. The WHO collaborates with UN agencies and other development entities to implement road safety initiatives. It is also responsible for supporting the 2030 Agenda road safety targets and monitoring progress through harmonized data collection, ensuring a coherent, system-wide approach to reducing road traffic injuries worldwide. The Global Plan for the Decade of Action for Road Safety 2021–2030 aligns with the UN Sustainable Development Goals (SDG targets 3.6 and 11.2) and the 12 UN voluntary global road safety performance targets (UN 2015; WHO 2018, 2021). Based on the Safe System approach, the global plan focuses on five strategic areas contributing to road safety: multimodal transport and land-use planning, safe road infrastructure, vehicle safety, safe road users, and postcrash response.

The burden of road traffic crashes in Africa remains critical in the context of rapid urbanization and motorization coupled with exponential growth of two-wheeler use, inadequate funding for road engineering safety measures, and lack of compliance to safety standards and monitoring of road user behavior. Responding to this challenge requires a harmonized and collective effort that fosters shared expertise and resources, using advanced technologies to create safer road environments and reduce fatalities. Simultaneously, it calls for developing a modern infrastructure network to realize Africa's full economic potential and physical integration. The African Union Commission (AUC), through its mandate to enhance sustainable transportation and road safety, leads these efforts in collaboration with continental and regional bodies such as the United Nations Economic Commission for Africa (UNECA), the African Development Bank (AfDB), regional economic communities, the WHO, and the Africa Transport Policy Program (SSATP). Together, these assist the AUC to harmonize road transport policies, improve road infrastructure, and promote regional cooperation to implement proven solutions in the efforts to address road safety. The adoption of the Intergovernmental Agreement on Trans-African Highways (TAH) in 2014 and the African Road Safety Charter in 2016, the establishment of the African Road Safety Observatory (ARSO) in 2018, and the development of the African Road Safety Action Plan for the Decade 2021–2030 are significant initiatives of the AUC, born out of these collaborative efforts. Ultimately, the goal of these efforts is to strengthen road safety management in Africa under the strategic framework of the SDG-AU Agenda 2063 (AU 2016; SSATP 2021; UNECA and AUC 2020).

The African Union (AU) developed the African Road Safety Action Plan 2021–2030 to guide continental road safety initiatives (AU 2021). The plan aligns with and focuses on the five pillars of the UN Decade of Action for Road Safety—road safety management, safe road infrastructure, vehicle safety, safe road users, and postcrash response—and aims to address road safety challenges through coordinated efforts. The African action plan has an additional pillar on cross-cutting issues that addresses rural road safety.

Multilateral development banks play a crucial role in enhancing road safety in Africa through their investments and support for country-level implementation. These banks, through their Road Safety Working Group, established in 2009, have committed to a comprehensive approach that includes strengthening road safety management capacity, integrating safety measures in road infrastructure projects, improving safety performance metrics, and mobilizing resources for road safety initiatives and standalone investments. The World Bank, through its funding platform the Global Road Safety Facility (GRSF) and its donors, has been instrumental in promoting harmonized road safety practices to support these efforts while also developing tools like the Road Safety Screening and Appraisal Tool (RSSAT) to ensure road investments consider safety from early stages. The World Bank's portfolio includes various projects aimed at reducing road fatalities and injuries, with an estimated road safety financing under World Bank projects in continental Africa between fiscal year 2021 and the present of US$797 million. Through these collaborative efforts, multilateral development banks and other relevant organizations, such as FIA Foundation and Bloomberg Philanthropies, are making significant strides in improving road safety and saving lives across Africa.

Africa has demonstrated strong commitments to improving road safety outcomes; however, effective monitoring of the African Road Safety Action Plan requires systematic reporting and high-quality data to facilitate cross-country comparisons, knowledge sharing, and evidence-based decision-making. While WHO Global Status Reports on Road Safety, along with regional reports for Africa and the Eastern Mediterranean (WHO AFRO 2024; WHO EMRO 2024a), have tracked progress over the years, a comprehensive understanding of the burden of road traffic crashes and road safety performance in Africa remains essential for developing a unified, continent-specific approach. The *Africa Status Report on Road Safety 2020* (SSATP 2021) marked an important step by establishing a baseline for measuring future progress; however, the limited participation of countries in the report prevented a fully comprehensive review of the situation in the continent.

Objectives of the Report

The *Africa Status Report on Road Safety 2025* represents a significant milestone in establishing a harmonized monitoring mechanism for Africa, building on prior efforts by the SSATP, AU, WHO, and other partners. It aims to facilitate informed decision-making and to enhance systematic reporting across the continent. Specifically, this report

- Describes the burden of road traffic crashes on injuries and deaths in Africa;
- Provides an overview of the status of institutional road safety management practices and legislation on risk factors, road infrastructure, vehicle standards, and postcrash response systems in Africa; and
- Identifies key gaps and provides proposed actions to enhance road safety data and implementation strategies across Africa.

This report builds on the *Africa Status Report on Road Safety 2020*, offering a comprehensive analysis of road safety trends and management of road safety across the continent. It further explores additional areas of relevance to Africa using data from the WHO *Global Status Report on Road Safety 2023 (GSRRS 2023)* and country-specific case studies. It highlights persistent gaps within each of the five pillars, delivering proposed actions to address them.

Methodology

This report was developed using data generated for the *GSRRS 2023*,[1] incorporating, among others, data from 51 countries that participated in the *GRSSR 2023* survey, representing 97 percent of the population of the African continent. Data for the *GSRRS 2023* was collected in each country, under the supervision of a designated coordinator who assembled multisectoral teams of up to 10 contributors from relevant fields, including an in-country representative of ARSO, to ensure comprehensive and representative data collection. A rigorous multitier validation process ensured accuracy, consistency, and completeness of the data. At the national level, the data were validated and endorsed through a stakeholders' consensus meeting, while at the global level, the data underwent further verification and quality checks to ensure uniformity and reliability before analysis, enhancing the credibility and standardization of the data set.

Variables for analysis were selected from the *GSRRS 2023* database, guided by the *Africa Status Report on Road Safety 2020*, and key frameworks, including the African Road Safety Action Plan 2021–2030, ARSO minimum road safety indicators (miniARSO), the 12 UN voluntary targets, and the Road Safety Performance Monitoring Framework (RSPMF) for African Countries (UNECA and AUC 2020; Segui-Gomez et al. 2021; WHO 2018; SSATP 2025). An indicator matrix was developed to link variables in the GSRRS 2023 data to the frameworks and the *Africa Status Report on Road Safety 2020* (see appendix A).

1. WHO publishes the Global Status Report on Road Safety every two to three years. The *GSRRS 2023* contains data spanning the period between the fourth status report in 2018 and the fifth one in 2021, although most countries reported on 2021 data and 2022 legislation status. Because of delays caused by COVID-19, the fifth status report was published in 2023 instead of 2021.

The *GSRRS 2023* data collection was guided by the Global Action Plan for Road Safety, UN voluntary global road safety performance targets, and previous Global Status Reports on Road Safety. While the African Road Safety Action Plan 2021–2030 aligns with the global frameworks, it includes specific indicators tailored to the African context. Consequently, some indicators in the African action plan were not included in the analysis for this report as they were not included in the *GSRRS 2023* data collection effort.

Topics for the case studies were derived from the indicators not covered in the *GSRRS 2023* data, and information on these topics was solicited from countries that have implemented relevant interventions. Each country completed a standardized case study template, which was subsequently used to develop the case studies. The information for each case study was provided by national governments and/or implementing agencies.

Besides the *GSRRS 2023* specific survey, data for this report include WHO-derived mortality estimates, data on country populations (UN population division), country income level (World Bank), data on UN road safety conventions (UNECE, UN Treaty Collection), and data on road safety core ratings (iRAP).[2]

Key Considerations for Interpreting the Findings

This report presents a descriptive analysis of road safety governance, legal frameworks, enforcement mechanisms, safety regulations, and data collection systems based on data captured in the *GSRRS 2023*. While this report provides an overview of their existence and comprehensiveness, it does not assess their operational effectiveness, implementation consistency, or real-world impact. As such, the findings should be interpreted as a status report rather than a performance evaluation, and any conclusions regarding road safety outcomes should be made with caution.

Additionally, this report provides a summary of findings from across the continent. For certain elements, such as estimated deaths and fatality rates, data are available for 54 countries. For other elements, the analysis relies on country-reported data and thus the total number of data points varies; for example, reported deaths are available for only 51 countries. Unless noted, the data presented refer to these 51 countries. Appendix B lists the participating countries and provides link to their respective country profile.

Data for this report are available on the WHO Road Safety Data mobile app; on the country profiles, which can be downloaded from https://www.who.int/teams/social-determinants-of-health/safety-and-mobility/global-status-report-on-road-safety-2023; and from the country and territory profiles document available at https://www.who.int/publications/i/item/9789240087712.

2. The data used on road safety core ratings are those from the iRAP Safety Insights Explorer (https://irap.org/safety-insights-explorer).

SECTION 1.

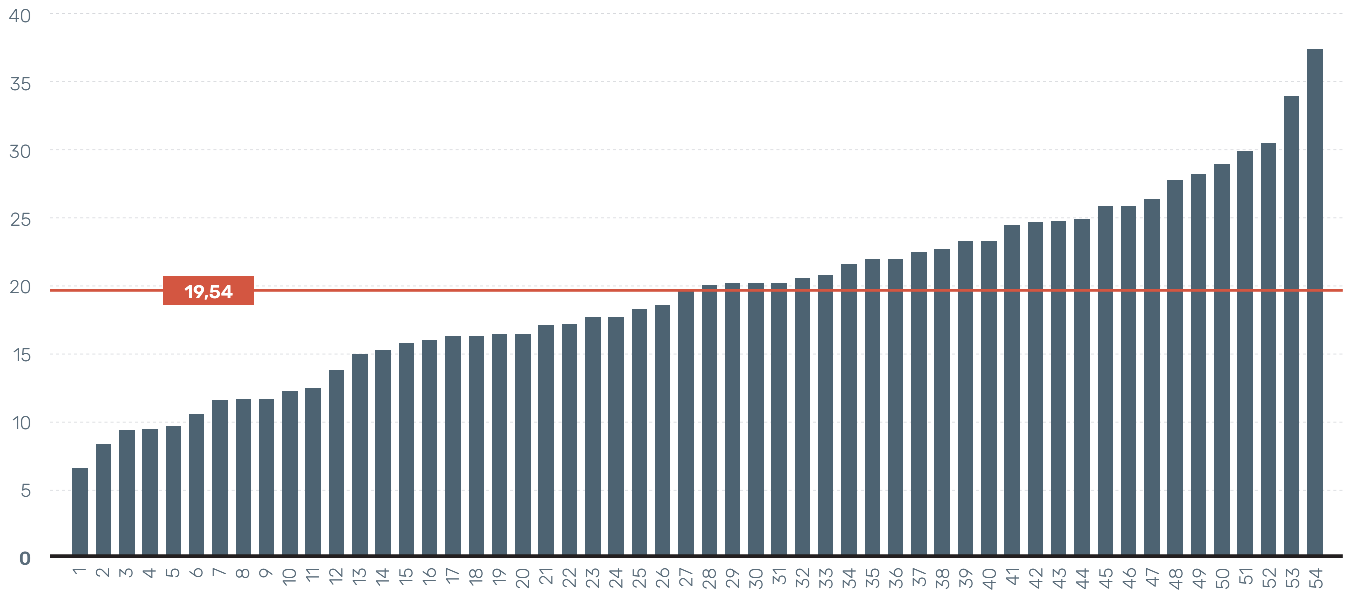
Burden of Road Traffic Injuries in Africa

In 2021, an estimated 259,601 road traffic deaths occurred across 54 countries of the African continent, accounting for 24 percent of the global burden of deaths resulting from road traffic injuries.

In 2021, an estimated 259,601 road traffic deaths occurred across 54 countries of the African continent,[3] accounting for 24 percent of the global burden of deaths resulting from road traffic injuries. The average estimated road traffic fatality rate for Africa is 19.6 per 100,000 population, with significant variation ranging from 6.6 per 100,000 to 37.4 per 100,000, and 26 countries exceeding the continental average (figure 1).

The distribution of deaths across the continent is not consistently correlated with the subregional share of the vehicle fleet. Western Africa and eastern Africa bear 64 percent of the continent's deaths but account for only a third of the vehicle fleet, while northern Africa and southern Africa bear less than a third of the deaths despite having two-thirds of the vehicle fleet (figure 2).

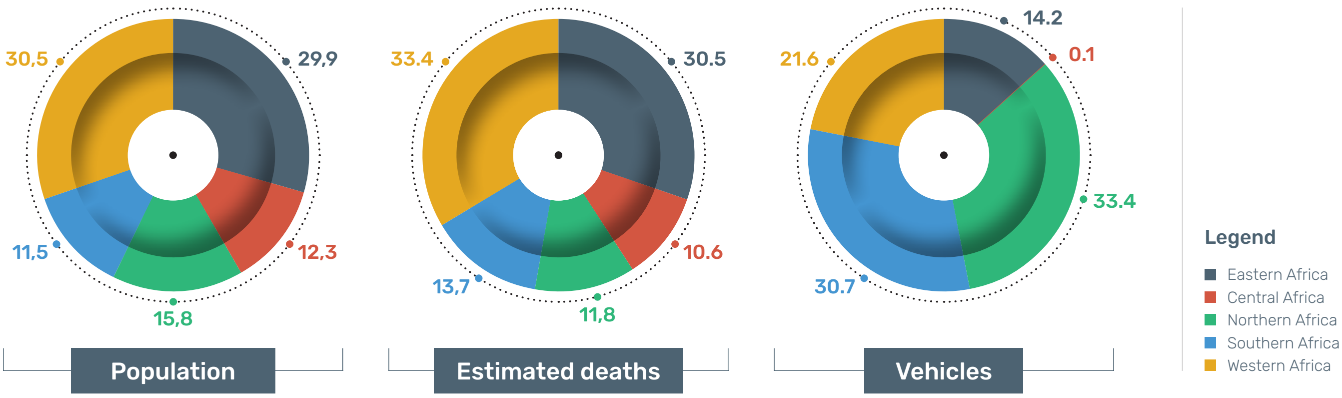
Figure 1: Estimated Road Traffic Fatality Rates per 100,000 Population, 2021



Source: WHO 2023.
Note: N=54.

3. Estimates of road traffic fatalities for all member states are periodically produced by the World Health Organization (WHO). Methods used to derive the estimates can be found in annex 1 of the *GSRRS 2023*.

Figure 2: Proportion of Population, Estimated Deaths, and Registered Vehicles, 2021

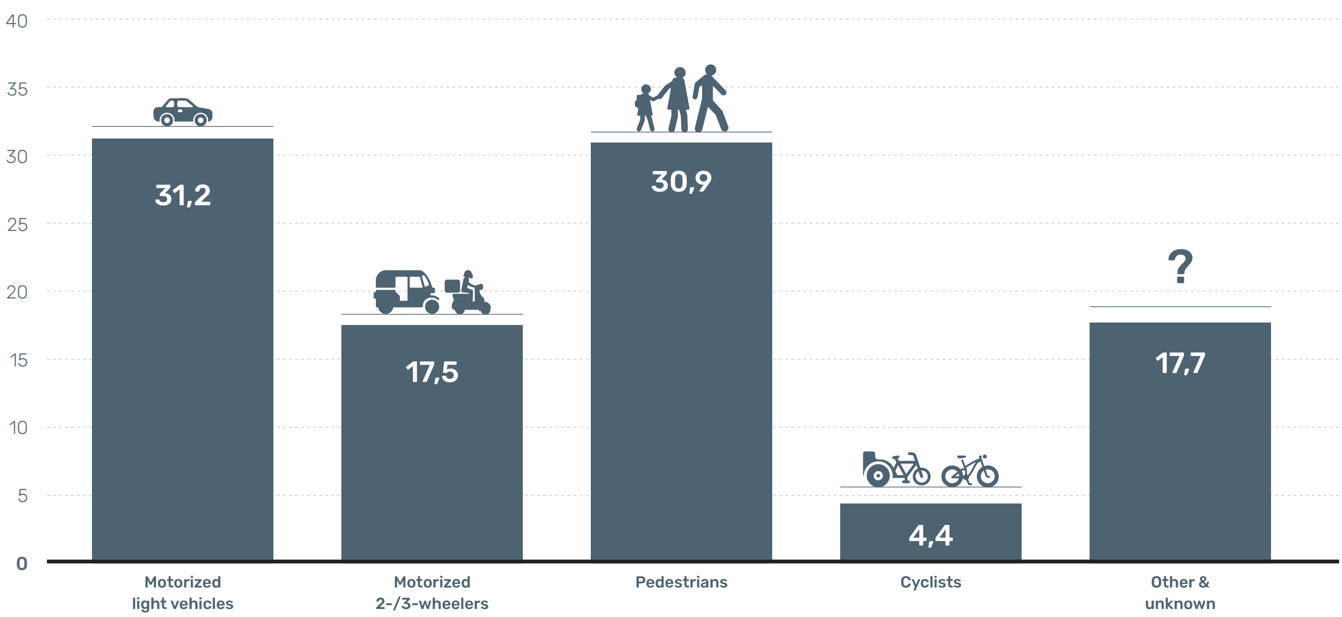


Source: WHO 2023.
Note: N=54.

The highest proportion of road traffic fatalities occur among males (75 percent), individuals ages 18 to 59 years (66 percent), and vulnerable road users (53 percent), with pedestrians accounting for 31 percent of all deaths (figure 3).

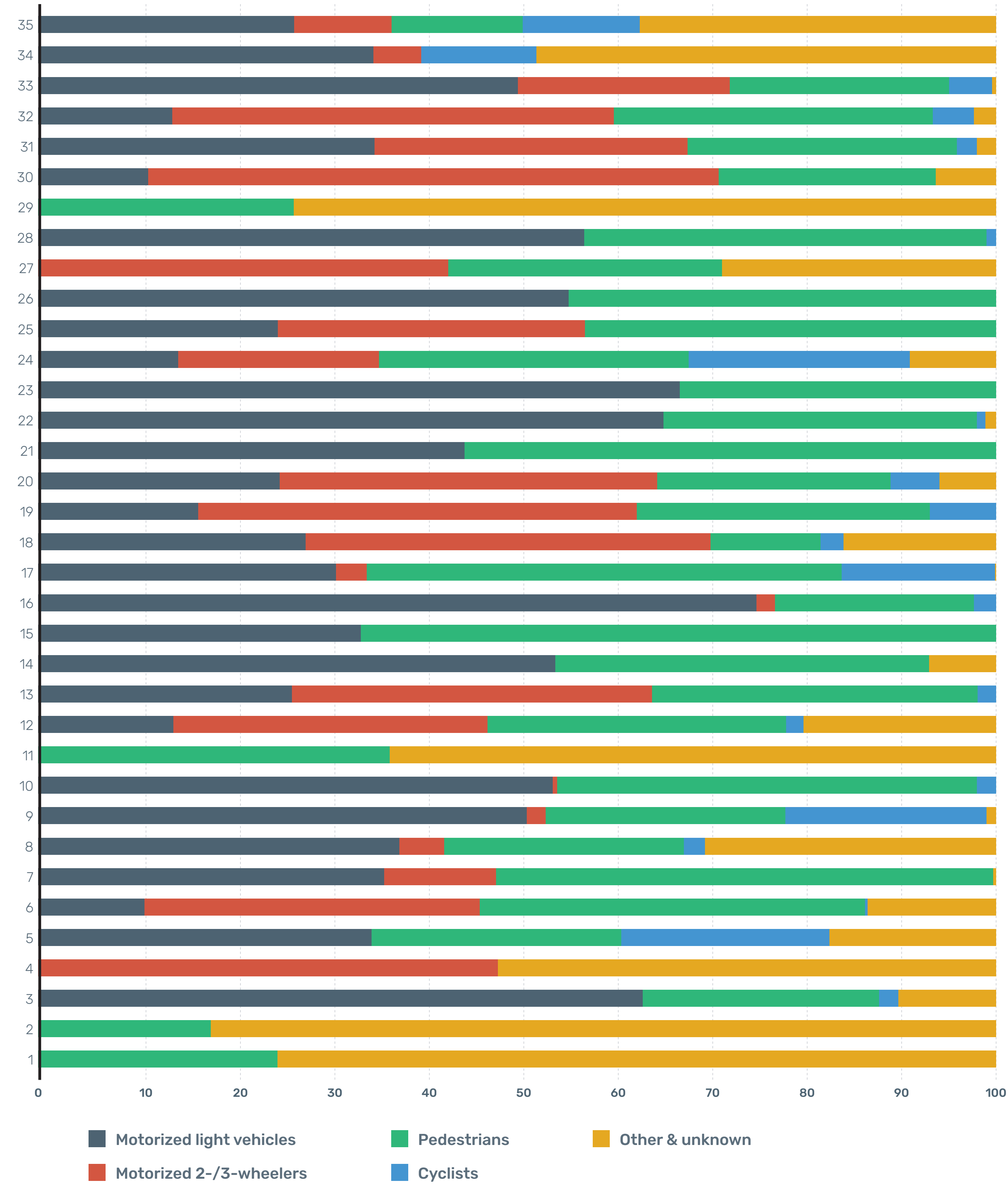
The distribution of road user fatalities varies across countries, with eight countries having distributions that differ from the continental trend. In four of these countries, car occupants account for over 60 percent of all deaths, while in the other four, unspecified or other road users account for more than 60 percent of all deaths (figure 4).

Figure 3: Road Traffic Fatalities by Road User Type, 2021



Source: WHO 2023.
Note: N=35.

Figure 4: Distribution of Road Traffic Fatalities by Road User Type, 2021

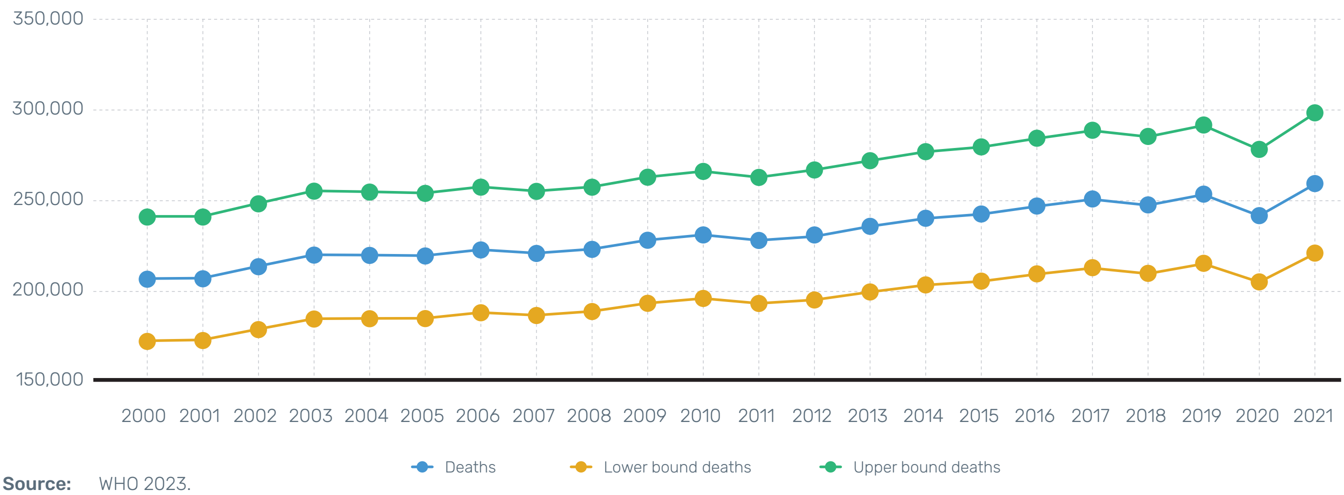


Source: WHO 2023.
Note: N=35.

Trends in Estimated Road Traffic Fatalities between 2000 and 2021

Since 2000, there has been an overall increase in the estimated road traffic fatalities in Africa. The number of road traffic fatalities has been increasing gradually, with a slight decrease in 2020, which can be explained by the reduced mobility during the COVID-19 pandemic (figure 5). It is worth noting that, despite the overall increase, since 2010 there has been a reduction in the estimated road traffic fatalities in 22 countries—specifically, six countries each in central and eastern Africa, four in northern Africa, and three countries each in southern and western Africa. Of these, three countries have reduced fatalities by 40–49 percent, two countries by 30–39 percent, five countries by 20–29 percent, 10 countries by 10–19 percent, and two countries by less than 10 percent.

Figure 5: Estimated Road Traffic Fatalities, 2000–2021



Source: WHO 2023.
Note: N=54.

Reporting on Road Traffic Injuries and Fatalities

Twenty-six countries report on the number of serious injuries and only four countries have data on the estimated proportion of people with road traffic injuries who incur a long-term impairment because of a crash. Fifty-one countries reported a total of 82,865 road traffic fatalities in 2021. The reported fatality numbers are obtained from country data collection systems that mostly rely on a single source and do not capture all deaths that occur because of road traffic crashes. The World Health Organization (WHO) uses mathematical models to estimate road traffic fatalities to overcome existing challenges in the data collection systems to ensure the numbers more accurately present the burden of road traffic fatalities (Mitra and Bhalla 2023; Martensen et al. 2021; Papadimitriou, Iaych, and Adamantiadis 2019).[4]

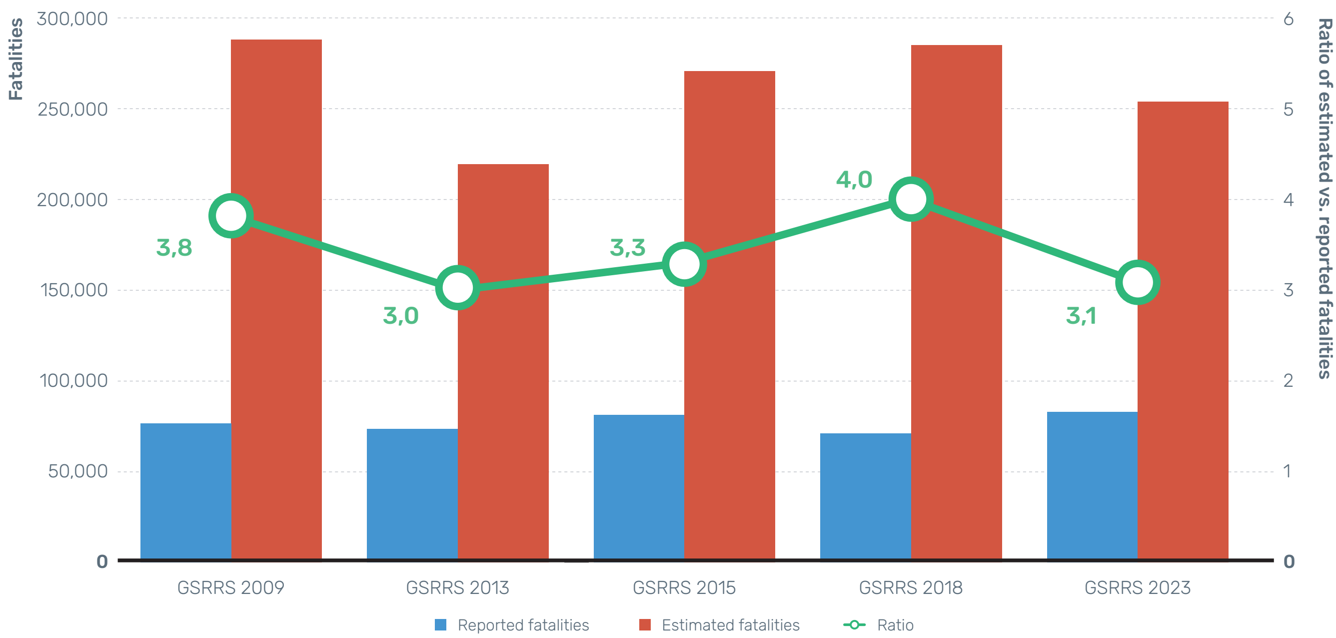
4. See the GSRRS 2023 for details on estimation methodology.

The WHO estimates the road traffic fatalities for 2021 among 54 countries in Africa at 259,601, which is three times higher than that reported by countries.[5] When estimated and reported figures are compared for the 51 countries that have reported death data, the reported fatalities match or almost match the WHO estimations for only six countries. For the other countries, the ratio of estimated versus reported fatalities ranges from 0.1 to 49.1, indicating significant underreporting in some countries. Figure 6 shows estimated and reported fatalities since the GSRRS 2009, highlighting persistent but fluctuating discrepancies. The highest discrepancy was observed in the GSRRS 2018, where estimated road fatalities were four times higher than reported fatalities.

Thirty-nine countries report having taken action to address the discrepancies between estimated and reported data. These efforts include collaboration among data custodians (for example, police, hospitals, forensics) to integrate data sources and capacity-building initiatives. However, discrepancies between reported and estimated deaths have been identified since the first Global Status Report on Road Safety (2009) and continue to increase in some countries. In this regard, the Marrakech Declaration at the 1st African Road Safety Forum (2018) urged countries to prioritize the development of their civil registration and vital statistics (CRVS) systems to improve the accuracy of road traffic fatality data. Individual country assessments, including those conducted in Ethiopia and Tanzania, have demonstrated significant discrepancies between official statistics and global estimates (Martensen et al. 2021; Segui-Gomez et al. 2021; WHO 2010).

Several countries (Côte d'Ivoire, Morocco, Senegal, Tanzania, and Zambia) have made progress in improving their road safety data collection systems through various country or regional initiatives, collaborations, and capacity-building efforts. While initiatives have focused on integrating data from police, hospitals, and mortality records, gaps in coordination and system interoperability persist (Mitra and Bhalla 2023).

Figure 6: Estimated versus Reported Road Traffic Fatalities, 2009–2021



Source: WHO 2023.

5. Discrepancies between reported and estimated deaths have been identified since the first Global Status Report on Road Safety (2009). For updates on the estimated deaths, the WHO produces revisions of the General Health Estimates, which are available at https://www.who.int/data/global-health-estimates.

While countries report the total number of road traffic fatalities, the reporting on fatalities by different population groups is incomplete. The distribution of road traffic fatalities by age, gender, and road user type is not uniformly reported across the continent. Gender distribution is reported by 23 countries, while 16 countries report on age distribution, with data gaps in some of the age groups. Thirty-five countries report on road user type distribution. Notably, in 10 countries road traffic fatalities are distributed among only two road user types, with four countries recording a considerable number of fatalities among the unknown/other road user types.

Other population groups are age and user type (11 countries), deaths in crashes related to work, including deaths among drivers traveling to and from work, while traveling for work (for example, delivery drivers), and among professional vehicle drivers (for example, bus drivers, truck drivers), all of which are reported by less than 10 countries.

Ensuring driver safety is essential for reducing work-related road traffic deaths, and it entails a combined effort from employers, governments, and corporations. Employers can implement driver safety programs, provide well-maintained vehicles with modern safety features, enforce rest periods to prevent fatigue, and utilize technologies like telematics and tachographs to monitor driving behavior. Corporations can establish fleet safety protocols, including speed management, driving hour limits, and safety monitoring devices. Governments complement these efforts by enforcing workplace safety regulations, improving road infrastructure, and incentivizing best practices (ERSO 2015; WHO 2021).

CASE STUDY 1

The African Road Safety Observatory: Toward a Pan-African Road Safety Knowledge Forum and Data Center

Africa is the region with the highest road traffic fatality rates globally. Each year, road crashes claim tens of thousands of lives, leaving millions injured and imposing significant economic and social burdens on countries across the continent. In response to this challenge, the African Road Safety Observatory (ARSO) was launched in 2018 as a regional knowledge platform and data repository to guide evidence-based road safety interventions. With its mission to empower African countries through robust data systems and policy support, ARSO plays a pivotal role in fostering safer roads and sustainable mobility across the continent.

Addressing Data and Capacity Challenges

The lack of reliable road safety data has long hindered African nations' ability to implement targeted and effective safety interventions. Challenges such as inconsistent data collection methods, limited capacity for analysis, and insufficient cross-border collaboration have perpetuated high fatality and injury rates. Recognizing these issues, African ministers of transport initiated the Lomé Declaration in 2017, calling on the African Union Commission (AUC), the World Bank, the Africa Transport Policy Program (SSATP), the United Nations Economic Commission for Africa (UNECA), and the African Development Bank (AfDB) for the establishment of a regional observatory to harmonize and strengthen road safety data systems.

ARSO was subsequently established under the auspices of the AUC and aligned with the African Road Safety Charter. The observatory provides a centralized platform for member states to collect, analyze, and share road safety data, enabling policy makers to monitor trends, identify high-risk areas, and design evidence-based interventions.

Core Components and Governance

ARSO's activities have so far been structured around several core components:

1

Data repository and analytics: ARSO serves as a centralized repository for crash and road safety data, supporting trend analysis, monitoring, and decision-making. Deliverables like the Africa Status Report on Road Safety establish baselines and track progress toward the UN Decade of Action for Road Safety goals.

2

Harmonized indicators and "miniARSO": A major milestone was the agreement among member countries on minimum harmonized indicators for collection of crash data. Known as "miniARSO," this framework will ensure consistency and comparability across nations, enabling more accurate cross-country analyses.

3

Knowledge sharing and capacity building: ARSO facilitates collaboration among member states through high-impact webinars, training programs, and technical workshops. These initiatives strengthen national data management systems, including safety performance indicators (SPIs) and civil registration and vital statistics (CRVS).

Governance and Sponsoring

ARSO's activities are guided by a Transitional Steering Committee, currently composed of representatives from Benin, Cameroon, Kenya, Morocco, Nigeria, Uganda, and South Africa. The committee provides strategic oversight and ensures alignment with ARSO's mission and goals. ARSO's work has so far been supported by a diverse range of funding partners, including the European Union (EU), the World Bank, SSATP, the Global Road Safety Facility, AfDB, UK Aid, and Agence Française de Développement (AFD). Technical support from organizations like the World Health Organization (WHO), UNECA, Fédération Internationale de l'Automobile (FIA), and International Transport Forum (ITF) has been instrumental in advancing ARSO's objectives. From 2025 onward, the EU will be the main sponsor.

Impact and Lessons Learned

ARSO's efforts have already had a transformative impact on road safety data management across the continent. By providing a centralized data repository, ARSO can empower countries to analyze crash data more effectively and implement targeted interventions.

One of ARSO's greatest strengths lies in its collaborative approach. Partnerships with national governments, regional economic communities, and international organizations have been vital to its success. However, challenges such as uneven technical capacity among member states and data quality issues highlight the need for continued support and investment.

Key Achievements

Since its inception, ARSO has made significant progress in strengthening road safety across Africa:

+

Engagement through General Assemblies and meetings:
ARSO has facilitated numerous gatherings, including the 1st African Road Safety Forum in Marrakech (2018), General Assemblies in South Africa (2019) and virtually (2022), and the Continental Road Safety Meeting in Morocco (2024). These events have fostered collaboration and advanced ARSO's agenda.

+

Publications:
The Africa Status Report on Road Safety 2020 marked an important step by establishing the first continent-wide baseline report. This report provided critical insights into road safety challenges and opportunities. The current report is another important milestone toward establishing a harmonized monitoring mechanism for Africa.

+

Harmonized indicators:
Through agreements like the Dakar Communiqué, Abuja Communiqué, and Marrakesh Declaration, member states committed to using harmonized indicators to monitor road safety data systematically.

+

Capacity building through webinars:
A series of webinars have equipped lead agencies with the skills needed to enhance their data systems, manage crash data, and implement safety performance indicators.

In 2020, ARSO and the Asia-Pacific Road Safety Observatory received the Prince Michael International Road Safety Award, recognizing their innovative contributions to global road safety.

Conclusion

The African Road Safety Observatory represents a groundbreaking approach to addressing Africa's road safety crisis. By harmonizing data collection, fostering knowledge sharing, and building capacity, ARSO can provide member states with the tools needed to implement evidence-based policies and programs. Its achievements to date underscore the importance of collaboration and innovation in saving lives and creating safer roads.

Effective partnerships and intensive cooperation between national authorities, international organizations, and key experts are crucial at every stage of ARSO's development, operation, and enhancement. As ARSO continues to evolve, it holds immense potential to serve as a model for regional road safety observatories worldwide, contributing to sustainable transportation and improved public health across Africa.

CASE STUDY 2

Data-Driven Road Safety Policies: Morocco's Collision Matrix Underpins and Facilitates Road Safety Policy Measures and Interventions

In Morocco, a novel initiative is reshaping how road safety can be understood and addressed. The Collision Matrix, developed by the National Road Safety Agency (NARSA), leverages data to uncover the dynamics of crashes and identify high-risk interactions among road users. This innovative diagnostic tool equips decision-makers with actionable insights, paving the way for targeted interventions to save lives.

Context and Challenges

Road traffic crashes in Morocco, as in many other countries, disproportionately affect road users such as pedestrians, cyclists, and motorcyclists. Effective safety planning has been hampered by limited understanding of the specific factors contributing to these crashes. To address this, NARSA embarked on the Collision Matrix project to provide a granular understanding of road crash dynamics.

The Collision Matrix is designed to diagnose crash patterns by analyzing interactions among road users. It highlights high-risk scenarios, such as collisions involving motorcyclists and trucks or cars and pedestrians, offering a foundation for prioritizing safety measures. NARSA considers that reliable data are the cornerstone of effective road safety planning, emphasizing the matrix's potential in addressing Morocco's road safety crisis.

Project Design and Implementation

The Collision Matrix project followed a structured, multiphase approach:

(1) **Data collection:** Crash data were collected from police reports, encompassing over 120,000 crashes. Each case was categorized to capture details such as road type, time of day, and the road user types involved.

(2) **Matrix development:** Using the collected data, NARSA developed a detailed Collision Matrix to visualize interactions between road users. Crashes were categorized into single-vehicle incidents, multi-vehicle collisions involving pedestrians, and other configurations. This categorization highlighted the primary contributors to fatalities and injuries.

(3) **Stakeholder engagement:** Findings were shared with stakeholders, including local authorities and ministerial departments, to facilitate informed decision-making. By providing both national and localized insights, the matrix empowered policy makers to design tailored interventions.

(4) **Targeted interventions:** Based on the insights, targeted action plans were implemented. For instance, the project prioritized motorcyclists, who are particularly vulnerable. Interventions included distributing safety helmets, enforcing helmet use laws, and restricting engine modifications on motorcycles. Dedicated bike lanes and cycling paths were also established in urban areas to improve safety for nonmotorized road users.

Lessons Learned

The Collision Matrix[a] underscores the importance of reliable data in road safety planning. Accurate crash data not only inform interventions but also enable ongoing evaluation of their effectiveness. Collaboration among stakeholders proved equally critical. By engaging local authorities, policy makers, and enforcement agencies, the project ensured that solutions were both inclusive and practical.

The initiative also highlighted the need for continuous innovation. Future efforts should prioritize adopting advanced technologies, such as real-time traffic monitoring, to provide more accurate and timely insights.

Results and Impact

The Collision Matrix has already had a considerable impact on road safety interventions in Morocco. By offering a comprehensive view of crash dynamics, it has enabled decision-makers to focus resources on the most critical issues. Key achievements include the following:

+ **Enhanced insights:** The matrix provided a detailed breakdown of road traffic crashes, identifying that single-vehicle incidents and collisions involving motorcyclists and heavy vehicles were major contributors to fatalities.

+ **Targeted actions:** Interventions based on the matrix have led to noticeable improvements. Helmet distribution campaigns, coupled with stricter enforcement, have significantly increased helmet usage among motorcyclists. These measures, along with enhanced road infrastructure, have reduced the severity of injuries.

+ **Informed decision-making:** Local authorities have adopted the matrix to tailor safety measures to specific regional challenges, such as urban congestion or rural road conditions.

While the project's early successes are evident, challenges remain. Ensuring the sustainability of interventions and expanding the matrix's scope to include automated traffic monitoring systems are among the next steps identified by NARSA.

Conclusion

Morocco's Collision Matrix exemplifies how data-driven approaches can transform road safety strategies. By focusing on high-risk interactions and empowering stakeholders with actionable insights, the initiative has laid a solid foundation for measures and interventions that can reduce road traffic fatalities and injuries.

As Morocco continues to refine and expand the Collision Matrix, its impact is expected to grow, offering a model adoptable by other nations seeking to address road safety challenges through evidence-based planning. The project demonstrates that with the right tools and collaborations, it is possible to create safer roads and save lives.

a. For an example of a Collision Matrix, please visit *collision_matrix_2024_update.png (3780×2126)*.

SECTION 2.

Road Safety Pillars

The African Road Safety Action Plan 2021–2030 aligns with and focuses on five pillars of road safety: road safety management, safer roads and mobility, vehicle safety, safe road users, and postcrash response. The following sections present an overview of the status of implementation of the interventions in each pillar.

Road Safety Management

Road safety management is a systematic approach to reducing the burden and severity of road traffic injuries and fatalities. An effective road safety management system integrates institutional management functions, interventions, and outcomes to address road safety comprehensively, emphasizing collaboration, accountability, and evidence-based strategies. The key road safety management functions are coordination, legislation, funding and resource mobilization, promotion, monitoring and evaluation, research, development, and knowledge transfer (Bliss and Breen 2009), and a key institution should be appointed for carrying out these functions (that is, road safety lead agencies).

The African Road Safety Action Plan 2021–2030 outlines six expected accomplishments for road safety management, each accompanied by actions or recommendations to improve road safety (refer to appendix A for details). The following sections provide an overview of the implementation status of these recommendations.

Road Safety Lead Agencies

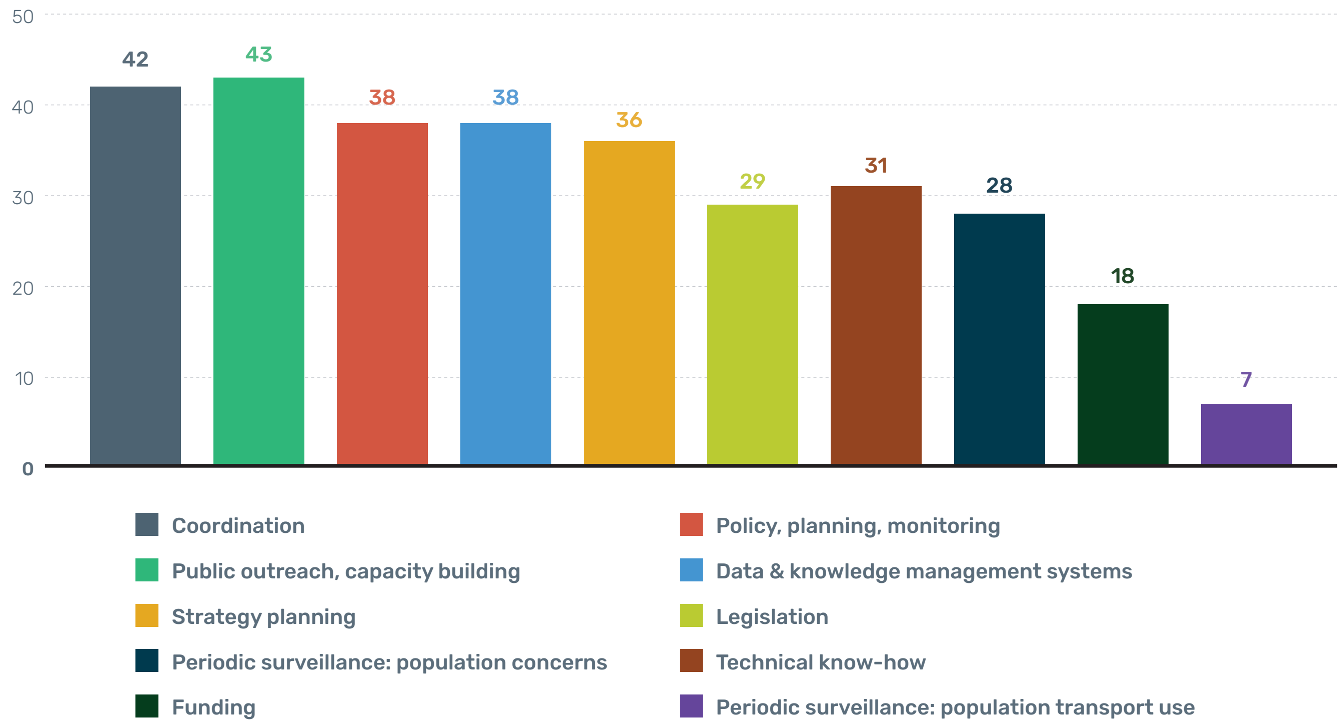
Road safety lead agencies (RSLAs) play a pivotal role in strengthening road safety management by driving strategic funding, setting well-defined targets, and ensuring effective data management aligned with global frameworks. These agencies are central to a holistic approach that integrates sustainable funding mechanisms, robust strategy development, internationally aligned targets, and advanced data systems. According to the SSATP working paper on RSLAs in Africa, these agencies coordinate the involvement of government, civil society, and other stakeholders to improve safety outcomes (Mitullah, Small, and Azzouzi 2022).

Forty-nine countries report having a national RSLA to lead and coordinate road safety activities. The main functions of the RSLAs, reported by 43 countries, include coordination; public outreach and capacity building; policy, planning, and monitoring; and data and knowledge management systems (figure 7). However, conducting periodic surveillance of population transport use (that is, monitoring the extent to which the population uses different modes of transport) is a less prioritized function, as it is assigned to RSLAs in only seven countries.

Funding for RSLAs

Adequate funding is essential for RSLAs to perform effectively their functions to achieve national road safety goals. Government budget allocations for RSLAs are reported in 29 countries, with 20 countries providing details on the amount of funding. These budget allocations primarily focus on crash and injury prevention, capacity building, injury care and treatment, as well as surveillance, monitoring, and evaluation, with about two-thirds of the countries receiving allocations for these

Figure 7: Countries Reporting Road Safety Lead Agency Functions, 2021



Source: WHO 2023.
Note: N=43.

activities. In contrast, only about a third of countries report budget allocations for survivor rehabilitation and palliative care, and research.

Funding for road safety activities, reported by 18 countries, is mainly sourced from general government revenues. Twelve countries attribute 50 percent or more of their total funding to this source, and six attribute less than 50 percent. Additional sources of funds include motor vehicle insurance (16 countries), international donors (15 countries), earmarked taxes (14 countries), national donors (13 countries), and general insurance (11 countries). Contributions from these sources range from 2 percent to 25 percent, except for that from national donors, which in one country contribute up to 60 percent.

Fiscal interventions such as taxation on fuel, road use (for example, tolls), and vehicle purchase, economic sanctions for infractions, and vehicle insurance provide additional funding opportunities. Among these, the most widely adopted measures are taxes on vehicle insurance (implemented in 37 countries), fuel (34 countries), road tolls (32 countries), alcoholic beverages (31 countries), and vehicle purchase (30 countries). However, only 19 countries earmark funds raised through fiscal measures specifically for road safety.

Lessons drawn from the *SSATP study of RSLAs in Africa* (Mitullah, Small, and Azzouzi 2022) highlight the importance of a comprehensive understanding of their management capacity and performance in implementing road safety interventions. Further analysis, using such tools as the road safety management capacity reviews from the Global Road Safety Facility (GRSF) (Bliss and Breen 2013), is recommended to assess in detail the institutional ownership, financial and human resources, and core functions of RSLAs. This comprehensive evaluation would help identify gaps and opportunities for strengthening the institutional effectiveness of RSLAs, ensuring they are well equipped to implement the African Road Safety Action Plan 2021–2030 and contribute to broader regional road safety objectives.

CASE STUDY 3

Transforming Road Safety in Kenya: National Road Safety Action Plan 2024–2028

Kenya, a country that relies heavily on road transport for its economic and social vitality, faces a grave challenge in road safety. With over 90 percent of goods and services transported via road networks, crashes have become a significant threat to lives and livelihoods. Recognizing this urgency, the Kenyan government launched the National Road Safety Action Plan (NRSAP) 2024–2028, an ambitious and multifaceted strategy aimed at reducing road traffic fatalities by 50 percent by 2030. This initiative reflects a bold commitment to creating safer roads through multisectoral collaboration and sustainable interventions.

A Strategic Framework for Road Safety

The NRSAP draws its foundation from global frameworks, such as the UN Decade of Action for Road Safety, while integrating local priorities. Anchored on the Safe System approach, it recognizes the interdependence of road design, vehicle standards, user behavior, and postcrash services. The strategy is structured around eight key priorities:

(1) Strengthening partnerships:
Enhancing coordination among government agencies, private sectors, and civil society

(2) Sustainable financing:
Establishing dedicated funding mechanisms, including the National Road Transport and Safety Fund

(3) Risk targeting:
Identifying high-risk areas and deploying targeted interventions

(4) Infrastructure safety:
Upgrading road designs to meet safety standards

(5) Vehicle standards:
Enforcing compliance with safety regulations

(6) Behavioral change:
Targeting unsafe road behaviors through enforcement and education

(7) Postcrash services:
Improving emergency response and trauma care

(8) Data and monitoring:
Building robust systems for road safety data collection and evaluation

President William Ruto, speaking at the plan's launch, emphasized the significance of road safety, highlighting the collaboration required across all sectors to transform roads into safe corridors of productivity and opportunity.

Collaborative Implementation for Impact

The NRSAP's implementation is managed through a robust governance structure that includes the following: the Cabinet Committee on Health and Social Protection, which provides high-level oversight; the Multi-Agency Steering Committee (MASC), which ensures inter-agency coordination; and technical working groups, which execute technical and operational aspects.

Stakeholders such as the National Transport and Safety Authority (NTSA), the Kenya National Police Service, and private transport operators play pivotal roles in driving the agenda. Notably, the NTSA is tasked with overseeing the strategy, leveraging its mandate established under the NTSA Act of 2012 to ensure road safety compliance.

One key innovation under the NRSAP is the allocation of 10 percent of road infrastructure budgets to safety measures, such as pedestrian crossings, lighting, and barriers. Additionally, a portion of the fuel levy will be dedicated to safety programs, ensuring consistent funding.

Addressing Road User Behavior

Speeding, drink driving, using mobile devices while driving, not using seat belts, and reckless driving are major contributors to road traffic fatalities in Kenya. The NRSAP prioritizes education and enforcement to combat these road user behaviors. Public awareness campaigns are planned to promote responsible road use, complemented by stricter penalties for traffic violations.

The Kenya National Police Service is undergoing capacity building to enhance its enforcement capabilities. Automated systems, including speed cameras and mobile Breathalyzers, are being deployed to reduce human error and corruption during enforcement.

Advancing Vehicle Safety Standards

Kenya's strategy also addresses vehicle safety by enforcing compliance with standards such as regular inspections and crashworthiness requirements. Collaborations with manufacturers aim to improve vehicle quality, while stringent penalties for noncompliance are expected to deter substandard practices. These efforts align with the NRSAP's goal of ensuring that vehicles on Kenyan roads meet international safety benchmarks.

Improving Postcrash Services

A critical component of the NRSAP is improving postcrash services to save lives and reduce the severity of injuries. Ambulance services are being expanded, and emergency response times are being shortened through centralized coordination. Hospitals are receiving enhanced training and equipment to handle trauma cases effectively. A national trauma registry will track injury data, enabling targeted interventions and resource allocation.

Early Results and Public Perception

Since its launch, the NRSAP has shown promise. Initial evaluations indicate a reduction in speeding violations and improved adherence to traffic rules in targeted areas. Public support for the plan is growing, particularly among transport operators and civil society organizations. However, challenges such as inadequate infrastructure in rural areas and resistance to behavioral change remain.

Lessons Learned and Path Forward

The NRSAP demonstrates that multisectoral collaboration and sustainable funding are crucial for road safety interventions. The Kenyan government has successfully mobilized resources and partnerships, including support from development partners such as the World Bank and the European Union. President Ruto's leadership has been instrumental in rallying diverse stakeholders, ensuring alignment with national priorities.

Looking forward, Kenya aims to expand its safety measures to underserved regions, strengthen enforcement mechanisms, and scale up data-driven interventions. The government's commitment to automating traffic management and integrating digital solutions will further enhance efficiency and transparency.

Conclusion

The National Road Safety Action Plan 2024–2028 reflects Kenya's determination to address its road safety challenges comprehensively. By fostering partnerships, prioritizing evidence-based interventions, and committing resources, the government is laying the foundation for safer roads. While the journey is far from complete, the NRSAP serves as a model for other nations seeking to reduce road traffic fatalities and build safer, more sustainable transport systems.

President Ruto aptly reiterated the need for a zero-tolerance approach to negligence on the roads, aiming to ensure every Kenyan can travel safely and reach their destination.

National Road Strategy and Targets

RSLAs play a critical role in developing ambitious yet actionable strategies and targets that align with global and regional frameworks. However, these efforts must be supported by adequate and sustained funding to close the gap between planning and implementation (Mitullah, Small, and Azzouzi 2022). Thirty-eight countries have national road safety strategies, of which 32 are developed, implemented, and evaluated in collaboration with stakeholders, including academia, civil society organizations, the private sector, and youth groups. Funding for strategy implementation is reported in 33 countries.

While 24 countries include fatality reduction targets in their strategies, only 17 report having nonfatality reduction targets. Additionally, only 19 of the fatality reduction targets and 14 of the nonfatality reduction targets align with Sustainable Development Goal (SDG) target 3.6, to halve road traffic deaths and injuries by 2030. While some national road safety strategies address alternative forms of transport, safe road user behavior, and adherence to vehicle and road safety standards, only a few have set targets with clear time frames for achievement (table 1).

Table 1: Road Safety Targets Included in Road Safety Strategies, 2021

	Addressed in strategy	Strategy sets targets
Alternative modes of transport		
Promotion of walking as an alternative to car travel	14	4
Promotion of bicycling as an alternative to car travel	13	3
Promotion of convenient access to public transport	25	8
Safe road user behavior		
Promotion of the use of seat belt use	35	17
Promotion of the use of child restraints	23	10
Promotion of the use of helmets	38	15
Limiting vehicle speed	37	13
Preventing alcohol-impaired driving	29	11
Preventing drug-impaired driving	26	5
Decreasing distracted driving	30	10
Ensuring rest periods for professional drivers	22	14
Vehicle and road safety standards		
Ensuring roads traveled meet technical safety standards for all users	27	12
Ensuring new vehicles meet United Nations technical safety regulations or equivalent	23	5
Improved times between crash and access to professional emergency health care	28	12

Source: WHO 2023.

Ratification of International and Regional Legal Road Safety Instruments

The United Nations (UN) road safety conventions serve as a foundation on which states can build national legal frameworks governing road safety interventions. To apply these conventions, countries must accede to and integrate them into national legislation with clear enforcement measures (UNECE 2020). Seven road safety conventions are considered priorities for accession (box 1). African countries could adapt these standards to their local context when updating or improving their national legislation and policies to ensure relevance and effectiveness. In this respect, the African Road Safety Charter further provides a structured framework for improving road safety across the continent and serves as an advocacy tool for creating an enabling environment to reduce road traffic crashes (AU 2016).

BOX 1: United Nations Road Safety Conventions

Conventions on Road Traffic (1949 and 1968)

Convention on Road Signs and Signals (1968)

"Vehicle Regulations" Agreements (1958, 1997, 1998)

European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) (1957)

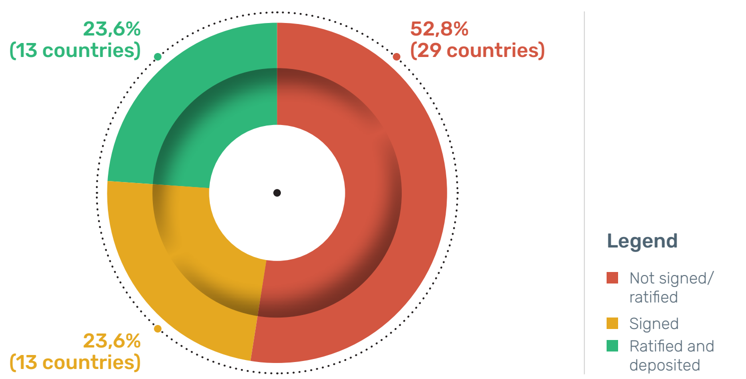
European Agreement concerning the Work of Crews of Vehicles Engaging in International Road Transport (AETR) (1970).

Source: UNECE 2020.

Other international convention and regulations include the 1950 Traffic Arteries Convention, the 1975 AGR Convention, and the 2003 International Asian Highway Network.

To date, 31 African countries adhere to at least one UN convention; only three adhere to all seven. In the same vein, 13 countries have signed, ratified, and deposited their instruments of ratification of the African Road Safety Charter to the AU Chairperson Legal Office (figure 8).

Figure 8: Ratification of the African Road Safety Charter, 2021



Source: AU 2025.
Note: N=55.

Data Management

Effective road safety management requires robust data systems to define road safety problems, identify risk factors, set priorities, and monitor progress (WHO 2010). Comprehensive road safety data management systems comprise the mechanisms and arrangements for data collection and analysis that cover all road safety interventions, including process indicators (for example, legislation), performance indicators (for example, helmet use), exposure measures (for example, vehicle fleet), outcome indicators (injuries and fatalities), and the social costs of road traffic crashes.

Outcome Indicators

Most countries (47) collect data on road traffic crashes and injuries.[6] Thirty-four countries also have a system to document serious injuries. Road traffic fatalities are recorded through the civil registration and vital statistics (CRVS) system in 21 countries, yet this system is the source of road traffic fatality data in only three countries. Most countries (28) rely on police records as their only source of road traffic fatality data, and one country did not report on the source of data used (table 2). Reliance on a single source of data likely leads to underreporting.

Definitions of serious injuries and fatalities vary widely, with countries using more than one definition. Thirty countries use the definition "died within 30 days of crash" for fatalities, while only three countries use standard criteria (MAIS, RTS, or MGAP)[7] for injury severity. Inconsistent definitions compromise data quality, limiting the ability to manage road safety effectively.

Over the past decade, reviews to address the challenges in road safety data systems have consistently highlighted issues such as underreporting of road traffic injuries and fatalities, fragmented data collection processes, and the absence of standardized methodologies (Martensen et al. 2021; Mitra and Bhalla 2023). Efforts to harmonize road safety data, such as the establishment of the African Road Safety Observatory (ARSO), have provided a platform for regional collaboration to regularly exchange data on road safety issues and share information on safety performance indicators. Despite the abundance of diagnostic studies, limited technical and financial resources remain a major barrier to achieving robust and reliable data systems. As emphasized in the Marrakech Declaration of the 1st African Road Safety Forum (2018), there is a need for sustained investment and capacity building tailored to the African context (Segui-Gomez et al. 2021; WHO 2010).

Table 2: Sources of Road Traffic Fatality Data, 2021

Single source		Two sources		Three sources		Four or more sources
Other/health facility records	Police	Police, health facility records	Police, other	Police, health facility records, other	Police, health facility records, CRVS	Police, CRVS, health facility records, insurance, other
5	28	5	7	2	1	2

Source: WHO 2023.
Note: CRVS = civil registration and vital statistics.

6. This survey did not assess whether countries collected data on the social costs of road traffic crashes.
7. MAIS = Maximum Abbreviated Injury Severity; RTS = Revised Trauma Score; MGAP = Mechanism, Glasgow Coma Scale, Age, Arterial Pressure.

Performance Indicators

More countries have systems to monitor road user behavior compared to transport modality use. Among road-use behaviors, seat belt use (25 countries) and speeding violations (24 countries) are the most monitored, while the use of child restraint systems is monitored in only eight countries. Data are obtained mainly from issuance of tickets for violation or police crash reports.

Only 10 countries report on the use of public transport, and no country reports on the use of motorized two- and three-wheelers. This lack of performance indicator data undermines efforts to identify risk factors, monitor trends, and evaluate the effectiveness of road safety interventions.

Reporting on process indicators is described in other sections of this report.

Strengthening road safety data systems requires standardized definitions, diversified data sources, sustained investment, capacity building, effective monitoring, and regional collaboration to enable evidence-based policy making and impactful interventions (Mitullah, Small, and Azzouzi 2022). Numerous country data reviews conducted across Africa in recent years have provided a clear understanding of road safety challenges; the focus must now shift from diagnosing the problems to implementing effective solutions.

CASE STUDY 4

Intelligent Transport Management: Improving the Safety of Interurban Transport in Cameroon with Ym@ne Driver

Road safety has long been a pressing issue in Cameroon, where traffic accidents claim an average of 1,200 lives annually and leave thousands more injured. The economic cost of these incidents is staggering, estimated at 1 percent of the national GDP, or roughly US$1.3 billion. Recognizing the need for transformative action, the Ministry of Transport, in collaboration with public and private partners, introduced the Ym@ne Driver system, a centralized, intelligent platform designed to address key risk factors in interurban transport. This initiative represents a milestone in the country's efforts to modernize transport safety and reduce traffic-related fatalities and injuries.

Addressing the Road Safety Crisis

The development of Ym@ne Driver stems from three primary concerns: human error, vehicle defects, and poor road conditions. Studies attribute up to 70 percent of crashes to risky driver behavior, including speeding, fatigue, and distraction. Previous government interventions, from regulatory reforms to infrastructure upgrades, achieved limited success in tackling these multifaceted challenges.

In response, the Ym@ne Driver system was conceptualized to leverage advanced technology in monitoring, managing, and improving interurban transport safety. The platform, launched as a public-private partnership with CAMTRACK-MTN, represents an investment of approximately US$20 million. It combines real-time data collection, driver behavior analysis, and fleet management to address these systemic issues proactively.

Key Features of Ym@ne Driver

The Ym@ne Driver system comprises several interconnected components:

(1) **Establishment of a centralized traffic control center:**
Located at the Ministry of Transport, this state-of-the-art facility collects, processes, and stores data on interurban transport operations. High-resolution monitors display vehicle locations, traffic patterns, and potential hazards in real time.

(2) **Continuous in-vehicle surveillance:**
Participating vehicles are equipped with GPS trackers, multiple cameras, and behavior-monitoring sensors. These devices capture critical data such as driver actions (for example, speeding, fatigue, phone use), passenger interactions and seat belt use, and external road conditions, including obstacles and congestion.

(3) **Real-time alerts and reporting:**
The system immediately notifies drivers, transport companies, and police enforcement teams of risky behaviors or violations, enabling prompt corrective actions.

(4) **Provision of fleet management tools:**
Transport operators benefit from features that track vehicle maintenance schedules, monitor compliance with administrative requirements, and generate automated reports on fleet performance.

(5) **Behavioral scoring and accountability:**
Transport companies are ranked based on their adherence to safety standards, fostering accountability and encouraging industry-wide improvements.

Implementation and Achievements

The implementation of Ym@ne Driver has been phased, beginning with high-risk sectors such as hazardous goods transport and interurban passenger services. Over five years, 764 goods transport vehicles and 934 passenger transport vehicles have been equipped with the system. Key achievements include the following:

- **Zero fatalities in hazardous goods transport:**
  Since the system's deployment in this sector, no fatal accidents have been recorded, demonstrating its effectiveness in mitigating risks.
- **Reduction in risky behaviors:**
  Instances of speeding, phone use, and seat belt noncompliance have significantly decreased among drivers monitored by Ym@ne Driver.
- **Strong decrease in crash numbers:**
  Transport companies that previously recorded an average of three crashes every 10 days have reported a near-total elimination of incidents post-implementation.

Challenges and Lessons Learned

While Ym@ne Driver has achieved notable success, its implementation has not been without challenges. Some transport operators initially resisted adopting the system because of the costs involved and concerns over privacy. Public awareness campaigns, coupled with financial incentives such as insurance discounts for compliant vehicles, have helped address these issues.

Lessons learned from the project highlight the importance of collaboration. The partnership between the Ministry of Transport, private sector entities like CAMTRACK-MTN, and transport operators has ensured the system's sustainability. Additionally, the use of real-time alerts and feedback has proven crucial in improving driver behavior and preventing accidents.

Recommendations for the Future

To build on the success of Ym@ne Driver, the following steps are recommended:

(1) **Expand coverage:**
Mandatory installation of the system in all interurban transport vehicles should be enforced, with phased implementation for smaller operators.

(2) **Enhance training:**
Continuous education programs for drivers and transport operators are needed to maximize the system's impact.

(3) **Integrate advanced analytics:**
Incorporate artificial intelligence to predict high-risk scenarios based on historical data, further improving preventive measures.

(4) **Strengthen incentives:**
Broaden financial benefits, such as reduced leasing costs or tax breaks, to encourage adoption among hesitant operators.

(5) **Improve emergency response:**
Use data from Ym@ne Driver to enhance coordination among emergency services, reducing response times to accidents.

Conclusion

Ym@ne Driver is a groundbreaking approach for improving the safety of interurban transport in Cameroon. By combining cutting-edge technology with robust governance, the system addresses key risk factors and sets a new standard for traffic management in the region. With its demonstrated success in reducing crashes and fatalities, Ym@ne Driver can serve as a model for other countries grappling with similar challenges.

As Cameroon continues to refine and expand this initiative, its commitment to innovation and collaboration offers hope for safer roads and a more efficient transport network. The project underscores the potential of technology-driven solutions to transform road safety, saving lives and fostering economic growth.

Safer Roads and Mobility

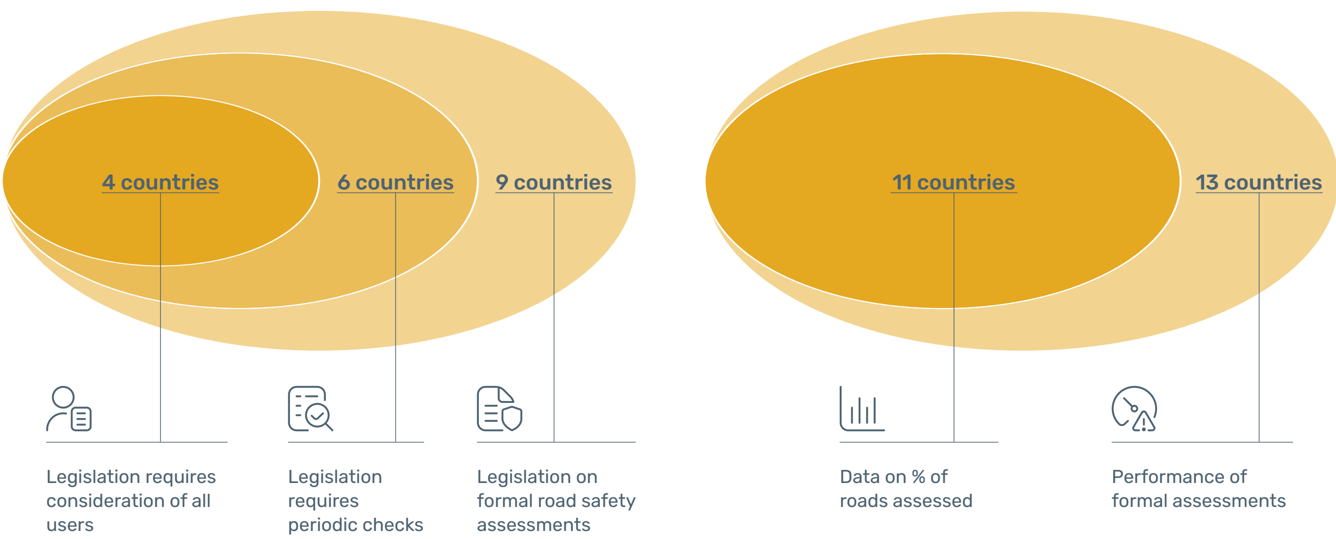
Safe road infrastructure is essential for reducing road traffic crashes and injuries. It serves as a preventive measure by minimizing risks, promoting safe road user behavior, and ensuring safety for all road users, particularly pedestrians, cyclists, and motorcyclists. Effective road infrastructure supports multimodal mobility—including public transport, walking, and cycling—through careful design, construction, and maintenance (Mitra et al. 2022; AU 2021; WHO 2021).

Establishing mechanisms that prioritize safety in the design and maintenance of new and existing roads is crucial for achieving safer mobility. The African Road Safety Action Plan 2021–2030 recommends adopting technical design standards that consider the safety of all users, supported by formal road safety audits. The star rating system developed by the International Road Assessment Programme (iRAP) is an objective measure of the level of safety, with three stars the minimum acceptable rating for both new and existing roads (iRAP 2018).

Technical design standards for new roads are present in 38 countries but are aligned with relevant international conventions in 35 countries. Safety features for pedestrians and cyclists (such as managing speed, global street design guidelines, safe crossings, and separation from vehicular traffic) are included in the standards of 36 countries; in 29 countries, the standards recognize the importance of land use and how land-use considerations influence the expected mix of different road users within the transport system.

Only nine countries have laws mandating formal road safety assessments. Six countries legally require periodic maintenance checks, while only four countries mandate consideration for all road users. Formal road assessments are performed in 13 countries, of which 11 report the proportion of the road network undergoing safety rating assessment. Additionally, only 11 countries report on the use of specific guidelines for auditing, including safety/star ratings and global street design standards (figure 9).

Figure 9: Road Safety Assessment: Legislation, Performance, and Data Availability, 2021

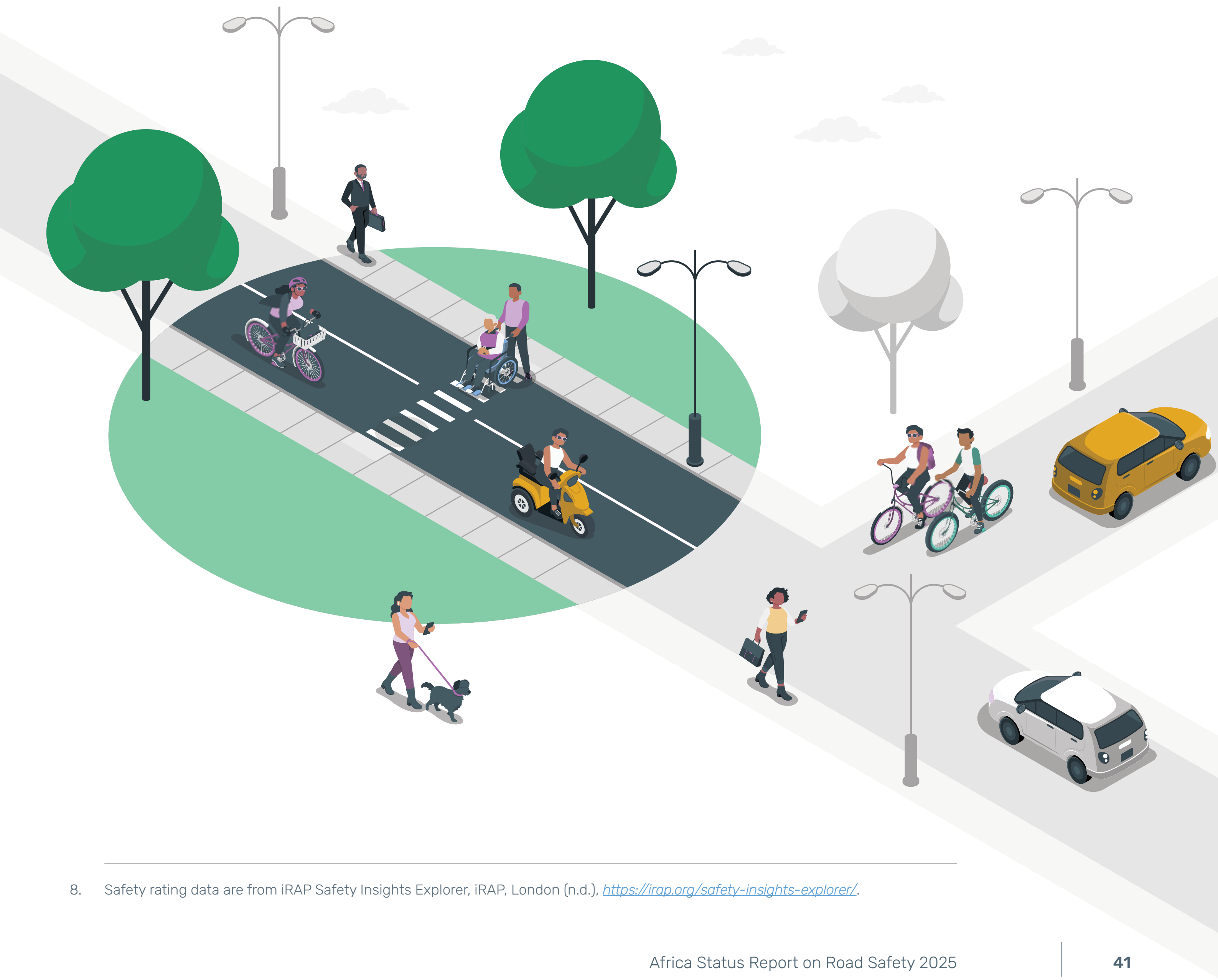


Source: WHO 2023.
Note: N=49.

Based on available data from 37 countries, there are 1,188,734 kilometers of paved roads. Only six countries report having dedicated cyclist lanes, with a combined total length of 1,233.4 kilometers, 94 percent of which is in one country.

According to assessments performed using the iRAP star rating methodology on 50,166 kilometres of roads across 13 countries, only 17 percent meets a three-star or higher safety rating for pedestrians, 29 percent for motorized two- and three-wheelers, 15 percent for cyclists, and 38 percent for passenger vehicles.[8] These findings suggest that few roads in Africa achieve a three-star or higher rating, though it is important to note that these assessments were not necessarily based on a representative sample of all roads within the continent.

The design, construction, and maintenance of road and transport systems in Africa reflect prioritization of motorized vehicles over vulnerable road users. Given that over 70 percent of road users in Africa are pedestrians (UNEP and UN-Habitat 2022), and that vulnerable road users account for the highest proportion of fatalities, prioritizing their safety and accessibility is essential. This is especially important considering the rapid urbanization of African cities, where equitable transport systems are urgently needed.



8. Safety rating data are from iRAP Safety Insights Explorer, iRAP, London (n.d.), https://irap.org/safety-insights-explorer/.

CASE STUDY 5

Reimagining Mobility: Regional Collaboration, Kenya, and the Pan African Action Plan for Active Mobility

In the heart of Africa's dynamic urban landscapes, where walking and cycling remain dominant yet perilous modes of transport, a transformative initiative is taking shape. Kenya, alongside several other African nations, is pioneering efforts under the Pan African Action Plan for Active Mobility (PAAPAM) to revolutionize mobility and prioritize safety and inclusivity for nonmotorized transport users.

A Systematic Neglect

Active mobility—walking and cycling—is the lifeblood of African cities and rural areas, where millions depend on these modes daily, yet infrastructure planning has historically catered to private vehicles, leaving pedestrians and cyclists neglected. In many cities, this oversight manifests in poorly designed and disconnected walkways, nonexistent cycling lanes, and alarming road fatality rates disproportionately affecting vulnerable groups like women, children, and persons with disabilities.

The 2022 Africa Regional Forum for Action in Kigali illuminated this widespread challenge. Stakeholders from across the continent recognized a shared crisis: walking and cycling, while crucial to economic and social mobility as well as local transport pollution reduction targets, were consistently sidelined in policy and investment frameworks. This gathering catalyzed the creation of PAAPAM, a blueprint for reversing decades of neglect and reshaping African mobility systems.

A Unified Vision for Active Mobility

PAAPAM, launched in 2024 at the World Urban Forum in Cairo, represents a bold vision. Anchored in three strategic pillars—safety, advocacy, and integration into policy—the plan sets ambitious goals to eliminate road fatalities for pedestrians and cyclists, enhance accessibility, reduce pollution, and create infrastructure that fosters comfort and health.

In Kenya, the plan is not just an abstract document; it is a road map for action. With support from international organizations like the United Nations Environment Programme (UNEP), United Nations Human Settlements Programme (UN-Habitat), and the World Health Organization (WHO), Kenya is one of five pilot countries implementing the plan. Local governments are conducting baseline analyses, revisiting outdated urban policies, and committing to building infrastructure that reflects PAAPAM's safety, climate, and inclusivity goals.

Collaborative Action Across Sectors

The success of PAAPAM hinges on a multisectoral approach. In Kenya, national ministries, local authorities, civil society organizations, and international development partners work hand in hand across sectors. At the international level, UNEP leads policy development and capacity-building initiatives, while UN-Habitat integrates urban planning expertise. The WHO emphasizes health and safety components, ensuring that the plan is as much about well-being as it is about mobility.

Workshops and training sessions have equipped Kenyan officials with the tools to draft both national and local-level active mobility policies and strategies. Stakeholders, including local nongovernmental organizations and research institutions, are rallying communities to embrace the vision. From Nairobi to smaller cities, the message is clear: active mobility is no longer an afterthought but a critical component of sustainable development.

Progress and Challenges

Since its launch, PAAPAM has galvanized action across Africa, with dedicated consultations and collaboration from north to south, east to west. Over 1,400 stakeholders across sectors have been directly engaged in consultations, fostering a sense of ownership and commitment. These dialogues have not only highlighted diverse perspectives but also ensured that solutions are tailored to Africa's unique urban and rural dynamics.

The plan's most tangible achievement is the prioritization of nonmotorized transport in urban policy discussions. For the first time, a regionally specific framework exists to guide investment in walking and cycling infrastructure. However, challenges remain. Shifting cultural perceptions about walking and cycling, ensuring sustained financial commitment, and addressing enforcement gaps require unwavering effort.

Looking Ahead

PAAPAM is more than a plan; it is a movement toward a safer, more equitable future. By embedding walking and cycling prioritized in the urban and rural fabric, the initiative promises reduced greenhouse gas emissions, healthier lifestyles, and safer streets. The ripple effects extend beyond mobility, fostering social cohesion and bridging economic divides.

For Kenya, the path forward lies in sustained advocacy, robust stakeholder engagement, and scaling successful pilot projects to the national level as well as exploring opportunities for a national commitment for walking and cycling. The lessons learned will not only shape the country's transport future but also serve as a beacon for other African nations striving to reimagine mobility in an inclusive, sustainable manner.

Vehicle Safety

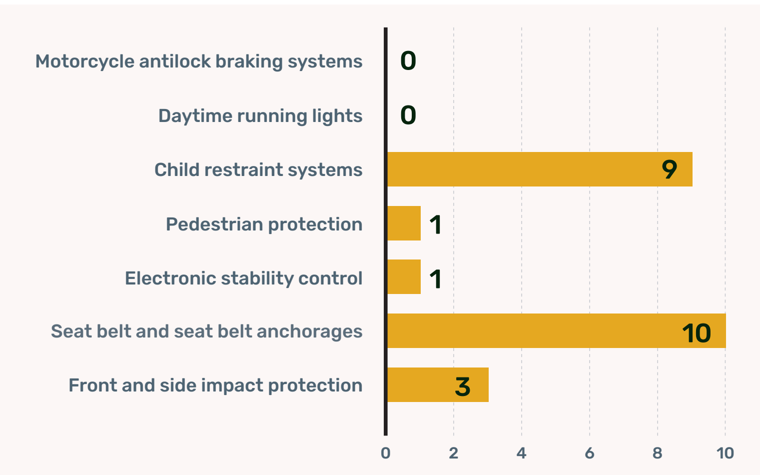
The design of vehicles plays a significant role in determining the likelihood of crashes and the risk and severity of injuries for both vehicle occupants and other road users. Adherence to the UN legislative standards for vehicle design and technology ensures a uniform and acceptable level of safety for motorized vehicles (WHO 2017).

Table 3: Registered Vehicles in Africa, 2021

Registered vehicles	Number	n/51
Total registered vehicles	87,724,608	37
Cars and wheeled light vehicles	20,122,458	21
Motorized two- and three-wheelers	7,810,822	21
Heavy trucks	2,785,166	23
Buses	853,711	21
Other	2,125,209	12

Source: WHO 2023.
Note: N=37.

Figure 10: Vehicle Safety Legislation, 2021



Source: WHO 2023.
Note: N=33.

Laws on the registration of motorized vehicles are present in 49 countries, but these laws apply to both private and professional vehicles in only four countries. Despite the presence of vehicle registration systems in 44 countries, data on the number of registered vehicles are available in only 37 countries, with even fewer countries reporting on the breakdown of vehicles by type. This highlights significant weaknesses in vehicle registration systems, which fail to adequately capture the number and types of vehicles in circulation.

Based on available data, there were 87,724,608 registered vehicles in Africa in 2021. Cars and wheeled light vehicles form the bulk of all registered vehicles, accounting for 23 percent, followed by motorized two- and three-wheelers (9 percent), heavy trucks (3 percent), other vehicles (2 percent), and buses (1 percent) (table 3).[9]

Periodic vehicle inspections are required by law in 42 countries. While 33 countries have national laws addressing vehicle safety for four-wheeled motorized vehicles, only one country has similar laws for motorized two- and three-wheeled vehicles. The safety features most included in these laws are seat belts, seat belt anchorages, and child restraints, while pedestrian protection and electronic control stability are the least included features (figure 10).

Restrictions on the import and export of used vehicles are reported in 36 countries, of which 31 use vehicle safety criteria (none of the countries specified the vehicle safety criteria used) with or without age limits. Additionally, government vehicle procurement practices include safety prerequisites in 30 countries. As Africa remains the largest global market for used vehicles (UNEP 2021), restricting the import and export of unsafe vehicles is critical for protecting all road users and preserving the environment.

9. Reporting on the number of registered vehicles was incomplete, with some countries not reporting the registration of some types of vehicles. Totals of the types of vehicles do not add up to the total number of registered vehicles.

CASE STUDY 6

Tunisia's National Road Safety Strategy: A Framework for Safer Roads (2023–2034)

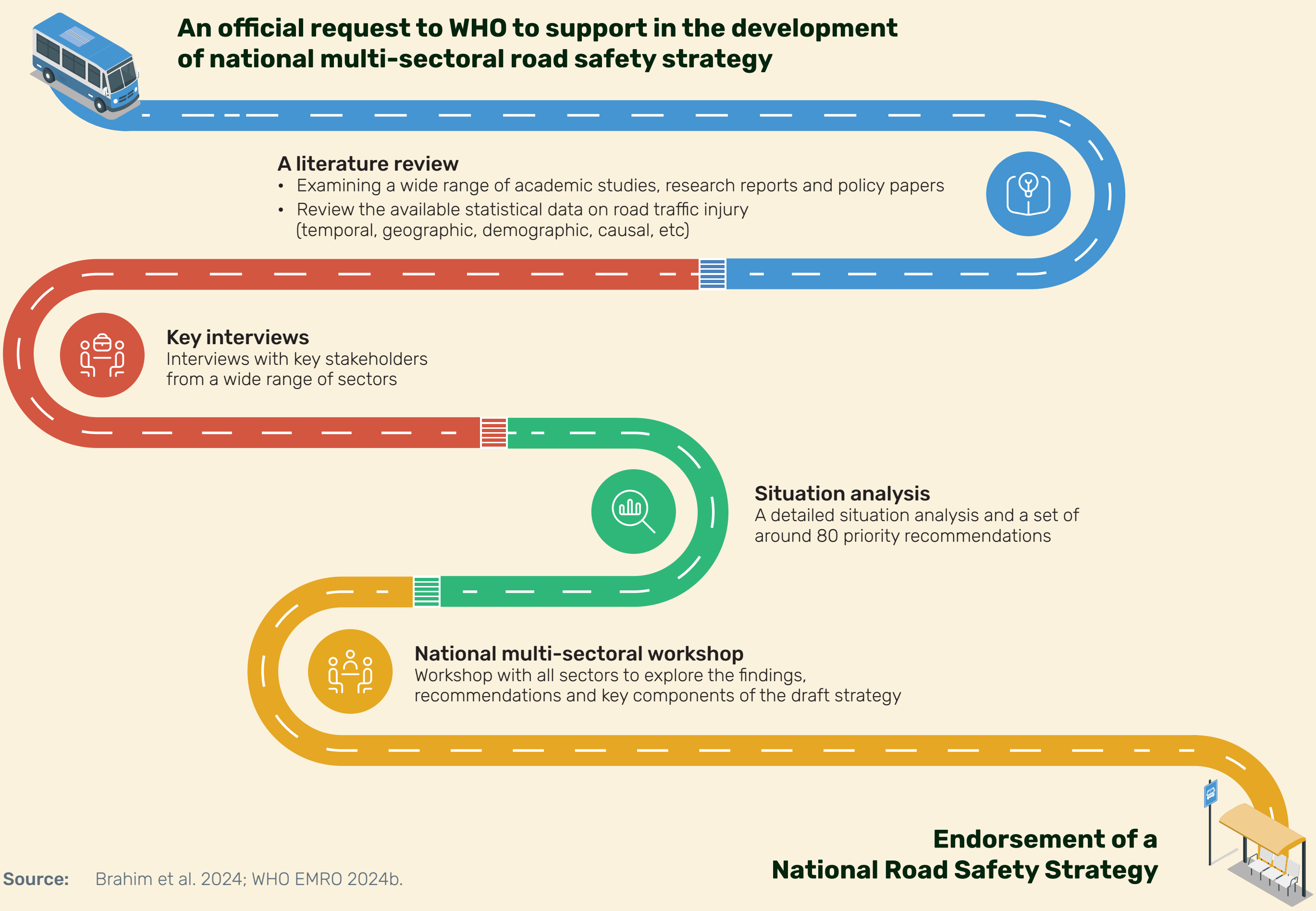
Tunisia's National Road Safety Strategy (2023–2034) is the latest effort in addressing the country's persistent road safety challenges. While progress has been made—reducing road traffic fatalities from 24 per 100,000 in 2016 to 16 per 100,000 in 2021—Tunisia still faces over 2,000 road fatalities annually, alongside economic and social repercussions. The new strategy, developed with support from the World Health Organization (WHO), takes a structured approach to reduce these numbers through evidence-based interventions and multisectoral collaboration.

Supported by WHO Normative Guidance

The National Road Safety Strategy has been informed by global best practices and guidance from the WHO's Global Plan for the Decade of Action for Road Safety 2021–2030 as well as findings of the *Global Status Report for Road Safety 2023*, the Strategic Action Framework to Strengthen Road Safety Systems in the Eastern Mediterranean Region, and *Documenting Road Safety, a Guide for Governments and Lead Agencies*.

These frameworks emphasize a "safe system" approach, which recognizes that human errors are inevitable and aims to mitigate their consequences through safer infrastructure, vehicles, and behaviors. This approach also aligns with Sustainable Development Goal 3.6, which targets a 50 percent reduction in road traffic deaths and injuries by 2030.

WHO provided technical expertise throughout the strategy's development, ensuring it was both evidence based and aligned with international standards. This included workshops to assess Tunisia's existing road safety policies and to identify priority areas for intervention, as well as capacity-building activities to enhance the knowledge of national stakeholders.



Source: Brahim et al. 2024; WHO EMRO 2024b.

Strategic Themes and Objectives

Tunisia's strategy is organized around three key themes:

(1) Inclusive mobility:
This requires safe and accessible transport for all users, with a focus on vulnerable road users such as pedestrians and cyclists.

(2) Forgiving roads:
This requires improving road design and management to reduce the severity of crashes and protect users from fatal outcomes.

(3) A secure future:
Utilizing technological advancements and fostering a culture of accountability should sustain long-term road safety improvements.

These themes are underpinned by detailed action plans aimed at reducing road traffic fatalities and serious injuries by 50 percent by 2030. Additionally, the strategy guided enabling actions including governance, performance management, capacity building, and resource mobilization.

Key Priority Areas for Action

The strategy outlines priority actions under five broad categories:

(1) Safe infrastructure and speeds:
Immediate measures include deploying automated speed controls, establishing safer school zones, and conducting safety assessments of high-risk roads using tools such as the International Road Assessment Programme (iRAP). Over the medium term, national speed limits will be reviewed to reflect road safety principles.

(2) Promoting multimodal transport:
Measures to encourage sustainable mobility include restricting vehicle use in dense urban areas, improving public transport systems, and implementing user-friendly ticketing platforms.

(3) Safer road users:
Initiatives in this area focus on driver education and enforcement, including stricter helmet requirements, public awareness campaigns, and technology-based monitoring of seat belt and mobile phone use.

(4) Safer vehicles:
Tunisia plans to harmonize its vehicle safety regulations with international standards, ensuring compliance with features such as electronic stability control (ESC) and antilock braking systems (ABS).

(5) Postcrash response:
Enhancing emergency medical services is a key focus, with the aim of halving average emergency response times and expanding access to trauma care and rehabilitation services.

Actions under each theme have been prioritized into groups to be completed over different time periods. For the short term, these actions are expected to be complete in less than two years, medium term actions should be complete in three to five years' time, while longer term actions will take more than five years to be fully implemented.

Governance and Implementation Requirements

The strategy emphasizes the importance of robust governance structures and clear implementation pathways. Oversight is provided by the National Road Safety Council, which coordinates activities among government agencies, local authorities, and private stakeholders. Regional committees and the National Road Safety Observatory (ONSR) monitor progress and adapt interventions to local contexts.

The successful implementation of the strategy will rely on several prerequisites:

- Translation of all priority actions into specific, well-defined tasks
- Attribution of responsible agencies to all tasks
- Definition of timescales and measurable performance indicators for all tasks
- Provision of specific resource inputs and seeking additional funding to support the implementation plan
- Organization of monitoring, communication, and evaluation components

World Health Organization

NATIONAL ROAD SAFETY COUNCIL

Governmental institutions

- National Traffic Safety Observatory
- Ministry of Interior
- Ministry of Transport
- Ministry of Equipment and Housing
- Ministry of Health
- Ministry of Education
- National Security
- Civil Protection
- Youth and Sports
- Cultural Affairs
- Ministry of Women, Family, Children and the Elderly

Non-governmental institutions

- Tunisian Federation of Insurance Companies
- Tunisian Association for the Prevention of Road Accidents
- Tunisian Red Crescent, Traffic safety ambassadors
- Tunisian Traffic Safety Association
- National Authority for Driving Schools
- Tunisian Roads Association
- Tunisian Organization for Transport and Services
- Tunisian Association for Traffic Safety and Ethics

Further political support

- Presidency of the Government
- Tunisian Institute for Strategic Studies
- Ministry of Finance

Source: Brahim et al. 2024; WHO EMRO 2024b.

Challenges and Regional Implications

Although the strategy represents a significant step forward, its success will depend on overcoming several challenges. These include addressing gaps in technical capacity, managing resistance to behavioral changes, and securing consistent funding for interventions. Furthermore, expanding public awareness and fostering a culture of accountability among road users will be critical for achieving lasting results.

On a broader level, Tunisia's strategy may serve as a potential model for other nations in the region. By aligning its actions with WHO's global framework and prioritizing data-driven interventions, Tunisia demonstrates the feasibility of structured road safety planning in resource-limited settings.

Conclusion

Tunisia's National Road Safety Strategy for 2023–2034 provides a structured framework for addressing the country's road safety challenges. The strategy lays the groundwork for reducing road fatalities and injuries in a sustainable manner. Effective partnerships and intensive cooperation between national authorities, international organizations, and key experts will remain essential at every stage of the strategy's further development, implementation, and ongoing refinement. While significant challenges remain, the strategy reflects a pragmatic approach to improving road safety, with the potential to save thousands of lives and serve as a regional benchmark for similar initiatives.

Safe Road Users

Speeding, driving under the influence of alcohol or drugs, distracted driving, and the nonuse of seat belts, child restraints, and motorcycle helmets significantly increase the risk of crashes and the vulnerability of people to serious injuries and death. Addressing these behavioral risk factors requires an integrated strategy that combines legislation, enforcement, and education. The WHO recommends a minimum set of best-practice criteria for laws and regulations that are based on scientific evidence to prevent and mitigate the impact of crashes (box 2).[10]

BOX 2: WHO Best-Practice Criteria

RISK FACTOR	WHO BEST-PRACTICE CRITERIA
Speed	National speed law in place Speed limits on urban roads ≤50 km/h Local authorities have the power to modify national speed limits
Drink driving	National drink-driving law in place Drink-driving law is based on BAC or equivalent BrAC BAC limit for general population ≤0.05 g/dl BAC limit for novice population ≤0.02 g/dl
Motorcycle helmets	National motorcycle helmet law in place Law applies to all riders Law applies to all road types Law applies to all engine types Law requires helmet to be properly fastened Law requires helmet to meet a national or international standard
Seat belts	National seat belt law in place Law applies to driver and front seat passengers Law applies to rear seat passengers
Child restraints	National child restraint law in place Law requires that children up to 10 years and 135 cm in height must use a child restraint Law restricts children under a certain age from sitting in front seat Law requires that child restraint meet a national or international standard

Source: WHO 2023.
Note: BAC = blood alcohol concentration; BrAC = breath alcohol concentration; WHO = World Health Organization.

10. WHO best-practice criteria do not exist for laws on drug driving, distracted driving, and professional driver time limits.

The comprehensiveness of laws on behavioral risk factors was assessed based on their alignment with the WHO recommended minimum set of best-practice criteria. For each risk factor, countries are categorized as: have laws that meet best practices, include only some of the criteria, or lack the criteria entirely. Most countries have comprehensive laws for only one risk factor, and no country has comprehensive laws for all five risk factors (figure 11).

The most common behavioral risk factor addressed by comprehensive laws is the use of seat belts (21 countries), and the least common is the use of child restraints (1 country) (table 4).

Speeding

Speed is a widely recognized factor influencing the risk of road traffic crashes, injury severity, and death. A 1 percent increase in mean speed correlates with a 3 percent increase in the risk of serious injuries and a 4 percent increase in the risk of death. Reducing speed by 5 percent can reduce fatalities by 20 percent. More recent evidence suggests that a change in speed has a greater impact on injury severity and fatal crash outcomes (GRSP and IFRC 2023). Setting and enforcing national speed limits is therefore essential to minimize fatalities.

Figure 11: Countries Meeting One or More of the Five Risk Factor Best Practices, 2021

18 countries
National law does not meet best practice for any risk factor

20 countries
National law meets best practice for 1 risk factor

8 countries
National law meets best practice for 2 risk factors

4 countries
National law meets best practice for 3 risk factors

1 country
National law meets best practice for 4 risk factors

NO country
National law meets best practice for all risk factors

Source: WHO 2023.

Table 4: Countries with Comprehensive Laws on Behavior Risk Factors, 2021

Risk factor	Countries with comprehensive laws
Speed	15
Drink driving	7
Seat belts	21
Helmets	8
Child restraints	1

Source: WHO 2023.

National laws setting upper speed limits for private passenger cars and motorcycles exist in 48 countries, covering urban roads in all 48 countries, rural roads in 44 countries, and motorways in 34 countries. Local authorities are legally permitted to reduce national speed limits, based on local road situations, in 24 countries.

To be effective, laws setting speed limits must be rigorously enforced. While the laws prescribe penalties for violation in 45 countries (figure 12), enforcement is reported in 41 countries. Manual enforcement is the most common measure used (31 countries), followed by use of speed limiters (8 countries) and automated enforcement (2 countries).

Monitoring systems for speeding while driving are present in 44 countries, but data on vehicles exceeding speed limits is available in only eight countries, and information on road traffic deaths attributable to speeding is reported in only 13 countries (figure 12).

Progress made in speed laws since the *GSRRS 2018* includes two additional countries enacting speed laws and two countries strengthening their laws to meet best practice. Additionally, three countries modified their existing speed laws to include penalties for violations of speed limits.

Driving under the Influence of Alcohol

Driving under the influence of alcohol significantly increases the risk and severity of a crash, with studies attributing 33–69 percent of road traffic fatalities and 8–29 percent of injuries among drivers with alcohol impairment. The WHO recommends that drink-driving laws are based on blood alcohol concentration (BAC) or breath alcohol concentration (BrAC), with specific limits for the general population, novice drivers, and commercial drivers (WHO 2014). The level of alcohol in the body can be measured as BAC by testing a sample of urine or blood, or as BrAC, which is tested using a Breathalyzer (GRSP and IFRC 2022).

While 48 countries have laws restricting alcohol-impaired driving, 41 countries base their laws on BAC/BrAC limits. Of these, only 15 countries set the BAC limit at ≤0.05 g/dl for the general population, seven countries have a BAC limit of ≤0.02 g/dl for novice drivers, and only three countries have a BAC limit of ≤0.02 g/dl for commercial drivers. This leaves drivers, especially young ones, at risk of being involved in alcohol-related road traffic crashes.

Testing for BAC/BrAC is limited, with seven countries allowing random testing, 11 countries testing drivers suspected of traffic offenses, and six countries requiring testing of drivers involved in fatal crashes. Penalties for violations are specified in the laws of 48 countries. Monitoring systems are present in 24 countries, but only 12 countries have data on the deaths attributable to drink driving (figure 13).

Since the *GSRRS 2018*, three more countries have enacted drink-driving laws, five countries have included BAC/BrAC limits in their existing laws, and one country has included all criteria in its law to meet best practice.

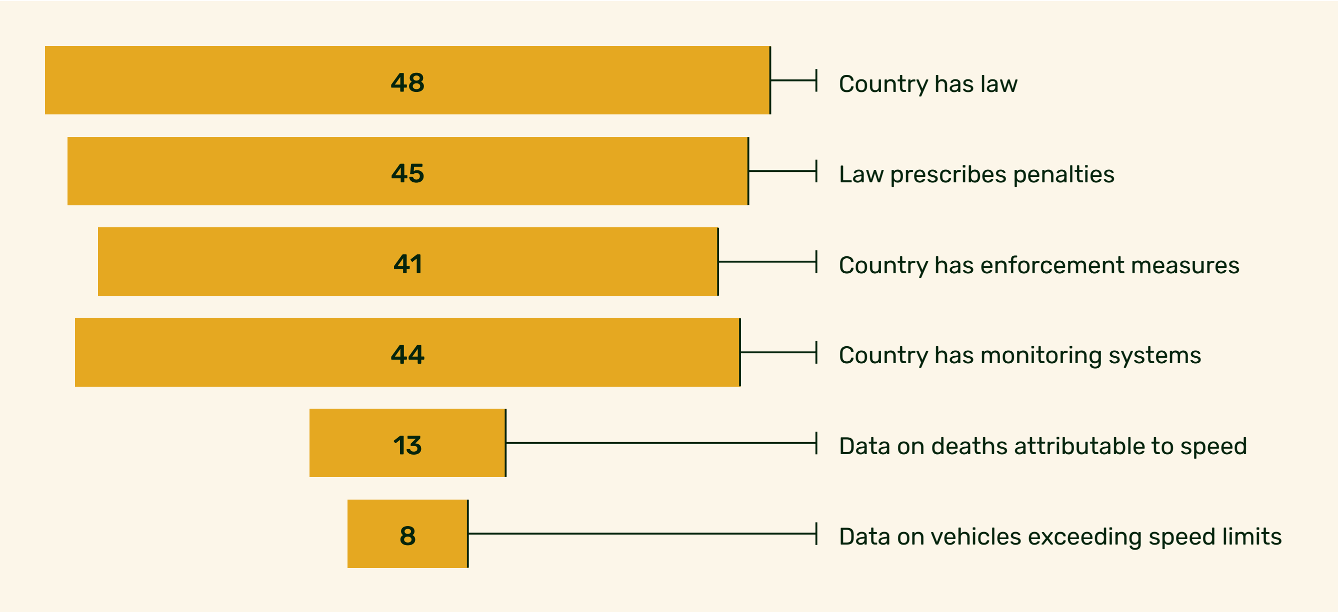
Driving under the Influence of Drugs

Drug-impaired driving is associated with an increased risk of road traffic crashes, with the severity depending on the type of drug consumed (WHO 2016a). Laws prohibiting drug-impaired driving exist in 41 countries, but only five countries specifically reference cannabis, cocaine, amphetamines, methamphetamines, and opiates.

Random testing for drugs is mandated in only three countries and in cases of suspected offenses in 11 countries. Testing of drivers involved in fatal crashes is prescribed in the laws of only five countries. Despite this, the laws require penalties for violation in 35 countries.

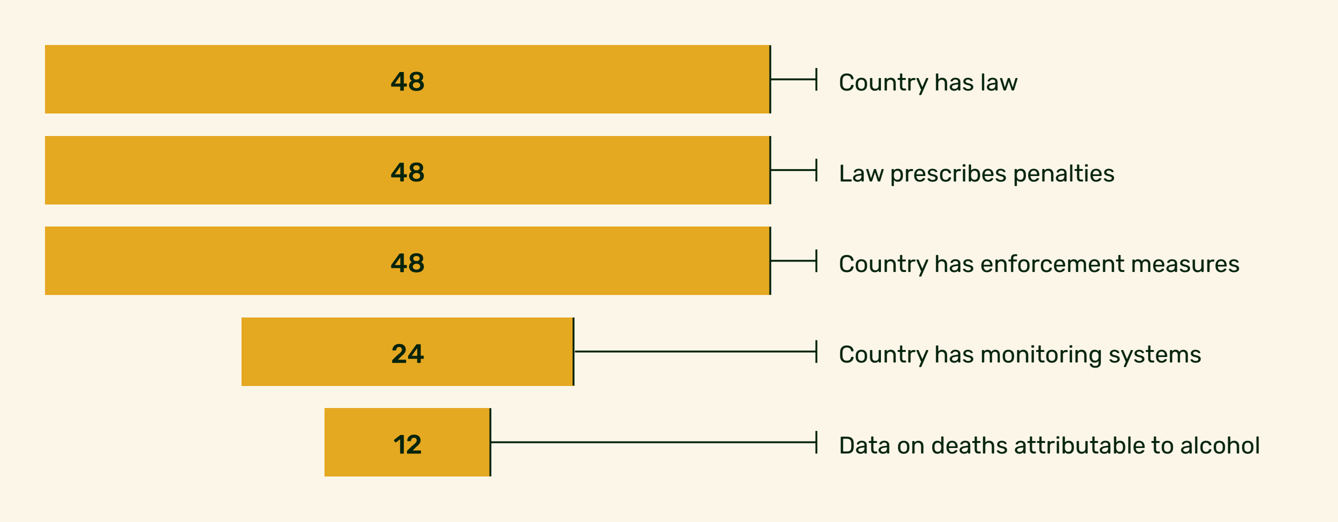
The status of drug-driving laws represents an increase of six countries since the previous status report in 2018.

Figure 12: Speed Laws, Enforcement Measures, Monitoring Systems, and Data Availability, 2021



Source: WHO 2023.

Figure 13: Drink-Driving Laws, Enforcement Measures, Monitoring Systems, and Data Availability, 2021



Source: WHO 2023.

CASE STUDY 7

Rwanda: Innovating in Road Safety

Rwanda, often heralded as a pioneer in digital transformation across Africa, has embraced technology to tackle one of its most pressing challenges: road safety. With traffic-related fatalities and injuries rising across the continent, Rwanda has positioned itself at the forefront of innovation, employing advanced solutions to safeguard its citizens. Two landmark initiatives, the deployment of drones for traffic monitoring and the implementation of a nationwide Automated Speed Enforcement system, underscore the country's commitment to making its roads safer while serving as a model for other nations.

Revolutionizing Traffic Management with Drones

In 2023, the Rwanda National Police launched an ambitious program to deploy drones for monitoring road traffic. This initiative builds on Rwanda's previous success in using drones for various public service applications, from health care delivery to environmental monitoring. The aim is simple yet transformative: reduce road traffic violations, enhance enforcement efficiency, and ensure safer mobility for all road users.

Addressing Traditional Limitations

Rwanda, like many African countries, faces challenges in managing traffic violations because of resource constraints and geographic complexities. Traditional enforcement methods, relying heavily on manual observation, struggle to cover sprawling urban areas and remote rural regions. Drones, equipped with high-resolution cameras, offer a solution by providing aerial views of roads and capturing real-time data on traffic flow and driver behavior.

The drone initiative stems from pilot projects that demonstrated their potential for public safety applications. For instance, drones were used to monitor illegal mining activities and large gatherings, proving their utility in complex enforcement scenarios. Their success prompted the Rwanda National Police to expand their use to road safety, starting with high-risk areas prone to traffic violations.

Implementation and Early Impact

The drones operate under strict protocols, capturing violations such as speeding, dangerous overtaking, and illegal parking. The data are transmitted to centralized traffic control centers, where law enforcement officers can respond promptly. In addition to issuing penalties, the drones provide valuable insights into traffic patterns, helping policy makers identify hot spots for intervention.

Initial results are promising. Traffic violations have visibly decreased in drone-monitored areas, reflecting a shift in driver attitudes and behavior. Moreover, the use of drones has significantly reduced response times for accidents and other emergencies, potentially saving lives.

Overcoming Challenges

Despite its success, the initiative has faced some hurdles. Not surprisingly, privacy concerns emerged as a key issue, with citizens questioning how drone footage would be used. To address this, the Rwanda National Police launched public awareness campaigns, emphasizing that the data are strictly regulated and used solely for enforcement purposes. Another challenge has been the high cost of drone technology, which has necessitated partnerships with private sector actors and international donors to ensure scalability.

The drones not only symbolize Rwanda's commitment to innovation but also highlight the importance of leveraging technology to address systemic challenges in road safety.

Automated Speed Enforcement: A Game Changer

Building on its digital transformation agenda, Rwanda also became the first low-income African country to implement a nationwide Automated Speed Enforcement (ASE) system. Launched in 2017 and scaled up by 2023, the ASE initiative aims to curb speeding—a major contributor to road traffic fatalities—and foster a culture of accountability among drivers.

A Pioneering Approach to Speed Management

Speeding remains one of the most critical risk factors for road safety in Rwanda, contributing significantly to crash severity and fatalities. Previously, manual enforcement methods were labor-intensive and limited in scope, often leaving high-risk areas unmonitored. The ASE program introduced fixed, mobile, and covert cameras, which are now strategically deployed across the country's highways and urban areas.

These cameras automatically detect vehicles exceeding speed limits and record violations, linking them to vehicle registration databases. Drivers receive notifications via mobile phone, detailing the infraction and associated penalties. This streamlined process not only enhances enforcement efficiency but also minimizes opportunities for corruption.

Impact on Road Safety

The introduction of the ASE system has led to a marked reduction in speeding violations and crash severity. Between 2019 and 2022, serious injury crashes declined by 87 percent in areas covered by the system. The considerable reduction in serious injuries and fatalities underscores the program's success. Minor crashes appear to have increased, but this most likely is due to improved reporting mechanisms.

Furthermore, the data generated by ASE cameras have become a valuable resource for traffic management. Authorities now have a clearer understanding of speeding hot spots, enabling targeted infrastructure improvements and better allocation of enforcement resources.

Community Engagement and Public Perception

The ASE initiative has been widely accepted by the public, thanks in part to sustained awareness campaigns. Surveys indicate that most Rwandans view the system as a fair and effective means of ensuring compliance with traffic laws. However, the program has not been without criticism. Some drivers expressed concerns about excessive penalties, particularly for minor infractions. To address this, the government introduced a tiered penalty system, distinguishing between minor and severe violations.

Transparency has also been a cornerstone of the initiative. The Rwanda National Police regularly publishes reports on ASE performance, reinforcing public trust in the system.

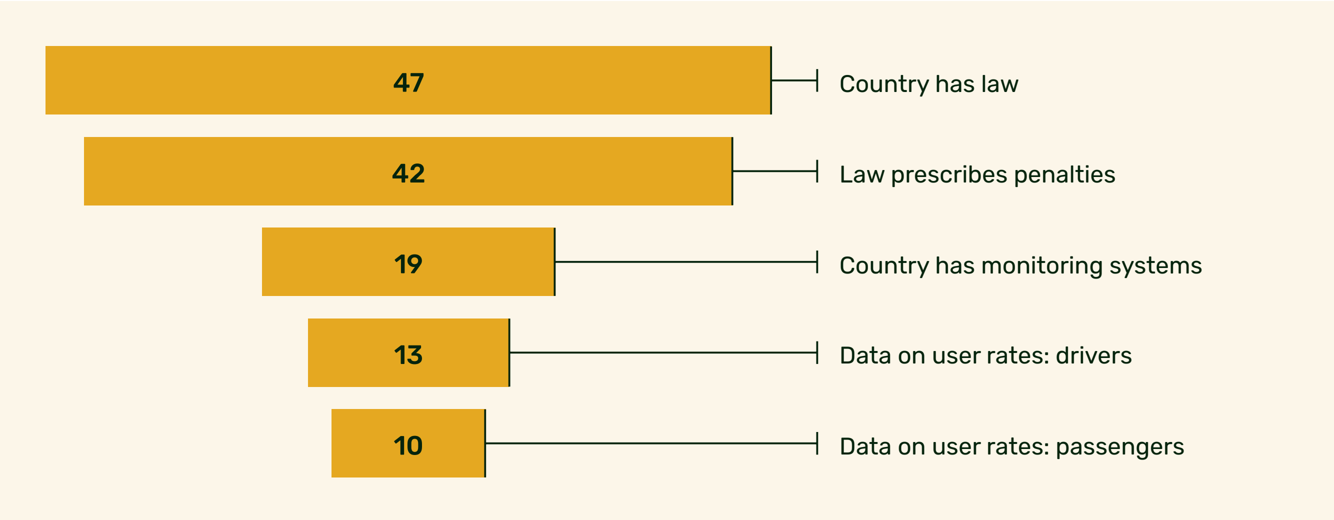
Overcoming Data and Capacity Challenges

While the ASE program has demonstrated considerable success, challenges persist. For instance, the absence of baseline speed data and inconsistencies in crash reporting have made it difficult to assess the full impact of the system. To address this, the government has partnered with international organizations to enhance data collection and analysis capabilities.

Rwanda's dual initiatives—the deployment of drones and the nationwide ASE system—represent a bold vision for road safety. Both programs showcase the country's ability to integrate advanced technology into public safety strategies, setting an example for other nations grappling with similar challenges. By reducing traffic violations and enhancing enforcement efficiency, these innovations are saving lives and fostering safer mobility. However, the journey is far from complete. Rwanda must continue to address challenges such as data gaps, public awareness, and financial sustainability to ensure the long-term success of these programs. Additionally, the lessons learned from these initiatives can serve as a blueprint for scaling similar efforts across Africa.

In a region where road traffic injuries remain a leading cause of death, Rwanda's commitment to innovation offers hope. By leveraging technology and fostering collaboration, the country is charting a path toward safer, more equitable roads—proving that with vision and determination, transformative change is possible.

Figure 14: Helmet Laws, Monitoring Systems, and Data on Helmet Use, 2021



Source: WHO 2023.

Distracted Driving

Distracted driving diverts attention away from safe driving toward activities such as the use of a handheld or hands-free mobile phone or other distractions (cognitive, visual, or auditory). With rapidly increasing ownership and use of mobile phones, distracted driving is becoming a growing concern (WHO 2011, 2016a).

Laws restricting distracted driving exist in 46 countries, with a ban on the use of handheld mobile phones reported in 41 countries and a ban on the use hands-free devices reported in 16 countries. Penalties for violations are prescribed in 41 countries.

Some progress has been made in restricting the use of mobile phones while driving, with three more countries enacting laws and four more countries banning the use of hands-free devices. Additionally, the number of countries with penalties for violations has increased by four.

Helmet Laws

The use of motorcycle helmets can reduce the risk of death by 42 percent and severe head injuries by 70 percent if the appropriate standard is used and when the helmets are properly fastened (WHO 2014). With the increasing demand for and ownership of motorcycles in Africa, establishing and enforcing laws and standards on helmet use are critical to reduce road traffic fatalities involving motorcycles.

Laws mandating helmet use are in place in 47 countries, but only 20 countries reference specific helmet standards, and 10 countries require proper fastening. Penalties for violation are prescribed in 42 countries.

Helmet use rates are reported in 23 countries, of which 13 provide data on driver helmet use; the use rates range from 9 percent to 100 percent, with nine countries reporting rates above 50 percent. Passenger helmet use rates, reported by 10 countries, range from 2 percent to 100 percent, with four countries having rates above 50 percent (figure 14).

Progress made in helmet laws since the *GSRRS 2018* includes an increase in the number of countries with a law by five, and strengthening of existing laws to meet best practice (1 country) and to prescribe penalties for violation (three countries).

Seat Belt Use

Seat belt use reduces the number of fatalities and severity of injuries. When properly restrained with seat belts, the risk of death is reduced by 40–50 percent among front seat passengers (WHO 2014).

National laws mandating the use of seat belts are reported in 45 countries, but only 22 countries require all car occupants to use seat belts, while 23 countries limit the requirement to only drivers. Penalties for noncompliance exist in 40 countries (figure 15).

Seat belt use among drivers was provided by 13 countries (with usage ranging from 30 percent to 100 percent), use among front seat passengers by 10 countries (with usage ranging 18–100 percent), and use among rear seat passengers by 5 countries (with usage ranging 1–10 percent).

Since the *GSSRS 2018*, the number of countries with seat belt laws has increased by five. Additionally, countries have strengthened laws by including criteria to meet best practice (three countries), requiring all care occupants to wear a seat belt (four countries), and prescribing penalties for violation (two countries).

Child Restraint Laws

Studies show that road traffic fatalities and injuries are significantly reduced when children are properly restrained in vehicles. The effectiveness of child restraint systems is maximized when technical requirements for their use, based on the child's seating position, age, height, and weight, are specified in the laws and enforced (WHO 2014).

Laws mandating the use of child restraints exist in 14 countries, with requirements for appropriate age, height, and reference to specific standard included in the laws of 11 countries. Penalties for violations are prescribed in only eight of the countries.

Since the previous status report (*GSRRS 2018*), the number of countries with a child restraint law has increased by five, but no additional countries have amended their existing laws to meet best practice or include penalties for violations.

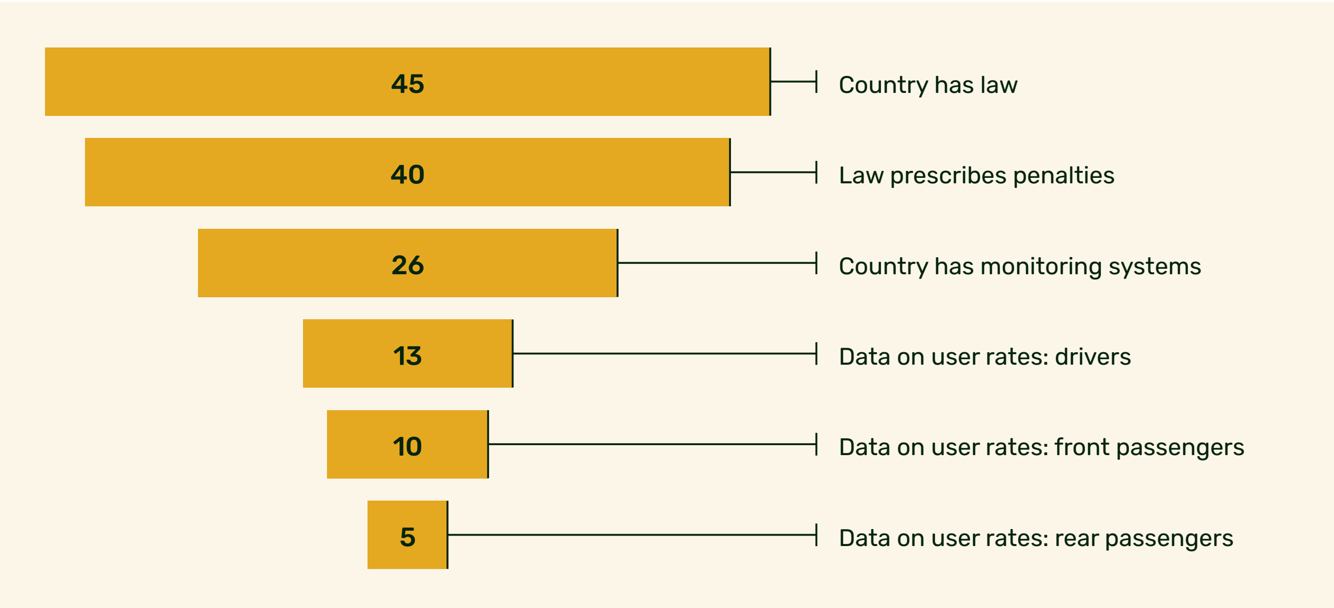
Driver Licensing

Driver licensing requirements and enforcements ensure that drivers have the requisite knowledge, skills, and experience to safely use motorized vehicles. Institutional and legislative mechanisms that regulate the entry of drivers into the road system form crucial elements of the Safe System approach to road safety (WHO 2021).

Formal licensing systems exist in 49 countries, but only two countries include additional licensing requirements for professional drivers, and none of the countries specify minimum requirements for obtaining a full licence or require holding a learner's permit prior to obtaining a full licence. Penalties or demerit systems for violations for repeated driving offences are specified in the laws of only two countries and include license suspension and revocation.

Mandatory driving time and rest periods for professional drivers exist in 16 countries, of which five specify maximum driving hours and minimum rest periods.

Figure 15: Seat Belt Laws, Monitoring Systems, and Data on Seat Belt Use, 2021



Source: WHO 2023.

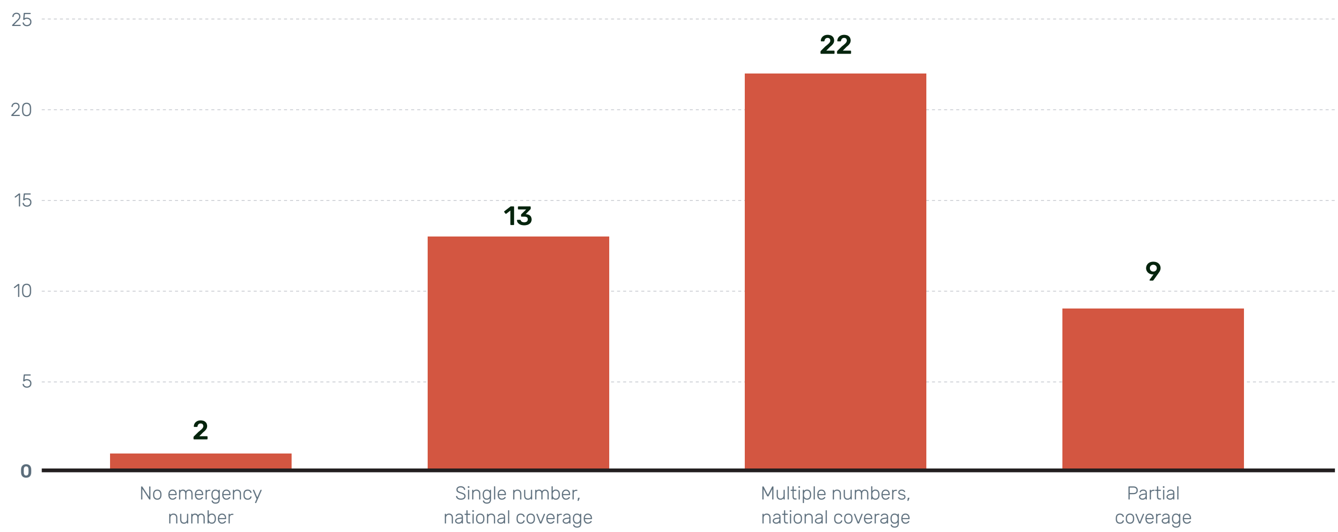
Postcrash Response

The first few minutes following a road traffic crash are critical for survival, as studies indicate that 50 percent of all deaths occur either at the scene or during transport to the hospital. Timely and effective emergency care can save lives and reduce disability. This requires time-sensitive actions at the scene of the crash, rapid transport to an appropriate facility for emergency care, and access to rehabilitation services to mitigate the long-term effects of road traffic crashes for victims and their families (WHO 2016b).

Key components of a postcrash response include the following:

- A system to activate postcrash response, such as emergency service numbers
- Bystanders and lay responders (nonmedical professionals) with the capacity to provide basic lifesaving interventions
- Professional medical care, supported by trauma registries and integrated prehospital, hospital, and rehabilitation services that are accessible 24 hours, regardless of ability to pay
- Multidisciplinary, postcrash investigation; financing mechanisms, such as mandatory third-party liability motor vehicle insurance; and appropriate social, judicial, and financial support to bereaved families and survivors

Figure 16: Status of Emergency Care Numbers, 2021



Source: WHO 2023.
Note: N=48.

Prehospital Care

Emergency care service numbers are available in 35 countries with national coverage using either a single number (13 countries) or multiple numbers (22 countries). Partial coverage exists in nine countries, while two countries lack emergency care service numbers entirely (figure 16). While 28 countries have included a target to improve times between occurrence of a crash and access to professional emergency health care, only 12 have set target times, nine of which aim to ensure that professional care is provided within one hour of a crash.

Forty countries have agencies that coordinate prehospital and emergency medical services; five countries have national laws requiring training, licensing, or other certification processes for first health responders.

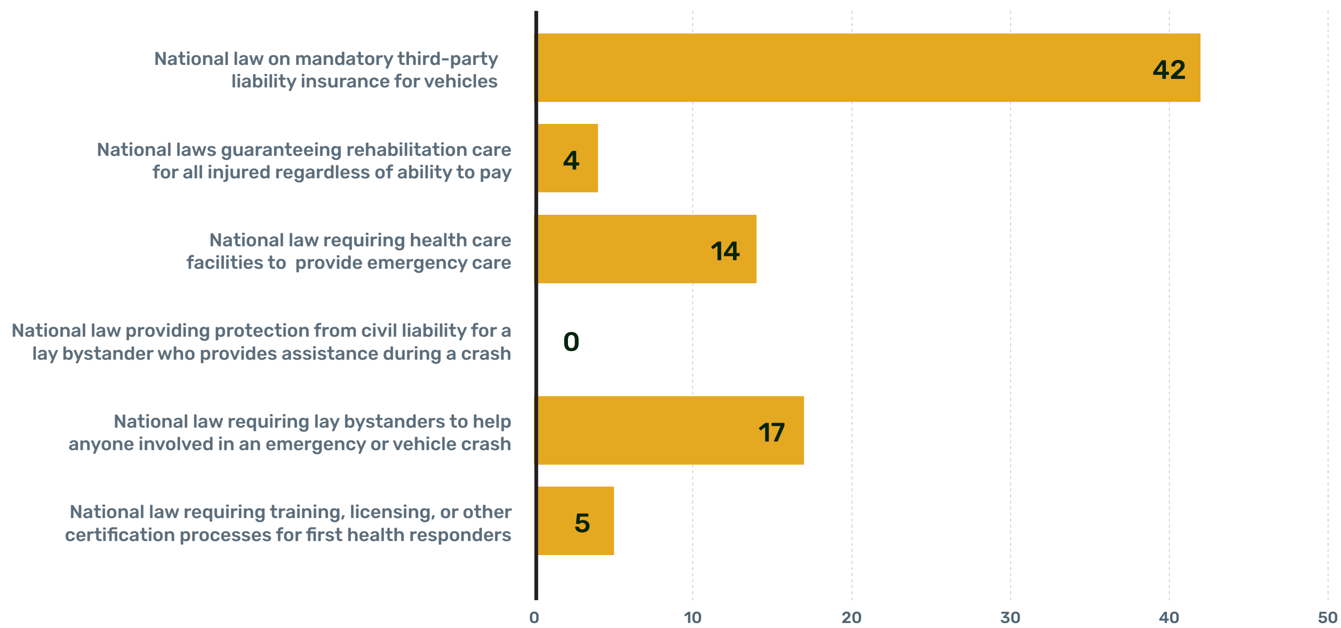
Seventeen countries have laws that require individuals to provide assistance at crash sites. Notably, no country has laws that provide protection from civil liability for a lay bystander assisting crash victims (Good Samaritan laws) (figure 17).

Professional Hospital Care

In terms of ensuring the quality of emergency care provided at health facilities, certified specialist or subspecialist training programs are reported in 26 countries for emergency medicine physicians, in 30 countries for trauma surgeons, and in 18 countries for nurses in emergency care or trauma care. Additionally, standardized assessments of the prehospital and facility-based emergency care systems are performed in only 10 countries. Trauma registries are present in 24 countries, of which 13 aggregate facility data at the national level and 11 in selected facilities.

National laws requiring health care facilities to provide emergency care are reported in 14 countries, while national laws guaranteeing rehabilitation care for all injured regardless of ability to pay are present in only four countries. Forty-two countries have mandatory third-party liability motor insurance, but the laws apply to all vehicles in only four countries, and no country has a national law that sets up a fund to cover victims of uninsured or unidentified (unregistered) vehicles. Furthermore, only two countries have a law regulating insurance premiums (figure 17).

Figure 17: Postcrash Response and Care Legislation, 2021



Source: WHO 2023.
Note: N=51.

CASE STUDY 8

Transforming Trauma Care in Madagascar: CAREnet-MG

Madagascar, an island nation in the Indian Ocean, faces significant challenges in health care delivery, particularly trauma care. With one of the highest road traffic fatality rates in the world (23 per 100,000 people) and an underdeveloped emergency response system, the country collaborates with partners to provide timely and quality care to its population. Among the initiatives, the CAREnet-MG project, launched in 2024 and funded by the Else Kröner-Fresenius Stiftung, is transforming trauma care in Madagascar by establishing a hospital network, implementing a trauma registry, and providing advanced training for health care providers. This ambitious initiative showcases the potential for innovation and collaboration in tackling systemic health care challenges.

Building a Trauma Care Network

Central to the CAREnet-MG project is the creation of a structured hospital network that links five university hospitals and two regional referral hospitals. These hospitals, located in the northwest, central highlands, eastern, and southern regions, form the backbone of the country's trauma care system. For example, CHU JRA, Madagascar's largest hospital, serves as a critical hub in the central highlands, treating up to 32,000 emergency cases annually. Similarly, CHU PZaGa in Mahajanga handles over 8,400 admissions yearly, providing specialized care across 23 disciplines.

By connecting these facilities, the network aims to address long-standing gaps in coordination and referral pathways. Patients requiring specialized treatment are now referred more efficiently, with regional hospitals like CHRR Maevatanana and CHRR Ambatondrazaka providing initial care before transferring critical cases to university hospitals. This system minimizes delays in treatment, which is critical in trauma care where timely interventions can save lives.

The steering committee established under CAREnet-MG ensures strategic oversight of the network. Comprising representatives from the Ministry of Health, participating hospitals, and international partners, the committee develops clinical guidelines, monitors project progress, and facilitates communication among stakeholders.

Leveraging Data for Better Outcomes: WHO Trauma Registry

One of the project's most innovative components is the implementation of the WHO Trauma Registry. This data collection system enables hospitals to capture detailed information about trauma cases, including demographics, injury mechanisms, and treatment outcomes. For a country like Madagascar, where data on trauma care performance has been sparse and sometimes inconsistent, the registry represents a game-changing development.

The registry's pilot phase began in CHU PZaGa, where early adoption has already yielded valuable insights. For example, data analysis revealed a high prevalence of head injuries resulting from motorcycle crashes, prompting targeted interventions such as helmet advocacy campaigns. The registry also supports continuous monitoring, allowing hospitals to identify trends and allocate resources more effectively.

During a workshop in Antananarivo in November 2024, Malagasy health care professionals received training on using the registry, with technical guidance provided by the World Health Organization (WHO), Charité–Universitätsmedizin-Berlin, and BG Unfallklinik Frankfurt am Main. The workshop highlighted the system's adaptability to local contexts, ensuring its successful integration into Madagascar's health care framework.

Despite these successes, challenges remain. Data privacy and reliability are key concerns, requiring strict protocols to safeguard patient information. Additionally, expanding the registry to rural hospitals will require significant investments in infrastructure and training.

Training the Frontline Workforce

Improving trauma care requires not just infrastructure and data but also skilled health care providers. To this end, CAREnet-MG has planned a series of training programs tailored to Madagascar's unique needs. These include the Advanced Trauma Life Support (Demo-ATLS) course for physicians, the Advanced Trauma Care for Nurses (Demo-ATCN), and the Basic Critical Care (BCC) course for multidisciplinary teams.

The ATLS and ATCN courses focus on the critical "golden hour" following trauma, equipping participants with skills to assess, resuscitate, and stabilize patients. For example, physicians learn to perform lifesaving procedures such as chest tube placement and intubation, while nurses gain expertise in assisting with airway management and hemorrhage control. These courses emphasize the ABCDE (Airway, Breathing, Circulation, Disability, Exposure) algorithm, a globally recognized approach validated by the American College of Surgeons.

The BCC course complements these programs by teaching health care providers to identify and manage critical illnesses in resource-limited settings. Participants develop skills in teamwork, effective communication, and ongoing patient monitoring, ensuring comprehensive care for trauma patients.

By the end of the program's first year, 64 health care professionals will have completed these courses, with plans to expand the training to additional staff through a "train-the-trainer" model. This approach not only enhances capacity but also ensures the sustainability of the program by embedding knowledge within the local workforce.

Strengthening Emergency Coordination

Another critical element of CAREnet-MG is the joint development of a working structure within the emergency coordination center in Antananarivo. Once fully operational, this center will act as a central hub for dispatching emergency medical services and coordinating hospital responses. Personnel training will begin this year, focusing on efficient communication, rapid decision-making, and integration with the trauma registry.

The center addresses a major gap in Madagascar's prehospital care system, where the lack of centralized coordination often leads to delays in emergency response. By streamlining communication between ambulances and hospitals, the center will reduce response times and improve patient outcomes.

Early Results and Future Direction

Though still in its early stages, the CAREnet-MG project has already made significant strides. The establishment of the hospital network and the trauma registry has laid a strong foundation for improving trauma care, while training programs will enhance the skills of frontline health care workers, with the expectation of better coordination in patient referrals and improved outcomes for trauma patients in participating hospitals.

However, challenges persist. Expanding the project to rural areas, where health care access is limited, remains a priority. Plans include integrating telemedicine to support remote hospitals and scaling the trauma registry nationwide. Securing long-term funding and political commitment will be critical to sustain these efforts.

Conclusion

The CAREnet-MG initiative exemplifies how innovation, collaboration, and data-driven approaches can address systemic health care challenges. By building a robust hospital network, leveraging advanced data systems, and investing in workforce training, Madagascar is transforming its trauma care landscape. While the journey is far from over, the progress made thus far offers a blueprint for other resource-limited countries striving to improve health care outcomes.

In a nation where every second counts in saving lives, CAREnet-MG is not just a project. It's a lifeline, paving the way for a safer, healthier Madagascar.

Conclusion and Proposed Actions

The burden of road traffic injuries and deaths in Africa remains alarmingly high, disproportionately impacting the most economically productive age group (18–59 years). This crisis poses a severe public health and development challenge, with significant economic and social implications, including diminished workforce productivity, escalating health care costs, and long-term setbacks to sustainable development and poverty reduction across the continent. Pedestrians, cyclists, and users of two- and three-wheelers, who account for 53 percent of fatalities and represent the largest transport modality, are particularly affected, further intensifying the impact. Addressing this challenge requires urgent, collective action and increased political will to implement robust policies, prioritize investments in safer infrastructure, and ensure effective design and delivery of road safety measures to protect lives and secure Africa's development future.

Most countries report having road safety lead agencies tasked with performing key institutional functions and have national road safety strategies. These encouraging developments signal the need for a decisive shift in related global and regional support, from an emphasis on advocacy and good practice guidelines to addressing the practical realities and priorities of country delivery. Attention must now be focused on supporting executive management leaders and senior specialists responsible for country road safety performance, to ensure the necessary strengthening of the country management processes required for the mobilization of scaled-up road safety financing and the effectiveness of their action plans' implementation.

The lack of sustainable and adequate funding for strengthening institutional management functions and related interventions remains a significant obstacle to the effective operation of many lead agencies. In particular, data limitations, including the lack of data on underlying factors that influence road traffic crashes and other safety indicators, hinder the design of targeted interventions and the evaluation of progress toward road safety goals. Countries should be supported in developing data collection systems that align with the recommendations of the African Road Safety Action Plan 2021–2030, African Road Safety

Observatory minimum road safety indicators, and the Road Safety Performance Monitoring Framework. Strengthening data systems is essential to enable countries to collect and manage road safety data effectively.

In Africa, road infrastructure is often designed and built with insufficient consideration of vulnerable road users, exposing them to increased risks of road traffic injuries and fatalities. This approach also fails to promote alternative, safer modes of transport. More efforts are required to enact and enforce laws, regulations, and standards that ensure road design, construction, and maintenance address the safety and accessibility needs of all users. As urbanization accelerates across the continent, transport systems should be planned and designed with consideration of an appropriate land-use mix to provide safe, affordable, and sustainable modes of transport while preserving the environment. Strengthening data collection systems on transport modality use will play a critical role in improving transport system and land-use planning.

The regulation of vehicles in Africa is characterized by weak vehicle registration systems and weak legislation on vehicle safety standards, which lack measures to protect the most vulnerable road users, including young children. Countries should ensure adherence to United Nations road safety conventions by integrating safety requirements into vehicle safety laws and regulations. This should be accompanied by rigorous enforcement measures, including restrictions on the import and export of used vehicles to ensure all vehicles in circulation are roadworthy and properly registered.

Ensuring safe road user behaviors requires comprehensive laws that are rigorously enforced to promote the safe use of roads and transport systems. While most countries in Africa have laws addressing the key behavioral risk factors, few meet the World Health Organization criteria for best practice, with seat belt laws being the notable exception. This highlights gaps in addressing all elements of these risk factors that influence the likelihood and severity of road traffic crashes. Countries should amend their laws to meet best-practice standards, specify enforcement measures, and implement strong monitoring systems. This effort must be complemented by the implementation of enforcement measures and strengthening of data collection systems to monitor road-use behavior and assess the burden of road traffic crashes attributable to noncompliance with laws and regulations.

Postcrash response systems are deficient, with insufficient access to emergency care facilities. Legislative gaps further hinder progress; only a few countries have the necessary laws to facilitate access to prehospital emergency and rehabilitative services. Financial protection for crash victims is inadequate, with insufficient motor vehicle insurance regulations and no funds for victims of uninsured or unidentified vehicles. To address these challenges, countries must invest in expanding access to emergency care, strengthen prehospital systems, strengthen comprehensive legislation for care and rehabilitation and bolster financial protection. These actions will enhance postcrash response systems, reduce fatalities, and alleviate the socioeconomic burden of road traffic injuries.

In essence, effective road safety management is paramount to achieving the goal of the African Road Safety Action Plan 2021–2030. This involves a holistic approach encompassing strengthening country management processes and related executive leadership and specialist knowledge and skills robust institutional frameworks, to enable sustainable funding, robust data systems, and enforcement of laws and standards. By prioritizing the safety of all road users through thoughtful infrastructure design, rigorous vehicle regulation standards, and promotion of responsible road behaviors, countries can significantly reduce road traffic injuries and fatalities. Strengthened postcrash care systems and equitable access to emergency services will further ensure that progress toward these goals is inclusive and sustainable. The collective effort to enhance road safety management will not only save lives in the African continent but contribute to the broader objectives of sustainable development and improved quality of life for all.

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Appendices

APPENDIX A.

Indicator Matrix

Pillar 1: ROAD SAFETY MANAGEMENT

African Road Safety Action Plan 2011–2021 & 2021–2030	Africa Status Report on Road Safety 2020	GSRRS 2023	n/51	UN voluntary targets & indicators	RSPMF
Sustainable funding					
Allocate 10% of road infrastructure funding to road safety	N/A	N/A		N/A	Percentage of financed annual RSLA budget
Set specific budget for road safety	N/A	Dedicated funding allocated in the government budget for prevention of crashes	48	N/A	
	N/A	Dedicated funding allocated in the government budget for prevention of injuries	46	N/A	
	N/A	Dedicated funding allocated in the government budget for health care and treatment of injuries sustained as the result of a crash	46	N/A	
	N/A	Dedicated funding allocated in the government budget for rehabilitation for survivors of crashes	47	N/A	
	N/A	Dedicated funding allocated in the government budget for palliative care for survivors of crashes	46	N/A	
	N/A	Dedicated funding allocated in the government budget for surveillance monitoring and evaluation of road safety strategies	46	N/A	
	N/A	Dedicated funding allocated in the government budget for capacity building for road safety	46	N/A	
	N/A	Dedicated funding allocated in the government budget for research relevant to road safety	46	N/A	
	N/A	Funding for lead agency to carry out core functions	47	N/A	
	N/A	Funding for strategy	42	N/A	
Create a fund for road safety	N/A	N/A		N/A	
Provide a clear framework for public-private partnerships	N/A	N/A		N/A	
Facilitate financing of road safety by technical and financial partners	N/A	N/A		N/A	

Allocate sufficient financial/ human resources to road safety	N/A	Dedicated funding allocated in the government budget for capacity building for road safety	48	N/A	
Allocate 5% of road maintenance resources to road safety	N/A	N/A		N/A	
Fully empowered lead road safety agencies (strong collaboration among national actors)					
Establish or strengthen national lead road safety agencies	Existence of national lead road safety agency	Existence of national lead road safety agency	51	Number of countries that have a national lead agency to coordinate, monitor, evaluate and implement the multisectoral national road safety action plan	
National road safety strategy developed					
Develop national road safety strategies	Existence of national road safety strategy	Existence of national road safety strategy	51	Number of countries with published national action plan with regularly updated time-bound targets for reductions in fatalities and injuries	National road safety action plan with time-bound targets published
Set road safety targets and key performance indicators	N/A	National/subnational strategies set measurable targets to reduce the number of people who are killed and/or seriously injured in a road traffic crash	51		
		Ensuring roads traveled meet technical safety standards for all users	47		
		Ensuring new vehicles meet UN technical safety regulations or equivalent	46		
		Limiting vehicle speed	47		
		Preventing alcohol-impaired driving	46		
		Preventing drug-impaired driving	47		
		Decreasing distracted driving	47		
		Ensuring rest periods for professional drivers	45		
		Improved times between crash and access to professional emergency health care	46		
		Nonfatality reduction target	17		
		Fatality reduction target	24		
		National target for time between serious crash and initial provision of professional emergency care	46		
		Promotion of walking as an alternative to car travel	46		

		Promotion of bicycling as an alternative to car travel	45		
		Promotion of convenient access to public transport	45		
		Promoting seat belt use	46		
		Promoting child restraint use	47		
		Promoting motorcycle helmet use	46		
Business and enterprises to provide annual public sustainability reports including road safety disclosures	N/A	N/A			
Governments and private sectors should prioritize road safety following the Safe System approach in procurement of fleet vehicles and transport services, road safety investments, and operation of public transit and commercial vehicles	N/A	N/A			
Effective data management					
Adopt minimum reporting requirement	N/A	N/A			
Adopt and implement a common strategy to establish centralized databases on road safety	N/A	N/A			Centralized database on road safety established and operationalized
Encourage the transmission of data by forces of public order (police), hospitals and other sources to lead road safety agencies	N/A	N/A			
Build national capacity to manage road safety data	N/A	N/A			
Take advantage of regional good practices in the development and use of databases	N/A	N/A			
Join IRTAD	N/A	N/A			
Use of state-of-the-art data management tools and techniques	N/A	N/A			
Create knowledge management portals on road safety	N/A	N/A			
Enforce mandatory reporting, use of standardized data, sustainable funding	N/A	N/A			
Undertake road safety research/ studies	N/A	N/A			
Establish/strengthen/harmonize injury data system for health facilities	N/A	Existence of a system to document individuals who are “seriously injured” due to a crash	51		
Establish baseline data on road safety	N/A	N/A			
Harmonize data format, international standards in reporting	N/A	N/A			
Creation of African Road Safety Observatory	N/A	N/A			

Ratification and implementation of legal instruments					
Ratification and implementation of the African Road Safety Charter	N/A	N/A			
Ratification of the Intergovernmental Agreement on Norms and Standards of the Trans-African Highways (TAH), with emphasis on the annex on road safety	N/A	N/A			
Ratification and implementation of UN conventions on road safety	N/A	Country adheres to corresponding UN or equivalent international safety regulation	51	Number of countries that have ratified or acceded to one or more of the core road safety–related UN legal instruments	
	N/A	Technical design standards for roads align with relevant international conventions	40		
Multimodal transport and land-use planning					
Implement policies that promote compact urban design	N/A	N/A			
Implement policies that lower speeds, and prioritize the needs of pedestrians, cyclists, and public transport users	N/A	N/A			
Promote transit-oriented development to concentrate urban and commercial developments around mass transit nodes	N/A	N/A			
Strategically locate—where feasible—public, subsidized, and workforce housing to provide convenient access to high-capacity transit services	N/A	N/A			
Discourage the use of private vehicles in high-density urban areas by putting restrictions on motor vehicle users, vehicles, and road infrastructure, and provide alternatives that are accessible, safe, and easy to use, such as walking, cycling, buses and trams	N/A	N/A			
Provide intermodal connectivity between transit and bike share schemes at major transit stops and create transport connections for bicycle and pedestrian travel that reduce total travel time	N/A	N/A			
Construct (or reconstruct existing) transport networks to ensure that nonmotorized modes of travel are as safe as motorized ones, and most importantly serve the travel needs of all ages and abilities	N/A	N/A			

Note: GSRSS 2023 = *Global Status Report on Road Safety 2023*; N/A = variables not included; RSPMF = Road Safety Performance Monitoring Framework.

PILLAR 2: SAFE ROADS AND MOBILITY

African Road Safety Action Plan 2011–2021 & 2021–2030	Africa Status Report on Road Safety 2020	GSRRS 2023	n/51	UN voluntary targets	RSPMF
Mandatory risk assessment of road infrastructure (safety ratings)					
Develop road safety audit and inspection guidelines	N/A	Guidelines were used for the auditing (star rating/ safety rating assessments considering all road users, Global Street Design guidelines, other)	15	Number of countries using systematic approaches to assess/audit new roads	
	Formal inspections on existing networks	Presence of systematic approaches to assess/audit new roads	47	Number of countries using systematic approaches to assess/audit existing roads	
Safety rating on new and rehabilitated roads	Safety rating systems for conducting formal inspections on existing roads, % road network evaluated	Length or roads with 3-star or higher rating for road users	12		Percentage of trunk (national/ primary) road length (km) with 3-star or better rating for road users (vehicle occupants, motorcyclists, cyclists, pedestrians)
					Percentage of other (secondary and tertiary) road length (km) with 3-star or better rating for road users (vehicle occupants, motorcyclists, cyclists, pedestrians)
Building capacity for use of infrastructure road safety assessment tools and techniques at the local level	N/A	N/A			

Shift travel toward cleaner, safer, and affordable modes	N/A	N/A			
Eliminate risks along routes frequently traveled by children to school and for other purposes	N/A	Technical design standards on roads where pedestrians and cyclists are present provide for: Managing speed to Safe System outcomes (e.g., 20 mph or 30 km/h), Global Street Design guidelines, safe crossings for pedestrians and cyclists, separation of pedestrians and cyclists from vehicular traffic	45		
Allocate sufficient resources to upgrade existing road infrastructure to incorporate Safe System principles as soon as feasible	N/A	N/A			
Develop functional classifications and desired safety performance standards for each road user group at the geographic land-use and road-corridor levels	N/A	Presence of technical design and operational standards that recognize the importance of land use and how land-use considerations influence the expected mix of different road users within the transport system	48		
Review and update legislation and local design standards that consider road function and the needs of all road users, and for specific zones	N/A	Legislation for the existing road network to undergo formal road safety inspections/assessments considering all road users on a periodic basis	49		
		Legislation for the existing road network to undergo maintenance safety inspections on a periodic basis	50		
Specify a technical standard and star rating target for all designs linked to each road user, and the desired safety performance standard at that location	N/A	Presence of technical design standards that are required to be met in the development of new roads that account for the safety of all road users	49	Number of countries that have implemented technical standards for new roads that consider the safety of all road users, or that are aligned with the relevant UN conventions and regulate compliance to those standards Number of countries that have implemented technical standards for existing roads that consider the safety of all road users, or that are aligned with the relevant UN conventions and regulate compliance to those standards	

Implement infrastructure treatments that ensure logical and intuitive compliance with the desired speed environment (e.g., 30 km/h urban centers; ≤ 80 km/h undivided rural roads; 100 km/h expressways)	N/A	N/A			
Undertake road safety audits on all sections of new roads (prefeasibility through to detailed design) and complete assessments using independent and accredited experts to ensure a minimum standard of three stars or better for all road users	All designs for new infrastructure require a formal road safety audit prior to construction	Design (plans) for new road infrastructure projects mandate a formal road safety audit and/or star/safety rating assessment prior that considers the safety of all road users	50	Number of countries that have implemented technical standards for new roads that consider the safety of all road users, or that are aligned with the relevant UN conventions and regulate compliance to those standards	
Undertake crash-risk mapping (where crash data are reliable) and proactive safety assessments and inspections on the target network with a focus on relevant road user needs as appropriate	N/A	N/A			
Set a performance target for each road user based on the inspection results with clear measurable metrics at the road-attribute level (e.g., sidewalk provision)	N/A	Ensuring roads travelled meet technical safety standards for all users	39		

Note: GSRSS 2023 = *Global Status Report on Road Safety 2023*; N/A = variables not included; RSPMF = Road Safety Performance Monitoring Framework.

PILLAR 3: VEHICLE SAFETY

African Road Safety Action Plan 2011–2021 & 2021–2030	Africa Status Report on Road Safety 2020	GSRRS 2023	n/51	UN voluntary targets	RSPMF
Mandatory technical control of vehicles (vehicle inspections)					
Introduce incentives for importation of safer vehicles	N/A	N/A			
Vehicle standards and safety ratings for new and used vehicles	N/A	Presence of high-quality safety standards for used vehicle imports/exports	47	Number of countries implementing high-quality safety standards for new vehicles	Percentage of vehicles that pass first registration inspection
	N/A				Percentage of registered motor vehicle fleets that pass periodic roadworthiness inspection (RWI)
Establish a reliable system for regular technical controls and inspections	N/A	Legislation on periodic vehicle technical inspection	47	Number of countries using systematic approaches for vehicle assessments	
Vehicles produced for every market should be equipped with recommended levels of safety performance, and incentives should be provided for use of vehicles with enhanced safety	N/A	N/A			
Require high-quality harmonized safety standards for new and used motor vehicles, safety belts, child restraint systems, and motorcycle helmets					
Standards on front and side impact to ensure that occupants are protected in a front and side-impact crash	N/A	Legislation on standard front and side impact protection to ensure occupants are protected in a front and side-impact crash	36		
Safety belts and safety belt anchorage for all seats to ensure that safety belts are fitted in vehicles when they are manufactured and assembled	N/A	National law on vehicle safety includes safety regulations on safety belt anchorage	50		
ISOFIX child restraint anchor points to secure the child restraint systems attached directly to the frame of the vehicle to prevent misuse	N/A	National law addressing vehicle safety for new 4-wheeled motorized vehicles: child restraint systems	50		

Electronic stability control to prevent skidding and loss of control in cases of oversteering or understeering	N/A	Legislation on electronic stability control to prevent skidding and loss of controls in cases of over- or understeering	37		
Advanced emergency braking to reduce collisions	N/A	Legislation on advanced emergency braking to reduce collisions	16		
Pedestrian protection standards to reduce the severity of impact with a motor vehicle	N/A	Legislation on pedestrian protection standards to reduce the severity of impact with a motor vehicle	38		
Motorcycle helmets certified according to international harmonized standards	N/A	Legislation (relating to motorized two-wheelers) make specific reference to a helmet standard (national or international), or refer to a body responsible for setting such a standard	50		
Antilock braking system and daytime running lights for motorcycles	N/A	Legislation on daytime running lights & antilock braking systems for 2-/3-wheelers	38		
Intelligent speed assistance systems to help drivers keep to speed limits	N/A	N/A			
eCall or Accident Emergency Call System (AECS) to trigger an emergency response by an in-vehicle sensor	N/A	Legislation mandating the availability of eCall or AECS to trigger an emergency response by a vehicle sensor in all new vehicles	48		
Mandatory certification and registration systems for new and used vehicles based on established safety requirements and combined with routine inspections	N/A	National legislation mandating periodic inspection of motorized vehicles	47		Percentage of registered motor vehicle fleets that meet UN vehicle safety standards
Regulations for the export and import of used vehicles that are accompanied by inspections at entry and exit points, and mandatory periodic technical inspection of vehicles	N/A	Country imposes any restrictions on the export or import of used vehicles	47		
Building demand for safer vehicles by encouraging independent new car assessment programs	N/A	N/A			
Ensure that high-quality, harmonized safety standards are kept throughout the full life cycle of the vehicle	N/A	N/A			Percentage of registered motor vehicle fleets that meet UN vehicle safety standards
	Vehicle registration	Vehicle registration	37		
	Age of vehicle fleet				Mean age of registered motor vehicle fleet in years

Note: GSRSS 2023 = *Global Status Report on Road Safety 2023*; N/A = variables not included; RSPMF = Road Safety Performance Monitoring Framework.

PILLAR 4: SAFE ROAD USERS

African Road Safety Action Plan 2011–2021 & 2021–2030	Africa Status Report on Road Safety 2020	GSRRS 2023	n/51	UN voluntary targets	RSPMF
Effective road safety regulatory environment					
Comprehensiveness of legislation on risk factors and enforcement of existing laws	N/A	Legislation on risk factors that meet best-practice criteria	23-50		
Driver training and driving licences, special focus on professional drivers	N/A	Formal driving licensing process for motorized vehicles, additional licensing requirements for professional drivers	50		
Stronger and more consistent enforcement by traffic police	N/A	N/A			
Promote the use of child restraints	N/A	Promoting child restraint use	47	Number of countries in which the proportion of all child motor vehicle occupants using standard child restraints systems is close to 100%	
Vehicles produced for every market should be equipped with recommended levels of safety performance, and incentives should be provided for use of vehicles with enhanced safety	N/A	N/A			
Empowered road users					
Establish or strengthen Road Safety Clubs in schools	N/A	N/A			
Empower road users, establish road safety as a right, including for vulnerable road	N/A	N/A			
Enact and enforce road safety legislation					
Set maximum speed limits considering the type and function of roads	N/A	National speed limits on urban roads (maximum default limit) km/h	45	Number of countries having legislation setting appropriate speed limits and effective enforcement	

		National speed limits on rural main roads (maximum default limit) km/h	41	Number of countries that have reduced by half the proportion of vehicles traveling over the posted speed limit	Percentage of drivers exceeding speed limits
		National speed limits on motorways (maximum default limit) km/h	30	Number of countries that have national and, where applicable, subnational data systems on speeding violations and speeding-related injuries and fatalities	
				Number of countries that achieved reductions in speeding-related injuries and fatalities	
Establish blood alcohol concentration (BAC) limits to prevent impaired driving (drink and drug driving) with specific provisions for novice and professional drivers	N/A	Maximum legal BAC/ BrAC for vehicle drivers in the general population	40	Number of countries having appropriate legislation and effective enforcement on driving under the influence of alcohol and/or other psychoactive substances	
		Maximum legal BAC/ BrAC for young-novice drivers	40	Number of countries that have national and, where applicable, subnational data on driving under the influence of alcohol and/or psychoactive substances and related road traffic-related fatalities and injuries	
		Maximum legal BAC/ BrAC for commercial drivers	49	Number of countries that have reduced by half the number of road traffic injuries and fatalities related to driving under the influence of alcohol and/or other psychoactive substances	Percentage of drivers under the influence of alcohol
Mandate the use of protective equipment (safety belts, child restraints, and helmets)	N/A	National laws or regulations requiring helmet use among users of motorized 2-wheelers	50	Number of countries having legislation requiring motorcycle riders to wear a helmet properly fastened and meeting appropriate standards for protection	
				Number of countries that effectively enforce legislation on helmet use	
				Number of countries implementing regulations on safety for child and adult helmets sold	
				Number of countries that have national and, where applicable, subnational data systems on helmet use	
				Number of countries in which the proportion of motorcycle riders correctly using helmets is close to 100%	Daytime helmet wearing rates by cyclists, moped riders, and motorcyclists

		National legislation (i.e., law, statue, regulation, etc.) regarding seat belt use	49	Number of countries having and effectively enforcing legislation requiring the use of safety belts for all motor vehicle occupants	
				Number of countries having and effectively enforcing legislation requiring the use of child restraint systems meeting appropriate standards	
				Number of countries in which the proportion of all motor vehicle occupants using safety belts is close to 100%	Daytime seat belt-wearing rate of all occupants
				Number of countries in which the proportion of all child motor vehicle occupants using standard child restraints systems is close to 100%	
				Number of countries having and effectively enforcing regulations on safety for child restraints systems sold	
				Number of countries that have national and, where applicable, subnational data on use of safety belts, as well as the appropriate use of child restraint systems	
				Number of countries having and effectively enforcing legislation on restricting or prohibiting the use of mobile phones while driving	
Restrict the use of handheld electronic devices while driving.				Number of countries that have national and, where applicable, subnational data systems on the use of mobile phones while driving	Percentage of drivers using a mobile phone while driving
Establish a dedicated enforcement agency, provide training, and ensure adequate equipment for enforcement activities	N/A	N/A			
Establish traffic rules and licensing requirements					
Set out and regularly update traffic rules and codes of conduct for road users	N/A	N/A			
Provide information and education on traffic rules	N/A	N/A			
Set minimum age and vision requirements for drivers	N/A	Minimum requirements to obtaining a full license, earliest age a person is legally allowed to drive a motorized vehicle	50		

Implement competency-based testing for driver licensing and adoption of graduated driver licensing for novice drivers	N/A	New drivers required to hold a learner's permit prior to obtaining a full license	50		
Set limits for maximum driving time and minimum rest periods for professional drivers	N/A	Government-issued rules for mandatory driving time and rest periods for professional drivers	50	Number of countries having acceded to international/ regional regulation on driving time and rest periods for professional drivers	
				Number of countries with regulation, effective enforcement, and audit of driving time and rest periods for professional drivers	
Make liability insurance mandatory for operators of motorized vehicles	N/A	Coverage of the mandatory motor insurance	50		
Ensure road infrastructure takes account of the needs of all road users and is designed to facilitate safe behaviors	N/A	N/A			
Clear road signage and road markings that are intuitive	N/A	N/A			
Use of roundabouts and traffic calming designs such as speed humps	N/A	N/A			
Physical separation of road users including use of protected bicycle lanes and pedestrian only zones	N/A	Technical design standards on roads where pedestrians and cyclists are present for: managing speed to safe system outcomes (e.g., 20 mph or 30 km/h), Global Street Design guidelines, safe crossings for pedestrians and cyclists, separation of pedestrians and cyclists from vehicular traffic)	45		
Make use of vehicle safety features and technologies to support safe behaviors					
Automatic safety belts and seat belt alerts	N/A	N/A			
Intelligent speed assistance	N/A	N/A			
Technologies to disable texting and or other forms of distraction while driving	N/A	N/A			
		National (or subnational if applicable) information system to monitor alcohol-impaired driving	44		Percentage of drivers under influence of alcohol

		National (or subnational if applicable) information system to monitor mobile phone use while driving	41	Number of countries having and effectively enforcing legislation on restricting or prohibiting the use of mobile phones while driving	Percentage of drivers using a mobile phone while driving
		National (or subnational if applicable) information system to monitor speeding while driving	45	Number of countries that have reduced by half the proportion of vehicles traveling over the posted speed limit	Percentage of drivers exceeding speed limits
		Data routinely collected in your country on motorcycle helmet use	42	Number of countries that have national and, where applicable, subnational data systems on helmet use	Daytime helmet–wearing rates by cyclists and motorcyclists
		Data routinely collected in your country on seat belt use in car occupants	40	Number of countries in which the proportion of all child motor vehicle occupants using standard child restraints systems is close to 100%	Daytime seat belt–wearing rates of all occupants
		Data routinely collected in your country on child restraint use	40		N/A

Note: BrAC = breath alcohol concentration; GSRSS 2023 = *Global Status Report on Road Safety 2023*; N/A = variables not included; RSPMF = Road Safety Performance Monitoring Framework.

PILLAR 5: POSTCRASH RESPONSE

African Road Safety Action Plan 2011–2021 & 2021–2030	Africa Status Report on Road Safety 2020	GSRRS 2023	n/51	UN voluntary targets & indicators	RSPMF
Improved postcrash care					
Introduce emergency medical services coordinating centers at strategic locations	N/A	N/A			
Provide fully equipped ambulances with medical supplies, and crash extraction and rescue equipment	N/A	N/A			
Develop capacity for long-term hospital trauma care and rehabilitation	N/A	N/A			
Introduce health facilities along main highways	N/A	N/A			
Postcrash care, WHO protocol and training for professionals	N/A	Standardized assessment of the prehospital and facility-based emergency care systems conducted at the national level in your country			
Provide a system to activate postcrash response	N/A	N/A			
Unique emergency telephone number with national coverage	N/A	Coverage of the national emergency access telephone number	44		
Coordination mechanism for dispatching response (fire brigade, police, ambulance)	N/A	Presence of agencies that coordinate prehospital and emergency medical services	45	Number of countries that have appointed agencies for effective coordination of the provisions of prehospital and facility-based emergency medical services	Fully operationalized designated EMS lead agency for coordination of prehospital and facility-based EMS
				Number of countries that have achieved the national targets of the time interval between a crash resulting in serious injury and the provision first professional emergency care	Average response time for EMS

Build response capacity among lay responders (nonmedical professionals)					
Provide basic (EMS) training for lay providers such as taxi and public transport providers, police, fire brigade, etc.	N/A	National law requiring training/licensing/ certification of first health responders	50		
Enact Good Samaritan laws to ensure protection for lay responders	N/A	National law that provides protection from civil liability for a lay bystander who provides assistance during a crash	50		
Strengthen professional medical care					
Establish trauma registries in health care facilities to gather information on the cause of injury and clinical interventions	N/A	Presence of trauma registry	33		
Build capacity of prehospital, hospital, and rehabilitation care/ services, and establish a basic package of emergency care services for each level of the health system	N/A	Existence of fully certified specialist or subspecialist programs that doctors can train for in-country, post-graduate specialization courses for nurses in emergency care or trauma care	47 (45 nurses)		
Ensure 24-hour access—regardless of ability to pay—to operative and critical care services that are staffed and equipped	N/A	National law that requires health care facilities (e.g., hospitals or clinics) to take care of anyone who arrives with a health emergency	50		
Provide recovery and rehabilitation services to prevent permanent disability	N/A	National law guaranteeing rehabilitation care for all injured regardless of ability to pay	50		
Establish requirements multidisciplinary, postcrash investigation					
Mandate investigations for crashes resulting in serious and fatal injuries to inform prevention strategies and apply an effective judicial response for victims and their families	N/A	N/A			
Establish coordination mechanisms for postcrash investigation and sharing of data by relevant sectors	N/A	N/A			
Establish appropriate financing mechanisms such as road-user insurance schemes (e.g., mandatory third-party liability)	N/A	Coverage of third-party liability in mandatory motor insurance	49		
Provide social, judicial, and, where appropriate, financial support to bereaved families and survivors	N/A	N/A			

Note: EMS = emergency medical services; GSRSS 2023 = *Global Status Report on Road Safety 2023*; N/A = variables not included; RSPMF = Road Safety Performance Monitoring Framework.

APPENDIX B.

Participating Countries and Links to the Respective Country Profiles

Click on a country to view profile.

Algeria
Benin
Botswana
Burkina Faso
Burundi
Cabo Verde
Cameroon
Central African Republic
Chad
Comoros
Congo, Dem. Rep.
Congo, Rep.
Côte d'Ivoire
Egypt, Arab Rep.
Eritrea
Eswatini
Ethiopia
Gabon
Gambia, The
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Libya

Madagascar
Malawi
Mali
Mauritania
Mauritius
Morocco
Mozambique
Namibia
Niger
Nigeria
Rwanda
Sao Tome and Principe
Senegal
Seychelles
Sierra Leone
Somalia
South Africa
South Sudan
Sudan
Tanzania
Togo
Tunisia
Uganda
Zambia
Zimbabwe

APPENDIX C.

MiniARSO Crash Indicators

Crash-related minimum data set and data sources

ARSO minimum indicators

1.	Crash identification number	**Definition:** The unique identifier (e.g., a 10-digit number) within a given year that identifies a particular crash. **Obligation:** Mandatory **Data type:** Numeric or character string **Comments:** The police usually assign this value, as they are responsible at the crash scene. Other systems may reference the incident using this number.
2.	Crash date	**Definition:** The date (day, month, and year) on which the crash occurred. **Obligation:** Mandatory **Data type:** Numeric (DDMMYYYY) **Comments:** If a part of the crash date is unknown, the respective places are filled in with 99 (for day and month). Absence of year should result in an edit check. Important for seasonal comparisons, time series analyses, management/administration, evaluation, and linkage.
3.	Crash time	**Definition:** The time at which the crash occurred, using the 24-hour clock format (00.0023:59). **Obligation:** Mandatory **Data type:** Numeric (HH:MM) **Comments:** Midnight is defined as 00:00 and represents the beginning of a new day. Variable allows for analyses of different time periods.
4.	Crash location	**Definition:** The exact location at which the crash occurred. Optimum definition is route name and GPS/GIS coordinates if there is a linear referencing system (LRS), or other mechanism that can relate geographic coordinates to specific locations in road inventory and other files. The minimum requirement for documentation of crash location is the street name, the reference point, and distance from reference point and direction from reference point. **Obligation:** Mandatory **Data type:** Character string, to support latitude/longitude coordinates, linear referencing method, or link node system. **Comments:** Critical for problem identification, prevention programs, engineering evaluations, and mapping and linkage purposes.

5.	Crash type	**Definition:** The crash type is characterized by the first injury or damage-producing event of the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Crash with pedestrian – Crash between a vehicle and at least one pedestrian. 2. Crash with parked vehicle – Crash between a moving vehicle and a parked vehicle. A vehicle with a driver that is just stopped is not considered as parked. 3. Crash with fixed obstacle – Crash with a stationary object (for example, a tree, post, barrier, fence, and so on). 4. Non-fixed obstacle – Crash with a non-fixed object or lost load. 5. Animal – Crash between a moving vehicle and an animal. 6. Single vehicle crash/non-collision – Crash in which only one vehicle is involved and no object was hit. Includes vehicle leaving the road, vehicle rollover, and cyclists falling. 7. Crash with two or more vehicles – Crashes where two or more moving vehicles are involved. 8. Other crashes – Other crash types not described above. **Comments:** If the road crash includes more than one event, the first should be recorded, through this variable. If more than one value is applicable, select only the one that corresponds best to the first event. Important for understanding crash causation, identifying crash avoidance countermeasures.
6.	Impact type	**Definition:** Indicates the manner in which the road motor vehicles involved initially collided with each other. The variable refers to the first impact of the crash, if that impact was between two road motor vehicles. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. No impact between motor vehicles – There was no impact between road motor vehicles. Refers to single vehicle crashes, collisions with pedestrians, animals, or objects. 2. Rear-end impact – The front side of the first vehicle collided with the rear side of the second vehicle. 3. Head-on impact – The front sides of both vehicles collided with each other. 4. Angle impact, same direction – Angle impact where the front of the first vehicle collides with the side of the second vehicle. 5. Angle impact, opposite direction – Angle impact where the front of the first vehicle collides with the side of the second vehicle. 6. Angle impact, right angle – Angle impact where the front of the first vehicle collides with the side of the second vehicle. 7. Angle impact, direction not specified – Angle impact where the front of the first vehicle collides with the side of the second vehicle. 8. Side-by-side impact, same direction – The vehicles collided side by side while travelling in the same direction. 9. Side-by-side impact, opposite direction –The vehicles collided side by side while travelling in opposite directions. 10. Rear to side impact – The rear end of the first vehicle collided with the side of the second vehicle. 11. Rear to rear impact – The rear ends of both vehicles collided with each other. **Comments:** Useful for identifying structural defects in vehicles.

7.	Weather conditions	**Definition:** Prevailing atmospheric conditions at the crash location, at the time of the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Clear – No hindrance from weather, neither condensation nor intense movement of air. Clear and cloudy sky included. 2. Rain – Heavy or light. 3. Snow. 4. Fog, mist or smoke. 5. Sleet, hail. 6. Severe winds – Presence of winds deemed to have an adverse effect on driving conditions. 8. Other weather condition. 9. Unknown weather condition. **Comments:** Allows for the identification of the impact of weather conditions on road safety. Important for engineering evaluations and prevention programs.
8.	Light conditions	**Definition:** The level of natural and artificial light at the crash location, at the time of the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Daylight – Natural lighting during daytime. 2. Twilight – Natural lighting during dusk or dawn. Residual category covering cases where daylight conditions were very poor. 3. Darkness – No natural lighting, no artificial lighting. 4. Dark with streetlights unlit – Streetlights exist at the crash location but are unlit. 5. Dark with streetlights lit – Streetlights exist at the crash location and are lit. 9. Unknown – Light conditions at time of crash unknown. **Comments:** Information about the presence of lighting is an important element in analysis of spot location or in network analysis. Additionally, important for determining the effects of road illumination on night-time crashes to guide relevant future measures.
9.	Crash severity	**Definition:** Describes the severity of the road crash, based on the most severe injury of any person involved. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Fatal – At least one person was killed immediately or died within 30 days because of the road crash. 2. Serious/severe injury – At least one person was hospitalized for at least 24 hours because of injuries sustained in the crash, while nobody was killed. 3. Slight/minor injury – At least one of the participants of the crash was hospitalized less than 24 hours or not hospitalized, while no participant was seriously injured or killed. **Comments:** Provides a quick reference to the crash severity, summarizing the data given by the individual personal injury records of the crash. Facilitates analysis by crash severity level. Several crash-related variables can be derived from collected data, including number of vehicles involved (total), number of motorized vehicles involved, number of nonmotorized vehicles involved, number of fatalities, number of non-fatal injuries, day of week, and more. These variables provide counts or other information, without the user having to go back to individual records. Depending on the type of reports generated, deriving these data elements can save time and effort.

Road-related indicators

10. Type of roadway	**Definition:** Describes the type of road, whether the road has two directions of travel, and whether the carriageway is physically divided. For crashes occurring at junctions, where the crash cannot be clearly allocated in one road, the road where the vehicle with priority was moving is indicated. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Motorway/freeway – Road with separate carriageways for traffic in two directions, physically separated by a dividing strip not intended for traffic. Road has no crossings at the same level with any other road, railway or tramway track, or footpath. Specially sign-posted as a motorway and reserved for specified categories of motor vehicles. 2. Express road – Road with traffic in two directions, carriageways not normally separated. Accessible only from interchanges or controlled junctions. Specially sign-posted as an express road and reserved for specified categories of motor vehicles. Stopping and parking on the running carriageway are prohibited. 3. Urban road, two-way – Road within the boundaries of a built-up area (an area with signposted entries and exits). Single, undivided street with traffic in two directions, relatively lower speeds (often up to 50 km/h), and unrestricted traffic, with one or more lanes, which may or may not be marked. 4. Urban road, one-way – Road within the boundaries of a built-up area, with entries and exits sign-posted as such. A single, undivided street with traffic in one direction, relatively lower speeds (often up to 50 km/h). 5. Road outside a built-up area – Road outside the boundaries of a built-up area (an area with sign-posted entries and exits). 6. Restricted road – A roadway with restricted access to public traffic. Includes cul-de-sacs, driveways, lanes, private roads. 8. Other – Roadway of a type other than those listed above. 9. Unknown – Not known where the incident occurred. **Comments:** Important for comparing crash rates of roads with similar design characteristics, and for conducting comparative analyses between motorway and non-motorway roads.
11. Road functional class	**Definition:** Describes the character of service or function of the road where the first harmful event took place. For crashes occurring at junctions, where the crash cannot be clearly allocated to one road, the road where the vehicle with priority was moving is indicated. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Principal arterial – Roads serving long distance and mainly interurban movements. Includes motorways (urban or rural) and express roads. Principal arterials may cross through urban areas, serving suburban movements. The traffic is characterized by high speeds and full or partial access control (interchanges or junctions controlled by traffic lights). Other roads leading to a principal arterial are connected to it through side collector roads. 2. Secondary arterial – Arterial roads connected to principal arterials through interchanges or traffic light-controlled junctions, supporting and completing the urban arterial network. Serving middle distance movements but not crossing through neighborhoods. Full or partial access control is not mandatory. 3. Collector – Unlike arterials, collectors cross-urban areas (neighborhoods) and collect or distribute the traffic to/from local roads. Collectors also distribute traffic leading to secondary or principal arterials. 4. Local – Roads used for direct access to the various land uses (private property, commercial areas, and so on). Low service speeds not designed to serve interstate or suburban movements.

12. Road surface conditions	**Definition:** The condition of the road surface at the time and place of the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Dry – Dry and clean road surface. 2. Snow, frost, ice – Snow, frost, or ice on the road. 3. Slippery – Slippery road surface due to existence of sand, gravel, mud, leaves, oil on the road. Does not include snow, frost, ice, or wet road surface. 4. Wet, damp – Wet road surface. Does not include flooding. 5. Flood – Still or moving water on the road. 6. Other – Other road surface conditions not mentioned above. 9. Unknown – The road surface conditions were unknown. **Comments:** Important for identification of high wet-surface crash locations, for engineering evaluation and prevention measures.
13. Speed limit	**Definition:** The legal speed limit at the location of the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** nnn – The legal speed limit as provided by road signs or by the country's traffic laws for each road category, in kilometers per hour (km/h). 999 unknown – The speed limit at the crash location is unknown. **Comments:** For crashes occurring at junctions, where the crash cannot be clearly allocated to one road, the speed limit for the road where the vehicle with priority was moving is indicated.
14. Road obstacles	**Definition:** The presence of any person or object that obstructed the movement of the vehicles on the road. Includes any animal standing or moving (either hit or not), and any object not meant to be on the road. Does not include vehicles (parked or moving vehicles, pedestrians) or obstacles on the side of the carriageway (for example, poles, trees). **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Yes – Road obstacle(s) present at the crash site. 2. No – No road obstacle(s) present at the crash site. 9. Unknown – Unknown presence of any road obstacle(s) at the crash site. **Comments:** Countries where a large proportion of the road network is unpaved may wish to include the variable 'road surface type' to allow for analysis of crash rates by road surface type.
15. Junction	**Definition:** Indicates whether the crash occurred at a junction (two or more roads intersecting) and defines the type of junction. In at-grade junctions, all roads intersect at the same level. In not-at-grade junctions, roads do not intersect at the same level. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. At-grade, crossroad – Road intersection with four arms. 2. At-grade, roundabout – Circular road. 3. At-grade, T, or staggered junction – Road intersection with three arms. Includes T-intersections and intersections with an acute angle. 4. At-grade, multiple junction – A junction with more than four arms (excluding roundabouts). 5. At-grade, other – Other at-grade junction type not described above. 6. Not at grade – The junction includes roads that do not intersect at the same level. 7. Not at junction – The crash has occurred at a distance greater than 20 meters from a junction. 9. Unknown – The crash location relative to a junction is unknown. **Comments:** Crashes occurring within 20 meters of a junction are considered as crashes at a junction. Important for site-specific studies and identification of appropriate engineering countermeasures.

16.	Traffic control at junction	**Definition:** Type of traffic control at the junction where crash occurred. Applies only to crashes that occur at a junction. **Obligation:** Mandatory if crash occurred at a junction **Data type:** Numeric **Data values:** 1. Authorized person – Police officer or traffic warden at intersection controls the traffic. Applicable even if traffic signals or other junction control systems are present. 2. Stop sign – Priority is determined by stop sign(s). 3. Give-way sign or markings – Give-way sign or markings determine priority. 4. Other traffic signs – Priority is determined by traffic sign(s) other than 'stop', 'give way', or markings. 5. Automatic traffic signal (working) – Priority is determined by a traffic signal that was working at the time of the crash. 6. Automatic traffic signal (out of order) – A traffic signal is present but out of order at time of crash. 7. Uncontrolled – The junction is not controlled by an authorized person, traffic signs, markings, automatic traffic signals, or other means. 8. Other – The junction is controlled by means other than an authorized person, signs, markings, or automatic traffic signals. **Comments:** If more than one value is applicable (for example, traffic signs and automatic traffic signals), record all that apply.
17.	Road curve	**Definition:** Indicates whether the crash occurred inside a curve, and what type of curve. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Tight curve – The crash occurred inside a road curve that was tight (based on the judgment of the police officer). 2. Open curve – The crash occurred inside a road curve that was open (based on the judgment of the police officer). 3. No curve – The crash did not occur inside a road curve. 9. Unknown – It is not defined whether the crash occurred inside a road curve. **Comments:** Useful for identification and diagnosis of high-crash locations, and for guiding changes to road design, speed limits, and so on.
18.	Road segment grade	**Definition:** Indicates whether the crash occurred on a road segment with a steep gradient. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Yes – The crash occurred at a road segment with a high grade. 2. No – The crash did not occur at a road segment with a high grade. 9. Unknown – It is not defined whether the crash occurred at a road segment with a high grade. **Comments:** Useful for identification and diagnosis of high-crash locations, and for guiding changes to road design, speed limits, and so on.

Vehicle-related indicators

19. Vehicle number	**Definition:** Unique number assigned to identify each vehicle involved in the crash. **Obligation:** Mandatory **Data type:** Numeric, sequential number **Comments:** Allows the vehicle record to be cross-referenced to the crash record and person records.
20. Vehicle identification number (VIN, issued by manufacturer)	**Definition:** Unique vehicle number attached to the engine compartment of the vehicle by the manufacturer to identify each vehicle involved in the crash. **Obligation:** Mandatory **Data type:** Numeric, sequential number **Comments:** Allows the vehicle record to be cross-referenced with registration and person records.
21. Vehicle registration number	**Definition:** Unique vehicle registration number appearing on the number plate and registration documents. **Obligation:** Mandatory **Data type:** Numeric, sequential number **Comments:** Allows cross-referencing with vehicle VIN number and identification.
22. Country of vehicle registration	Whether the vehicle is registered in a country different than where it crashes.
23. Vehicle type	**Definition:** The type of vehicle involved in the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Bicycle – Road vehicle with two or more wheels, generally propelled solely by the energy of the person on the vehicle, in particular by means of a pedal system, lever, or handle. 2. Other non-motor vehicle – Other vehicle without engine not included in the list above. 3. Two/three-wheel motor vehicle – Two or three-wheeled road motor vehicle (includes mopeds, motorcycles, tricycles, and all-terrain vehicles). 4. Passenger car – Road motor vehicle other than a two or three-wheeled vehicle, intended for the carriage of passengers and designed to seat no more than nine (driver included). 5. Bus/coach/trolley – Passenger-carrying vehicle, most commonly used for public transport, interurban movements, and tourist trips, seating more than nine persons. Includes vehicles connected to electric conductors and vehicles that are not rail-borne. 6. Light goods vehicle (<3.5 t) – Smaller (by weight) motor vehicle designed exclusively or primarily for the transport of goods. 7. Heavy goods vehicle (>3.5 t) – Larger (by weight) motor vehicle designed exclusively or primarily for the transport of goods. 8. Pedestrian. 9. Animal-propelled vehicles. 10. Other motor vehicle – Other vehicle not powered by an engine and not included in the lists of values. 11. Unknown – The type of vehicle is unknown, or it was not stated. **Comments:** Allows for analysis of crash risk by vehicle type and road user type. Important for evaluation of countermeasures designed for specific vehicles or to protect specific road users.

24. Vehicle make	**Definition:** Indicate the make (distinctive name) assigned by motor vehicle manufacturer. **Obligation:** Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type:** Character string. Alternatively, a list of motor vehicle makes can be composed, with a code corresponding to each. Such a list allows for more consistent and reliable recording, as well as for easier interpretation of the data. **Comments:** Allows for crash analyses related to the various motor vehicle makes.
25. Vehicle model	**Definition:** The code assigned by the manufacturer to denote a family of motor vehicles (within a make) that have a degree of similarity in construction. **Obligation:** Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type:** Character string. Alternatively, a list of motor vehicle models can be composed, with a code corresponding to each. Such a list allows for more consistent and reliable recording, as well as for easier interpretation of the data. **Comments:** Record the name of the model as referred to in the country in which the crash occurred. Allows for crash analyses related to the various motor vehicle models.
26. Vehicle year of manufacture	**Definition:** The year assigned to a motor vehicle by the manufacturer. **Obligation:** Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type:** Numeric (YYYY) **Comments:** Can be obtained from vehicle registration. Important for use in identifying motor vehicle model year for evaluation, research, and crash comparison purposes.
27. Engine size	**Definition:** The size of the vehicle's engine is recorded in cubic centimeters. **Obligation:** Mandatory, if vehicle is motorized. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type:** Numeric **Data values:** nnnn – Size of engine 9999 – Unknown engine size **Comments:** Important for identifying the impact of motor vehicle power on crash risk.
28. Vehicle special function	**Definition:** The type of special function being served by this vehicle, regardless of whether the function is marked on the vehicle. **Obligation:** Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type:** Numeric **Data values:** 1. No special function – No special function of the vehicle. 2. Taxi – Licensed passenger car for hire with driver, without predetermined routes. 3. Vehicle used as bus – Passenger road motor vehicle used for the transport of people. 4. Police/military – Motor vehicle used for police or military purposes. 5. Emergency vehicle – Motor vehicle used for emergency purposes (includes ambulances, fire service vehicles, and so on). 8. Other – Other special functions, not mentioned above. 9. Unknown – It was not possible to record a special function. **Comments:** Important to evaluate the crash involvement of vehicles with special uses.

29.	Vehicle maneuver (what the vehicle was doing at the time of the crash)	**Definition:** The controlled maneuver for this motor vehicle prior to the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Reversing – The vehicle was reversing. 2. Parked – Vehicle was parked and stationary. 3. Entering or leaving a parking position – The vehicle was entering or leaving a parking position. 4. Slowing or stopping – The vehicle was slowing or stopping. 5. Moving off – The vehicle was still and started moving. Does not include vehicle leaving or entering a parking position. 6. Waiting to turn – The vehicle was stationary, waiting to turn. 7. Turning – The vehicle was turning (includes U-turns). 10. Changing lane – The vehicle was changing lane. 11. Avoidance maneuver – The vehicle changed its course in order to avoid an object on the carriageway (including another vehicle or pedestrian). 12. Overtaking vehicle – The vehicle was overtaking another vehicle. 13. Straightforward/normal driving – The vehicle was moving ahead away from any bend. 8. Other. 9. Unknown.

Person-related indicators

30.	Person ID	**Definition:** Number assigned to uniquely identify each person involved in the crash. **Obligation:** Mandatory **Data type:** Numeric (two-digit number, nn) **Comments:** The persons related to the first (presumed liable) vehicle will be recorded first. Within a specific vehicle, the driver will be recorded first, followed by the passengers. Allows the person record to be cross-referenced to crash, road, and vehicle records, in order to establish a unique linkage with the crash ID and the vehicle number.
31.	Occupant's vehicle number	**Definition:** The unique number assigned for this crash to the motor vehicle in which the person was an occupant. **Obligation:** Mandatory **Data type:** Numeric (two-digit number, nn) **Comments:** Allows the person record to be cross-referenced to the vehicle records, linking the persons to the motor vehicle in which they were traveling.
32.	Pedestrian's linked vehicle number	**Definition:** The unique number assigned for this crash to the motor vehicle that collided with this person. The vehicle number assigned under to the motor vehicle that collided with this person. **Obligation:** Mandatory **Data type:** Numeric (two-digit number, nn, from V1) **Comments:** Allows the person record to be cross-referenced to the vehicle records, linking the person to the motor vehicle that struck them.
33.	Date of birth	**Definition:** Indicates the date of birth of the person involved in the crash. **Obligation:** Mandatory **Data type:** Numeric (date format – dd/mm/yyyy, or 99/99/9999 if birth date unknown) **Comments:** Allows calculation of person’s age. Important for analysis of crash risk by age group, and for assessing effectiveness of occupant protection systems by age group. Key variable for linkage with records in other databases.

34.	Sex	**Definition:** Indicates the sex of the person involved in the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Male – Based on identification documents/personal ID number or determined by the police. 2. Female – Based on identification documents /personal ID number or determined by the police. 9. Unknown – Sex could not be determined (police unable to trace person, not specified). **Comments:** Important for analysis of crash risk by sex. Important for evaluation of the effects of sex of the person involved on occupant protection systems and on motor vehicle design characteristics.
35.	Type of road user	**Definition:** This variable indicates the role of each person at the time of the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Driver – Driver or operator of motorized or nonmotorized vehicle. Includes cyclists, persons pulling a rickshaw, or riding an animal. 2. Passenger – Person riding on or in a vehicle, who is not the driver. Includes person in the act of boarding, alighting from a vehicle, or sitting/standing. 3. Pedestrian – Person on foot, pushing, or holding a bicycle, pram, or a pushchair, leading or herding an animal, riding a toy cycle, on roller skates, skateboard or skis. Excludes persons in the act of boarding or alighting from a vehicle. 4. Cyclist – Person on bicycle. 8. Other – Person involved in the crash who is not of any type listed above. 9. Unknown – It is not known what role the person played in the crash. **Comments:** Allows for analysis of crash risk by road user type (in combination with Vehicle type, V2). Important for evaluation of countermeasures designed to protect specific road users.
36.	Seating position	**Definition:** The location of the person in the vehicle at the time of the crash. **Obligation:** Mandatory for all vehicle occupants **Data type:** Numeric **Subfield: Row** **Data values:** 1. Front 2. Rear 3. Not applicable (for example, riding on motor vehicle exterior) 8. Other 9. Unknown **Subfield: Seat** **Data values:** 1. Left 2. Middle 3. Right 4. Not applicable (for example, riding on motor vehicle exterior) 8. Other 9. Unknown **Comments:** Important for full evaluation of occupant protection programs.

37.	Injury severity	**Definition:** The injury severity level for a person involved in the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Fatal injury – Person was killed immediately or died within 30 days, as a result of the crash. 2. Serious/severe injury – Person was hospitalized for at least 24 hours because of injuries sustained in the crash. 3. Slight/minor injury – Person was injured and hospitalized for less than 24 hours or not hospitalized. 4. No injury – Person was not injured. 9. Unknown – Injury severity was not recorded or is unknown. **Comments:** Important for injury outcome analysis, evaluation, and appropriate classification of crash severity (PD1). Important element for linkage with records in other databases.
38.	Safety equipment	**Definition:** Describes the use of occupant restraints, or helmet use by a motorcyclist or bicyclist. **Obligation:** Mandatory **Data type:** Numeric **Subfield: Occupant restraints** **Data values:** 1. Seat belt available, used. 2. Seat belt available, not used. 3. Seat belt not available. 4. Child restraint system available, used. 5. Child restraint system available, not used. 6. Child restraint system not available. 7. Not applicable – No occupant restraints could be used on the specific vehicle (for example, agricultural tractors). 8. Other restraints used. 9. Unknown – Not known if occupant restraints were in use at the time of the crash. 10. No restraints used. **Subfield: Helmet use** **Data values:** 1. Helmet worn 2. Helmet not worn 3. Not applicable (for example, person was pedestrian or car occupant) 9. Unknown **Comments:** Information on the availability and use of occupant restraint systems and helmets is important for evaluating the effect of such safety equipment on injury outcomes.

39.	Pedestrian maneuver	**Definition:** The action of the pedestrian immediately prior to the crash. **Obligation:** Mandatory **Data type:** Numeric **Data values:** 1. Crossing – The pedestrian was crossing the road. 2. Walking on the carriageway – The pedestrian was walking across the carriageway, facing or not facing traffic. 3. Standing on the carriageway – The pedestrian was on the carriageway and was stationary (standing, sitting, lying, and so on). 4. Not on the carriageway – The pedestrian was standing or moving on the sidewalk or any point beside the carriageway. 8. Other – The vehicle or the pedestrian was performing a maneuver not included in the list of the previous values. 9. Unknown – The maneuver performed by the vehicle or pedestrian was not recorded or it was unknown. **Comments:** Provides useful information for the development of effective road design and operation, education, and enforcement measures to accommodate pedestrians.
40.	Alcohol use suspected	**Definition:** Law enforcement officer suspects that person involved in the crash has used alcohol. **Obligation:** Mandatory for all drivers of motorized vehicles, recommended for all nonmotorists (pedestrians and cyclists). **Data type**: Numeric **Data values:** 1. No 2. Yes 3. Not applicable (for example, if person is not driver of motorized vehicle) 9. Unknown
41.	Alcohol test	**Definition:** Describes alcohol test status, type, and result. **Obligation:** Conditional (mandatory if alcohol use suspected) **Data type:** Numeric **Subfield: Test Status** **Data values:** 1. Test not given 2. Test refused 3. Test given 9. Unknown if tested **Subfield: Test type** **Data values:** 1. Blood 2. Breath 3. Urine 8. Other 9. Test type unknown **Subfield: Test result** **Data values:** 1. Pending 9. Result unknown **Comments:** Alcohol-related crashes are a major road safety problem. Information on alcohol involvement in crashes facilitates evaluation of programs to reduce drink driving.

42.	Drug use	**Definition:** Indication of suspicion or evidence that person involved in the crash has used illicit drugs. **Obligation:** Mandatory for all drivers of motorized vehicles, recommended for all nonmotorists (pedestrians and cyclists). **Data type:** Numeric **Data values:** 1. No suspicion or evidence of drug use 2. Suspicion of drug use 3. Evidence of drug use (further subfields can specify test type and values) 4. Not applicable (for example, if person is not driver of motorized vehicle) 9. Unknown
43.	Driving licence issue date	**Definition:** Indicates the date (month and year) of issue of the person's first driving license, provisional or full, pertaining to the vehicle they were driving. **Obligation:** Mandatory for all drivers of motorized vehicles **Data type:** Numeric (MMYYYY) **Data values:** Value (MMYYYY) 1. Never issued a driving license 9. Date of issue of first license unknown **Comments:** Allows calculation of number of years' driving experience at the time of crash.
44.	Driving licence type fitting vehicle	**Definition:** Whether the driving license allowed the driver to operate the vehicle s/he was operating. **Data type:** Yes or No
45.	Age	**Definition:** The age in years of the person involved in the crash. **Data type:** Numeric **Comments:** Derived from Date of birth and Crash date. Important for analysis of crash risk by age group, and for assessing effectiveness of countermeasures by age group.
46.	Driver nationality*	
47.	Hit and run	**Definition:** The behavior of a driver of a vehicle who is involved in a collision with another vehicle, property, or human being, who knowingly fails to stop to give his/her name, license number, and other information as required by statute to the injured party, a witness, or law enforcement officers. **Data type:** Yes or No **Comments:** Information captured when more than one vehicle involved in the crash but only one vehicle's data available.

Source: SSATP 2021
* Added after deliberations during second workshop toward establishment of ARSO.

APPENDIX D.

Proposed Actions

Pillar 1: : ROAD SAFETY MANAGEMENT	
Lack of Sustainable and Adequate Funding for RSLAs	
›•• Only 29 countries have allocated government budget funding for implementation of activities ›•• Only 19 countries earmark funds raised through fiscal measures specifically for road safety	›•• Establish dedicated funding mechanisms for RSLAs through fiscal interventions like taxes on fuel, road use tolls, and vehicle purchases ›•• Government to allocate specific budget for road safety ›•• Promote regional partnerships to leverage international funding and technical support for RSLAs ›•• Mobilize public-private sector collaboration to implement local demonstration projects ›•• Allocate 10% of road infrastructure funding to road safety ›•• Allocate 5% of road maintenance resources to road safety ›•• Provide a clear framework for public private partnerships (PPP)
National Road Safety Strategies	
›•• 38 countries have national road safety strategies, 24 have set fatality reduction targets, and just 19 align with SDG target 3.6 ›•• Limited targets for key performance indicators: nonmotorized transport, safe road user behavior, road & vehicle safety ›•• Insufficient funding for strategy implementation	›•• Develop and fund national road safety strategies with explicit, measurable, and time-bound targets aligned with international frameworks like the SDGs ›•• Set clear, measurable targets for key performance indicators: nonmotorized transport, safe road user behavior, road & vehicle safety ›•• Building capacity of government authorities to implement holistic, evidence-based approaches that improve road safety ›•• Business and enterprises to provide annual public sustainability reports including road safety disclosures ›•• Ratification and implementation of the African Road Safety Charter and the UN Conventions on Road Safety
Weak Data Systems	
›•• Significant discrepancies between estimated and reported road traffic fatalities, ranging from one to 22-fold differences ›•• Insufficient use of multiple data sources, with 28 countries relying on a single source, often police records ›•• Limited disaggregation of data by road user type, sex, age, and other vulnerable groups ›•• Inconsistent data formats and reporting	›•• Adopt minimum reporting requirement such as miniARSO ›•• Harmonize data format, international standards in reporting in line with AU ARSO and WHO ›•• Strengthen CRVS systems through collaboration across government sectors to improve mortality data registration and reporting ›•• Promote the use of multiple data sources, such as CRVS systems, health records, and police reports, to improve data accuracy ›•• Implement capacity-building programs to train stakeholders on international classification standards like International Classification of Diseases (ICD) and cause-of-death certification ›•• Address underreporting by establishing robust systems for timely and accurate data collection ›•• Enhance the capacity of RSLAs to manage data collection, ensure disaggregation, and enable evidence-based decision-making
Insufficient Monitoring	
›•• Insufficient monitoring of road Infrastructure and mobility patterns	›•• Strengthen data collection systems to gather accurate and comprehensive information on mobility patterns to inform development of Safe System policies ›•• Leverage data to inform transport and land-use planning, ensuring resources are allocated effectively to meet user needs

PILLAR 2: SAFE ROADS AND MOBILITY

Limited National Strategies for Nonmotorized Transport	
›•• Only 25 countries have strategies promoting public transport ›•• Strategies for walking and cycling are even more limited (14 and 13 countries, respectively), and only a few include specific targets for increasing walking and cycling	›•• Develop and implement comprehensive national strategies that prioritize walking and cycling alongside public transport ›•• Set clear, measurable targets for increasing walking and cycling, aligning with sustainable mobility goals ›•• Promote public awareness and education campaigns to encourage the adoption of nonmotorized transport modes ›•• Integrate nonmotorized transport into national transport and urban planning strategies
Insufficient Focus on Vulnerable Road Users	
›•• Technical design standards: ≥ Include safety feature in 36 countries ≥ Include land-use consideration in 29 countries ›•• Laws mandating formal road safety assessments requires consideration of all road users in only 4 countries ›•• Cycling lanes present in only 6 countries	›•• Improve legislation to require consideration of all road users ›•• Prioritize infrastructure development for vulnerable road users, including protected bicycle lanes, pedestrian-only zones, and accessible walkways ›•• Implement land-use planning policies that ensure a mix of motorized and nonmotorized transport to enhance safety and accessibility ›•• Allocate funding for urban transport projects that address the needs of pedestrians and cyclists ›•• Invest in infrastructure like protected bicycle lanes and pedestrian-only zones to ensure the safety of vulnerable road users
Weak Implementation of Road Safety Audits and Standards	
›•• Only 9 countries have legislation mandating formal road safety audits ›•• Only 13 countries conduct formal road safety audits ›•• Only 11 countries report the use of guidelines for auditing	›•• Mandate road safety audits and assessments for all new roads and periodically evaluate existing roads ›•• Strengthen legislation to ensure compliance with road safety standards, including periodic maintenance checks ›•• Increase investment in upgrading existing infrastructure to meet at least a three-star safety rating, particularly for vulnerable road users ›•• Promote the use of guidelines like the iRAP star rating system to evaluate road safety performance

PILLAR 3: VEHICLE SAFETY	
Inconsistent Reporting	
›•• Inconsistent reporting on vehicle types and fleet size	›•• Strengthen vehicle registration systems and standardize reporting mechanisms across countries to ensure consistent and accurate data collection ›•• Enhance capacity-building initiatives to improve national reporting on vehicle types and fleet sizes ›•• Use regional platforms like the African Road Safety Observatory (ARSO) to facilitate data sharing and harmonization
Lack of Comprehensive Legislation on Vehicle Safety Standards	
›•• Legislation specifying requirements for core safety equipment recommended by the United Nations Economic Commission for Europe (UNECE) is missing in many countries ›•• None of the countries in the region mandates all eight core areas of vehicle safety equipment ›•• Only 1 country has legislation specifying requirements for core safety equipment for motorized 2- and 3-wheelers	›•• Develop and enforce comprehensive national legislation mandating core vehicle safety standards in line international standards for all motorized vehicles, including motorized 2- and 3-wheelers
Insufficient Regulation of Used Vehicle Imports	
›•• 36 countries have restrictions on used vehicle imports, and 31 require safety criteria with or without an additional age limit	›•• Strengthen regulation of used vehicle imports to ensure consistent application of safety criteria for combined with age limits ›•• Monitor compliance with import restrictions through regular inspections and enforcement mechanisms ›•• Foster regional agreements to harmonize import standards and reduce the entry of unsafe vehicles into the market ›•• Governments and private sectors should prioritise road safety following the Safe System approach in procurement of fleet vehicles and transport services, road safety investments, and operation of public transit and commercial vehicle

PILLAR 4: SAFE ROAD USERS

Low Adherence to Best Practices for Risk Factor Laws	
›•• 35% of the countries do not adhere to best practices for any of the five behavioral risk factors ›•• None of the countries meet best practices for all five risk factors ›•• Child restraint system laws show the least improvement, with only 1 country meeting best practices	›•• Amend national laws to align with WHO best practices for all five risk factors, with a focus on child restraint systems ›•• Ensure laws address all road users, including drivers and passengers ›•• Raise public awareness on the importance of compliance with these laws to reduce crashes and fatalities
Weak Enforcement of Risk Factor Laws	
›•• Enforcement measures, such as penalties for violations, are inconsistently applied across countries ›•• Random breath testing for drink driving is conducted in only 7 countries, and 6 countries routinely tests fatally injured drivers for alcohol ›•• Limited use of speed cameras and reliance on penalties alone to enforce speed laws	›•• Strengthen enforcement mechanisms by equipping authorities with the tools and training needed to monitor and penalize violations effectively ›•• Scale up random breath testing for drink driving ›•• Establish data collection systems to monitor compliance with laws and inform enforcement strategies ›•• Increase the use of automated enforcement tools, such as speed cameras, to monitor compliance
Limited Scope of Drink-Driving Laws	
›•• Only 7 countries meet best practice criteria for drink-driving laws, including BAC levels ≤0.02 g/dl for young and commercial drivers ›•• Limited BAC/BrAC testing of drivers	›•• Update drink-driving laws to meet best practices, including adhering to BAC limits for young and commercial drivers ›•• Institutionalize random breath testing and mandatory testing of fatally injured drivers to improve deterrence and data accuracy ›•• Launch education campaigns to increase public awareness about the dangers of drink driving
Insufficient Legislation on Distracted Driving	
›•• Only 16 countries have laws prohibiting the use of hands-free mobile phones.	›•• Expand legislation to address all forms of distracted driving, including hands-free device use
Inadequate Focus on Professional Driving Times	
›•• Only 21 countries have laws on rest periods for professional drivers, with inconsistent enforcement of maximum driving hours and minimum rest periods	›•• Standardize laws on professional driving times to align with international best practices ›•• Implement monitoring systems, such as tachographs, to ensure compliance with rest period laws ›•• Provide training for commercial drivers to emphasize the importance of rest in preventing fatigue-related crashes
Weak data systems for monitoring compliance	
›•• Limited data collection on compliance with risk factor laws and enforcement effectiveness	›•• Strengthen data collection systems to monitor compliance with road safety laws and enforcement measures ›•• Regularly analyze and publish data to inform policy decisions and assess the impact of interventions ›•• Promote regional collaboration to harmonize data collection methods and improve reporting consistency
Inadequate Licensing and Driver Regulation	
›•• Licensing laws lack provisions for minimum age and learner permits ›•• Penalty and demerit systems are implemented in only 2 countries	›•• Revise licensing laws to include minimum age requirements and learner permits ›•• Implement penalty and demerit systems to address repeated driving offenses and promote safer behavior ›•• Enhance enforcement capacity to ensure adherence to licensing laws

PILLAR 5: POSTCRASH RESPONSE

Inadequate Postcrash Care Assessments	
›•• Only 10 countries conduct assessments of prehospital and facility-based emergency care, essential for designing responsive services	›•• Conduct regular assessments of prehospital and facility-based emergency care systems to identify needs and allocate resources effectively ›•• Strengthen national health planning to integrate postcrash care into broader health systems
Limited Training and Certification for First Responders	
›•• Only 5 countries have laws requiring training, licensing, or certification processes for first health responders ›•• There is insufficient access to certified specialization programs for emergency care professionals, such as trauma surgeons and emergency nurses	›•• Mandate training and certification for first responders through national legislation ›•• Expand access to specialist and subspecialist training programs for emergency and trauma care professionals ›•• Develop regional training hubs to build capacity and ensure a skilled emergency care workforce
Insufficient Trauma Registries and Data Systems	
›•• Trauma registries are reported in only 24 countries, with aggregated facility-based trauma data limited to 13 countries nationally and 11 in selected facilities	›•• Establish or restore trauma registries in all countries to enable effective monitoring and planning of postcrash care services ›•• Standardize data collection and aggregation systems to ensure comprehensive national trauma data
Lack of Comprehensive Emergency Care Legislation	
›•• Only 14 countries have laws requiring health care facilities to provide emergency care ›•• No country has laws protecting lay bystanders from civil liability when assisting crash victims ›•• Only 4 countries guarantee rehabilitation care regardless of ability to pay ›•• Only 5 countries require training, licensing, or other certification processes for first health responders	›•• Support countries to enact or strengthen national legislation and regulations to ensure equitable access to emergency and rehabilitation services ›•• Support countries to enact laws to protect lay responders and encourage bystander assistance
Weak Financial Protections for Crash Victims	
›•• The law mandating third-party liability motor insurance covers all vehicles in only 4 countries ›•• The law lacks provision for a fund to provide protections for victims of uninsured or unregistered vehicles ›•• Motor insurance premiums regulated in only 2 countries	›•• Expand third-party liability insurance laws to cover all vehicles, ensuring universal protection ›•• Establish national funds to cover victims of uninsured or unidentified vehicles, reducing the financial burden on vulnerable populations ›•• Regulate and monitor insurance premiums to ensure affordability for all income levels

Note: BAC = blood alcohol concentration; BrAC = breath alcohol concentration; CRVS = civil registration and vital statistics; iRAP = International Road Assessment Programme; RSLA = road safety lead agency; SDG = Sustainable Development Goal; WHO = World Health Organization.

IOSR Journal of Business and Management (IOSR-JBM)
e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 17, Issue 4.Ver. IV (Apr. 2015), PP 58-77
www.iosrjournals.org

Analysis of Causes & Response Strategies of Road Traffic Accidents in Kenya

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Abstract: *Kenya has recently been experiencing an alarming road carnage involving deaths of many innocent people and this necessitated this study. The data for the study was gathered primarily through secondary sources. These sources included Kenya Road Safety, Police reports, Newspapers, internet, books, World Bank reports and other relevant sources. Practical experience and direct, observation of the roads was also provide some reasonable information. A visit will be made to some commercial motor garages in Nairobi to interact with daily users of the roads. Analysis will be conducted using descriptive statistics that will include mean values, standard deviations and frequencies among others. There are many factors contributing to increase in road traffic accident which include human (corruption,, errors of omission and commission etc), physical including (inferior materials, soil texture) and systemic factors. The conclusion is that the situation is so complex that various strategies or approaches are needed and to tackle it which may include enlighten campaign, change of attitude on the part of officials especially the police and appropriate intervention approach in order to bring the carriage to a halt or reduce it to the barest minimum. Given the importance of road transport in the social, economic and political life of Kenya as a nation, it is hardly surprising that the government has taken several policy measures in order to address the problem of road crashes. These measures have resulted from the realization that a functioning low cost road transport service supported by a good road infrastructure, as well as informed and disciplined road users, is crucial for economic development and poverty alleviation. It is largely because of this that Kenya's Economic Recovery Strategy for Wealth and Employment Creation for 2012-2017 regards transport as the third pillar of the country's economic recovery efforts.*
Keywords: *Response Strategies, Road accidents*

I. Introduction

Road traffic crashes occur on all continents, in every country of the world. Every year they take the lives of more than a million people and incapacitate many millions more. Rapid economic development has resulted in an increase in the transport sector in Kenya. However, the increase in the transport sector has been a problem in road safety by increasing the number of road accidents. Incidences of road accidents are one of the main problems to the nation. Road accidents are one of the major contributors of human deaths in Kenya. Abdul-Kareem (2003) has stated in his book that 1.17 million deaths occur each year worldwide due to road accidents 70% of which occur in developing countries. 65% of deaths involve pedestrians, 35% of which are children.

Road safety involves three major components: the road system, the human factor and the vehicle element. These three elements are inter-linked through geo-referenced traffic events and provide the basis for road safety analyses and attempts to reduce the number of road traffic incidents and improve road safety. Road safety and road incident reduction relates to many other fields of activity including education, driver training, publicity campaigns, police enforcement, road traffic policing, the court system, the National Health Service and Vehicle engineering. Globally deaths and injuries resulting from road traffic crashes are a major and growing public health problem. The Kenyan government appreciates that road traffic injuries are a major public health problem amenable to prevention. Road Traffic accident is an unplanned occurrence of auto crash that may result in injuries, loss of lives and properties (Kual et al., 2005).

Road Traffic accidents are having a worsening effect on our society and economy. Road Traffic accidents claim the largest toll of human life and tend to be the most serious problem all over the world. Every year, according to the statistics, 1.2 million people are known to die in road accidents worldwide. Millions of others sustain injuries, with some suffering permanent disabilities. No country is spared this toll in lives and suffering, which strikes the young particularly. Enormous human potential is being destroyed, with also grave social and economic consequences. Road safety is thus a major public health issue throughout the world (World Bank, 2007a).

According to World Bank, 2007a, Road transport system is the most important mode of transportation in Kenya and indeed in many developing countries. This is because roads connect Countries, towns, cities and villages. Road transport plays a significant role in the Kenyan economy encompassing 80% of the .land transport demand. As a result of steady economic growth over the last decade, traffic on the national highways has grown by 6 to 7.5% per year.

Most inter-regional transport is still dominated by Kenyan transport companies. Public transport services are available in all areas of the country. In Kenya's public transport, the most significant transformation in recent times was the introduction of Government reforms in 2003. Key changes included: fitting of speed governors in all PSV's and commercial vehicles whose weight limit should not exceed the 3,048 kilograms; speed limit of 80 kilometres per hour; fitting of seat belts on all vehicles; employment of drivers and conductors on permanent basis; indication of route details and painting of a yellow band on Matatus for purposes of easy identification; re-testing of drivers after every two years; and approval of all driver's identification by the police and also ban on night travelling (Ministry of Transport and Communication [MOTC], 2004). The measures streamlined the industry but there is a compelling need to ascertain whether the situation is improving or deteriorating.

1.1 The Public Road Transport Industry in Kenya

In Kenya the Public road transport accounts for about 45% of the bulk goods and passenger transport services (Economic Review, 1997). This may be seen to as a result of the convenience this transport mode of service renders to its users. However, this service has its adverse share to the economy of the country, as a result of the high costs of road traffic accidents.

In Kenya, Matatu vehicles dominate the public Road Transport in Kenya The term Matatu is derived from a local Kikuyu vernacular. Over time, the Matatu industry has grown rapidly and by 2003 and Asingo, 2004, notes that the number of Matatus operating in both urban and rural areas was estimated at 40,000 They provide employment to nearly 250,000 persons and generated vast revenue for the Government in the form of charges for licenses, duty, VAT and other taxes. In addition, the industry plays a leading role in transportation of both persons and goods in both rural and urban areas.

In 2003, the newly by then formed Government of the National Alliance Rainbow Coalition took up the road safety challenge. It was focusing on specific measures to curtail the prevalent disregard of traffic regulations and mandating speed limiters in public service vehicles. Along with these measures the Government also launched a six-month Road Safety Campaign and declared war on corruption, which contributes directly and indirectly to the country's unacceptably high levels of road traffic accidents (World Bank, 2007a).

It's Unfortunate, the industry's vast growth has been accompanied by increasing road traffic accidents that have threatened the safety of Kenyan travellers. The causes of accidents include reckless driving, non-roadworthy vehicles and the poor conditions of the roads. The Ministry of Transport and Communications in October 2003 listed Legal Notice No. 161 that sought to regulate the Public Service Vehicle (PSV) sub-sector. The objectives of the Legal Notice 5 were to: reduce accidents caused by over speeding; enhance the safety of commuters; ensure responsibility, accountability and competency of drivers, conductors; eliminate illegal drivers, conductors and criminals that had infiltrated the industry; facilitate identification of vehicles and restrict their operation to authorized routes (MOTC, Transformation of Road Transport Report, 2004).

1.2 Reforms in the Public Transport Sector

Kenya loses nearly 3,000 people a year, who die as a result of road crashes According to report on statistical indicators of Public transport performance in Africa, 2010. Nearly ten times that number of people is injured annually on the roads. It is a heavy cost to them, their families, friends, colleagues and the economy. There are many factors behind road traffic crashes, but human error is the greatest, with over 85% of crashes caused by errors, such as speeding, dangerous overtaking, driving whilst drunk and poor use of the road. The government is committed to reducing the carnage on Kenya's roads.

In late 2003, the Ministry of Transport introduced new regulations to bring discipline to the public transport sector, including regulations on vehicle carrying capacity, seat belt use, speed governors and driver certification. In 2004, there was a remarkable reduction in road traffic crashes, fatalities and injuries, with fatalities falling 20% to 2,264. Since then the road transport sector has experienced many challenges requiring urgent remedy. In order to ensure this does not revert to the pre-2003 situation, the government has been seeking to revamp efforts to improve safety on Kenyan roads in a structured and coordinated manner (Ministry of Transport, 2003).

Together with other key stakeholders in Government, the transport sector and civil society, the Ministry of Transport developed a comprehensive five-year National Road Safety Action Plan and reconstituted the National Road Safety Council as the national body responsible for coordinating road safety efforts. This plan covered many aspects, from improving the road safety of children, to raising vehicle standards and drivers' skills, especially in the public transport sector, to addressing the safety needs of non-motorised transport, including provision of infrastructure and enhancing national emergency capacity to deal with victims of road crashes. There are very many aspects related to road safety with many actors involved, hence the need for effective coordination (Ministry of Transport, 2003).

The government plays a major role in developing the regulatory and institutional framework for road safety and appropriate infrastructure for road users. The police as law enforcers play a key role but, most of all, it is the people's attitude and behaviour on the road that need to change. There is a need for more public awareness and education to persuade citizens that it is in each individual's interest and in our collective interest to obey the traffic rules in order to reduce the deaths and injuries on Kenya's roads (Ministry of Transport, 2003).

1.3 The Concept of Strategy

Many different organizations will respond differently to the changes in the environment. Strategy concerns itself with what an organization is doing in order to gain a sustainable competitive advantage (Porter, 1980). The principal concern of an organization strategy is identifying the business areas in which an organization should participate in order to maximize its long run profitability. Business strategy is essentially about two questions: what kind of business is the firm in? And, given this choice, how do firms compete? Strategic management is concerned with how firms generate and sustain competitive advantage in order to generate superior profit. In developing strategy, firms undertake three sets of activities: strategic analysis, strategic choice and strategic implementation. Typically, businesses are reported to assess their strategic position by: scanning the environment for potential market opportunities and threats then evaluating their strategic capability and, assessing the enablers and constraints of strategy. Firms differ in how they undertake these activities. In large enterprises, strategic analysis, choice and implementation are often distinct activities, carried out by different people, whereas in small firms, a single person might perform all three, often at the same time (Curran 1996; O'Gorman 2006).

Johnson and Scholes (1999) view strategy as the direction and scope of an organization over the long term, which achieves advantage for the organization through its configuration of resources within a changing environment, to meet the needs of markets and fulfill stakeholders' expectations. Goldsmith (1995) points out that strategy comprises actions employed to meet a firm's long-term objectives. Pearce and Robison (2000) have recommended three critical ingredients for the success of strategy. These are strategy must be consistent with conditions in the competitive environment, it must take advantage of existing and emerging opportunities and minimize the impact of major threats, and strategy must place realistic requirement on the firm's resources.

Strategy, according to Hill and Jones (2001) is an action that a company takes to attain one or more of its goals. More precisely, it is the action that an organization takes to attain superior performance. Strategy is the pattern of organizational moves and managerial approaches used to achieve organizational objectives and to pursue the organization's mission (Thompson and Strickland, 1993). Andrews (1971) in a more elaborative version, recognized strategy as the pattern of major objectives, purposes of goals, stated in such a way as to define what business the company is in or is to be in, and the kind of company it is to be. Johnson and Scholes (1990) view strategic responses as strategic fit and stretch. The basis of this argument is that strategy is the matching of the resources and activities of an organization to the environment in which it operates. Strategic fit is when an organization develops strategy by identifying opportunities in the business environment and adapting resources and competencies so as to take advantage. This calls for the organization to position itself to meet identified market needs-strategic fit. Stretch is the leverage of the resources and competitive advantage and/or yield new opportunities. This is achieved through differentiation based on the competencies suited to or creating market needs.

1.4 The social and economic costs of road traffic injuries

Everyone killed, injured or disabled by a road traffic crash has a network of others, including family and friends, who are deeply affected. Globally, millions of people are coping with the death or disability of family members from road traffic injury. It would be impossible to attach a value to each case of human sacrifice and suffering, add up the values and produce a figure that captures the global social cost of road crashes and injuries. The economic cost of road crashes and injuries is estimated to be 1% of gross national product (GNP) in low-income countries, 1.5% in middle-income countries and 2% in high-income countries. The global cost is estimated to be US$ 518 billion per year. Low-income and middle-income countries account for US$ 65 billion, more than they receive in development assistance. Road traffic injuries place a heavy burden, not only on global and national economies but also household finances. Many families are driven deeply into poverty by the loss of breadwinners and the added burden of caring for members disabled by road traffic injuries. By contrast, very little money is invested in preventing road crashes and injuries. (World Bank, 2007a).

1.5 Kenyan situation

Road Traffic accident claims the largest toll of human life and tends to be the most serious problem all over the world (Kual et al., 2005). No day passes in Kenya without one hearing of one major accident or the other and loss of human lives. Kenyan roads have indeed become death traps with their attendant consequences and effects on human lives, merchandise and peoples movement. The situation is so complex that various strategies or approaches are needed and to tackle it hence the desire for this study. Effective transport networks are key components of the investment climate enabling people and goods access to markets and reducing cost of doing business Olaleye (2010). Transport is a major sector of any nation's economy (Hillman, 1992). The significant place it holds reflects the fact that cars are generally seen as the most attractive means of travelling comfortably, quickly, privately and safely. Lorries enable speedy transfer of goods on a door to-door basis and with the minimum of double handling. Odero, Khayesi and Heda (2003) observe that Kenya, with an average of 7 deaths from the 35 crashes that occur each day, has one of the highest road fatality rates in relation to vehicle ownership in the world. They add:

"Nearly 3,000 people are killed on Kenyan roads annually. This translates approximately 68 deaths per 1,000 registered vehicles, which is 30-40 times greater than in highly motorized countries. Road traffic crashes are the third leading cause of death after malaria and HIV/AIDS and present major public health problem in terms of morbidity, disability and associated health care costs. Despite this huge burden, road safety measures in place are ineffective, characterized by crack downs on motor vehicles following a tragic road crash".

In Kenya the Traffic Police collect all accident data for the purpose of legal prosecution and insurance claims. The accident data P41 form filled at the Police Stations are collated and forwarded to the Roads Department, Ministry of Roads and Public Works for further processing and analysis .The Roads Department analyses the information in order to determine:

(i) Number and type of injuries
(ii) Cause of accident
(iii) Classification of black spots (determined based on number of fatalities)

Based on the road accident information, the Roads Department prepares work plans for enhancement of road safety at identified black spots and other dangerous locations on public roads. This data however does not fully address hospital based information. According to the Institution of Highways and Transportation (1997), investigations into road crashes should proceed in five phases - identification of problems that are related to road transport crashes; diagnosis of their causes and situation; selection of treatment; design and implementation of remedy measures; and evaluation of the performance of the selected remedy measures. In addition, the Institution identifies four approaches to road accident response: -Single Site Action, which involves investigating specific sites or short lengths of a road, which are considered as accident black spots; Mass Action which involves the application of a particular type of remedy to locations having common accident factors; Route Action, which involves the use of a particular remedy to a length of road having above average accident rates for that particular class of road; and Area Action which is the aggregate of the remedial measures over an area.

1.6 Statement of the Problem

Road traffic accidents have been recognized as one of those adverse elements which contribute to the suffocation of economic growth in the developing countries, due to the high cost related to them, hence causing social and economic concern. One of the major challenges faced today is the improvement of the quality of service in both urban and rural transportation systems in order to make them efficient and safe. Safe roads are key to protecting our investment in the road network, reducing the cost in the network; reducing the cost of doing business in the Kenyan economy; improving the welfare of households and retaining productive personnel in institutions and enterprises. In this regard, accurate and objective road safety data is key. The importance of safety roads and other means of transport have therefore long been recognized. No day passes in Kenya without one hearing of one major accident or the other and loss of human lives. Kenyan roads have indeed become death traps with their attendant consequences and effects on human lives, merchandise and peoples movement. This calls for serious efforts that should be put, in order to incorporate methods of accurate determination of causes of Road Traffic Accident on our roads. The traffic safety problem in Kenya has obviously become more and more important day by day.

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Survey of literature in Africa shows that various specialists have carried out research on road safety including those of public health, general surgeons and orthopaedic surgeons (Aswoga, 1982). Though the bulk of research has been carried out by public health personnel most are based on police data (Obara, 2009.). The majority of injuries suffered following road traffic crushes are of orthopaedic concern (Odero, 1995). The traditional role of the orthopaedic surgeon in road safety in Kenya as analysed by Mulimba, 2009, which includes; Rescue from the scene of accident ,resuscitation, teaching, treatment of victims, rehabilitation and occasional research.

All have noted that Road traffic accidents as one of those adverse elements which contribute to the suffocation of economic growth in the developing countries, due to the high cost related to them, hence causing social and economic concern. They have discussed about the various strategies that ought to be adopted to bring change in the reduction of the Road Traffic Accident in Kenya and though some have looked at various ways of reacting to it, it's not exhaustive and hence this paper tries to look deeper in the various causes of accident and the response strategies Kenya can adopt in its endeavour to bring Road Traffic Accident to a halt of bare minimum.

1.7 Research Hypotheses

The research hypotheses of the study are:

H1: There is significant association between Road Traffic Accidents, causes of Accidents and Response Strategies.

1.8 Study Objective

Road transport plays a significant role in the Kenyan economy encompassing 80% of the land transport demand. As a result of steady economic growth over the last decade, traffic on the national highways has grown by 6 to 7.5% per year (The World Bank, 2007a). The situation is so complex that various strategies or approaches are needed to tackle it. It is therefore, recommended that strategies be adopted for appropriate intervention approach in order to bring down the carnage to a halt or reduce it to the barest minimum.

Kenya has recently been experiencing an alarming road carnage involving deaths of many innocent people. The study contributes to the general understanding of Causes, implications and Response strategies for Road Traffic Accident Reduction in Kenya and it will provide a detailed examination on how Kenya responds to alarming road carnage involving deaths of many innocent people. Based on the road accident information, the Roads Department who are the policy makers will be able to prepare work plans for enhancement of road safety at identified black spots and other dangerous locations on public roads also persuade policy-makers and decision- makers of the necessity to address injuries in general as a major issue, and of the importance of adopting improved approaches to road traffic safety. This study attempts to contribute to the body of knowledge on road safety.

Prevention and appropriate management of road traffic injuries must include emphasis on research on road traffic injuries and outcomes, translating effective science-based information into policies and practices that protect pedestrians, cyclists and the occupants of vehicles and finally promoting capacity building in all these areas, particularly in the gathering of information and in research. The recommendations given if considered are going to benefit the public at large on prevention of road accidents. The data can also be utilised as baseline data in future related researches.

This study will try to understand the human factors in influencing road Traffic accident Kenya because researcher wants to give some awareness to the road users, traffic police, and government. This study helps Kenyan road users to be more careful and prepare, either physically or mentally while using the roads. Kenyan roads consumers can provide precautions to avoid themselves from getting involved in road Traffic Accident. Traffic police also can put more focus on these roads and increase their patrolling. It will guide the Government to make a decision either to increase the awareness campaign to the road users. So that, the road users, traffic police, and government can gather to do some improvements to reduce road accidents and to find the best way to overcome the road accidents problem at road in Kenya.

1.9 General Objective.

The general objective is to determine the relationship between Causes, and Response strategies for Road Traffic Accident Reduction in Kenya.
More specifically, the study will be geared to attain the following objectives:

1. To examine the general trends of road accidents in Kenya
2. To evaluate the interrelationships between road accident victim categories in Kenya
3. To examine the specific trends of road accidents according to the different categories of victims
4. To evaluate the response strategies adopted over the past 7 years and estimate the impact it had on road Traffic accidents
5. To test the hypothesis that the mean difference are the same for persons killed, serious and slight injuries for the 16+ years old and that for under 16 years old groups.

Literature Review

2.1 Introduction

In October 2003, Kenya's Minister for Transport and Communications issued Legal Notice No. 161 that sought to regulate the Public Service Vehicle sub-sector. The objectives of the Legal Notice were to: reduce accidents caused by over speeding; enhance safety of commuters; ensure responsibility, accountability and competence of drivers and conductors; eliminate illegal drivers, conductors and criminals that had infiltrated the industry; and facilitate identification of vehicles and restrict their operation to authorized routes (MOTC, Transformation of Road Transport Report, 2004).

Gachuki, (2004) observes that its provisions were not new since the Traffic Act 403 section 42 (1) and (3) of 1975 specified speed limits for PSV vehicles. He observes further that it has always been mandatory for all motor vehicles to fit seat belts for the driver and front passenger seats. Similarly, Act No.10 of 1984 set out rules for drivers and conductors. He concludes that whereas the rules exist, a main weakness has been lack of their enforcement by the government. Secondly, Gachuki noted further that the rules were discriminatory in so far as they targeted only Matatus. He argued that the rules should be applied to all vehicles including private ones. The reason for his argument was that whereas Matatus caused about 19% of the accidents on Kenyan roads, private vehicles caused 25% of the accidents. He emphasized the need for a national road safety policy that applies to all road users without discrimination.

2.2 Causes of Road Traffic Accidents

Ansari et. al., 2000 noted that causes of Road traffic accidents in Saudi Arabia could be divided into: general and specific causes. General causes:1. A large increase in the number of vehicles and expansion of road networks within and between cities. 2. Large national development projects which require the development of supporting transport systems. 3. Increased number of expatriates from different countries with different habits and culture who are unfamiliar with local driving conditions and requirements.

Specific causes: Most accidents occurred as a result of driver error. 2. Over 50% of the traffic accidents are due to excess speed and violation of signals at intersections 3. Road safety and vehicle condition contribute to accidents, particularly those on open roads. Therefore errors and negligence of drivers contribute significantly to traffic accidents throughout Saudi Arabia. Analysis of the spinal cord injury patients admitted to Riyadh Armed Forces Hospital's Spinal Unit showed 79.2% of the patients having been involved in a road accident compared to 47.7% in the USA and 36% in the UK.

2.2 Theoretical Framework

According to Asingo.P.(2007). Transport network should be understood using an integrated systems approach with structural-functional linkages as part of the larger system. The sector is important for economic development, due to its forward and backward linkages with all sectors of the economy. In both urban and rural areas, transport facilitates access to places, economic sectors and related services, including agricultural inputs. At a sub system level, road transport is viewed as a super-structure supported by two functional pillars, namely road infrastructure and road transportation. The two pillars have a common objective of promoting safe and efficient road transport. Each of them is built on some institutional foundation. The pillars should be strong, with adequate structural and functional linkages between them. The efficiency and safety of road transport depends on the strength of its supportive functional pillars, which in turn depend on the strength of their institutional foundations. The strength of each of the institutional foundations also depends on the extent to which they embrace stakeholder involvement and participation in their activities.

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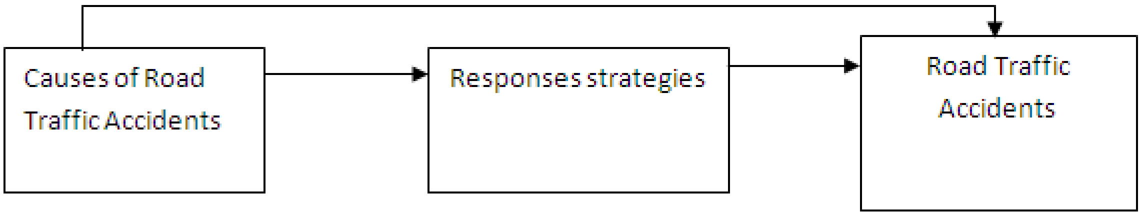
2.3 A conceptual road safety framework

A conceptual framework or model is an abstraction or simplification of reality to help us better understand real world systems, facilitate communication and integrate knowledge across disciplines (Heemskerk et al. 2003, Ford 2009). According with systems theory, i.e. open systems are viewed as interrelated components that are kept in a state of dynamic equilibrium by feedback loops (Leveson 2004). These goals are best served by models with a limited number of factors, such as the Van Wee (2009) model and three traffic safety pillars (Othman et al. 2009) models.



2.4 Road Traffic Accidents Response Strategies

Christie N, et al., 2010 notes that effective preventive strategies exist and need to be applied through multi-sectoral approaches. Many Road Traffic Accidents are preventable and the following proposed strategies can reduce reduce road deaths and serious injuries by at least 33% by 2020. A wide variety of interventions have been implemented both in the UK and elsewhere to prevent or reduce the occurrence of accidents on the road and the severity of injuries sustained which includes:

Adapting the environment: Environmental changes such as implementing area-wide traffic calming measures (e.g. speed humps, 20mph zones and speed cameras), marked pathways for cyclists, and school crossing patrols are effective in reducing road traffic accidents (RTAs) and associated injuries. Adapting the environment Changes to the road environment to reduce traffic volumes and speeds, separate cyclists from other vehicles and improve safety for pedestrians can have a positive impact on levels of RTAs and injuries. The diverse environmental and social characteristics seen between area types (e.g. urban, suburban and rural areas) mean that different locations often require different solutions. Area-wide traffic calming measures (e.g. speed humps, narrowing roads, 20mph zones or road closures) have been found to reduce traffic speeds and injuries, particularly among children. (Jones SJ et al., 2005) Research exploring the impact of environmental changes tends to focus on urban areas and there are far fewer studies investigating environmental changes in rural locations. However, rural initiatives have included (Christie N, et al., 2010).

• By-passes that divert traffic out of towns and villages;
• Improving rural routes for walkers and cyclists;
• Reviewing and reducing traffic speeds on country lanes;
• Reducing speeds at problematic junctions or locations
(e.g. through the use of vehicle activated signs or rough road surfaces);
• Removing road markings (e.g. central white lines) from narrow roads;
• Designating specific country lanes as “quiet roads”, which are adapted to make them more suitable for walking, cycling and horse riding (e.g. reducing vehicle speeds, restricting access and narrowing roads). Other evaluated environmental measures to reduce RTAs include:

The use of red light cameras (these identify vehicles crossing a junction after a traffic light has turned red). There is some evidence that they can reduce right-angled collisions, but rear-end collisions have been found to increase, suggesting they may not be a successful safety measure (Erke A.Red, 2009).
• **Marked pathways for cyclists on roads.** Clearly marked lanes for cyclists on the road can reduce injury rates when compared to unmarked roads
• **The use of school crossing patrols.** In the UK, an evaluation of their use in the late 1980s suggested that they can reduce the number of accidents occurring to child pedestrians at, or near, crossing sites.
Safe routes to school initiatives. These combine different measures to create safer routes to school for children, including: better pavements; traffic calming measures; safe crossings for pedestrians and cyclists; traffic
Safety education and skills training: There is some evidence that injuries from RTAs can be reduced through education and promotional interventions that encourage the use of safety equipment (often including the

provision of discounted or free safety equipment). Less is known about the impacts of: safety education programmes for child pedestrians; driver education programmes; or road safety media campaigns, on injuries. However, these interventions can improve knowledge and safety behaviours.

Promoting the use of safety equipment

The use of safety equipment to prevent injuries from RTAs Safety equipment has an important role to play in preventing RTAs and reducing the likelihood of injury in the event of an accident. It is well known that the use of helmets for motorcyclists (Lui BC et al, 2008), and seatbelts and child car seats (booster seats) for vehicle drivers and passengers, reduce the risks of road traffic injury and fatality (Evans L.,1986). For cyclists, wearing a helmet is generally regarded as beneficial. Data from case-control studies suggests that cycle helmet use can reduce head, brain and severe brain injury by between 63% and 88% (Thompson DC et al, 2006).

A range of educational and promotional methods have been used to encourage the use of safety equipment, often with the provision of free or discounted equipment. These have included: information and lessons targeting parents and/or children; media campaigns highlighting the importance of their use; and health promotion counselling by clinicians. In general, these types of programmes have been successful in increasing the use of safety equipment (e.g. cycle helmet use among children and use of booster seats (Ehiri JE et al.,2006)

Zaza S et al(2001) notes that there is less research exploring impacts on injury. However, some evaluations have reported encouraging findings. For instance: , true case scenarios of Road traffic accidents A review of evidence for prevention injured children, demonstrations of helmet protection and information about how to wear a helmet properly. Helmets were offered to children at a low cost. Compared to a control group, self-reported helmet use significantly increased among those targeted after a five-year period from 11% to 31%. This was accompanied by a decrease in the rate of accident and emergency (A&E) attendances for cycle injuries and head injuries among children .

Safety education programmes for pedestrians

Education programmes have been used to increase an individual's ability to cope with traffic environments and so reduce pedestrian injuries. Education courses are usually targeted at children and can include items such as: how to cross a road; concepts of speed; and traffic knowledge. They have been implemented in a variety of settings (home, school or traffic environments) and have been targeted either directly at children or at children with parents or teachers.

Safety education programmes can increase safety knowledge and skills or behaviours among children (Duperrex O. et al.,2002)

Driver training / education programmes

Driver education programmes aim to increase the safety behaviours of drivers and reduce driver errors. Programmes may be provided one-to-one, within a group, or in the form of written materials (e.g. an information manual). They can be targeted at specialist groups such as those with a higher risk of accidents (e.g. those experiencing high numbers of crashes or offences), older people or novice drivers. They may also be offered to the general driving population in the form of advanced driving lessons The national driver offender retraining scheme.

II. Media education campaigns

In the UK, media education campaigns have been used to increase knowledge, and change attitudes towards, a range of road safety behaviours using television, radio, and printed materials such as newspapers, posters and magazines. Other campaigns have warned of the dangers and implications of drunk driving, drug driving, driving when tired and using a mobile phone while driving (Scottish Executive, 2010). Similar campaigns have been run in Scotland through the Scottish Executive (e.g. drink and drug driving campaigns (Scottish Executive, 2010). Although the impact of campaigns on behaviour and road traffic injuries is difficult to measure, some positive results have been reported

Addressing drink driving: Bar server training programmes can improve server behaviours (e.g. refusing service to intoxicated patrons) and reduce customer intoxication levels when there is strong support from management. There is some evidence that they can also reduce night time RTAs. The Kenya Law (Section 44 and Section 45) requires that a motor vehicle operator blood alcohol content (BAC) to be about 0.34. According to the new regulations, those found drunk while driving risk a fine of up to Sh100, 000 or a jail term of one year or both. At the same time the Mututho Law (Alcoholic Drinks Control Act, 2010) restricts drinking hours from 5 pm to midnight on weekdays and 2 pm to midnight on weekends and public holidays. In the mid-2000s the government gazetted the use of the alco-blow. The Breathalyzer where were last used in and around Nairobi before they were taken off the road in January 2006 after motorists complained that it was a violation of their constitutional rights. Concern was raised about their proper usage owing to complaints of bribery. There were claims of the alco-blow being a cash cow for the police in roadblocks.

Multi-component interventions: Comprehensive programmes that combine strategies such as education and traffic calming measures can reduce the incidence of child pedestrian injury, particularly when a wide variety of organisations are involved.

Enforcement of legislation: Speed enforcement detection devices can be effective in reducing RTAs and associated injuries. There is some evidence that increased policing for drunk driving, including selective and random sobriety check points, can have a beneficial effect on road traffic fatalities and crashes.

3.1 Philosophy of the Study

This study employed a positivist philosophical orientation. The positivists tend to assume that a single, objective reality exists independent of what individuals perceive; they share the fundamental belief that the material word of tangible objects does not exist unperceived. They place a high priority on identifying casual linkages between and amongst variables. The positivists views involves:- (a) the observation of real world facts or phenomena,(b) the formulation of explanations for such facts or phenomena using inductive processes, (c) the generation of predictions about real world phenomena using the previously formulated explanations and deductive processes.(d) the attempted verification of these predictions through systematic, controlled experimentation or observation.

3.2 Research Design

In view of the philosophical orientation which was adopted for this study, a cross sectional descriptive survey design was adopted. Cross sectional descriptive design aimed, to describe or define a subject, by creating a profile of Road Traffic Accidents through the collection of data and tabulation of the frequencies on research variables or their interaction as indicated by Cooper and Schindler (2003).

3.3 Data Collection

The information and data for the study was gathered through secondary sources. These sources include Kenya Road Safety Police reports, Ministry of Transport Newspapers, internet, books, the Kenya bureau of Statistics World Bank reports and other relevant sources. Statistics for the years 2007-2013 was also reviewed.

3.4 Data Analysis

Data analysis was conducted using descriptive statistics that includes mean values, standard deviations and frequencies among others. According to Mugenda and Mugenda (1999) descriptive statistics enable meaningful description of a distribution of scores or measurements using a few indices or statistics. The data obtained from secondary sources will be analyzed largely qualitatively, and will be presented in a descriptive manner. Statistical data will be used only to the extent that they demonstrate the magnitude of the problem of road crashes.

III. Data Analysis, Interpretations and Discussions

4.1 Introduction

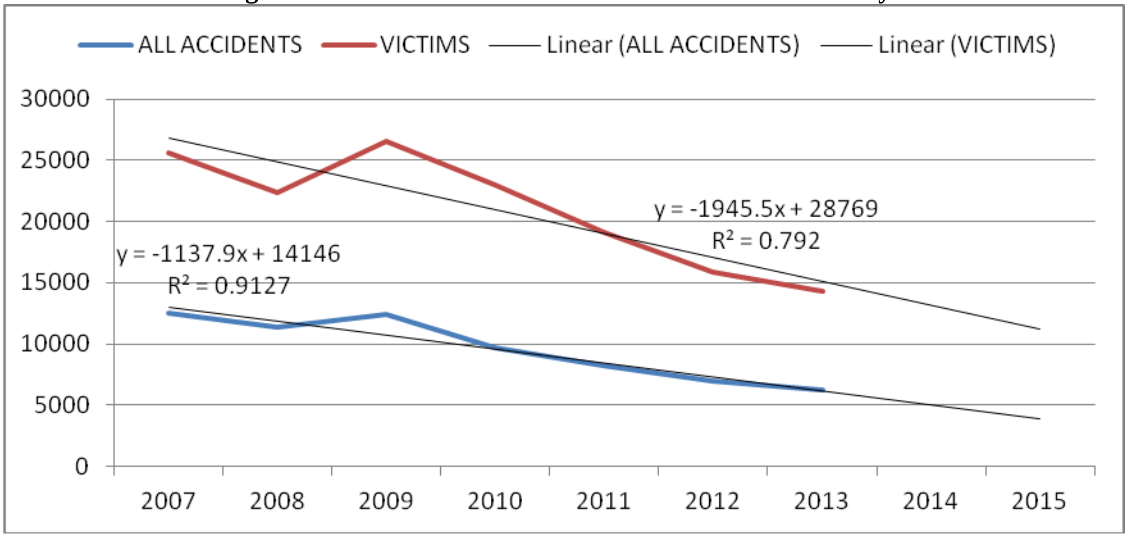
This chapter presents the data analysis results, interpretation and discussion of findings. The data was collected from secondary sources and covers a period of 7 years from 2007 to 2013,with the following being the main statistical tools: regression analysis, correlation analysis and use of charts to present the data.

4.2 General Trends of Accidents in Kenya

4.2.1 Trends of annual total number of accidents and number of victims

The study sought to find out the general trends of accident occurrences in Kenya over the years. Annualized data for the total number of accidents and total number of victims was plotted on a chart and a trend line was fitted to both data sets. The resulting chart was as shown below.

Figure 4.1: Linear fit for General Accident Trends in Kenya



From the figure above, it is quite clear that the number of accidents has generally been falling since 2007. However it can also be observed that there was a major deviation in the downward trend in year 2009 where accident levels peaked at over 12000 for that year.

The following equations represent the trend lines fitted:

For total number of accidents we had $y = -1945.5x + 28769$ with an $R^2 = 0.792$

For total number of victims we had $y = -1137.9x + 14146$ with an $R^2 = 0.9127$

Both trend lines had a goodness of fit (R^2) over 0.7 which is considered the threshold for a good fit. This indicates that the fitted line had a strong fit with the data. Both trends were on the downward side as represented by the negative gradient of the trend linear fit.

Monthly type of Accidents Reported

ANOVA Table below tests difference among groups of accident groups (accident, victims, drivers, motor cyclist, pedal cyclist etc) by different outcomes. The average amount of variation between groups is greater than that within groups in all the outcome variables. The $p < .05$ in all the four outcomes means that there were significant differences between the average number of accident groups and outcomes.

ANOVA

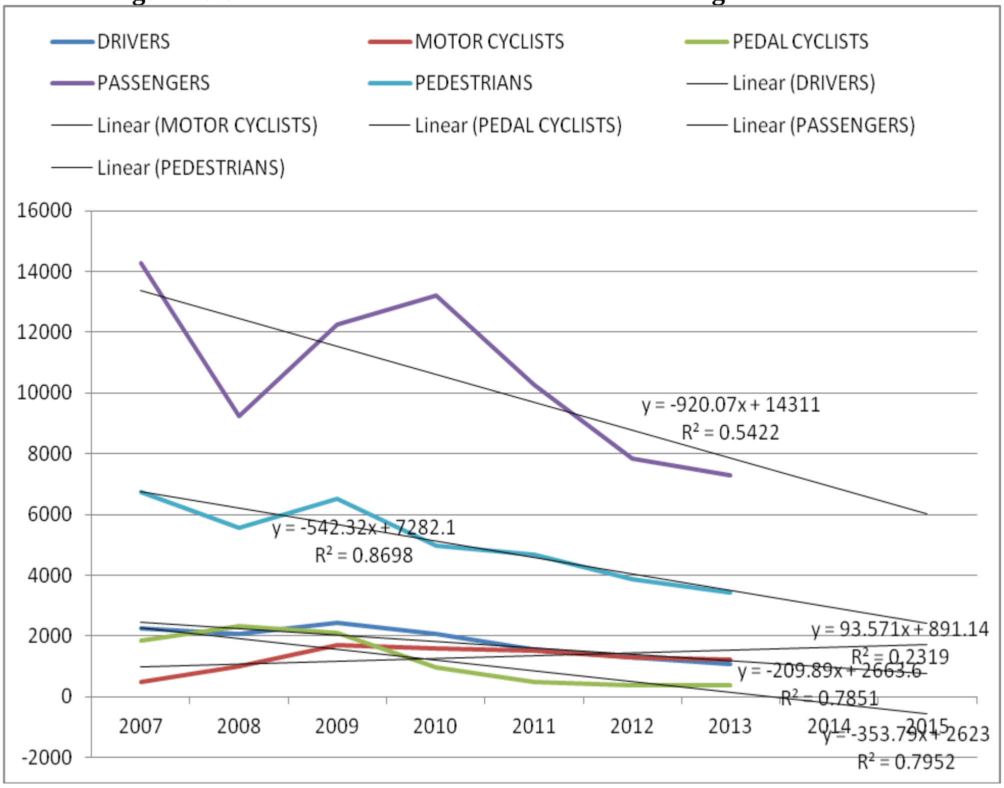
		Sum of Squares	df	Mean Square	F	Sig.
Fatal accidents	Between Groups	818259.156	7	116894.165	403.802	.000
	Within Groups	25474.583	88	289.484		
	Total	843733.740	95			
Serious injury accidents	Between Groups	2424897.167	7	346413.881	172.108	.000
	Within Groups	177123.333	88	2012.765		
	Total	2602020.500	95			
Slight inj.acc	Between Groups	2063797.656	7	294828.237	243.411	.000
	Within Groups	106588.750	88	1211.236		
	Total	2170386.406	95			
Total no accdts	Between Groups	13413582.990	7	1916226.141	384.620	.000
	Within Groups	438427.417	88	4982.130		
	Total	13852010.406	95			

4.2.2 General trends of different categories of victims

The study also sought to determine the general trends for the different categories of victims of road accidents in Kenya. The victims were grouped as follows: drivers, motor cyclists, pedal cyclists, passengers and pedestrians. The chart below shows the data on a line graph with trend lines fitted to each and the corresponding equation.

DOI: 10.9790/487X-17435877

Figure 4.2: General accident trends for different categories of victims



From the table above, except for motor cyclists, all other categories of accident victims have a downward trend. The following equations represent the trend lines fitted as also indicated in the chart above.

Table 4.1: Equations of trend lines for the various categories of victims

	Trend line equation	R-Square
DRIVERS	y = -209.89x + 2663.6	$R^2 = 0.7851$
MOTOR CYCLISTS	y = 93.571x + 891.14	$R^2 = 0.2319$
PEDAL CYCLISTS	y = -353.79x + 2623	$R^2 = 0.7952$
PASSENGERS	y = -920.07x + 14311	$R^2 = 0.5422$
PEDESTRIANS	y = -542.32x + 7282.1	$R^2 = 0.8698$

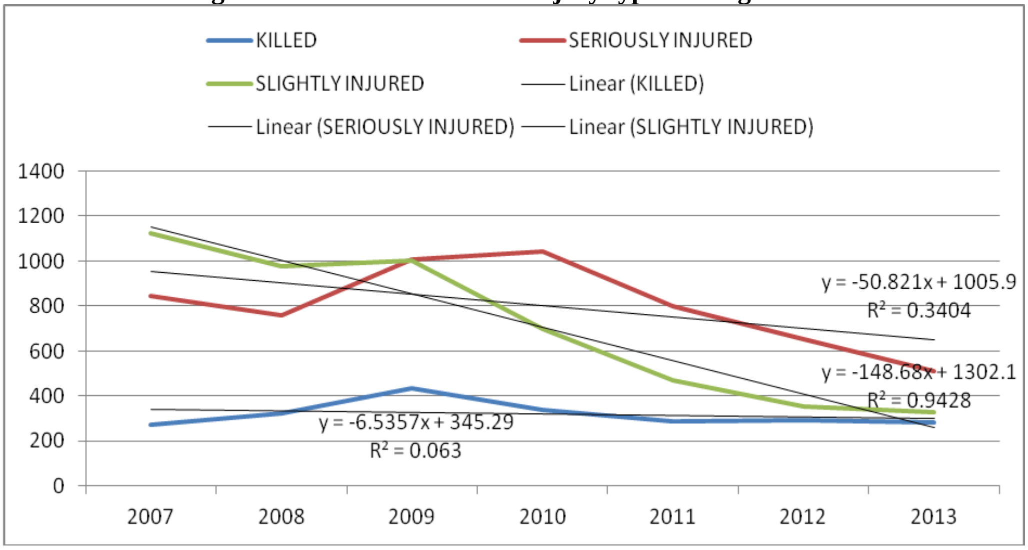
From the table above, the trend lines for drivers ($R^2 = 0.7851$), pedal cyclists ($R^2 = 0.7952$) and pedestrians ($R^2 = 0.8698$) had a very good fit while that of passengers ($R^2 = 0.5422$) had a moderately strong fit and that of motor cyclists ($R^2 = 0.2319$) had a very weak fit.

4.3 Specific trends by category of victim

4.3.1 Drivers

The study sought to establish the specific trends according to nature of injury for drivers. The chart below shows the results.

Figure 4.3: Trend of different injury types among drivers

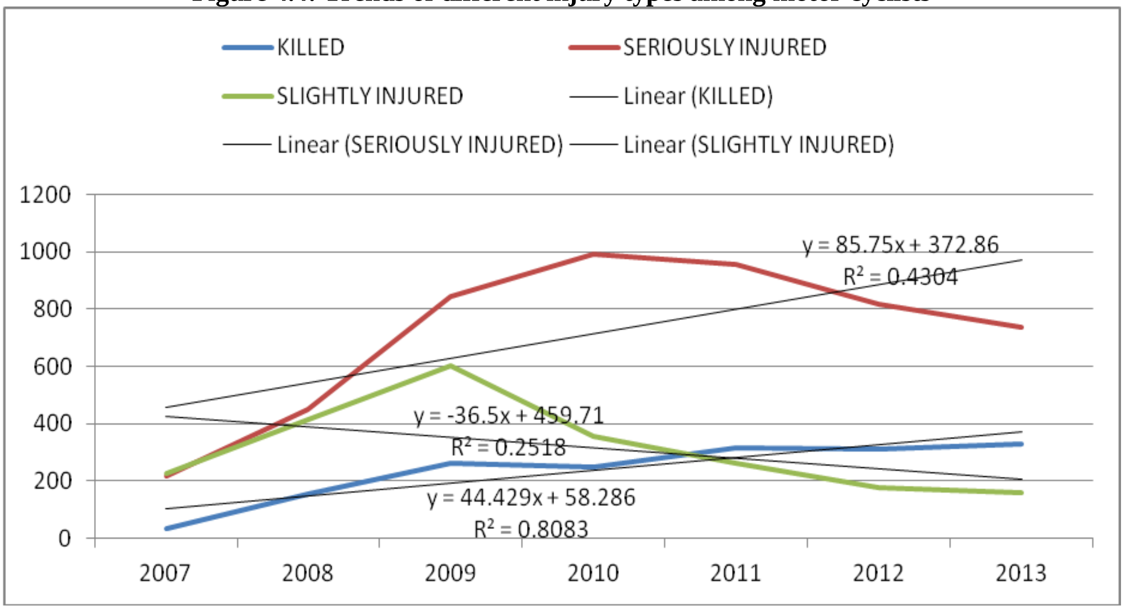


From the chart above, seriously injured generally represents the majority of driver victims followed by slightly injured and those killed. Overall the trend for slightly injured, seriously injured and those killed was downward as shown by the negative gradients of the trend lines. The number of drivers killed has however remained fairly constant over the years as shown by the near zero gradient of -6.5.

4.3.2 Motor Cyclists

The study sought to establish the specific trends according to nature of injury for motor cyclists. The chart below shows the results.

Figure 4.4: Trends of different injury types among motor cyclists

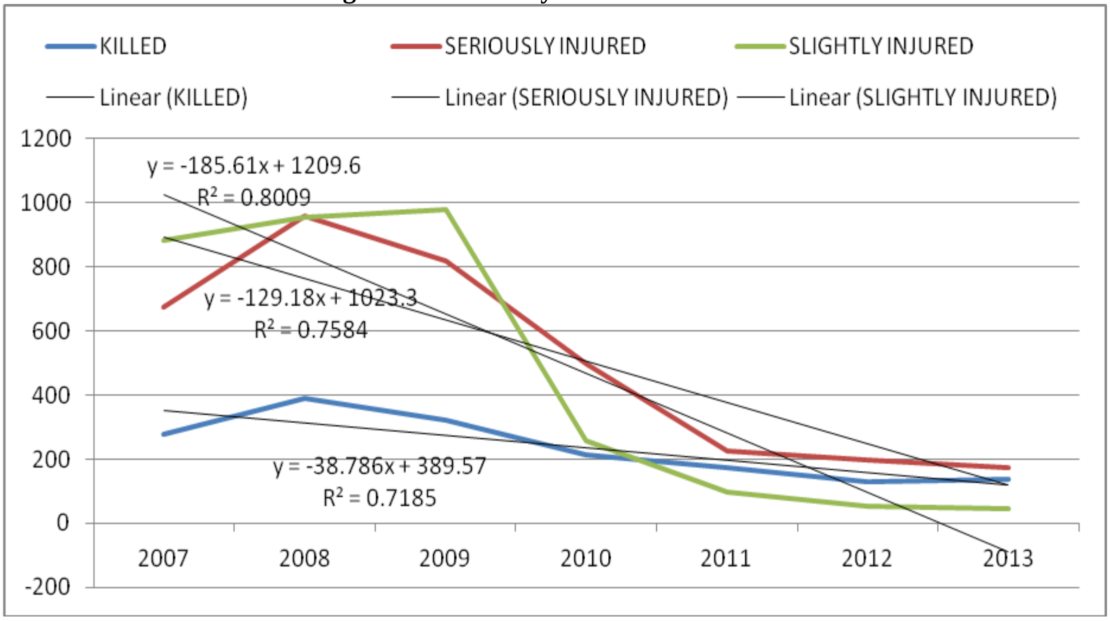


From the chart above, seriously injured generally represents the majority of motor cyclist victims followed by slightly injured and those killed. Overall the trend for seriously injured and those killed was upward as shown by the positive gradients of the trend lines. On the other hand, those slightly injured demonstrated a general downward trend.

4.3.3 Pedal Cyclists

The study sought to establish the specific trends according to nature of injury for pedal cyclists. The chart below shows the results.

Figure 4.5: Pedal Cyclists accident trends

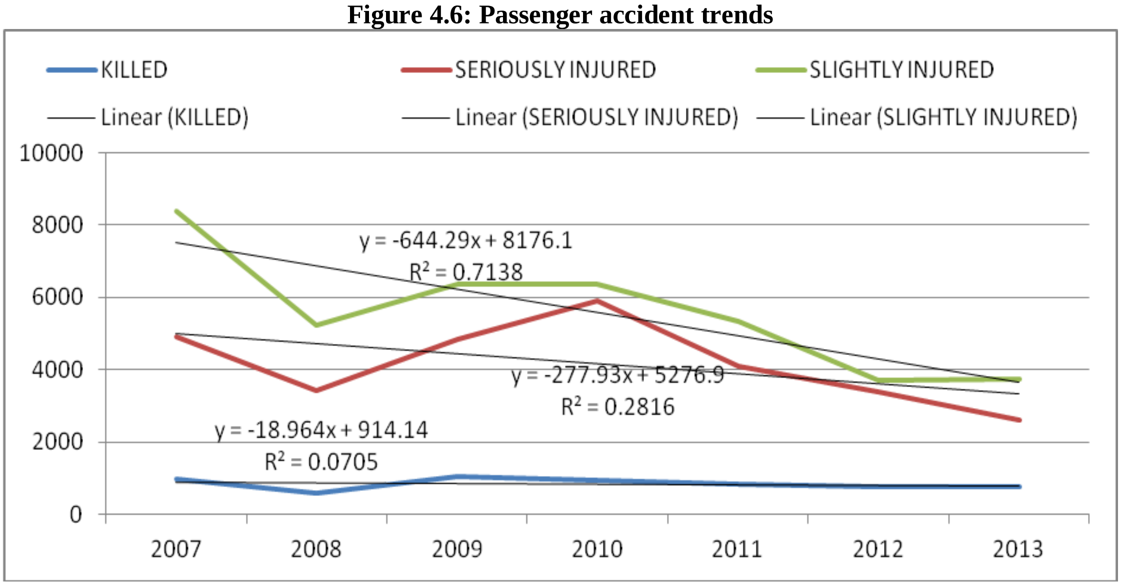


From the chart above, majority of pedal cyclist victims has kept altering between slightly injured, seriously injured and those killed. However, for the last 4 years in the study period, there has been a consistency with those seriously injured being the majority followed by those killed and finally those slightly injured. Overall the trend for slightly injured, seriously injured and those killed was downward as shown by the negative gradients of the trend lines.

4.3.4 Passengers

The study sought to establish the specific trends according to nature of injury for passengers. The chart below shows the results.

Figure 4.6: Passenger accident trends

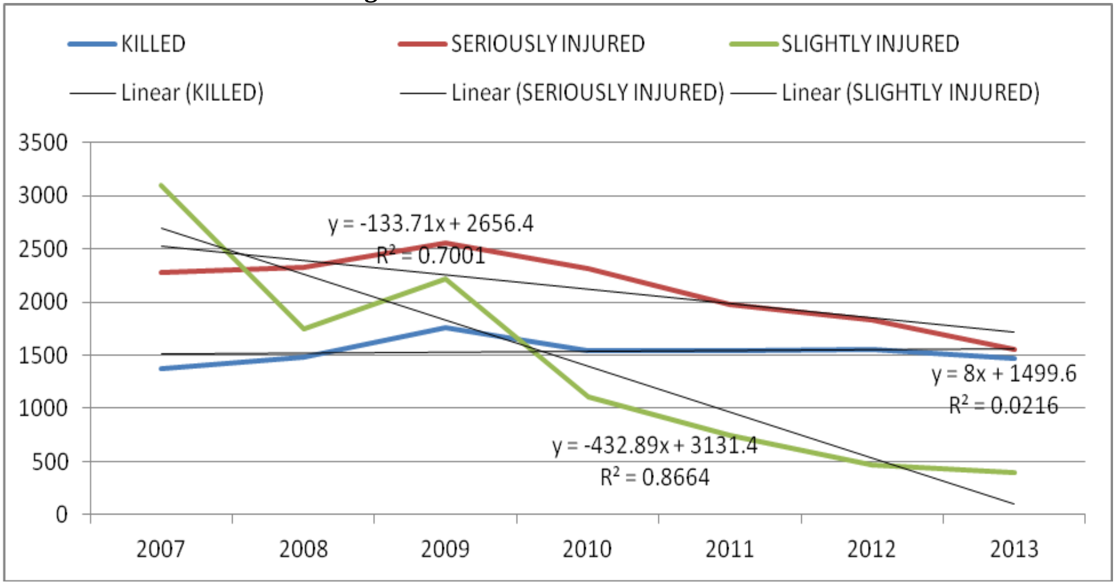


From the chart above, slightly injured generally represents the majority of passenger victims followed by seriously injured and finally those killed. Overall the trend for slightly injured, seriously injured and those killed was downward as shown by the negative gradients of the trend lines. The number of passengers killed has however remained fairly constant over the years as shown by the near zero gradient of -18.9.

4.3.5 Pedestrians

The study sought to establish the specific trends according to nature of injury for pedestrians. The chart below shows the results.

Figure 4.6: Pedestrian accident trends



From the chart above, for the past four years in the study, seriously injured generally represents the majority of pedestrian victims followed by those killed and finally those slightly injured. Overall the trend for slightly injured and seriously injured was downward as shown by the negative gradients of the trend lines. The trend for those killed has shown a small upward trend though the gradient is small indicating near constant figures of those killed over the 7 year period.

4.4 Relationship between different categories of victims and total number of accidents

The study sought to establish the interrelationships between the various categories of accident victims. Correlation analysis was used to test these interrelationships and the results were as shown in the table below.

Table 4.2: Interrelationships between various groups of accident victims

		Drivers	Motor cyclists	Pedal cyclists	Passengers
DRIVERS	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	7			
MOTOR CYCLISTS	Pearson Correlation	-.066	1		
	Sig. (2-tailed)	.888			
	N	7	7		
PEDAL CYCLISTS	Pearson Correlation	.865	-.289	1	
	Sig. (2-tailed)	.012	.529		
	N	7	7	7	
PASSENGERS	Pearson Correlation	.832	-.146	.505	1
	Sig. (2-tailed)	.020	.755	.248	
	N	7	7	7	7
PEDESTRIANS	Pearson Correlation	.943	-.289	.870	.811
	Sig. (2-tailed)	.001	.530	.011	.027
	N	7	7	7	7

From the table above statistically significant correlations were found between drivers and passengers (r = .832, p = .020), drivers and pedestrians (r = .943, p = .001), drivers and pedal cyclists (r = .865, p = .012), pedestrians and pedal cyclists (r = .870, p = .011) and pedestrians and passengers (r = .811, p = .027).

4.4 Correlation between the various types of injuries

The study sought to establish the interrelationships between the various categories of injuries. Correlation analysis was used to test these interrelationships and the results were as shown in the table below.

Table 4.3: Interrelationship of various types of accident injuries

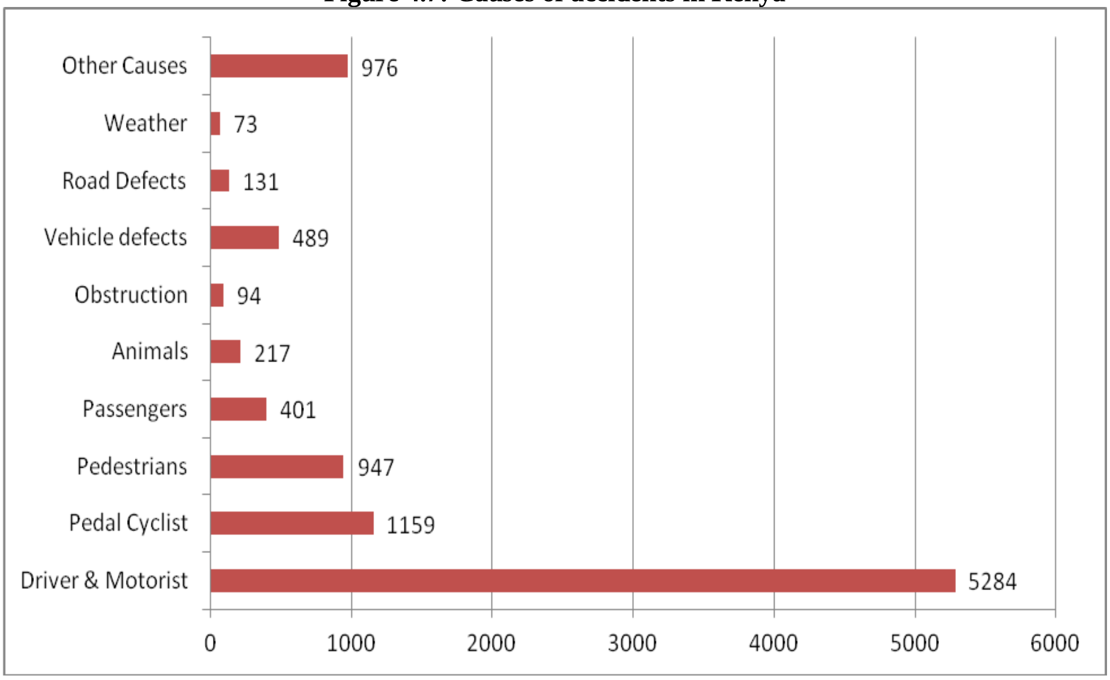
		PERSONS KILLED	SERIOUSLY INJURED	SLIGHTLY INJURED
PERSONS KILLED	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	42		
SERIOUSLY INJURED	Pearson Correlation	.908		
	Sig. (2-tailed)	.000		
	N	42		
SLIGHTLY INJURED	Pearson Correlation	.772	.936	1
	Sig. (2-tailed)	.000	.000	
	N	42	42	42

From the table above, the highest correlation was observed between seriously injured and slightly injured ($r = .936$, $p = .000$) followed by seriously injured and persons killed ($r = .908$, $p = .000$) and finally slightly injured and persons killed ($r = .772$, $p = .000$). All the correlations were found to be statistically significant ($p < .05$). The implication of these results is that the various categories of accident injuries have near equal likelihood of occurring at any given time.

4.5 Causes of accidents in Kenya

The study sought to examine the various causes of accidents in Kenya. The causes of accidents for the year 2013 were as displayed in the chart below.

Figure 4.7: Causes of accidents in Kenya

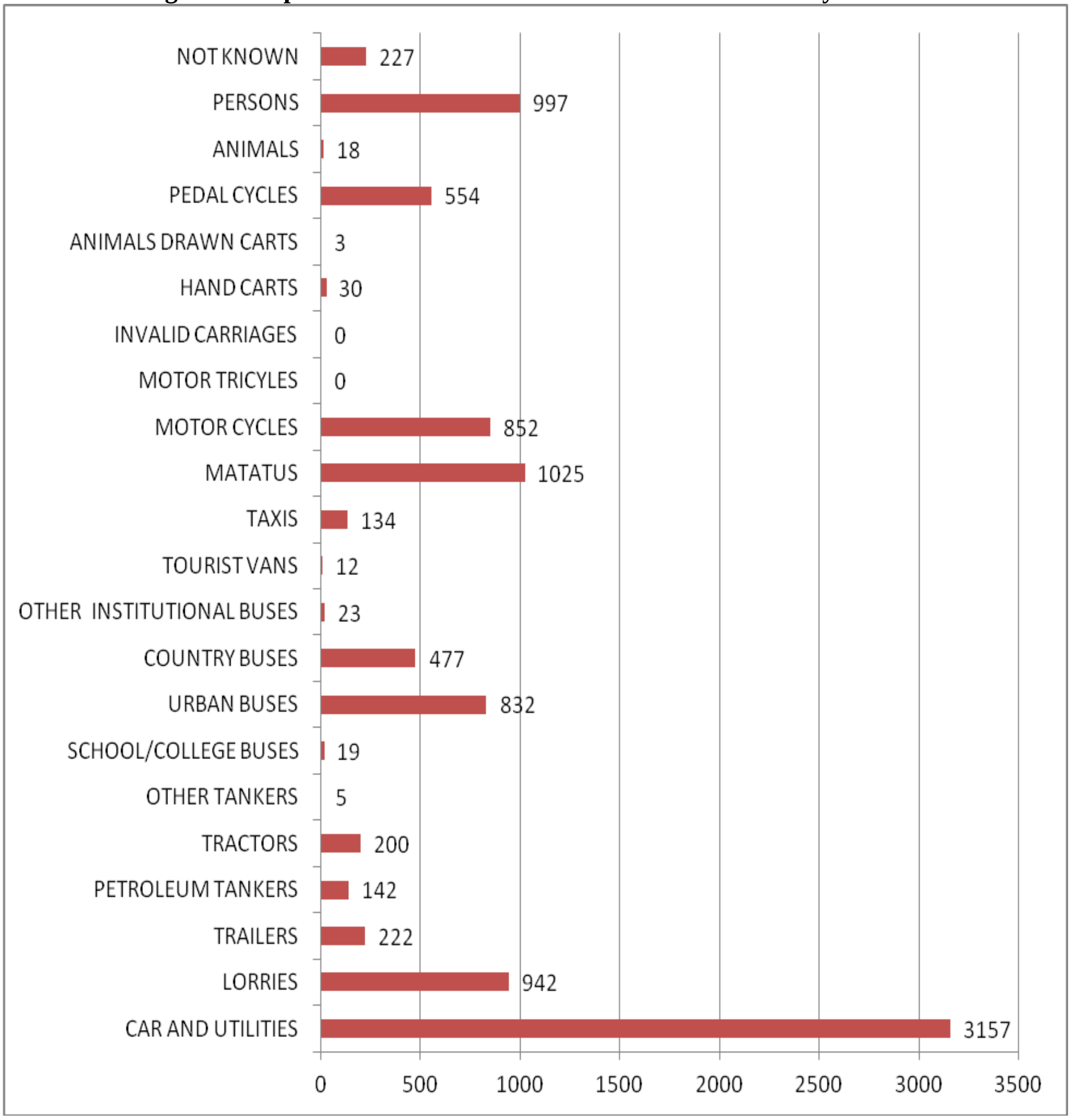


From the figure above, most accidents were attributed to drivers and motorists (5284), followed by pedal cyclists (1159), other causes (976) and pedestrians (947). The implications of these findings is that remedial measures must focus on the main causes of accidents as this will have a high impact in accident reduction.

3.5. Specific vehicles/items causing accidents (Perceived)

The study sought to evaluate the specific types of vehicles/items involved in road accidents over the year 2013. The figure below shows the findings.

Figure 4.8: Specific vehicles/items involved in accidents in the year 2013

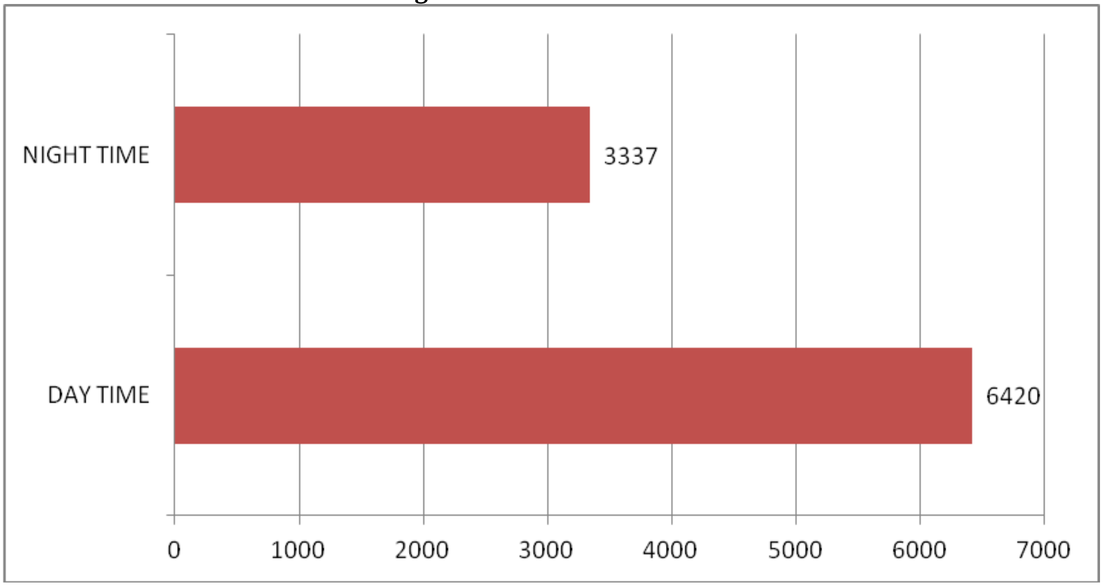


From the chart above, most accidents involved car and utilities (3157), matatus (1025), persons (997), lorries (942), motor cycles (852), urban buses (832) and pedal cyclists (554). These constitute the main vehicles involved in road accidents in the year 2013.

4.5.2 Time of accident

The study sought to establish the times when the accidents took place, that is whether at night or at day time. The figure below shows the results.

Figure 4.9: Time of accident



From the chart above, majority (6420) accidents took place during daytime and nearly half as much (3337) took place at night.

Table below shows the average number of accidents outcomes by the age group.

Table 4.4: Average Difference in Age Group by Accident Type

Ages		N	Mean	Std. Deviation
PERSONS KILLED	Over 16 yrs	8	334.25	179.031
	Under 16 years	8	47.63	28.056
SERIOUSLY INJURED	Over 16 yrs	8	1051.25	600.829
	Under 16 years	8	114.63	80.014
SLIGHTLY INJURED	Over 16 yrs	8	1108.00	687.845
	Under 16 years	8	109.38	74.885

Generally, the mean persons killed, serious and slight injuries for the 16+ years old are higher than for under 16 years old groups.

From the t-test, we reject the null hypothesis (that the mean difference are the same). This means that there was enough evidence to suggest a significant difference between the average accident outcomes of the two age cohorts).

5.1 Introduction

This chapter represents the summary, conclusion and recommendations from the finding. The overall purpose of the study was to identify causes & response strategies of road traffic accidents in Kenya**.** The study established that there are various response strategies that Kenya has adopted due to rising road carnage and has been experimenting various available options.

5.2 Summary of findings

Results indicated that serious effort at addressing road safety must proceed from two related questions. First, what causes road crashes? Secondly, who are the greatest casualties of road crashes? With regard to the first question, available data show that for a long time, motor vehicle drivers have been the greatest cause of road crashes in Kenya, followed by pedestrians, cyclists and passengers respectively this study agrees with a study of road crashes in Leeds, United Kingdom, Carten, et al (1989) who observed that the main problem among drivers which lead to crashes include failure to give way, lack of anticipation, loss of control and improper overtaking. They noted that the underlying reason for all this is basically over speeding, not keeping safe distance, obstruction by parked vehicles, overloading, slippery roads, poor visibility and wrong judgments.

The study established that these problems are equally serious in Kenya. Indeed, Kenyan drivers cause crashes largely because of behavioural and attitudinal problems. These problems include failure of drivers to give-way to fellow drivers and other road users and improper overtaking; lack of anticipation, wrong judgments and loss of control while driving; not keeping safe distance and making unwarranted emergency brakes; careless driving, over speeding and violation of speed limits; influence of toxic substance; Stress and fatigue due to long hours of work in the quest to meet daily collection targets set for them by PSV vehicle owners; failure to detect mechanical defaults in their vehicles; and obstructive parking. Related to this, there is suspicion and mistrust among various categories of drivers. While matatu drivers are viewed as crooks, they regard other drivers as amateurs and always try to show them that they have superior driving skills. Generally, these behavioural and attitudinal problems are more acute among PSV drivers. It has been established that another problem is driver training, examination and certification in Kenya where there is a weak legal framework for driver training and certification.

According to the Kenyan legislation, prospective motor vehicle drivers receives driving training from any registered driving school or from any private individual who holds a driving license for at least the class for which one wants to be trained as a drive, this means that any one holding a driving license can train others how to drive. There is neither set standard curriculum nor set textbooks for drivers. There is also no requirement for proof of good health before one enrols for driving training.

In terms of accident casualties, available data shows that pedestrians and passengers are the two greatest casualties as 1HT (1997) observes, pedestrians are the most vulnerable road users, making over half of the deaths in the urban areas. In Kenya, pedestrians generally cause crashes due to ignorance of road traffic signs and signals, influence of alcohol and other toxic substances, wrong judgments, and general lack of anticipation. Passengers cause a significant percentage of road crashes. First, some passengers do insist on alighting from vehicles at some dangerous places like roundabouts, sharp bends or in the middle of the road. As a result, an on-coming vehicle may crash them, or the vehicle they are alighting from may be hit by another vehicle. Similarly, an on-coming vehicle may ram into another vehicle or swerve off the road as it tries to avoid hitting the alighting passenger or the vehicle the passenger is alighting from.

Passengers also attempt to alight from a moving vehicle, as a result of which they may sustain injuries. Thirdly, some passengers and prospective passengers also induce drivers to violate traffic rules for example, by shunning slow moving vehicles and urging drivers to speed up, or even by waiting and waving for vehicles to stop and carry them in non-bus stops. Finally, some passengers who sit on the co-driver’s seat engage the drivers in distractive talks that make them loose concentration and cause crashes. Notable among the latter category include nagging spouses, drivers' 'long time lost friends' and female passengers.

More crashes occur during daytime than at night. This is probably because there are fewer activities at night than daytime. However, accident risks are as high at night as they are daytime. While there are more road users daytime, problems of visibility are more acute at night.

Government of Kenya through the ministry of Transport and Communications started to address the issue of road safety by the introduction of the Legal Notice No. 161 of October 2003, which amended the Traffic Act Cap 403 of the Laws of Kenya. The Notice provided that every motor vehicle shall be fitted with seatbelts in every sitting position. Driving a motor vehicle without a safety belt is therefore an offence under the Act, which attracts a penalty. It is also an offence for any one including the driver not to put on a safety belt while inside a moving vehicle. The Act prescribes a fine for every person inside a moving vehicle who does not put on a safety belt.

Every Public Service Vehicle owner is required to employ a driver and a conductor on permanent basis and to pay them monthly salaries as opposed to daily wages that they were receiving prior to these regulations. It was hoped that this would prevent vehicle owners from imposing unrealistic daily targets that force the vehicle crew to make many trips and work late into the night to meet. It is this setting of targets that explains the tendency by matatus for example to always be in a hurry, carry excess passengers, and defy established traffic rules in their madness rush for passengers.

Vehicles with tare weight exceeding 3,048 kilograms shall be fitted with a speed governor. The speed governor shall be of the type approved by the minister for transport, and must be adjusted in such a way that at no time can the vehicle fitted with it move at a speed exceeding 80 km/hr. This measure is aimed at ensuring the safety of both the passengers and pedestrians and enabling the drivers to be firmly in control of the vehicle at all times.

The Public Service Vehicles on both sides should be painted with the yellow band, shall be painted a dark colour of sufficient contrast as to allow the continuous yellow band to be visible at the said distance. While at the surface value this requirement might sound aesthetical, it aimed at making public service vehicles clearly distinguishable, and ensures that unauthorized vehicles do not carry passengers as this exposes such passengers to risk of accident.

Public Service Vehicle owners are required to indicate their names and address on the body of the vehicle. In addition, they are required to indicate the registered route applied by the vehicle, licensed passenger carrying capacity, and tare weight. Public Service Vehicle drivers and conductors are required to wear uniforms as well as special identification badges issued by the Registrar of Motor Vehicles. The drivers are supposed to display their photographs where all passengers can see them.

5.3 Conclusion

The objective of this study was to identify causes & response strategies of road traffic accidents in Kenya. There is a need for improved driver training and testing which agrees with Chitere (2004) who established that more often the prospective drivers begin as touts and learn from those who already know how to drive. They then go to driving schools mainly to book driving test. Furthermore, drivers tend to work for long hours, in some cases up to 13 hours a day for seven days a week. They are also paid low wages on daily basis, and operate on daily collection targets set for them by vehicle owners. So the Government has tried to pass the law on this but implementation should be followed.

The measures being taken by the government shows the commitment and determination to address road safety issues. The government has initiated several legal, policy and institutional reforms in her quest to address both road infrastructural problems and transportation issues. The measures being implemented do not seem to have correctly diagnosed the root cause of road crashes in Kenya. While it increasingly becoming evident that human behaviour and attitude significantly contribute to road carnage, neither the past road safety measures or the prescriptions of the Legal Notices adequately address the behaviour and attitude of road users and regulators. Change of behaviour and attitude of road users and regulators has great potential of reducing road crashes. A vehicle can be mechanically sound but unless the users and the regulators observe and respect road transport regulations, the fight against carnage remains a mirage.

In dealing with the behaviour and attitude of road users, experience in Kenya shows that road users are aware of the rules relating to road use, but do not apply them unless there is an enforcement officer within sight. Lack of compliance with legal requirements is a major problem in most developing countries, including Kenya. Unless road users respect and observe traffic rules and regulations, the noble goals and objectives of road safety policies will be difficult to achieve. It is therefore necessary to study what motivates road users to develop such a high propensity to flout regulations and traffic rules.

This study has attempted to contribute to the body of knowledge on road safety. It is hoped that it will inspire and facilitate increased cooperation, innovation and commitment to preventing road traffic crashes in Kenya and around the world. Road traffic crashes are predictable and therefore preventable. In order to combat the problem, though, there is a need for close coordination and collaboration, using a holistic and integrated approach, across many sectors and many disciplines. While there are many interventions that can save lives and limbs, political will and commitment are essential and without them little can be achieved. The time to act is now. Road users everywhere deserve better and safer road travel.

5.4 Recommendations for Policy and Practice

Based on the findings the capacity and competence of the driving schools has also been a major concern. Most driving schools are not properly equipped and staffed to provide effective training. At the same time, driver testing also lacks in rigor and can easily be passed even by a very weak candidate. This is partly because there are very few driving test examiners. There is need to reorganize the training of drivers. Most attention and focus is usually directed towards how the PSV drivers are trained. However, it should be noted that the training of drivers for smaller vehicles is no better. In fact, rarely do trainees leave the driving schools competent to drive on their own. Hence there is need for regularized training and thorough inspection of the driving schools.

Government should also develop and enforce vehicle standards through regular inspection of vehicles; developing training curriculum for drivers, traffic law enforcement agents and other road users and establishing and enforcing regulatory framework and undertaking public awareness.

Investigation and reporting of road crashes needs to be strengthened to ensure accuracy of reports and to transform the reports into inputs to be processed for the purposes of addressing road safety concerns. Currently there is a very weak link between the police who collect accident data and the policy makers who need the data to design appropriate response mechanisms for the problem of road safety.

There is need to understand the volume of traffic deaths, injuries and crashes, but also of which road users are most affected; in which geographic areas the greatest problems are found; what risk factors are contributing; what road safety policies, programmes and specific interventions are in place; what institutional structures are addressing the road traffic injury problem; and what their capacity is. Intermediate outcome measures – such as mean speeds, rates of seat-belt wearing, and rates of helmet wearing – can also be useful and can be obtained through simple surveys.

Involvement of Various stakeholders, including the wider community. Awareness, communication and collaboration are key to establishing and sustaining national road safety efforts. National efforts will be boosted if one or more well-known political leaders can actively champion the cause of road safety for instance using the President or the Vice President.

5.5 Limitations of the Study

During the study a number of limitations were encountered, the researcher was not able to prescribe of how Kenya ought to adapt to curb the accidents because little attention is given to the conditions that make such adaptations possible and influence the occurrence of accidents.

The researcher was not also able to know yet whether particular adjustments like introducing alco-blow or changing the time to travel lay the foundations for improving from Road Traffic Accident Occurrence. The study focused on Kenya, there are specific factors such as size, which may not be universally applicable to all therefore the finding of this research may have some variation.

5.6 Suggestions for Further Studies

This study was only done in Kenya. The study can be conducted in other nations facing may be similar challenges and see whether its applicability is to all.

There was very little analysis elaborating why Kenya choose to adopt any specific response strategy, the conditions enabling or constraining each strategy, or the connections between the response strategy and reduction of Road Traffic Accidents in the short run so, a study can be conducted to elaborate why Kenya choose to adopt certain response strategies and those enabling or constraining of the same.

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FACT SHEET
ROAD SAFETY

- Every 24 seconds, one person dies in a road accident. That's 1.35 million people per year.
- Globally, over 500 children under the age of 18 are killed on the road each day.
- Road traffic injuries are the leading cause of death among young people aged 15 to 29 years.
- More than half of the global road traffic deaths are among pedestrians, cyclists and motorcyclists.
- Boys and men account for 75% of road fatalities.
- Between 20 and 50 million non-fatal injuries yearly are caused by road traffic crashes.
- 93% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have approximately 60% of the world's vehicles. The death rate from road crashes is over 3.5 times higher in low-income countries.
- In addition to human loss and suffering, road traffic accidents cause billions of dollars of associated costs which amounts, in many countries, to 3% of GDP.
- Traffic-related mortality and injury cost the global economy billions each year.

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ROAD SAFETY DATA IN AFRICA:

A proposed minimum set of road safety indicators for data collection, analysis, and reporting

Maria Segui-Gomez
Tawia Addo-Ashong
Veronica I. Raffo
Pieter Venter

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1818 H Street, NW Washington D.C. 20433 USA.

Attribution – Please cite the work as follows: Maria Segui-Gomez, Tawia Addo-Ashong, Veronica I. Raffo, and Pieter Venter. 2021. Road Safety Data in Africa: A Proposed Minimum Set of Road Safety Indicators for Data Collection, Analysis, and Reporting. Washington, DC: SSATP.

Graphic design: Wayne Banks

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Africa Transport Policy Program

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ROAD SAFETY DATA IN AFRICA:

A proposed minimum set of road safety indicators for data collection, analysis, and reporting

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An international partnership supported by:

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Confédération suisse
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Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
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Acknowledgement

This report acknowledges contribution from participants who took part in the second workshop towards the establishment of an African road safety observatory, held in Abuja (Nigeria) in July 2018, and who debated the proposed minimum crash variables to be collected at country level. Mrs. M. Teresa Sanchez-Villegas participated in discussions on the subset of crash data to be shared between countries in the observatory. Acknowledgement also goes to Veronique Feypell (IRTAD), Sudeshna Mitri (WB), Dipan Bose (WB), Sveta Milusheva (WB), and Racheal Ngangwa (IRAP), who provided comments on the document. Final acknowledgment goes to the partnership with the Global Road Safety Facility (GRSF) and financial support from UK Aid and Total Energies Foundation.

Abbreviations

ARSO	African Road Safety Observatory
AU	African Union
EC	European Commission
EU	European Union
FHA	Federal Highway Administration
FIA	Federation Internationale de l'Automobile
GIS	Geographic Information System
GPS	Global Positioning System
IRAP	International Road Assessment Programme
IRTAD	International Traffic Safety Data and Analysis Group
ITF	International Transport Forum
LRS	Linear Referencing System
MAIS	Maximum Abbreviated Injury Scale
OECD	Organisation for Economic Co-operation and Development
OISEVI	Ibero-American Road Safety Observatory
REC	Regional Economic Communities
SDG	Sustainable Development Goal
SPI	Safety Performance Indicators
SSATP	Africa Transport Policy Program
UN	United Nations
UNECA	United Nations Economic Commission for Africa
WB	World Bank
WHO	World Health Organization

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Summary

Road safety in Africa remains a big challenge. Globally, Africa has the highest fatality rate of all the continents, despite having the lowest motorization rate and smallest road infrastructure network.

Through the Global Plan for the Decade of Action (2011-2020), the African Road Safety Action Plan, the African Road Safety Charter, and the targets set out in the Sustainable Development Goals (SDGs), Africa has made strong commitments to improve road safety outcomes on the continent.

However, documents assessing the magnitude of the problem show that there exists a need to address it by implementing effective and efficient interventions, which require determination, professional qualification, and personnel and economic resources.

In order to make informed decisions on effective interventions to mitigate this challenge, a deeper analysis of the road safety-related environment in the region is required. The required data includes, but is not limited to, crash-related data – for example, the location of the most serious crashes, the type of road users most commonly involved in road crashes categorized by type of road environment, or the impact of foreign drivers involved a crash in a particular country.

This document outlines a process that began in 2017 to define a common set of indicators to be collected, analyzed, and monitored by African countries, as part of their efforts to improve road safety in Africa. Some of these indicators will be collected individually at country level and serve country level decision-making. A smaller subset of indicators could be reported in aggregate form to regional or global road safety observatories and inform other decisions. This data-focused effort runs in parallel with the effort led by the Africa Transport Policy Program (SSATP) to establish an African Road Safety Observatory to act as a platform for faster and more homogeneous strengthening of road safety data in the 54 African countries under the African Union (AU).

This report details road safety data systems on the continent and describes the process required to agree on a common set of police-reported, crash-related variables. It is presented in three sections. In the first section, the challenge of and the commitment to address road safety in Africa is set out, together with recommendations to improve road safety data on the continent. The second section documents relevant points to consider when deploying and improving road safety- and crash-related data systems. The third and final section documents the methodology undertaken to produce a list of agreed upon crash-related variables, as well as their values. African country representatives participated in this process, with the expectation that this list will help them to consolidate and aggregate the information they collect, as well as assisting collaboration. It was further expected that data collection would be standardized. The detailed list of these variables (including the ones chosen as the core variables) are presented as Appendix B of this report.

Part A: The rationale for road safety data in Africa

Introduction

According to the Global Status Report on Road Safety released in 2018 by the World Health Organization (WHO), "Road traffic injuries claim more than 1.35 million lives each year and have an enormous impact on health and development."

In Africa, the risk of road traffic death is increasing annually. Statistics from the WHO Africa region show that road traffic fatality estimates increased from 24.1 per 100,000 population in 2010 to 26.6 per 100,000 population in 2016. If action is not taken, road trauma in Africa is expected to worsen further, with fatalities per capita projected to double from 2015 to 2030.

The risk of a road traffic death varies significantly from region to region, and there has been little change in regional road traffic death rates of since 2010. Globally, the highest rates are still found in the African region, while the European region has a rate far below the global average at 9.3 per 100,000 population, relative to the global rate of 17 (WHO 2018).

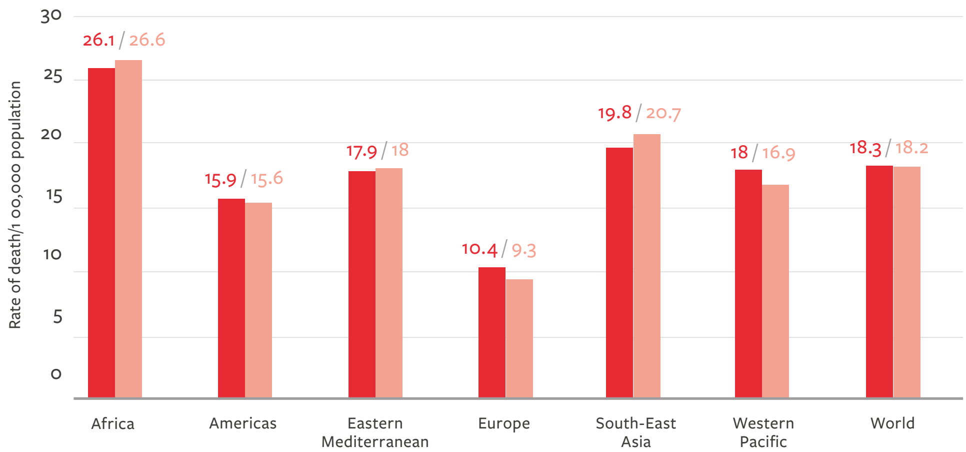


Figure 1. *Rates of road traffic death per 100,000 population by WHO regions: 2013, 2016. Source, WHO 2018*

The Global Status Report on Road Safety 2018 indicates that 53 percent of the road users killed in Africa are vulnerable road users. Of these, 40 percent are pedestrians, four percent are cyclists, and nine percent are people using two- or three-wheelers.

Despite this evidence, most of the existing data collection systems mainly focus on car occupants and produce figures that are substantially different (and in general lower) than figures derived from mathematical models using socioeconomic variables specific to each country. Therefore, this raises the issue of possible underreporting of police-based data sources on the continent.

The United Nations (UN) Global Plan for the Decade of Action for Road Safety 2011-2020 called for action across member states to stabilize and reduce the number of road fatalities and serious injuries. The plan looked to achieve this through better road safety management, safer roads and mobility, safer vehicles, safer road users, and improved post-crash response. Among the suggestions for improving road safety management was the development of data systems to monitor and evaluate outcomes. This highlighted the importance of data systems in identifying priority intervention areas, such as the most vulnerable road users or most common crash interactions, and in evaluating the effectiveness and efficiency of adopted interventions.

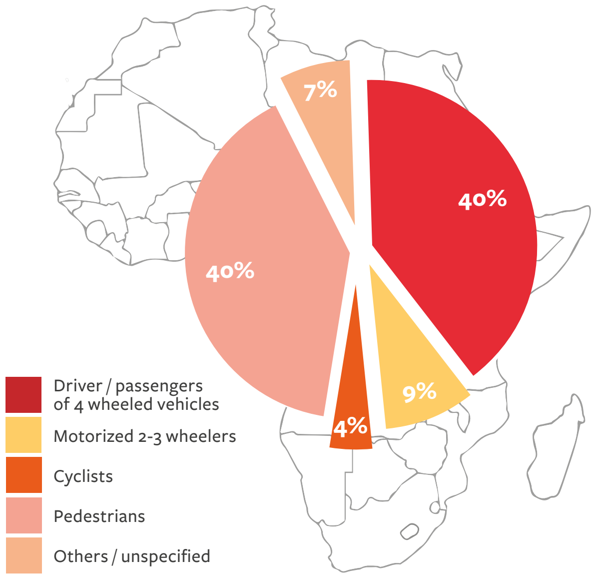


Figure 2. *Distribution of deaths by road user type (WHO Region Africa region selected). Source, WHO 2018*

The WHO status reports on road safety have highlighted the fact that there is a substantial lack of detailed knowledge on the number of road crashes and fatalities occurring in Africa, as well as on the factors that lead to road crashes or their consequences. The 2015 status report estimated that, in 2013, the number of road fatalities occurring in Africa amounted to 31 percent of total world reported road fatalities. Furthermore, it also highlighted that 40 percent or more of African countries have not taken any significant action on:

- Establishing, strengthening, and harmonizing the injury data system for health facilities;
- Engaging local research centers on road safety data management;
- Building capacity for road safety data management;
- Mandatory reporting, using standardized data; or
- Sustainable funding for road safety data management

Fewer than 18 percent of countries monitor important road safety performance indicators, such as seatbelt or helmet use.

In 2014, SSATP acknowledged that Africa's road safety performance has deteriorated to a point where it is becoming a major obstacle to Africa's competitiveness and development. Unfortunately, road safety impacts the most vulnerable road users and the poor (SSATP, 2014).

The UN Economic Commission for Africa (UNECA) found through a review of the implementation of the Africa Road Safety Action Plan that most countries which responded to the review are performing below average, as far as data management is concerned.[1] The chart below, taken from the review, illustrates the self-assessment of the countries' performance with respect to the following parameters:

- Existence of a national database
- Mandatory reporting on crash data
- Analysis and reporting system
- Harmonized data
- Harmonized vehicle and driver registration system
- Data management capacity
- Engagement with local research centers
- Enhanced injury data system
- Enhanced baseline data on road safety.

[1] UNECA, Mid-term review of the Africa Road Safety Action Plan, 2015.

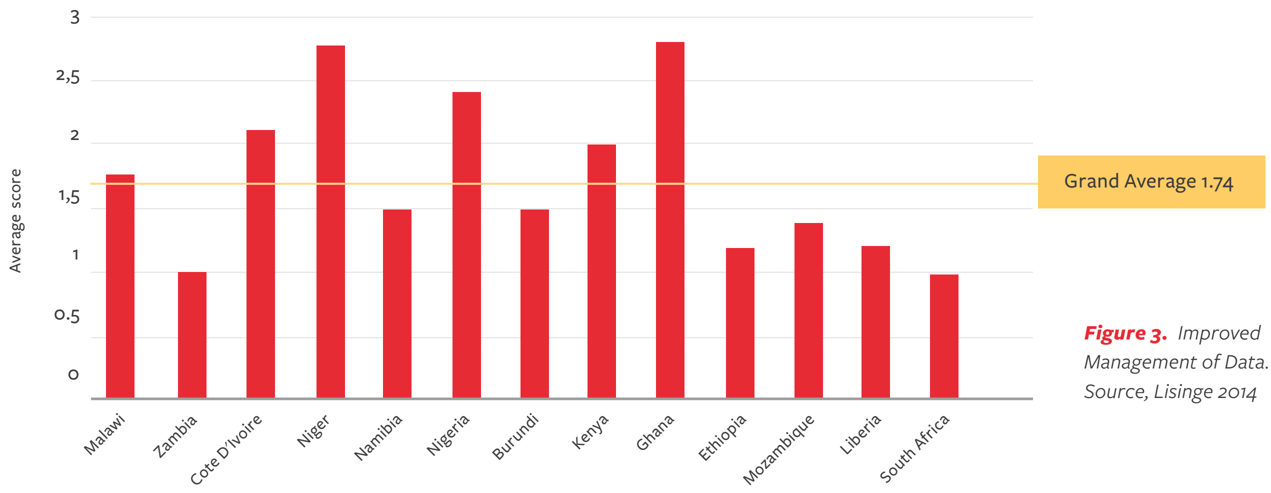


Figure 3. *Improved Management of Data. Source, Lisinge 2014*

Appendix A summarizes the main road safety initiatives on a regional and subregional level that incorporated these road safety data considerations.

The need for road safety data

Road safety data is essential to road safety management. It can be used to identify hazardous locations, diagnose safety problems, understand the types of crashes that are prevalent, assess the effectiveness of interventions, monitor country-level trends, tailor and prioritize prevention efforts, assess progress, and compare the scale of road traffic deaths and injuries relative to deaths and injuries from other causes. Having data to back up the need for action is vital, not only to gain support, but also to advocate for resources and capacity building. The lack of accurate and reliable data hampers progress towards safer road and transportation systems in any country. The availability of data is key to accurately identifying patterns of crashes and targeting those that are likely to yield the most effective results. (WHO 2018; PIARC 2007).

The most important aspect of collecting data relates to its validity. Historically, the most commonly monitored road safety indicator has been the number of crashes with severe outcomes. Fatality counts are the most precise example of this. However, in many countries around the world, the method of determining these statistics is disputed. For instance, according to the WHO Global Road Safety status report from 2018, the total number of road deaths officially reported by all African countries in 2016 amounted to 73,854 – whereas the WHO estimations suggest 291,998 deaths occurred. This is almost a 300 percent difference. And these discrepancies have widened since the WHO report from 2015.

The ability to obtain unbiased data is key to assessing the magnitude of the problem and essential in assisting decision-making for road safety policies. The WHO estimates, which are a model based on the situation in comparable countries, consider other known factors that affect the number of road traffic deaths in that country. This needs to be understood by those using the data, in order to ensure that conclusions drawn from it can be supported as findings, rather than theories.

Underreporting of road traffic data in Africa

The degree to which the statistical output of a country's data system reflects the actual road safety situation is affected by the accuracy of recording and reporting of the data.

Underreporting is a common issue of concern in Africa. Police records are the primary source used to determine the magnitude of road accidents and injuries. However, not all road accidents or injuries are reported to or recorded by the police.

Underreporting of accidents varies according to severity, vehicle type, and casualty age. It is especially frequent in the cases of single-vehicle accidents, pedestrian accidents, and accidents involving bicycles, mopeds, or motorcycles (Safer Africa 2019).

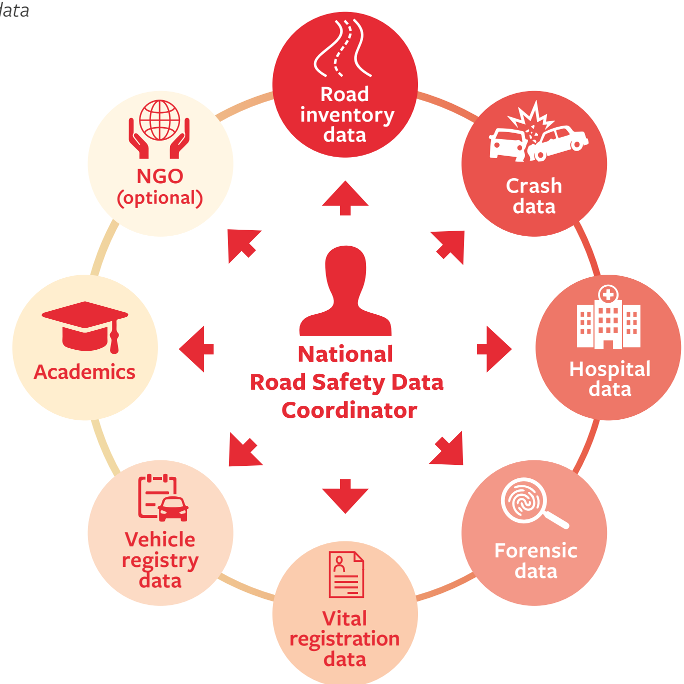
In many countries, resources for the collection of data are in decline, partly due to increasing pressure on law enforcement agencies to address other priorities. This is leading to many countries or law enforcement agencies to consider changing the types of crashes that are reported on – for example, only crashes resulting in fatalities. This could result in a relatively large proportion of crashes – especially those that result in severe injuries and have a substantial impact on quality of life and on the economy – not being reported, particularly in urban areas.

In a study conducted in Ethiopia, researchers compared the country's two main sources of road safety data and found that while police records captured 57.4–60.9 percent of road deaths and 23.5–23.9 percent of injuries, hospital records captured just 31.5–33.4 percent of road deaths and 55.2–56 percent of injuries. Deaths and injuries among females, younger victims, cyclists, motorcyclists, and pedestrians were found to have been particularly underreported by traffic police. The study concluded that neither of the two data systems independently provided accurate coverage of road traffic-related deaths and injuries. Strengthening both systems is necessary to obtain accurate information on road accidents and human causalities.[2]

The type of road safety data to collect, and how and when to collect it, is critical. One of the most important uses of crash data is to identify high-risk locations where crashes have, or are likely, to occur. To do this, the location of a crash is the single most important data item. Without this piece of information, it is not possible to identify with absolute certainly hazardous spots on a road network. Once high-crash locations are identified, it is then possible to identify contributing causes without additional crash causation information. It is, therefore, important to introduce crash reporting systems that include the accurate capturing of crash locations.

In any one country, it is possible to have several different databases, managed by different institutions. These can include the police or gendarmerie, the road administration or ministries of transport, hospitals or the health system, and insurance companies. By combining or integrating these databases, safety researchers can access a richer source of data and are better able to understand the factors that may affect the occurrence and severity of crashes. The integration of databases opens up a world of information that could lead to better safety decisions. Some countries are currently in the process of combining or linking their crash database with other traffic safety databases, such as their driver licensing database, vehicle registration database, injury database, and so on. The graphic below, adapted from the processes used by the WHO to produce their periodic Global Status Reports, summarizes potential road safety-related data sources.

Figure 4. *Road safety-related data sources. Adapted, WHO 2018*



This report focuses on a subset of road safety data that relates to crashes (or "crash data" in the graphic seen above). Historically, this is the data most often cited in safety circles and one that has drawn the most attention from international organizations since the late 1980s.

[2] Abegaz T, Berhane Y, Worku A, Assrat A, and Assefa A. Road Traffic Deaths and Injuries are Under-Reported in Ethiopia: A Capture-Recapture Method (2014).

Basic requirements for crash data analysis

In order to effectively analyze, compare, and draw informed conclusions from the data, it is necessary to fulfil the following basic requirements:

- Accuracy (to exactly describe the individual parameters)
- Complexity (to include all features within the given system)
- Availability (to be accessible to all users)
- Uniformity (to apply standard definitions)

The last parameter (uniformity) is of vital importance for comparisons at local, regional, and national levels of governance. An agreement on national standards and definitions is desirable, helping to facilitate comparison of data and contribute to accuracy.

Importance of international comparisons

A similar approach should be followed at an international level. International comparisons are important for the definition of national road safety policies, providing:

- A comparison of national crash data
- A ranking of countries
- An indication of the urgency of international support
- Information on development and progress
- Better identification of weak areas in the safety system
- Safety levels of roads and road users

In order to make international comparisons, national standards that reflect international agreements should be developed. This could be achieved by adopting international standards or developing similar guidance, allowing production of comparable datasets.

The users of crash data and the need for uniform definitions

Crash data can be extremely useful to many agencies and individuals, including:

- **Traffic engineers** – in the identification, analysis, and treatment of existing risks, as well as the prevention of future risks
- **Policy-makers** – at national, regional, and local levels in setting crash reduction targets, developing road safety action plans, and monitoring performance
- **Police** – in the identification of problem locations and times for enforcement
- **Health sector** – for resource planning, injury surveillance, health promotion, and injury prevention
- **Research community** – in preventative studies, and in testing and improving the effectiveness of road safety treatments
- **Insurance companies** – in setting insurance rates and premiums
- **Vehicle manufacturers** – in the development of safer vehicles
- **Prosecutors** – in the use of data as evidence (IRTAD – Road Safety Management)

In order to make useful comparisons across countries, it is important that consistent definitions for crash terms are used. Countries should consider using the following definitions provided by the WHO (WHO 2010):

- **Road traffic crash**: A collision or incident involving at least one road vehicle in motion, on a public or private road to which the public has right of access. This can include collisions between road vehicles, road vehicles and pedestrians, road and rail vehicles, road vehicles and animals, or fixed obstacles and one road vehicle alone. Multi-vehicle collisions are counted as a single crash, provided that any successive collisions happen within a very short time period.

- **Injury**: Physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy. This can be a bodily lesion resulting from acute exposure to excessive energy or impairment of function resulting from lack of vital elements.
- **Road traffic injury (or casualty)**: A person who has sustained physical damage as a result of a road traffic crash, possibly with MAIS (Maximum Abbreviated Injury Scale) injury severity level of 3+.
- **Road user**: A person using any part of the road system as a non-motorized or motorized transport user.
- **Road traffic fatality**: Any person killed immediately or dying within 30 days as a result of an injury crash, excluding suicides. For countries that do not apply the threshold of 30 days, conversion coefficients are estimated so that comparisons on the basis of the 30 day-definition can be made.
- **Injury crash**: Any road traffic crash resulting in at least one injury or death.
- **Fatal crash**: Any road traffic crash resulting in a person killed immediately or dying within 30 days as a result of the crash.

The position of crash data within a road safety information system

Although road safety management systems have traditionally focused on road crash registration, a new approach has been developed in recent years, visualized as a pyramid in the graphic below.

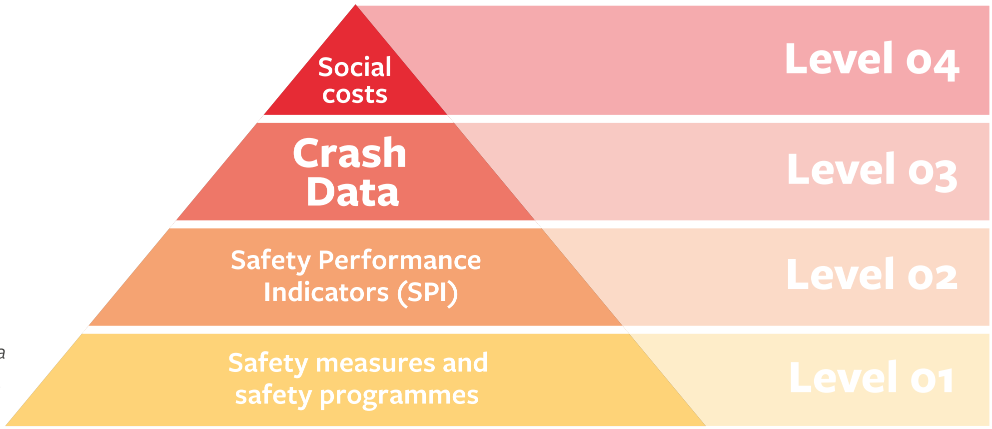


Figure 5. *Essential elements of a road safety management system. Adapted from Wegman, 2001*

The pyramid illustrates the idea that, in order to describe and understand the process leading to crashes, it is necessary to obtain data from four levels of the road safety management system:

- **Level one (Safety measures and safety programs):** Road safety policies, programs, and measures form the foundation of the road safety management system. The effective application or utilization of these elements should lead to measurable interventions and changes in the road safety situation – for example, the number of roadblocks and their impact seatbelt use.
- **Level two (Safety Performance Indicators)**: Safety performance indicators (SPIs) are measurable parameters that have a causal relationship or strong association with crashes and casualties/victims. They are not used instead of data on crashes and victims, but in addition to them. The purpose is to be able to better interpret road safety developments and to better understand the impact of policy interventions.
- **Level three (Crash data)**: The national crash database contains information on details of crashes and victims. The data is usually based on police registration of road crashes, which is processed into national crash statistics.
- **Level four (Social costs)**: The top level of the pyramid counts the social cost of crashes. This data concerns the damage that society views as negative and should therefore be prevented.

When data at all four levels are available, crashes and the reasons why they happen can be described, analyzed, and understood. This knowledge can then serve as a basis for crash management, in order to lower the social costs. The pyramid model illustrates that while the collection of crash data is usually regarded as the main element of a road safety information system, it is not the only one required to form a full overview.

The remainder of this report focuses on the collection of data, with particular attention to crash data.

Part B: Principles related to the gathering of road safety data in Africa

Challenges faced in road safety data management

Crash data should be a key source of information that is utilized in national development strategies in alignment with the AU Agenda 2063 and Sustainable Development Goals (see Box 1).

However, there are some concerns regarding crash data. These are well illustrated, for example, by the United States Federal Highway Administration guidelines for crash data improvement, which state that there may be various potential reasons for inadequate crash data. The reasons fall into three broad categories – people, processes, and/or technology.

People

There are many reasons that the quality of crash investigation and reporting may vary from agency to agency, and from officer to officer. In Africa, specifically:

- The level of training provided to officers may vary among law enforcement agencies. Furthermore, when officers are transferred to alternative roles within an agency, this can result in knowledge loss.
- Officers may lack an understanding of the crash data element definitions or of how to measure or interpret some of the information they are asked to report on.
- They may lack an understanding of the importance of crash data collection because they do not know the multitude of uses for this information.
- Road safety data management may not be a top policy priority.
- Some police agencies may not view the timely and accurate completion of the crash form as critical. Therefore, data has the potential to be delayed, prone to error, or incomplete.
- The data collection forms can be very detailed. As a result, some officers find the process tedious and therefore prefer not to make a record.

- The focus may be on undertaking rescue activities and not on reporting the crash.
- The form may be completed manually at the site of the crash, before later being entered onto an electronic system by an administrator, which may lead to errors or loss of forms.
- Police may believe that crash forms are completed simply for insurance purposes.
- Insurance is not fully utilized, resulting in crashes not making it on to the insurance register.
- There could be a measure of underreporting due to one or more of the following:
  - Police are not always informed of every crash, meaning not all crashes are reported – for example, crashes that occur in remote areas where matters are dealt with directly.
  - The police do not always go to the scene of the crash.
  - The police do not always complete a crash report form.
  - The police do not always complete the whole form in full.
  - The police do not always send the form to the national crash registration body.

One way of helping police perform better crash investigation and reporting may be to illustrate the value of the data by providing feedback on the quality of reports they are submitting. Another is to ensure that terminology and definitions on the report form are similar to those on the most commonly used international ones. Sustainable funding is vital for this to work. In some countries, data management systems have been implemented, only to later lose funding and become obsolete. But this data should always be seen as useful and a priority for numerous stakeholders.

Processes

Inaccurate data may result from the processing of crash data. This can be caused by:

- Poor editing of paper or electronic crash report forms, affecting the accuracy of the submitted crash data.
- The number of times that forms are handled by custodians of the crash database, affecting the timeliness of the data.
- Forms that are shipped to another office outside the custodial office for location coding, resulting in delays.
- Errant keystrokes by data input personnel, leading to accuracy errors.

When those responsible for processing crash data are provided with information and feedback, they are in a better position to improve their data handling and performance. In addition, putting a quality check procedure in place during the data entry process may help to minimize errors. In many instances, having an electronic form for data entry at the scene of the crash allows the police officer to capture information early and ensure it is entered into the system immediately. This, combined with a quality check at the data processing center, helps to ensure the record is captured accurately and that it contains at least the minimum amount of data.

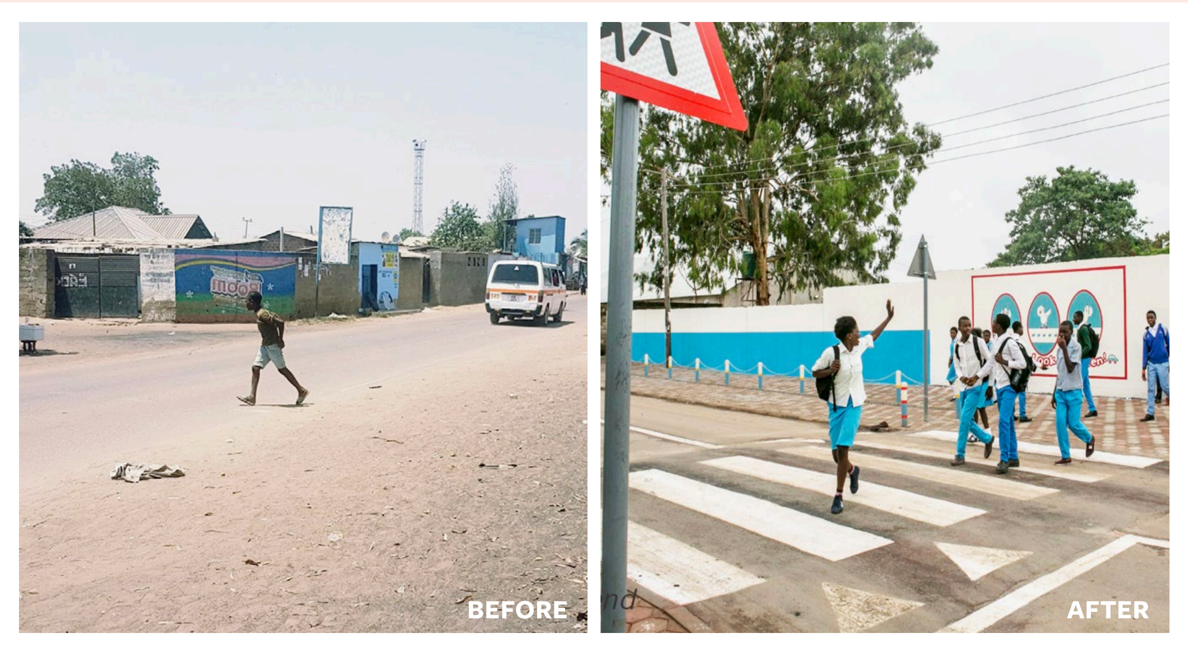
Box 1: Five-star school journey for Lusaka students

Road safety inspections and the star rating of roads can help to identify existing road design and speed management features that may affect crash likelihood and severity. Systematic risk rate mapping, performance tracking, and safety ratings using objective data are carried out by international and national road assessment programs.[3]

Sub-Saharan Africa has the world's highest road traffic injury rates. However, for students of Justin Kabwe Primary School in Lusaka, Zambia, their journey to school has been much safer since 2017, thanks to infrastructure improvements, such as the addition of a raised platform pedestrian crossing, footpaths, fencing, and a school zone warning. Now, access roads have been raised from one- and two-star 'dangerous' status to five-star safety excellence.

Before the upgrades were made, four children had been injured on roads around the school. At peak hours, 4,700 vehicles pass the entrance, 200 people cross the road, and over 900 people walk past the school. After the project, the star rating results, assessed by the International Road Assessment Programme's (iRAP) Star Rating for Schools mobile application, reflected major improvements in safety. In particular, the school's main entrance and nearby street corner achieved star rating improvements from one to five stars and two to five stars, respectively.

Justin Kabwe Primary School in Lusaka, Zambia, before and after infrastructure improvements.



Source: iRAP: *https://www.vaccinesforroads.org/case-studies-of-success/*

Technologies

To the degree that countries can afford it, the adoption of new and innovative technologies can help improve the quality of the crash data. Specifically, for Africa:

- Electronic data collection, whether through offline or online entry of crash reports, can help improve the timeliness, accuracy, and comprehensiveness of crash data.
- The use of global positioning system (GPS) units or geographic information system (GIS)-based "smart mapping" can more precisely determine the location of crashes (see Box 1).

[3] Source: WHO Global Status Report on Road Safety, 2018.

- The creation of "data warehouses" can assist in making crash data available to users, as well as in integrating crash data with other traffic safety information system databases.
- User-friendly interfaces ease the strain of data entry personnel (whether officers at the scene or in an office) and minimize errors.
- Internet and power outages can cause frustration, delays in data entry, and loss of manual forms, if not managed efficiently.
- The data collection process can be complicated by a lack of efficient technical hardware, as well as inadequate institutional and technical capacities to support data entry and management, whether on site or in an information center.
- Sufficient, well-trained personnel to undertake the task of data collection, entry, and processing are key to ensure the electronic database is up to date with useful information.
- Various cost-effective technologies to encourage and support validation of the database should be adopted to build confidence in the accuracy of the data.

All of the above and more can affect the quality of a crash database. However, when a country has established a mechanism to assess the quality of its data, it is in a much better position to detect defects and take steps to correct them (FHWA 2014).

For low- and middle-income countries, the challenges at policy level to support crash data management go even further to include:

- Insufficient attention to road safety issues at regional and national levels.
- Lack of understanding and appreciation of the scale of the problem, as well as its negative impact on health, social, and economic costs.
- Lack of specialized institutional frameworks for road crash data management in some countries.
- Lack of defined road safety data collection methodologies, as well as the absence of disaggregated road safety data
- Lack of coordination among key stakeholders.
- Lack of sustainable funding.

Some of these challenges may be overcome by:

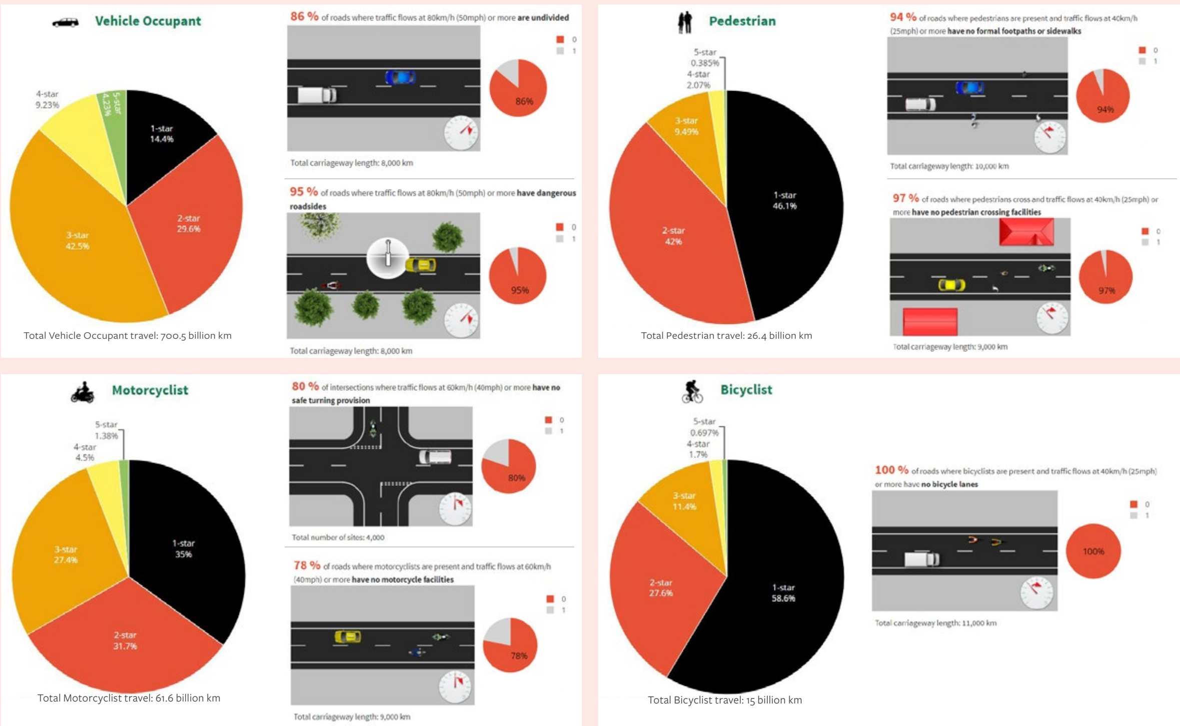
- A common dataset with a minimum set of road safety indicators, which should be established to ensure comparability among African countries (this will be further discussed in Part C of the report).
  - Consider the viability of embedding the crash data collection methodologies into existing critical processes to minimize additional resource needs and ensure the data is collected as part of something that is already active and successful.
  - Establish an accident investigation department where one does not exist, with a mandate to record, analyze, investigate, and report on all crashes to support diligent data collection.
  - Automate as much of the data collection process as possible when completed at the scene, especially key items such as GPS location and time, thereby reducing workload and data entry for the user. Automated synchronization with an electronic database may reduce errors in repeat data entry.
  - Develop reporting templates and tools that are standardized and introduced to officers who are straight out of training school. Offer continuous training after formal police training for new entrants.
- Ensure there is a demand for the data and that data-led decisions can be made.
  - Training and enforcement initiatives should be enhanced, in addition to strengthening post-crash response mechanisms.
  - Innovative and well-established technologies and best practices should be adopted to ease the task of data collection and analysis (for example, IRAP Box 1).

Box 2: Vaccines for Roads: Big Data Tool for assessing and mapping road safety problems

Ensuring that more than 75 percent of travel is on three-star or better roads by 2030 will save an estimated 450,000 lives every year worldwide and avoid 100,000 million deaths and serious injuries over the 20-year life span of road improvements.

iRAP's Big Data Tool, Vaccines for Roads V, shines a light on the safety of the world's roads, the road attributes that matter, case studies of success, and the projected human life and economic savings to be gained if countries meet the new UN Global Road Safety Targets. The tool, launched in 2018 and updated in 2020, unlocks the world's largest road infrastructure safety database. It summarizes star rating and investment plan data (over 400 million data points) based on 358,000km of roads across 54 countries globally, covering over 700 billion vehicle kilometers of travel.

Status of road infrastructure in Africa, 2020



Source: iRAP: *https://www.vaccinesforroads.org/irap-big-data-tool-map/*

The harmonization and standardization of road safety information

The need for international cooperation and harmonization

Harmonizing crash and other road safety data at a national level would benefit road crash analysis and accelerate the use of common variables and values across African countries.

Currently, existing African road crash data are not always comparable among the various countries, mainly due to the different national crash data collection systems. Data variables and values are collected under different definitions, and the various crash data collection forms have different structures, making the data systems difficult to compare. Both crash data quality and availability are affected and, as a result, data analyses and comparisons among the various African countries are not reliable. Making efforts to harmonize data would support coordinated efforts at a continental level to identify common challenges and areas of cooperation.

Cooperation across countries is essential for data coordination and benchmarking. International assessments and comparisons of safety performance (with similar peer countries, regions, cities, and so on) can help to identify and monitor national road safety issues, as well as evaluate the effectiveness of any methods implemented on a wider scale. It is important to note that this cannot be achieved unless there is consistency across crash variable definitions. Coordination also helps countries and governments to improve their road safety data quality and collection systems.

The role of road safety observatories

The term "observatory" is used to describe a variety of models that aim to collect, compare, analyze, and publish data. Some of the original observatories, which did not always include the term observatory in their names, began in developed countries and focused on crash data collection and analysis. Since then, the collection and analysis of crash data and other road safety related data has become more common in other countries too, where it has broadened beyond data gathering and analysis into policy discussions and development. Evidence-based approaches, supported by by quality crash and other road safety data, form the basis of the most successful road safety policies. The information collected by observatories includes data protocols and collection methodologies, national and in-depth crash data, exposure data, and safety performance indicators.

In Africa, various actors presently support the idea of a harmonized and coordinated approach to road safety data collection on the continent:

- The AU, through the Heads of African States, has adopted the African Union Specialized Technical Committee on Transport, Transcontinental and Interregional Infrastructure, Energy and Tourism's decision to work towards the establishment of a harmonized set of road safety indicators for African countries. This decision fully aligns with the African Road Safety Action Plan 2011-2020, the UN's Decade of Action 2010-2020, and targets set by the UN Sustainable Development Goals 3.6 and 11.2.

- SSATP is committed to improving road safety management in Africa through the development of sound policy, including the improvement of road safety information systems. One of the objectives outlined in its road safety activities results framework is the establishment of a continental observatory, as well as sub-regional observatories.

- The Federation Internationale de l'Automobile (FIA) focuses on providing guidelines for the establishment of observatories in Africa and Asia, as part of its continued support to countries to achieve the UN Decade of Action for Road Safety goals.

- The European Union (EU)-funded SaferAfrica project included some work on data and proposed the establishment of a "Road Safety Data and Knowledge Centre" to facilitate the dissemination of data on road crashes, as well as good practices, knowledge, risk factors, and so on.

- The International Traffic Safety Data and Analysis Group (IRTAD), within the Organisation for Economic Co-operation and Development's (OECD) International Transport Forum (ITF), aims to advance international knowledge on road safety and contribute to reducing the number of traffic casualties. The basis for its road safety work is the International Road Traffic and Accident Database, created in 1988. The IRTAD database collects and aggregates international data on road crashes, thereby providing an empirical basis for international comparisons and more effective road safety policies.

- An example of an initiative that seeks to address the lack of regional capacity in the collection and analysis of road safety data is the establishment of a broad cooperation between countries in Latin America and the Caribbean region, called the Ibero-American Road Safety Observatory (OISEVI). The OISEVI was created in 2012 and 18 countries joined, with the goal of sharing knowledge and best practice policy-making and planning. The main aim of OISEVI is to share road safety information, particularly best practices in policy formulation, planning, road safety strategies, and data management. It is also aimed at improving expertise in road safety and knowledge-sharing among practitioners, and at improving road safety outcomes in Ibero America. OISEVI is also supported by a regional road safety database based on the IRTAD model. The database uses the same standardized definitions and reporting as the core IRTAD system.

Building on all these experiences, the African Road Safety Observatory (ARSO) was launched in November 2018. It comprises a Transitional Steering Committee that oversees the implementation of a 2019-2021 work plan, a general assembly, national data coordinators, and national policy coordinators.

Part C: Defining a minimum crash-related data set in Africa

Process leading to proposed minimum set of road safety indicators for data collection, analysis, and reporting for africa

The need for a standardized minimum set of road safety indicators

Road crash data is collected in African countries through their own national collection systems. The variations in the systems, and the type and quality of data collected, necessitates the development and provision of a harmonized (standardized) minimum set of indicators, within a structure which allows for maximum flexibility to add indicators that fulfill individual countries' needs.

The minimum set of indicators can serve as a powerful tool, making it possible to identify and quantify road safety problems throughout Africa, evaluate the efficiency of road safety measures, determine the relevance of community actions, and facilitate the exchange of experience in this field.

It is accepted that more variables and values may be necessary to better describe and analyze the road crash phenomenon than is provided in the minimum set of indicators. The flexibility of the set makes it possible for countries to add more variables should their management systems require it.

Data contributing to essential research

The data obtained through the minimum set of indicators is not only useful for road safety management in general, but also for research purposes. The answers to some fundamental questions can be obtained from the data and used for the improvement of the road safety system. Research questions could include the following:

- What type of road users are involved in crashes?
- What type of vehicles are involved in crashes (age, type)?

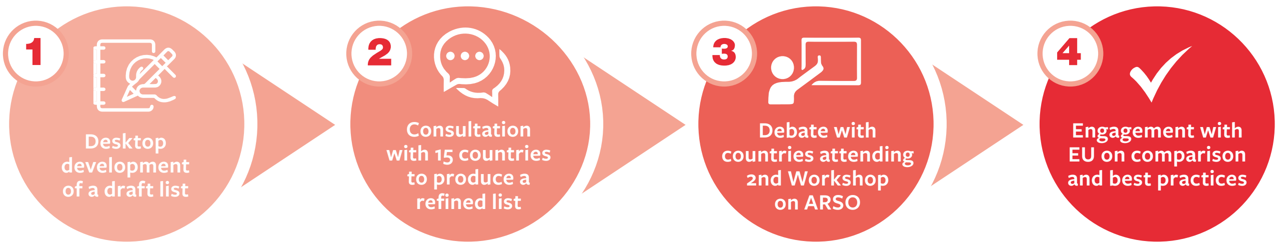
- What type of road infrastructure attributes or features are involved in consequences of crashes (for example, trees, guide rails, and poles)?
- Where are crashes frequently occurring and what is the road layout at those locations?
- What type of roads are crashes most commonly occurring on?
- Which gender/age is more likely to be involved in crashes?
- Which hour or time period is the most dangerous in terms of number of crashes?
- Which crash types can be controlled technically (vehicle or road infrastructure)?
- Which protective measures have the highest rate of reducing crashes?
- What type of countermeasures could save lives (test for cost-effectiveness)?
- Which crash type most commonly results in a serious injury or fatality?

Proposed minimum set of road safety indicators for data collection, analysis, and reporting

Methods

A minimum set of standardized data elements has been developed which allow for comparable road crash data to be available nationally, regionally, and internationally. The number of indicators varies depending on the level of reporting. The figure below summarizes these steps, although they are described in more detail in subsequent paragraphs.

Figure 6. *Steps to derive consensus on ARSO crash-related variables.*



Several steps were taken to generate the list of proposed indicators:

1. Starting in 2017, a list of indicators was produced based on the analysis of currently available national crash data collection systems in Africa, as well as other international recommendations (Safer Africa 2017; WHO 2010). More recent recommendations have also been considered as part of the review process described here (Euromed 2019).

2. A set of proposed road safety indicators was then sent to 30 countries to identify what they regard as the minimum set of key indicators that should be included in a system, in order to obtain meaningful information that may be used internally and provided externally to make valid comparisons across the region. The following 10 countries responded to the request for feedback: Botswana, Ethiopia, Gambia, Ghana, Malawi, Mauritius, South Africa, Sierra Leone, South Sudan, and Tanzania.

3. The proposed indicators were discussed in 2017 and 2018 in meetings with authorities in five additional countries: Kenya, Nigeria, Benin, Cameroon, and Togo.

4. The proposed set of indicators was circulated in English and French to government representatives from 29 countries, who were invited to a second workshop held in Abuja, Nigeria, on the establishment of ARSO. During the meeting, extensive presentations and debate took place, including a 'variable per variable' review and voting by country representatives for or against specific variables. The variables were all accepted with a few additions. A discussion on possible data sources for each variable was initiated.

5. The final document after this deliberation is attached as Appendix B[4]. The countries that participated in this debate were: Benin, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Comoros, Côte d'Ivoire, DR Congo, Egypt, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Nigeria, Sierra Leone, Tanzania, Togo, Tunisia, Uganda, and Zimbabwe.

   Forty-seven variables and their values were finally adopted as the suggested minimum crash-related variables to be collected on a voluntary basis in the national crash data collection systems of African countries. While all variables were labelled "mandatory", countries could accept answers such as "N/A" where information is not available.

6. It is expected that, over time, more and more common road crash data from various countries will be available in a uniform format. The currently disaggregated data collection on road safety will gradually contain more compatible and comparable data, allowing for more reliable analyses and comparisons.

7. During the meeting in Nigeria, participants discussed whether all 47 variables or a subset of these should be shared between countries in the observatory. Guidance was provided by experienced data managers from established observatories, such as the European Commission's (EC) CARE Observatory and the Ibero-American OISEVI. The similarities between the ARSO-proposed variables and the EC's CARE Common Accident Dataset (CADaS) variables ultimately enabled the adoption of Mini CADaS.[4] – a subset of crash-data collected at national level – by regional observatories. Out of the initial 47 variables proposed, 25 were identified for sharing between countries. These 25 variables, the MiniARSO, are listed in Appendix A. Despite the specific circumstances in each country, countries selected a very similar minimum set of indicators. These 25 variables will be at the heart of the crash-related data shared with ARSO. However, to begin with, this information will not be released at the crash level, but at the aggregate level.

Evaluating adherence of country practices to proposed minimum crash variables and recommendation

Following the third workshop on the establishment of ARSO, a survey to assess the degree of adherence to the list of national crash-data variables was prepared and circulated. A document summarizing its findings will be published soon, with very encouraging findings.

Initially, it is proposed that ARSO use the MiniARSO variables as the minimum crash data requirements in targeted requests, and that this reporting be done in an aggregated format. Some countries may already collect all these variables, while, in others, it will require some work to reach that level of adhesion. The ARSO objectives do not limit themselves to the collection and analysis of data, but include data improvement strategies to accelerate the breadth, depth, and validity of data gathered.

Appendix C contains some tailored recommendations on the setting up of a crash database.

[4] Source: WHO Global Status Report on Road Safety, 2018.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Appendix A:
Main initiatives at the regional and sub-regional levels

Several actions have taken place on the continent and relevant management documents are already in place, paving the way for road safety improvements. All of these activities are fully aligned, since all outcomes were focused on the delivery of the Africa Road Safety Action Plan and the African Charter, which were both derived from the Global Plan.

African Road Safety Action Plan 2011-2020

The AU, the UN Economic Commission for Africa (UNECA), and SSATP developed the African Road Safety Action Plan 2011-2020. The Action Plan is based on the five pillars of the UN's Decade of Action for Road Safety 2011-2020 (road safety management, safer roads and mobility, safer vehicles, safer road users, and post-crash response). Key outcomes around improving data management that were identified in the plan include for member states to:

- Develop and implement a sustainable and accurate national database on road safety crashes.
- Enforce mandatory reporting and standardized data that conforms with the computerized and integrated data management system established in member states and regional economic communities (RECs).
- Develop a national crash analysis and reporting system.
- Harmonize data formats in road crash reporting in line with international standards.
- Harmonize vehicle and driver registration data systems.
- Build capacity for data management on road safety.
- Engage local and regional research centers on road safety data management.

However, a 2015 mid-term review by the United Nations Economic Commission for Africa (UNECA) revealed that there was much work to be done by African countries in the area of road safety management, in particular. Road safety management challenges in Africa were identified and a roadmap was designed to facilitate implementation of the plan.

The African Road Safety Charter

Through the adoption of the African Road Safety Charter, AU member states aimed to build a political framework to enable road safety improvement. In particular, based on the provisions of the African Road Safety Action Plan, specific duties and commitments were defined for the states that had ratified or accepted the charter.

The main objective of the charter was to serve as an advocacy tool and instrument for road safety improvement on the continent, aimed at creating an enabling environment to drastically reduce the road traffic crashes. The specific objectives of the charter are to:

- Facilitate the formulation of comprehensive road safety policies at country level.
- Speed up implementation of national, regional, and continental road safety programs.
- Contribute to the coordination of road safety on the continent.
- Promote better coordination of development partners in the road safety field.
- Enhance private sector, civil society organizations, and nongovernmental organizations (NGO) participation in road safety issues.
- Promote the harmonization of the collection, treatment, and dissemination of road safety data.

Currently, only 14 countries have signed the charter, with a single ratification. For the charter to be formally adopted, it requires ratification by 15 member states. Considerable effort from the AU and key stakeholders is required to ensure this is achieved.

SSATP 3rd Development Plan

In its Third Development Plan 2016–2021 (DP3), SSATP, a key contributor to the African Road Safety Action Plan strategy, defined the following objectives:

- Enable African countries to achieve the road safety goals of the Action Plan.
- Promote effective policy and strategy formulation, and implementation, at the country level.
- Stimulate good practice in road safety management by promoting the systematic implementation of the African Road Safety Action Plan.
- Better integrate road safety policies and interventions in locally- and externally-funded road developments.

Over the course of the DP3, SSATP supported the development of country and city level strategies, the development and strengthening of road safety agencies, capacity-building efforts at senior management level, and the establishment of a continental road safety data observatory. SSATP recognized that member countries needed to improve their capacity to manage and monitor road safety performance in order to realize effective road safety management. This could only be done with the availability of timely and good quality data. A central outcome of the DP3 was to work with key stakeholders on the continent to improve the quality of road safety data management.

SSATP led and coordinated the effort to secure the establishment of ARSO, which was launched in 2018 and held its first general assembly in 2019. For more information, please visit https://www.ssatp.org/topics/african-road-safety-observatory.

The European Commission-funded "SaferAfrica" project

The general objective of the three-year SaferAfrica project (2016-2019) was to create favorable conditions and opportunities for the effective implementation of road safety and traffic management actions in African countries by forming a dialogue platform between Africa and Europe. This initiative focused on using effective tools, embedding innovative approaches, and identifying pragmatic and fundable next steps to address identified road safety and traffic management problems. The platform was composed of European and African regional and national authorities with key road safety responsibilities and other important stakeholders, such as international institutions, research institutes, and NGOs. It operated in accordance with the principles of Africa-Europe interdependence, strengthened political dialogue, partnership co-management, and co-responsibility, established by the Joint Africa-Europe Strategy (inspiring the Africa-EU Partnership, a cooperation between the EU and the AU).

The project succeeded in enhancing the dialogue and cooperation between African and European institutions to improve road safety outcomes in Africa. It developed road safety products, including training programs and an online road safety data repository for use by African countries, through a series of projects, grouped under four pillars – road safety knowledge and data, road safety and traffic management capacity reviews, capacity building and training, and sharing of good practices.

With regards to road safety data in Africa, the project identified that there was a significant demand for road safety data knowledge to enable countries to make effective road safety policy decisions. The review revealed that although there were similarities in the existing road safety data collection systems on the continent, the differences in data collection practices, especially on road safety monitoring and evaluation, varied based on the formal systems established in the country.

Appendix B:

ARSO recommended crash-related minimum data set at country level and possible data sources after discussion by countries, data to be shared between countries (MiniARSO) (July 2018)

Crash-related minimum data set and data sources after discussion by countries (July 2018)					Data sources							
		Agreed upon crash data variables and values (country level)		Proposed for submission to ARSO (MiniARSO)	Preference order (1= best to 6= least preferred)							
Votes against during meeting		Variables	Definition and Values		Death certificate	Hospital record	Police report	Insurance report	Driver license registry	Vehicle registry	Road inventory	National ID
0	1	Crash identification number	**Definition**: The unique identifier (e.g. a 10-digit number) within a given year that identifies a particular crash. **Obligation**: Mandatory **Data type**: Numeric or character string **Comments**: The police usually assign this value, as they are responsible at the crash scene. Other systems may reference the incident using this number.	X	2	3	1	N/A	N/A	N/A	N/A	N/A
0	2	Crash date	**Definition**: The date (day, month, and year), on which the crash occurred. **Obligation**: Mandatory **Data type**: Numeric (DDMMYYYY) **Comments**: If a part of the crash date is unknown, the respective places are filled in with 99 (for day and month). Absence of year should result in an edit check. Important for seasonal comparisons, time series analyses, management/ administration, evaluation, and linkage.	X	4	3	1	2	N/A	N/A	N/A	N/A
0	3	Crash time	**Definition**: The time at which the crash occurred, using the 24-hour clock format (00.00-23:59). **Obligation**: Mandatory **Data type**: Numeric (HH:MM) **Comments**: Midnight is defined as 00:00 and represents the beginning of a new day. Variable allows for analyses of different time periods.	X	4	3	1	2	N/A	N/A	N/A	N/A
0	4	Crash location	**Definition**: The exact location at which the crash occurred. Optimum definition is route name and GPS/GIS coordinates if there is a linear referencing system (LRS), or other mechanism that can relate geographic coordinates to specific locations in road inventory and other files. The minimum requirement for documentation of crash location	Latitude and longitude (but need to aggregate it if aggregated data submitted)	3	N/A	1	2	N/A	N/A	N/A	N/A

			is the street name, the reference point, and distance from reference point and direction from reference point. **Obligation**: Mandatory **Data type**: Character string, to support latitude/ longitude coordinates, linear referencing method, or link node system. **Comments**: Critical for problem identification, prevention programs, engineering evaluations, and mapping and linkage purposes.									
○	5	**Crash type**	**Definition**: The crash type is characterized by the first injury or damage-producing event of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Crash with pedestrian –** Crash between a vehicle and at least one pedestrian. **2. Crash with parked vehicle** – Crash between a moving vehicle and a parked vehicle. A vehicle with a driver that is just stopped is not considered as parked. **3. Crash with fixed obstacle** – Crash with a stationary object (for example, a tree, post, barrier, fence, and so on). **4. Non-fixed obstacle** – Crash with a non-fixed object or lost load. **5. Animal** – Crash between a moving vehicle and an animal. **6. Single vehicle crash/non-collision** – Crash in which only one vehicle is involved and no object was hit. Includes vehicle leaving the road, vehicle rollover, and cyclists falling. **7. Crash with two or more vehicles** – Crashes where two or more moving vehicles are involved. **8. Other crashes** – Other crash types not described above. **Comments**: If the road crash includes more than one event, the first should be recorded, through this variable. If more than one value is applicable, select only the one that corresponds best to the first event. Important for understanding crash causation, identifying crash avoidance countermeasures.		3	4	1	2	N/A	N/A	N/A	N/A
○	6	**Impact type**	**Definition**: Indicates the manner in which the road motor vehicles involved initially collided with each other. The variable refers to the first impact of the crash, if that impact was between two road motor vehicles. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. No impact between motor vehicles** – There was no impact between road motor vehicles. Refers to single vehicle crashes, collisions with pedestrians, animals, or objects.	X[5]	N/A	N/A	1	2	N/A	N/A	N/A	N/A

[5] Provided some adaptation

			2. Rear-end impact – The front side of the first vehicle collided with the rear side of the second vehicle. **3. Head-on impact** – The front sides of both vehicles collided with each other. **4. Angle impact, same direction** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **5. Angle impact, opposite direction** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **6. Angle impact, right angle** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **7. Angle impact, direction not specified** – Angle impact where the front of the first vehicle collides with the side of the second vehicle. **8. Side-by-side impact, same direction** – The vehicles collided side by side while travelling in the same direction. **9. Side-by-side impact, opposite direction** – The vehicles collided side by side while travelling in opposite directions. **10. Rear to side impact** – The rear end of the first vehicle collided with the side of the second vehicle. **11. Rear to rear impact** – The rear ends of both vehicles collided with each other. **Comments**: Useful for identifying structural defects in vehicles.									
○	7	**Weather conditions**	**Definition**: Prevailing atmospheric conditions at the crash location, at the time of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Clear** – No hindrance from weather, neither condensation nor intense movement of air. Clear and cloudy sky included. **2. Rain** – Heavy or light. **3. Snow** **4. Fog, mist or smoke** **5. Sleet, hail** **6. Severe winds** – Presence of winds deemed to have an adverse effect on driving conditions. **8. Other weather condition** **9. Unknown weather condition** **Comments**: Allows for the identification of the impact of weather conditions on road safety. Important for engineering evaluations and prevention programs.	X	N/A	N/A	1	2	N/A	N/A	N/A	N/A
○	8	**Light conditions**	**Definition**: The level of natural and artificial light at the crash location, at the time of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Daylight** – Natural lighting during daytime.	X	N/A	N/A	1	2	N/A	N/A	N/A	N/A

			2. Twilight – Natural lighting during dusk or dawn. Residual category covering cases where daylight conditions were very poor. **3. Darkness** – No natural lighting, no artificial lighting. **4. Dark with streetlights unlit** – Streetlights exist at the crash location but are unlit. **5. Dark with streetlights lit** – Streetlights exist at the crash location and are lit. **9. Unknown** – Light conditions at time of crash unknown. **Comments**: Information about the presence of lighting is an important element in analysis of spot location or in network analysis. Additionally, important for determining the effects of road illumination on night-time crashes to guide relevant future measures.									
○	9	**Crash severity**	**Definition**: Describes the severity of the road crash, based on the most severe injury of any person involved. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Fatal** – At least one person was killed immediately or died within 30 days because of the road crash. **2. Serious/severe injury** – At least one person was hospitalized for at least 24 hours because of injuries sustained in the crash, while nobody was killed. **3. Slight/minor injury** – At least one of the participants of the crash was hospitalized less than 24 hours or not hospitalized, while no participant was seriously injured or killed. **Comments**: Provides a quick reference to the crash severity, summarizing the data given by the individual personal injury records of the crash. Facilitates analysis by crash severity level. Several crash-related variables can be derived from collected data, including number of vehicles involved (total), number of motorized vehicles involved, number of non-motorized vehicles involved, number of fatalities, number of non-fatal injuries, day of week, and more. These variables provide counts or other information, without the user having to go back to individual records. Depending on the type of reports generated, deriving these data elements can save time and effort.	X (MAIS3+ is MiniCADaS proposal)	1	2	4	3	N/A	N/A	N/A	N/A
		Road related indicators										
○	10	**Type of roadway**	**Definition**: Describes the type of road, whether the road has two directions of travel, and whether the carriageway is physically divided. For crashes occurring at junctions, where the crash cannot be clearly allocated in one road, the road where the vehicle with priority was moving is indicated.	X[6]	N/A	N/A	2	3	N/A	N/A	1	N/A

[6] Provided some adaptation

			Obligation: Mandatory **Data type**: Numeric **Data values**: **1. Motorway/freeway** – Road with separate carriageways for traffic in two directions, physically separated by a dividing strip not intended for traffic. Road has no crossings at the same level with any other road, railway or tramway track, or footpath. Specially sign-posted as a motorway and reserved for specified categories of motor vehicles. **2. Express road** – Road with traffic in two directions, carriageways not normally separated. Accessible only from interchanges or controlled junctions. Specially sign-posted as an express road and reserved for specified categories of motor vehicles. Stopping and parking on the running carriageway are prohibited. **3. Urban road, two-way** – Road within the boundaries of a built-up area (an area with sign-posted entries and exits). Single, undivided street with traffic in two directions, relatively lower speeds (often up to 50 km/h), and unrestricted traffic, with one or more lanes, which may or may not be marked. **4. Urban road, one-way** – Road within the boundaries of a built-up area, with entries and exits sign-posted as such. A single, undivided street with traffic in one direction, relatively lower speeds (often up to 50 km/h). **5. Road outside a built-up area** – Road outside the boundaries of a built-up area (an area with sign-posted entries and exits). **6. Restricted road** – A roadway with restricted access to public traffic. Includes cul-de- sacs, driveways, lanes, private roads. **8. Other** – Roadway of a type other than those listed above. **9. Unknown** – Not known where the incident occurred. **Comments**: Important for comparing crash rates of roads with similar design characteristics, and for conducting comparative analyses between motorway and non-motorway roads.									
○	11	**Road functional class**	**Definition**: Describes the character of service or function of the road where the first harmful event took place. For crashes occurring at junctions, where the crash cannot be clearly allocated to one road, the road where the vehicle with priority was moving is indicated. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Principal arterial** – Roads serving long distance and mainly interurban movements. Includes motorways (urban or rural) and express roads. Principal arterials may cross through urban areas, serving suburban movements. The traffic is characterized by high speeds and full or partial access control (interchanges or junctions controlled by traffic lights). Other roads leading		N/A	N/A	2	3	N/A	N/A	1	N/A

			to a principal arterial are connected to it through side collector roads. **2. Secondary arterial** – Arterial roads connected to principal arterials through interchanges or traffic light-controlled junctions, supporting and completing the urban arterial network. Serving middle distance movements but not crossing through neighborhoods. Full or partial access control is not mandatory. **3. Collector** – Unlike arterials, collectors cross-urban areas (neighborhoods) and collect or distribute the traffic to/from local roads. Collectors also distribute traffic leading to secondary or principal arterials. **4. Local** – Roads used for direct access to the various land uses (private property, commercial areas, and so on). Low service speeds not designed to serve interstate or suburban movements.									
1	12	**Road surface conditions**	**Definition**: The condition of the road surface at the time and place of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Dry** – Dry and clean road surface. **2. Snow, frost, ice** – Snow, frost, or ice on the road. **3. Slippery** – Slippery road surface due to existence of sand, gravel, mud, leaves, oil on the road. Does not include snow, frost, ice, or wet road surface. **4. Wet, damp** – Wet road surface. Does not include flooding. **5. Flood** – Still or moving water on the road. **6. Other** – Other road surface conditions not mentioned above. **9. Unknown** – The road surface conditions were unknown. **Comments**: Important for identification of high wet-surface crash locations, for engineering evaluation and prevention measures.		N/A	N/A	1	2	N/A	N/A	N/A	N/A
1	13	**Speed limit**	**Definition**: The legal speed limit at the location of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **nnn** – The legal speed limit as provided by road signs or by the country's traffic laws for each road category, in kilometers per hour (km/h). **999 unknown** – The speed limit at the crash location is unknown. **Comments**: For crashes occurring at junctions, where the crash cannot be clearly allocated to one road, the speed limit for the road where the vehicle with priority was moving is indicated.	X	N/A	N/A	2	3	N/A	N/A	1	N/A
4	14	**Road obstacles**	**Definition**: The presence of any person or object that obstructed the movement of the vehicles on the road. Includes any animal standing or moving (either hit or not), and any object not meant to be on the road. Does not include vehicles (parked or		N/A	N/A	1	2	N/A	N/A	N/A	N/A

			moving vehicles, pedestrians) or obstacles on the side of the carriageway (for example, poles, trees). **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Yes** – Road obstacle(s) present at the crash site. **2. No** – No road obstacle(s) present at the crash site. **9. Unknown** – Unknown presence of any road obstacle(s) at the crash site. Countries where a large proportion of the road network is unpaved may wish to include the variable 'road surface type' to allow for analysis of crash rates by road surface type.									
4	15	**Junction**	**Definition**: Indicates whether the crash occurred at a junction (two or more roads intersecting) and defines the type of junction. In at-grade junctions, all roads intersect at the same level. In not-at-grade junctions, roads do not intersect at the same level. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. At-grade, crossroad** – Road intersection with four arms. **2. At-grade, roundabout** – Circular road. **3. At-grade, T, or staggered junction** – Road intersection with three arms. Includes T-intersections and intersections with an acute angle. **4. At-grade, multiple junction** – A junction with more than four arms (excluding roundabouts). **5. At-grade, other** – Other at-grade junction type not described above. **6. Not at grade** – The junction includes roads that do not intersect at the same level. **7. Not at junction** – The crash has occurred at a distance greater than 20 meters from a junction. **9. Unknown** – The crash location relative to a junction is unknown. **Comments**: Crashes occurring within 20 meters of a junction are considered as crashes at a junction. Important for site-specific studies and identification of appropriate engineering countermeasures.	X	N/A	N/A	2	3	N/A	N/A	1	N/A
3	16	**Traffic control at junction**	**Definition**: Type of traffic control at the junction where crash occurred. Applies only to crashes that occur at a junction. **Obligation**: Mandatory if crash occurred at a junction **Data type**: Numeric **Data values**: **1. Authorized person** – Police officer or traffic warden at intersection controls the traffic. Applicable even if traffic signals or other junction control systems are present. **2. Stop sign** – Priority is determined by stop sign(s). **3. Give-way sign or markings** – Give-way sign or markings determine priority.	X	N/A	N/A	2	3	N/A	N/A	1	N/A

			4. Other traffic signs – Priority is determined by traffic sign(s) other than 'stop', 'give way', or markings. **5. Automatic traffic signal (working)** – Priority is determined by a traffic signal that was working at the time of the crash. **6. Automatic traffic signal (out of order)** – A traffic signal is present but out of order at time of crash. **7. Uncontrolled** – The junction is not controlled by an authorized person, traffic signs, markings, automatic traffic signals, or other means. **8. Other** – The junction is controlled by means other than an authorized person, signs, markings, or automatic traffic signals. **Comments**: If more than one value is applicable (for example, traffic signs and automatic traffic signals), record all that apply.									
3	17	**Road curve**	**Definition**: Indicates whether the crash occurred inside a curve, and what type of curve. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Tight curve** – The crash occurred inside a road curve that was tight (based on the judgment of the police officer). **2. Open curve** – The crash occurred inside a road curve that was open (based on the judgment of the police officer). **3. No curve** – The crash did not occur inside a road curve. **9. Unknown** – It is not defined whether the crash occurred inside a road curve. **Comments**: Useful for identification and diagnosis of high-crash locations, and for guiding changes to road design, speed limits, and so on.		N/A	N/A	2	3	N/A	N/A	1	N/A
4	18	**Road segment grade**	**Definition**: Indicates whether the crash occurred on a road segment with a steep gradient. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Yes** – The crash occurred at a road segment with a high grade. **2. No** – The crash did not occur at a road segment with a high grade. **9. Unknown** – It is not defined whether the crash occurred at a road segment with a high grade. **Comments**: Useful for identification and diagnosis of high-crash locations, and for guiding changes to road design, speed limits, and so on.		N/A	N/A	2	3	N/A	N/A	1	N/A
		Vehicle related indicators										
3	19	**Vehicle number**	**Definition**: Unique number assigned to identify each vehicle involved in the crash. **Obligation**: Mandatory **Data type**: Numeric, sequential number **Comments**: Allows the vehicle record to be cross-referenced to the crash record and person records.	X	N/A	N/A	1	2	N/A	N/A	N/A	N/A

2	20	**Vehicle identification number (VIN, issued by manufacturer)**	**Definition**: Unique vehicle number attached to the engine compartment of the vehicle by the manufacturer to identify each vehicle involved in the crash. **Obligation**: Mandatory **Data type**: Numeric, sequential number **Comments**: Allows the vehicle record to be cross-referenced with registration and person records.		N/A	N/A	2	3	N/A	1	N/A	N/A
4	21	**Vehicle registration number**	**Definition**: Unique vehicle registration number appearing on the number plate and registration documents. **Obligation**: Mandatory **Data type**: Numeric, sequential number **Comments**: Allows cross-referencing with vehicle VIN number and identification.		N/A	N/A	1	2	N/A	3	N/A	N/A
2	22	**Country of vehicle registration**[7]	Whether the vehicle is registered in a country different than where it crashes.	X								
2	23	**Vehicle type**	**Definition**: The type of vehicle involved in the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Bicycle** – Road vehicle with two or more wheels, generally propelled solely by the energy of the person on the vehicle, in particular by means of a pedal system, lever, or handle. **2. Other non-motor vehicle** – Other vehicle without engine not included in the list above. **3. Two/three-wheel motor vehicle** – Two or three-wheeled road motor vehicle (includes mopeds, motorcycles, tricycles, and all-terrain vehicles). **4. Passenger car** – Road motor vehicle other than a two or three-wheeled vehicle, intended for the carriage of passengers and designed to seat no more than nine (driver included). **5. Bus/coach/trolley** – Passenger-carrying vehicle, most commonly used for public transport, inter-urban movements, and tourist trips, seating more than nine persons. Includes vehicles connected to electric conductors and vehicles that are not rail-borne. **6. Light goods vehicle (<3.5 t)** – Smaller (by weight) motor vehicle designed exclusively or primarily for the transport of goods. **7. Heavy goods vehicle (>3.5 t)** – Larger (by weight) motor vehicle designed exclusively or primarily for the transport of goods. **8. Pedestrian** **9. Animal-propelled vehicles**[8] **10. Other motor vehicle** – Other vehicle not powered by an engine and not included in the lists of values.	X	4	5	2	3	N/A	1	N/A	N/A

[7] This is one of the variables added after discussion in 2nd workshop towards establishment of ARSO

[8] This was suggested during discussion at second workshop towards establishment of ARSO.

			11. Unknown – The type of vehicle is unknown, or it was not stated. **Comments**: Allows for analysis of crash risk by vehicle type and road user type. Important for evaluation of countermeasures designed for specific vehicles or to protect specific road users.									
4	24	**Vehicle make**	**Definition**: Indicate the make (distinctive name) assigned by motor vehicle manufacturer. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Character string. Alternatively, a list of motor vehicle makes can be composed, with a code corresponding to each. Such a list allows for more consistent and reliable recording, as well as for easier interpretation of the data. **Comments**: Allows for crash analyses related to the various motor vehicle makes.		N/A	N/A	2	3	N/A	1	N/A	N/A
10	25	**Vehicle model**	**Definition**: The code assigned by the manufacturer to denote a family of motor vehicles (within a make) that have a degree of similarity in construction. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Character string. Alternatively, a list of motor vehicle models can be composed, with a code corresponding to each. Such a list allows for more consistent and reliable recording, as well as for easier interpretation of the data. **Comments**: Record the name of the model as referred to in the country in which the crash occurred. Allows for crash analyses related to the various motor vehicle models.		N/A	N/A	2	3	N/A	1	N/A	N/A
3	26	**Vehicle year of manufacture**	**Definition**: The year assigned to a motor vehicle by the manufacturer. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Numeric (YYYY) **Comments**: Can be obtained from vehicle registration. Important for use in identifying motor vehicle model year for evaluation, research, and crash comparison purposes.	X	N/A	N/A	2	3	N/A	1	N/A	N/A
11	27	**Engine size**	**Definition**: The size of the vehicle's engine is recorded in cubic centimeters. **Obligation**: Mandatory, if vehicle is motorized. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Numeric **Data values**: **nnnn** – Size of engine **9999** – Unknown engine size **Comments**: Important for identifying the impact of motor vehicle power on crash risk.		N/A	N/A	3	2	N/A	1	N/A	

2	28	**Vehicle special function**	**Definition**: The type of special function being served by this vehicle, regardless of whether the function is marked on the vehicle. **Obligation**: Mandatory if the vehicle is a motorized vehicle. Not applicable to bicycles, tricycles, rickshaws, and animal-powered vehicles. **Data type**: Numeric **Data values**: **1. No special function** – No special function of the vehicle. **2. Taxi** – Licensed passenger car for hire with driver, without predetermined routes. **3. Vehicle used as bus** – Passenger road motor vehicle used for the transport of people. **4. Police/military** – Motor vehicle used for police or military purposes. **5. Emergency vehicle** – Motor vehicle used for emergency purposes (includes ambulances, fire service vehicles, and so on). **8. Other** – Other special functions, not mentioned above. **9. Unknown** – It was not possible to record a special function. **Comments**: Important to evaluate the crash involvement of vehicles with special uses.		N/A	N/A	N/A	2	N/A	1	N/A	N/A
2	29	**Vehicle maneuver (what the vehicle was doing at the time of the crash)**	**Definition**: The controlled maneuver for this motor vehicle prior to the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Reversing** – The vehicle was reversing. **2. Parked** – Vehicle was parked and stationary. **3. Entering or leaving a parking position** – The vehicle was entering or leaving a parking position. **4. Slowing or stopping** – The vehicle was slowing or stopping. **5. Moving off** – The vehicle was still and started moving. Does not include vehicle leaving or entering a parking position. **6. Waiting to turn** – The vehicle was stationary, waiting to turn. **7. Turning** – The vehicle was turning (includes U-turns). **10. Changing lane** – The vehicle was changing lane. **11. Avoidance maneuver** – The vehicle changed its course in order to avoid an object on the carriageway (including another vehicle or pedestrian). **12. Overtaking vehicle** – The vehicle was overtaking another vehicle. **13. Straightforward/normal driving** – The vehicle was moving ahead away from any bend. **8. Other** **9. Unknown**		N/A	N/A	1	2	N/A	N/A	N/A	N/A

		Person-related indicators										
0	30	**Person ID**	**Definition**: Number assigned to uniquely identify each person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric (two-digit number, nn) **Comments**: The persons related to the first (presumed liable) vehicle will be recorded first. Within a specific vehicle, the driver will be recorded first, followed by the passengers. Allows the person record to be cross-referenced to crash, road, and vehicle records, in order to establish a unique linkage with the crash ID and the vehicle number.	X	4	3	2	5	N/A	N/A	N/A	1
4	31	**Occupant's vehicle number**	**Definition**: The unique number assigned for this crash to the motor vehicle in which the person was an occupant. **Obligation**: Mandatory **Data type**: Numeric (two-digit number, nn) **Comments**: Allows the person record to be cross-referenced to the vehicle records, linking the persons to the motor vehicle in which they were travelling.		N/A	N/A	1	2	N/A	N/A	N/A	N/A
4	32	**Pedestrian's linked vehicle number**	**Definition**: The unique number assigned for this crash to the motor vehicle that collided with this person. The vehicle number assigned under to the motor vehicle that collided with this person. **Obligation**: Mandatory **Data type**: Numeric (two-digit number, nn, from V1) **Comments**: Allows the person record to be cross-referenced to the vehicle records, linking the person to the motor vehicle that struck them.		N/A	N/A	1	2	N/A	N/A	N/A	N/A
2	33	**Date of birth**	**Definition**: Indicates the date of birth of the person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric (date format – dd/mm/yyyy, or 99/99/9999 if birth date unknown) **Comments**: Allows calculation of person's age. Important for analysis of crash risk by age group, and for assessing effectiveness of occupant protection systems by age group. Key variable for linkage with records in other databases.	X	3	2	5	4	N/A	N/A	N/A	1
2	34	**Sex**	**Definition**: Indicates the sex of the person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Male** – Based on identification documents/ personal ID number or determined by the police. **2. Female** – Based on identification documents / personal ID number or determined by the police. **9. Unknown** – Sex could not be determined (police unable to trace person, not specified). **Comments**: Important for analysis of crash risk by sex. Important for evaluation of the effects of sex of the person involved on occupant protection systems and on motor vehicle design characteristics.	x	3	2	5	4	N/A	N/A	N/A	1

1	35	**Type of road user**	**Definition**: This variable indicates the role of each person at the time of the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Driver** – Driver or operator of motorized or non-motorized vehicle. Includes cyclists, persons pulling a rickshaw, or riding an animal. **2. Passenger** – Person riding on or in a vehicle, who is not the driver. Includes person in the act of boarding, alighting from a vehicle, or sitting/standing. **3. Pedestrian** – Person on foot, pushing, or holding a bicycle, pram, or a pushchair, leading or herding an animal, riding a toy cycle, on roller skates, skateboard or skis. Excludes persons in the act of boarding or alighting from a vehicle. **4. Cyclist** – Person on bicycle. **8. Other** – Person involved in the crash who is not of any type listed above. **9. Unknown** – It is not known what role the person played in the crash. **Comments**: Allows for analysis of crash risk by road user type (in combination with Vehicle type, V2). Important for evaluation of countermeasures designed to protect specific road users.	X	4	3	1	2	N/A	N/A	N/A	N/A
2	36	**Seating position**	**Definition**: The location of the person in the vehicle at the time of the crash. **Obligation**: Mandatory for all vehicle occupants **Data type**: Numeric ***Subfield:*** *Row* **Data values**: **1. Front** **2. Rear** **3. Not applicable** (for example, riding on motor vehicle exterior) **8. Other** **9. Unknown** ***Subfield:*** *Seat* **Data values**: **1. Left** **2. Middle** **3. Right** **4. Not applicable** (for example, riding on motor vehicle exterior) **8. Other** **9. Unknown** **Comments**: Important for full evaluation of occupant protection programs.		3	4	1	2	N/A	N/A	N/A	N/A
0	37	**Injury severity**	**Definition**: The injury severity level for a person involved in the crash. **Obligation**: Mandatory **Data type**: Numeric	X (MAIS3+ in MiniCADaS)	2	3	5	4	N/A	N/A	N/A	1

			Data values: **1. Fatal injury** – Person was killed immediately or died within 30 days, as a result of the crash. **2. Serious/severe injury** – Person was hospitalized for at least 24 hours because of injuries sustained in the crash. **3. Slight/minor injury** – Person was injured and hospitalized for less than 24 hours or not hospitalized. **4. No injury** – Person was not injured. **9. Unknown** – Injury severity was not recorded or is unknown. **Comments**: Important for injury outcome analysis, evaluation, and appropriate classification of crash severity (PD1). Important element for linkage with records in other databases.									
1	38	**Safety equipment**	**Definition**: Describes the use of occupant restraints, or helmet use by a motorcyclist or bicyclist. **Obligation**: Mandatory **Data type**: Numeric ***Subfield:*** *Occupant restraints* **Data values**: **1. Seatbelt available, used** **2. Seatbelt available, not used** **3. Seatbelt not available** **4. Child restraint system available, used** **5. Child restraint system available, not used** **6. Child restraint system not available** **7. Not applicable** – No occupant restraints could be used on the specific vehicle (for example, agricultural tractors) **8. Other restraints used** **9. Unknown** – Not known if occupant restraints were in use at the time of the crash. **10. No restraints used** ***Subfield:*** *Helmet use* **Data values**: **1. Helmet worn** **2. Helmet not worn** **3. Not applicable** (for example, person was pedestrian or car occupant) **9. Unknown** **Comments**: Information on the availability and use of occupant restraint systems and helmets is important for evaluating the effect of such safety equipment on injury outcomes.	X	3	2	1	4	N/A	5	N/A	N/A
3	39	**Pedestrian maneuver**	**Definition**: The action of the pedestrian immediately prior to the crash. **Obligation**: Mandatory **Data type**: Numeric **Data values**: **1. Crossing** – The pedestrian was crossing the road. **2 .Walking on the carriageway** – The pedestrian was walking across the carriageway, facing or not facing traffic.		3	N/A	1	2	N/A	N/A	N/A	N/A

			3. Standing on the carriageway – The pedestrian was on the carriageway and was stationary (standing, sitting, lying, and so on). **4. Not on the carriageway** – The pedestrian was standing or moving on the sidewalk or any point beside the carriageway. **8. Other** – The vehicle or the pedestrian was performing a maneuver not included in the list of the previous values. **9. Unknown** – The maneuver performed by the vehicle or pedestrian was not recorded or it was unknown. **Comments**: Provides useful information for the development of effective road design and operation, education, and enforcement measures to accommodate pedestrians.									
○	40	**Alcohol use suspected**	**Definition**: Law enforcement officer suspects that person involved in the crash has used alcohol. **Obligation**: Mandatory for all drivers of motorized vehicles, recommended for all non-motorists (pedestrians and cyclists). **Data type**: Numeric **Data values**: **1. No** **2. Yes** **3. Not applicable** (for example, if person is not driver of motorized vehicle) **9. Unknown**		2	1	3	4	N/A	N/A	N/A	N/A
○	41	**Alcohol test**	**Definition**: Describes alcohol test status, type, and result. **Obligation**: Conditional (mandatory if alcohol use suspected) **Data type**: Numeric ***Subfield:*** *Test Status* **Data values**: **1. Test not given** **2. Test refused** **3. Test given** **9. Unknown if tested** ***Subfield:*** *Test type* **Data values**: **1. Blood** **2. Breath** **3. Urine** **8. Other** **9. Test type unknown** ***Subfield:*** *Test result* **Data values**: **1. Pending** **9. Result unknown** **Comments**: Alcohol-related crashes are a major road safety problem. Information on alcohol involvement in crashes facilitates evaluation of programs to reduce drink driving.	X	4	1	2	3	N/A	N/A	N/A	N/A

0	42	**Drug use**	**Definition**: Indication of suspicion or evidence that person involved in the crash has used illicit drugs. **Obligation**: Mandatory for all drivers of motorized vehicles, recommended for all non-motorists (pedestrians and cyclists). **Data type**: Numeric **Data values**: **1. No suspicion or evidence of drug use** **2. Suspicion of drug use** **3. Evidence of drug use** (further subfields can specify test type and values) **4. Not applicable** (for example, if person is not driver of motorized vehicle) **9. Unknown**	X[9]	2	1	3	4	N/A	N/A	N/A	N/A
3	43	**Driving license issue date**	**Definition**: Indicates the date (month and year) of issue of the person's first driving license, provisional or full, pertaining to the vehicle they were driving. **Obligation**: Mandatory for all drivers of motorized vehicles **Data type**: Numeric (MMYYYY) **Data values**: **Value (MMYYYY)** **1. Never issued a driving license** **9. Date of issue of first license unknown** **Comments**: Allows calculation of number of years' driving experience at the time of crash.		N/A	N/A	2	3	1	N/A	N/A	4
0	44	**Driver license type fitting vehicle**[10]	**Definition**: Whether the driving license allowed the driver to operate the vehicle s/he was operating. **Data type**: Yes or No									
0	45	**Age**	**Definition**: The age in years of the person involved in the crash. **Data type**: Numeric **Comments**: Derived from Date of birth and Crash date. Important for analysis of crash risk by age group, and for assessing effectiveness of countermeasures by age group.		4	3	5	6	2	N/A	N/A	1
8	46	**Driver nationality**[11]		X								
1	47	**Hit and run**	**Definition**: The behavior of a driver of a vehicle who is involved in a collision with another vehicle, property, or human being, who knowingly fails to stop to give his/her name, license number, and other information as required by statute to the injured party, a witness, or law enforcement officers. **Data type**: Yes or No **Comments**: Information captured when more than one vehicle involved in the crash but only one vehicle's data available.		N/A	N/A	1	2	N/A	N/A	N/A	N/A

[9] Drug test y/n is what is required

[10] Added in after deliberations during second workshop towards establishment of ARSO.

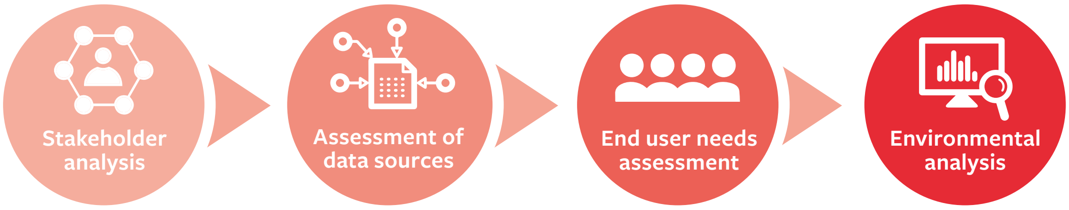
[11] Added in after deliberations during second workshop towards establishment of ARSO.

Appendix C:
Establishing a crash database system

Situational assessment

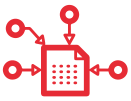
Before establishing a new crash database system (or improving a current system), it is recommended that a situational assessment be undertaken (WHO, 2010). This involves four steps:

Figure 7. *Recommended steps for situational assessment. Source, WHO 2010*



Stakeholder analysis

A stakeholder analysis involves identifying organizations and individuals who have (or should have) a role in the collection and use of road safety data. Critical stakeholders will include police, transport agencies, insurance companies, and health departments, but there are likely to be many others.



Assessment of data sources and existing systems/quality

An assessment of data sources is required to determine what information is already collected and review the quality of the data. This is often a significant problem in many countries.

End-user needs assessment

An end-user assessment involves understanding who the key users are and how these key stakeholders use the information. This knowledge will help to improve the usability of the data and the subsequent development of policies.

Environmental analysis

An environmental analysis involves understanding the political environment and critical partnerships required for the successful collection, analysis, and use of the data. Without this understanding and appropriate collaboration, it is likely that the collection and use of crash data will be severely hindered. There are many examples where expensive crash data systems have been established, but data has not been entered into the system due to inadequate communications and poor cooperation.

Process for establishing a crash database system

Following this situational assessment, the recommended process for establishing a crash database system is:

Figure 8. *Recommended steps for situational assessment. Source, WHO 2010*

Get started

- An assessment of data requirements should be made. In the particular case of crash-related information, this often entails evaluating the crash report form used by police officers attending the crash.
- Assessment of staff capacity to collect, store, manage, and analyze the data, including police officers and administrative staff.
- For countries with no comprehensive crash data, information on final and intermediate outcomes should be collected, especially for high-risk routes (for example, high-volume roads) to allow measurement of safety problems and identification of measures. This collection could be undertaken as part of a corridor demonstration project.
- A crash data system should be put in place. The steps required for this include the need to:
  - Assess current data sources.
  - Engage with key stakeholders (the road agency, police, insurance, and the health sector are especially important).
  - Develop a crash report form or improve the existing one.
  - Develop a data system.
  - Put in place a process to ensure data quality.
- The focus should be on the collection of the range of data needed to address fatal and serious injury crash outcomes, which will include exposure data and final outcome data, as well as intermediate outcome data.
- Road infrastructure/asset data collection should be considered to inform safety decisions – for instance, through a road assessment program (such as iRAP Star Rating). This can provide information on likely high-risk crash locations, as well as affordable treatments in the absence of comprehensive crash data.

Make progress

- A relevant data collection strategy should be developed to ensure that essential information is collected.
- The crash data system should be routinely checked for accuracy and completeness (for example, by comparing police and hospital data), particularly regarding the follow-up of victims and their possible death after the crash.
- The database should include basic features to allow comprehensive analysis of crash problem types and be fit for use by the required stakeholders.
- Information on the availability and condition of road assets and others relating to safety outcomes should be collected.
- Countries should be encouraged to aggregate data at national level.
- Other data relevant to the setting and monitoring of road safety targets and trends should be collected, and the accuracy of this data assessed.
- All outputs (such as reports) should be assessed to ensure that they are fit for purpose and address the needs of key stakeholders.

Consolidate activity

- A comprehensive data collection strategy should be put in place and regularly monitored to ensure that it is fit for purpose, accurate, and complete.
- A crash database that contains all crash data should be fully implemented. Data should be spatially coded, and appropriate quality control checks should be put in place.
- Information on the availability and condition of road assets relating to safety outcomes should be contained within a comprehensive roadway inventory database. This may require the development of a database, or linkage to an existing database.
- Linkages should be made between key sources of data, particularly between data collected by police and hospitals, and between crash and asset data.
- Every country can define their own data collection needs, both for crash-related and other safety outcomes. However, it helps to agree on a minimum number of data elements that countries should be collecting to ease international comparison.

Country data management assessment case study:

A short questionnaire to collect basic information about the national crash information procedures and systems in selected African countries was sent out by the researchers of the SaferAfrica programme. The surveyed countries were Botswana, Cameroon, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Liberia, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Sierra Leone, South Africa, South Sudan, Swaziland, Tanzania, Uganda, and Zimbabwe (Mavromatis, Yannis, Laio, 2016).

The survey revealed the following interesting facts about road safety data management in the 20 countries that participated in the survey:

- The majority (75-85 percent) of the countries indicated that they have a road safety lead agency, a national strategy for road safety, and national medium-term quantitative targets.
- The targets are not defined using a rational process on known key problems and potentially efficient measures.
- The targets are based on fatalities and do not include non-fatal injuries.
- 50 percent of the countries have not defined road safety performance indicators.
- 50 percent of the countries do not have sustainable systems in place to collect and manage data on crashes, fatalities, and injuries, although 65 percent indicated that they have a central organisation in charge of data systems for road safety.
- In general, crash databases are not linked to other databases, such as those of hospitals.
- 55 percent of the countries do not have a reporting procedure to monitor road safety interventions carried out, although 65 percent indicated that they do benchmarking.

The responses indicate that there is a gap between the capturing of comprehensive road safety data and the planning of strategies, defining of road safety performance indicators, and the monitoring of performance.

Good practice system design recommendations

In examining crash-data systems to identify innovative and efficient practices, five system components were identified as core elements in respect to data collection, data storage, analysis and reporting, data accessibility, and overall resource efficiency. The assessment led to the identification of a number of components, within the elements of an overall ideal system, that should be recommended to countries when refining their data management systems.

Data collection

Data collection is an area where innovative technology can be used to improve crash-data systems. Innovative practices improve data quality, reduce staff intervention, and expedite data availability.

Data storage

Data storage is one of the most critical aspects of an efficient system. Significant time is saved by receiving reports and records electronically, with minimal user intervention. The linkages to other enterprise systems enable advanced data analysis. Having the data stored in a technologically advanced database makes data sharing, as well as transfer to other systems and users, efficient and cost-effective.

Analysis and reporting

Data analysis and reporting capabilities vary widely from country to country. Among the innovations in analysis and reporting that add value to a user's daily workflow, GIS provides a good graphical component that helps users visualize trends that may not be apparent in a simple tabular format. GIS also allows users to query information at varying levels of geography, as opposed to the traditional intersection or area query. The ability to generate custom reports reduces the need for data export, ensuring that the user is analyzing the most current information available. The usage of centralized statistical analysis and charting tools helps to enforce data consistency across an organization in outputs, as well as equipping it with the most current data available.

Accessibility

While the aforementioned systems and technological innovations can dramatically increase a country's efficiency, the time and resources that are recovered can quickly disappear if users do not have adequate access to tools and data. Waiting for exported data or specialized software installations can be time-consuming and costly. This has directed the most progressive states toward internet/intranet solutions, which run within stable internet browsers such as Internet Explorer and Google Chrome.

Overall efficiency

One of the driving objectives for an improved crash management system is to improve the overall efficiency of its practices to collect, store, maintain, and analyze crash data. Improving efficiency will reduce the demand for resources and allow the government to direct funds toward other important safety-related activities. Through the utilization of an improved crash management system, a backlog of incident reports can be eliminated. Current systems give managers and analysts quick and seamless access to the necessary resources to achieve decreased response time for critical safety issues. The table below outlines the elements of an efficient data management system, listing good practice components and system design recommendations.

Table 1. *Country-level system design recommendations*

Good practice components	System design recommendations
Data collection	• Electronic data entry • GPS locator • GIS field display for locating • Data collection standard
Crash data storage	• Store individual crash data, possibly using relational databases • Create aggregated data summaries for sharing purposes
Analysis and reporting	• Generate custom ad-hoc reports • Custom data queries • Data export to multiple formats • User-friendly GIS capabilities • Insert GIS graphics in reports • Advanced statistical analysis • Chart and graph capabilities • Links for additional databases for advanced analysis • Create aggregated counts of selected variables for reporting to other institutions, including regional observatories or international bodies
Accessibility	• Centralized web application • One-stop portal for all information • All information live linked • Password security

OAK ARCADE
Just like football,
Onetouch connects
like no other.
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SSATP
Africa Transport Policy Program

GRSF
Global Road Safety Facility

WORLD BANK GROUP

Burden of Road Injuries in Sub-Saharan Africa

GRSF
Global Road Safety Facility

HARVARD SCHOOL OF PUBLIC HEALTH
Department of Global Health
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BURDEN OF ROAD INJURIES IN SUB-SAHARAN AFRICA

Data Sources, Methods, and Estimates of the National Incidence of Road Injuries

January 2014

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About this project

The 2010 Global Burden of Disease (GBD-2010) was a systematic effort to quantify the comparative magnitude of global health loss due to 291 diseases and injuries, 67 risk factors, and 1,160 sequelae by age, sex, and country from 1990 to 2010. The project was led by the Institute for Health Metrics and Evaluation (IHME) and included a consortium of academic institutions. The World Bank Global Road Safety Facility commissioned a special effort at Harvard University to improve the estimates of road injuries in sub-Saharan Africa generated as part of GBD-2010 by incorporating more data and better methods for the region.

For information about GBD-2010 visit www.healthmetricsandevaluation.org/gbd

For more information related with this report visit africa.globalburdenofinjuries.org

Suggested citation

Bhalla, K, Harrison, J, Shahraz, S, Abraham, JP, Bartels, D, Yeh, PH, Naghavi, M, Lozano, R, Vos, T, Phillips, D, Chou, D, Bollinger, I, Gonzalez-Medina, D, Wurtz, B, and Murray, CJL, 2013, Burden of Road Injuries in Sub-Saharan Africa, Department of Global Health and Population, Harvard School of Public Health, Boston, MA, africa.globalburdenofinjuries.org.

Acknowledgements

We extend our deepest appreciation to the members of the GBD-Injury Expert Group, many of whom have provided extensive feedback and advice during the development of this research effort. In particular, the following individuals helped access and analyze relevant data from Africa: Safa Abdalla, Kunuz Abdella, William Ackaah, Olumuyiwa Adebona, Frank Atuguba, Kidist Bartolomeos, Ayaga Bawah, James Damsere-Derry, Daniel Darko, Nicole DeSantis, Beth Ebel, Suad Eltahir, Stalin Ewoigbokhan, Uwom Eze, Alan Hill, Kenneth Hill, Michael Levin, Sydney Ibeanusi, Syed Jaffar Hussain, Lisa Knowlton, Olive Kobusingye, Adofo Koranteng, Steven Lwendo, Michael Lipnick, Fred Wabwire Mangen, Richard Matzopoulous, Charlie Mock, Robert Mtonga, Mable Nakitto, George Pariyo, Joan Ozanne-Smith, Margaret Peden, Megan Prinsloo, Georges Reniers, Frederick Rivara, Rania Saad, Osman Sankoh, Zeinab Swaraddahab, Maria Valenti, Bonnie Wandera, Ruru Wang, Jeffrey Witte, and Diego Zavala. This project relied primarily on secondary analysis of existing data sources. Many of these data exist because of years of hard work on the part of numerous researchers, professionals, medical institutions, and national and international health and transport agencies. Notably, these agencies include the World Health Organization, the INDEPTH network, AMEND, MEASURE DHS, and the International Physicians for the Prevention of Nuclear War. Without the primary data collection undertaken by these national and international agencies, our work would not be possible.

We are grateful to Professor Christopher Murray's team of researchers at IHME, who led the core GBD-2010 project.

Finally, we extend our gratitude to the World Bank Global Road Safety Facility (GRSF) for providing the core grant funding to support improving the estimates of the burden of road injuries in sub-Saharan Africa as part of GBD-2010 study.

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Executive Summary

The UN Decade of Action for Road Safety 2011-2020 calls on national governments in sub-Saharan Africa and worldwide to direct substantial resources to stem the increasing burden of road traffic injuries. Bringing such attention to road safety requires demonstrating the importance of the problem relative to other major threats that currently confront sub-Saharan Africa. Therefore, in this study, we estimate the burden of road injuries relative to other health issues in the region through a systematic and scientific effort to quantify the comparative magnitude of health loss due to all diseases and injuries. We track the relative evolution of diseases and injuries since 1990 to show the increasing importance of road injuries to the health and development agenda in sub-Saharan Africa. We find that:

- Road injury deaths are severely underreported in most sub-Saharan countries. Our estimates are often six times those of official government statistics. In Nigeria, they are 14 times the official statistics of the national road death toll.
- Road injuries killed 231,000 people in sub-Saharan Africa in 2010, accounting for almost one-fifth of the global road injury death toll. In addition, there were over 8 million non-fatal injuries, of which 885,000 were severe enough to warrant hospital admission if adequate access to medical care were available. The combined burden of non-fatal road injuries in sub-Saharan Africa exceeded 14 million healthy life years lost.
- Western, Central and Eastern sub-Saharan Africa have the highest road injury death rates of any global region. The death rate in Western sub-Saharan Africa is more than four times the rate in Western Europe.
- Road injuries are the 8th leading cause of death in sub-Saharan Africa and the 10th leading cause of healthy life years lost. The public health burden of road injuries exceeds that from tuberculosis and maternal disorders.
- Deaths due to road injuries have grown by 84% in sub-Saharan Africa since 1990, almost twice the global increase. The Western and Southern regions of sub-Saharan Africa had the highest growth in road deaths of any region in the world, more than doubling over this period.
- Road injuries are the 7th leading cause of death in males in sub-Saharan Africa. They are the 13th leading cause of death in females, compared with 18th globally. The road injury death rate for females in Western sub-Saharan Africa is more than twice the global average and almost five times the rate in Western Europe.
- Road injuries pose a high burden over the entire life course in sub-Saharan Africa, impacting not just young adults but also children and the elderly. Among children aged 1-4 years, road injuries are the 8th leading cause of death in the region. Among adults aged 70+ years, road injuries are the 12th leading cause of death and 14th leading cause of healthy life years lost, compared with 26th and 23rd globally.
- Pedestrians comprise 44% of road deaths in sub-Saharan Africa, substantially more than the global average of 35%. The rate of pedestrian deaths in Western sub-Saharan Africa is 8 times the rate in Western Europe.
- Nigeria has the highest road injury death rate (52.4 per 100,000 people) of any country globally. Mozambique has the third highest death rate (46.7 per 100,000). These rates are more than 15 times the death rates in Sweden, UK, and the Netherlands, which have among the lowest death rates globally.
- Four countries (Nigeria, Ethiopia, South Africa, and Sudan) together account for half the road injury death toll of sub-Saharan Africa.

Road safety has emerged as an important health priority in sub-Saharan Africa. Trends over the last two decades show that road injury rates in the region have remained at among the highest in the world even though substantial improvements are being made in controlling other diseases, such as tuberculosis, malaria, and diarrheal disease. Unless significant preventive efforts are undertaken, road safety will continue to climb in regional health rankings during the UN Decade of Action for Road Safety. National governments and the international development community need to prioritize road safety in the region and implement the recommendations of the 2004 World Report on Road Traffic Injury Prevention.

Chapter 1: Introduction

The need for reliable statistics in the UN Decade of Action

The United Nations (UN) Decade of Action for Road Safety 2011-2020 was launched in May 2011 with the goal of preventing five million road traffic deaths over 10 years. The launch of the Decade of Action was a culmination of substantial efforts by governmental, non-governmental, and international agencies across the world including in sub-Saharan Africa. These included the release of the 2004 World Report on Road Traffic Injury Prevention by the World Health Organization (WHO) and the World Bank, regional conferences such as the 2009 pan-African conference and several UN resolutions calling on governments to improve road safety. Numerous co-sponsoring country governments from Africa and worldwide, key UN agencies, and multilateral development banks have endorsed the call for the Decade.

If the Decade of Action is to deliver on its promise to halt the rise in road traffic injuries, it will need to create an important change in how development professionals view roads and highways. Transport infrastructure is a key contributor to economic growth and human development because it helps connect markets and provide access to health care services and education (World Bank, 2008). More particularly, Africa's deficit in the availability of paved roads has been shown to be a key barrier to development (Foster & Briceno-Garmenida, 2009). Therefore, improving access to all-season roads through low-cost designs is likely to be a key goal of the transport sector in Africa for the coming decades. However, simply increasing the stock of paved roads will inevitably lead to a concomitant increase in road traffic injury rates. Instead, the Decade of Action proposes a vision where highways incorporate safety infrastructure (e.g. median barriers, rumble strips, guardrails), motor vehicles include safety features (e.g. crashworthiness design, crash avoidance technology), people are encouraged to travel safely via enforcement and large-scale behavior change interventions, and all aspects of road safety, including post-crash response, are carefully managed by a suitably empowered road safety agency. This vision seeks to transform human transportation from an unmanaged environment of high-risk and high-energy interactions between people and vehicles, to a coordinated system in which risks are carefully managed, through measures such as segregation of transport modes and engineering of vehicles and infrastructure to make crashes more forgiving when they occur.

In order to justify the investments needed in safe transport systems, we need to estimate the social costs imposed by road traffic crashes and compare them with the range of other problems that threaten human health and wellbeing. The poorest regions of Africa have high rates of deaths from communicable, maternal, neonatal and nutritional causes. In regions that are undergoing rapid economic development there are rising rates of non-communicable diseases as well. In such a context, the Decade of Action will get the political and financial attention it needs only if we can show the relative importance of road safety to health and development in the region.

Therefore, the question before us at the beginning of the Decade is not whether road injuries pose a big problem in sub-Saharan Africa but how do they compare with other threats faced by the region. The Global Burden of Disease 2010 (GBD-2010) project provides one answer to this question through a systematic and scientific effort to quantify the comparative magnitude of health loss due to diseases and injuries, including road injuries by age, sex, and country. We present results from 1990 to 2010 allowing us to see not only how road injuries rank relative to other health issues in countries across sub-Saharan Africa, but also their relative evolution. The outputs – leading causes of death and ill health – can provide countries, regions, and the global development community guidance on how to prioritize road safety in their health and development agendas.

In addition to making the case for road safety in the national agenda, countries in sub-Saharan Africa that make the commitment to address the problem need reliable statistics for managing their progress towards safety. They need dependable information to develop road safety strategies, identify suitable interventions, set achievable safety targets and monitor progress towards achieving them. Although the primary focus of GBD-2010 is to construct reliable estimates of national health metrics for all diseases, the results of this analysis allow explicit comparisons with other data systems, such as traffic police, that are commonly used as a source of official national road injury statistics.

The poor state of knowledge about road injury metrics in sub-Saharan Africa

Unfortunately, the state of knowledge about the incidence and burden of road injuries in sub-Saharan Africa has remained dismal. In our 2011 report, Road Injuries in 18 Countries, we showed that official government statistics of road injuries in most low- and middle- income countries globally, and especially in sub-Saharan Africa, are substantially lower than statistically modeled national estimates (Bhalla et al. 2011). Most researchers and agencies were already aware that non-fatal crashes are severely underreported in official statistics. However, the 18 Countries Report highlighted that even death counts in official statistics are likely much lower than reality in many countries. The 18 Countries Report compared official government statistics compiled by the 2009 Global Status Report on Road Safety (WHO, 2009) with modeled estimates and found that in many developing countries estimates of road deaths were more than twice, and in many sub-Saharan African countries more than six times, the deaths reported in official government statistics.

Constructing national estimates of road injuries to validate official statistics is analytically challenging in sub-Saharan Africa. Most countries in the region have little infrastructure for large-population health surveillance. Therefore, most previous work in estimating the regional incidence of road injuries in sub-Saharan Africa has not used local measurements. Instead such estimates have relied on statistical models that predict road injuries based on national income or vehicle stocks. For instance, the recently released 2013 Global Status Report on Road Safety (WHO, 2013), only used health statistics from three sub-Saharan African countries – South Africa, Mauritius, and Zimbabwe – that together only account for 7% of the regional population.

However, although national health surveillance systems are rare in Africa, our report demonstrates that there are many sub-national sources of information that can be used to triangulate to estimates of the burden of road injuries. Typically, most countries in sub-Saharan Africa have a patchwork of data sources that include incomplete vital registration systems, small population demographic surveillance systems, urban mortuary and burial registers, hospital registries, among other sources. Most of these sources have never been used to construct estimates of national and regional road traffic mortality because this requires substantial analytical work and the results have substantial uncertainty.

It is, of course, important and urgent to invest in health surveillance infrastructure in the most information-poor settings. However, we must also recognize that it is unlikely that in many countries such infrastructure will not be available in the near future. In fact, despite repeated calls for investing in improving infrastructure for vital registration systems in Africa, there has been little improvement in such systems in several decades (Mahapatra et al., 2007). The call for the UN Decade of Action for Road Safety makes it clear that we cannot wait for data systems to improve in the poorest regions of the world before investing in road safety. If the Decade is to succeed, it needs large financial and political commitments and that requires a clear assessment now of the burden of road injuries compared with other threats that confront society.

The Global Burden of Disease and Injury Study

In this report we address the challenge of producing comparable estimates of the burden of road injuries in sub-Saharan Africa relative to other health threats that confront the region. Our analysis was done as a part of GBD-2010, which is the only comprehensive effort to estimate deaths and non-fatal health outcomes for the world. The results from the first revision of the study, GBD-1990 have proven immensely influential in shaping global health priorities and on shining the light on neglected diseases. For instance, GBD-1990 brought malaria and depression to the world health agenda (Murray & Lopez, 1997). Importantly, these results also showed for the first time that road safety was a leading and growing health concern not just in the highly motorized parts of the world but also in low- and middle-income countries. Estimates from the GBD study were the source of much of the statistical information provided in the 2004 World Report on Road Traffic Injury Prevention (WHO, 2004) that helped initiate the political processes that culminated in the declaration of the UN Decade of Action.

The broader GBD-2010 study and our specific work on road injuries involve several innovations that have important implications on the study findings. A key advancement is the large amount of local epidemiological data from sub-Saharan Africa that have been incorporated in this assessment of global disease and injury patterns. We worked within an overarching GBD vision of incorporating all possible sources of information in a region after careful correction of biases. A substantial project-wide effort was made to incorporate data from vital registers, sample registration systems, and demographic surveillance systems, among many others, in all global regions. We coupled this broad search with a targeted effort to improve data from the sub-Saharan Africa regions. Chapter 2 (Data Sources) describes the specific data sources and their regional availability and paints a picture of a world that is much richer in epidemiological data than previously believed.

Handling the large amounts of data, and the non-traditional nature of most of the data sources from sub-Saharan Africa, required the development of new analytical approaches and tools. These methodological innovations ranged from improved methods for identification and reattribution of cases coded to poorly defined causes, to the development of ensemble modeling for estimating causes of death from a wide range of statistical models. Another important analytical innovation was in weaving together vastly different types of data into a coherent set of estimates of non-fatal injuries. We developed a model to link incidence of road injury estimates derived from a large collection of national and sub-national household surveys, mappings from external cause to health outcomes developed from hospital data, and estimates of long term disability based on a set of recent follow-up studies. These methods rely on many assumptions and will likely undergo substantial refinements in the years to come. However, this is the only known attempt at large-scale coupling of empirical data to construct global estimates of the burden of non-fatal road injuries. Chapter 3 (Methods) describes these methodological innovations in more detail.

These analyses allow us to generate explicit comparisons of the problem of road safety with other health problems at the national and regional levels in sub-Saharan Africa, which we describe in Chapter 4 (Results). In addition to relative comparisons with other diseases, we provide estimates of the absolute magnitude of road injury rates. Further, we compare our national road injury mortality estimates with official government statistics to illustrate the extent of national underreporting. In addition to deaths, we provide national estimates of the incidence of non-fatal road injuries. These are the first comparable statistics of non-fatal road injury incidence ever estimated for the region.

Finally, in Chapter 5, we discuss the implications of this report focusing on road safety policy and future directions for research in road safety metrics.

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Chapter 2: Data Sources

Overview of data collection

Our basic guiding principle is that estimates of the burden of disease and injury should be generated through the careful analysis and correction for bias in all sources of information available in a region. Thus, we attempted to get access to all empirical measurements that could help inform estimates of the incidence of fatal and non-fatal injuries in sub-Saharan Africa. The broader GBD-2010 study undertook a project-wide effort to identify and acquire all relevant data sources for all diseases in all global regions. The Injury Expert Group of GBD-2010 aided these efforts via focused attention to improve access to global injury data (Bhalla et al. 2009). This hunt for data sources was conducted with a strategic focus on tracking the regional availability of data sources for mortality and morbidity and working to fill the information gaps. As we illustrate in this chapter, the quality of information available to estimate the burden of injuries varies substantially across the world – dividing the world into information-rich and information-poor regions. In some countries there are many sources of data for estimating both the incidence of deaths and non-fatal injuries from road crashes. In many others, the data sources for estimating deaths are fairly reliable but sources for estimating the incidence and burden of non-fatal injuries are not. And, in several others, there are comparatively few data sources available that allow population-based estimates of the incidence and public health burden of injuries. In these countries and regions, available data may not represent the entire national population, may have biases towards certain causes of diseases and injury, and may be poorly coded.

Our preliminary assessment of data availability for estimating the global burden of injuries identified the sub-Saharan Africa regions as the most information-poor regions of the world. Therefore, in this project we undertook a special effort to identify and acquire data sources in these regions that have not been traditionally used for estimating the burden of injuries. We conducted snowball searches of the published and gray literature from Africa, discussed data sources with regional experts, and worked closely with collaborators in seven countries to understand the architecture of local data sources and develop strategies for incorporating key data sources in the GBD analysis. We developed national and regional data source inventories and reviewed these with international and regional experts at two meetings (Boston, USA, 2009, and Swansea, UK, 2010) of the GBD Injury Expert Group.

When data sources were identified, we requested access to information as follows. We invited local collaborators to provide us with individual-record data, which would allow us to extract point estimates of various parameters classified to our definitions. When such data access was not feasible, we requested collaborators to provide tabulations extracted to our specifications (e.g. coded to GBD-2010 cause, age-, and sex- categories). Finally, when such analysis of data by our collaborators was not possible, we requested access to reports and publications that presented the most detailed results from the datasets.

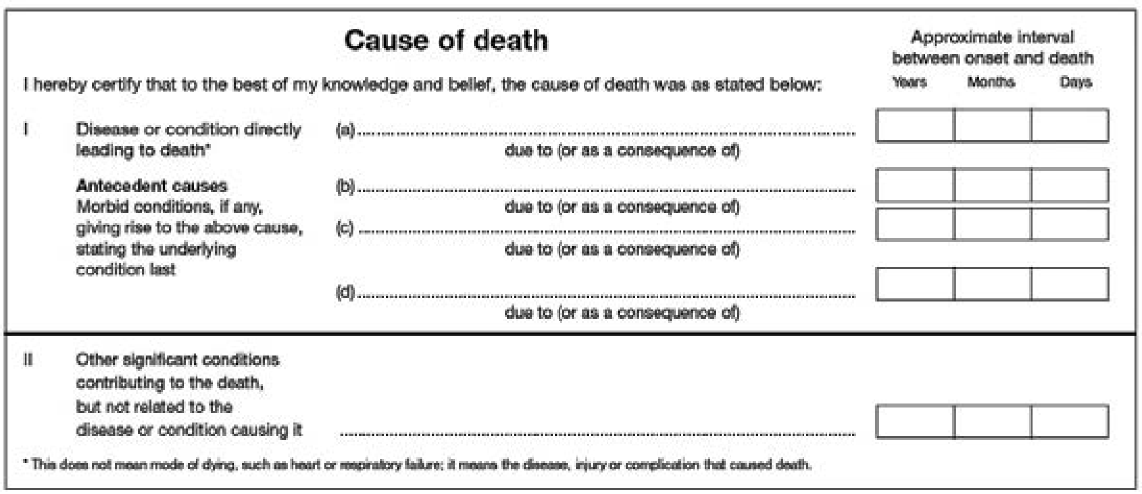
In the following sections, we highlight the various forms of data sources that we used to estimate the mortality and morbidity burden of injuries in sub-Saharan Africa. Wherever possible, we compare regional data availability with global data availability to highlight data weaknesses in the region. Our focus here is only on the data sources directly relevant to estimating road injuries. However, it should be noted that the estimates of the regional burden of disease involved many other data sources collected by the broader GBD-2010. These data are indirectly relevant to road injury estimates because the analytical structure of the project cross-links estimates of different diseases.

Data sources for estimating road injury mortality

Vital registration

Traditionally, public health researchers estimate national cause-specific mortality through analysis of data reported in national vital registration systems. Most countries around the world have civil registration systems that aim to provide individuals with an official government record of births and deaths that can be used for establishing legal status, nationality, and inheritance. In many countries, civil registers also include information about causes of death certified by a medical professional (Figure 2.1), giving civil registration the potential to be one of the most comprehensive sources for tracking national cause-specific mortality patterns. As a result, the availability and quality of vital registration statistics has received substantial attention in the global health literature (Hill et al., 2007, Mahapatra et al., 2007).

Figure 2.2 compares the availability of death registration data from countries in sub-Saharan Africa with countries in other regions. The figure illustrates that relatively few country-years of vital registration data were available from countries in the sub-Saharan Africa regions to GBD-2010. Even when available, much of the vital registration data from these countries has low completeness, often only covering selected urban centres, and uncertain quality of coding of causes of death (Mahapatra et al., 2007). Therefore, with a few exceptions such as South Africa, data from vital registers in sub-Saharan Africa are a relatively poor source for estimating the national incidence of injuries. However, they provide valuable information for the national sub-populations that they cover. In contrast, long time-histories of data are available from many regions of the world, including many low and middle-income regions. These include most countries in the Latin American regions, and Central and Eastern Europe, where national death registers are relatively complete, have high coverage, and relatively good quality of coding for estimating the national burden of injuries (Bhalla et al., 2010).



Cause of death

Approximate interval between onset and death

I hereby certify that to the best of my knowledge and belief, the cause of death was as stated below:

			Years	Months	Days
I	Disease or condition directly leading to death*	(a) .... due to (or as a consequence of)			
	Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) .... due to (or as a consequence of)			
		(c) .... due to (or as a consequence of)			
		(d) .... due to (or as a consequence of)			
II	Other significant conditions contributing to the death, but not related to the disease or condition causing it	....			

* This does not mean mode of dying, such as heart or respiratory failure; it means the disease, injury or complication that caused death.

Figure 2.1 Cause of death section of a sample medical certificate of death

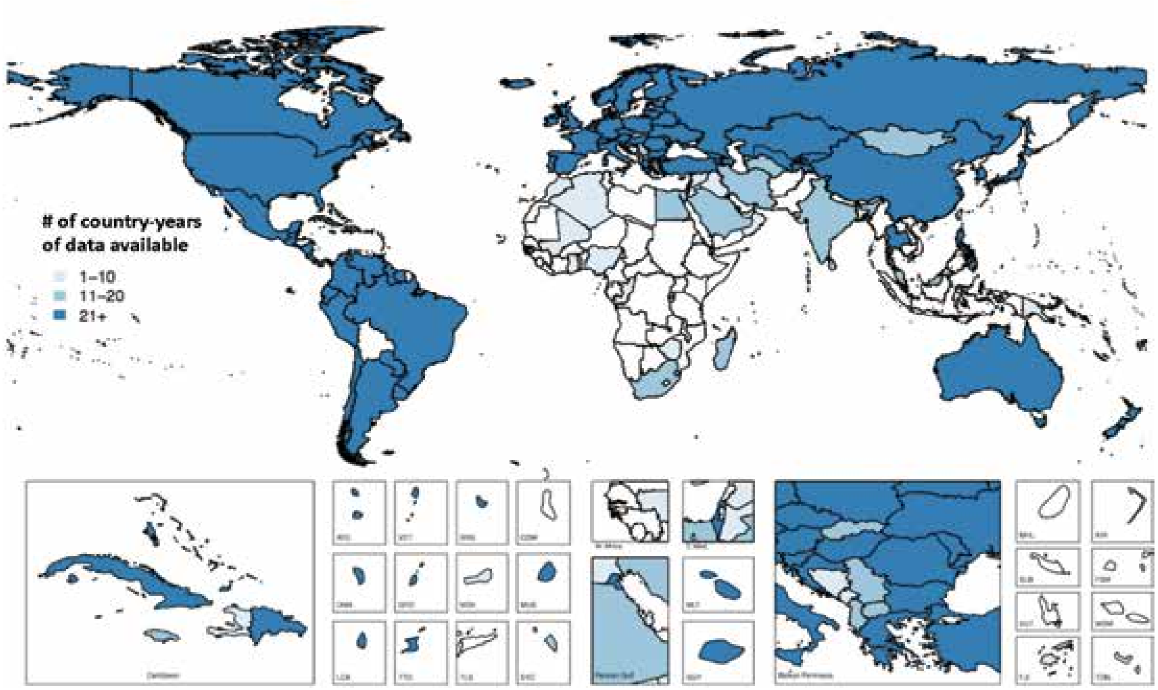


Figure 2.2 Global distribution of national vital registration datasets used for estimating injury mortality in GBD-2010

Verbal autopsy

In the absence of high quality vital registration systems in sub-Saharan Africa, alternate sources for estimating cause-specific mortality are particularly important. One approach for this involves assessing causes of death via a verbal autopsy, where family members of the deceased are asked about the circumstances and symptoms prior to death. Verbal autopsies may be conducted as large sample surveys or as part of surveillance in smaller communities. The process typically involves a team of trained researchers who use a structured list of questions (Figure 2.3). The validity of the causes of death identified by verbal autopsy methods has received substantial attention in recent years. In comparison with other causes of death, road injuries are usually identified accurately using verbal autopsies (Murray et al., 2007).

Figure 2.4 shows the global distribution of countries for which we used verbal autopsy data as an input for estimating road injury mortality. The figure shows that verbal autopsy data were available from many countries in regions that are poorly covered by vital registration systems. Notably, data were available from many countries in the sub-Saharan Africa regions, typically from Health and Demographic Surveillance Sites (HDSS) that monitor health of populations in rural communities. Many of these HDSS sites belong to the INDEPTH network and are among the only data sources available for estimating rural mortality patterns in sub-Saharan Africa. Figure 2.5 illustrates the injury death fraction (i.e. the fraction of all deaths that are due do injuries) at nine HDSS sites.

2012 WHO VERBAL AUTOPSY [FORM 3] DEATH OF A PERSON AGED 15 YEARS AND ABOVE		
NO.	QUESTIONS AND FILTERS	CODING CATEGORIES
SECTION 6. HISTORY OF INJURIES/ACCIDENTS		
3E100	Did s/he suffer from any injury or accident that led to her/his death? that led to her/his death?	YES NO DON'T KNOW
3E110	+ Did s/he suffer from a road traffic accident?	YES NO DON'T KNOW
3E120	+ + Was s/he injured as a pedestrian/walking?	YES NO DON'T KNOW
3E130	+ + Was s/he injured as an occupant of a car vehicle?	YES NO DON'T KNOW
3E140	+ + Was s/he injured as an occupant of a bus/heavy transport vehicle?	YES NO DON'T KNOW
3E150	+ + Was s/he injured as a driver or passenger of a motorcycle?	YES NO DON'T KNOW
3E160	+ + Was s/he injured as a pedal cyclist?	YES NO DON'T KNOW

Figure 2.3 Questions related with road injuries in a typical verbal autopsy questionnaire
Source: World Health Organization, 2012, Verbal Autopsy Standards: The 2012 WHO verbal autopsy instrument Release Candidate 1, Geneva: World Health Organization.

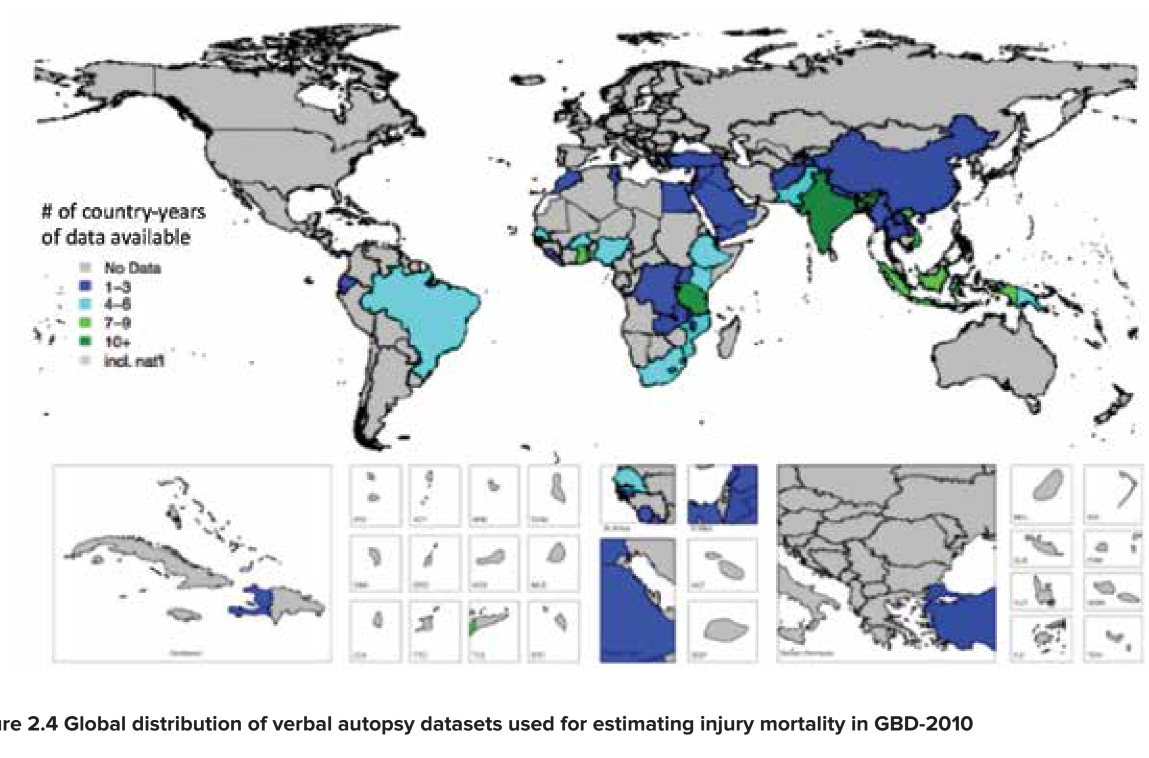


Figure 2.4 Global distribution of verbal autopsy datasets used for estimating injury mortality in GBD-2010

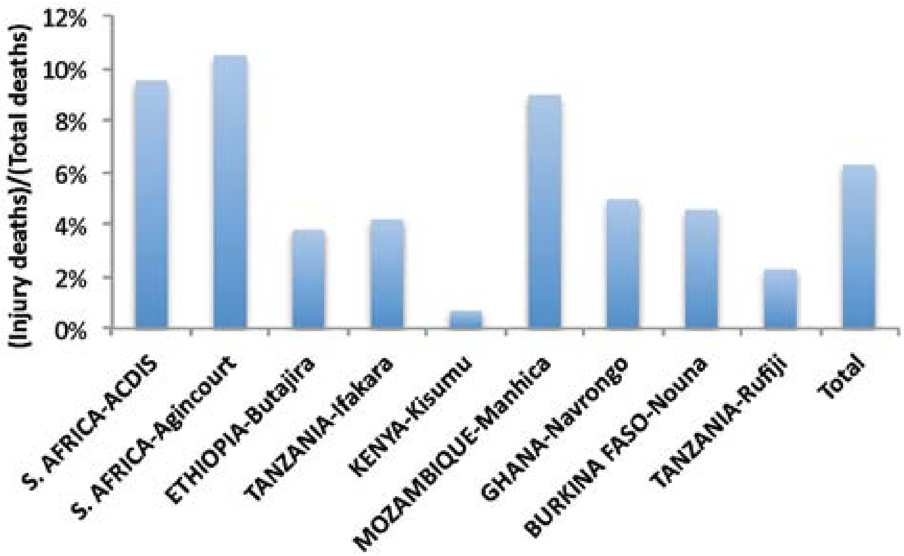


Figure 2.5 Injury death fractions reported at nine HDSS sites in sub-Saharan Africa
Source: Estimated from data for the period 1999-2002 provided by the INDEPTH Network to GBD-2010

Mortuary and burial registers

Even in countries that do not have a properly functioning vital registration system, local law can require a range of medico-legal practices that can create opportunities for obtaining statistics related with causes of injury deaths. Our investigations in sub-Saharan Africa revealed that the mortuaries attached to hospitals in the main urban centers of many countries routinely conduct investigation into the causes of deaths that do not have a history of disease. The findings from these investigations are usually recorded either digitally or in paper registers. Similarly, in many countries in the region, laws require relatives to obtain a permit before a dead body can be buried or cremated. The government offices issuing these certificates often keep records that identify causes of death as reported on the medical death certificate, if available, or as reported by the individual requesting the permit.

We expect relatively high quality of coding of road injury deaths in such data. Mortuaries typically employ trained professionals, who are often trained as forensic pathologists, and accurately identifying the causes of death is a primary focus of these investigations. Although causes listed in burial registers do not involve similar investigative efforts, our investigations comparing burial data with verbal autopsies in Ethiopia suggest that road injury deaths are accurately coded. This is likely because unlike most other causes of death, external causes of injury deaths are relatively easy to identify by lay reporters.

Therefore, we conducted a substantial effort aimed at identifying mortuaries and burial permit offices in sub-Saharan Africa. Whenever possible, we digitized existing data on causes of death available from mortuary and burial registers. In addition, we searched the published and gray literature for studies conducted at such sites and extracted information on causes of death.

Figure 2.6 shows the distribution of countries from sub-Saharan Africa for which we used mortuary and burial permits for estimating road injury mortality. Tables 2.1 and 2.2 provide locations, time period and case counts for the eight mortuary datasets from sub-Saharan Africa.

Our analysis of mortuary data revealed that the cause-of-death patterns were substantially biased towards injury deaths as expected from the medico-legal framework in which the mortuaries function. This bias implies that mortuary data cannot be used to estimate patterns for all causes of death. Thus, in our analysis, the use of mortuary data is restricted to identifying causes of injury deaths. Figure 2.7 illustrates the external causes of injury deaths that were recorded at these mortuaries.

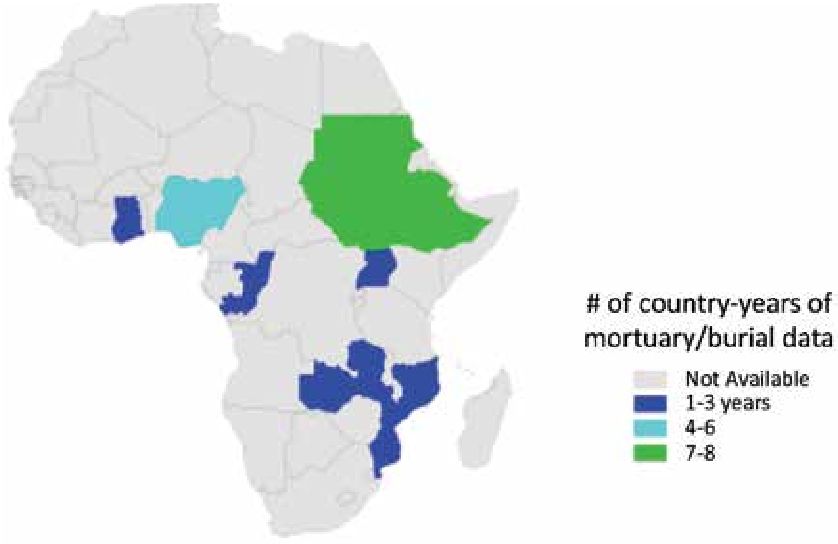


Figure 2.6 Distribution of verbal autopsy datasets from sub-Saharan Africa used in GBD-2010

REGION	COUNTRY	CITY	MORTUARY/BURIAL OFFICE
Sub-Saharan Africa, East	Ethiopia	Addis Ababa	King Menelik II Hospital Mortuary
Sub-Saharan Africa, West	Ghana	Kumasi	Komfo Anokye Teaching Hospital
Sub-Saharan Africa, South	Mozambique	Maputo	Maputo Central Hospital Mortuary
Sub-Saharan Africa, West	Nigeria	Ibadan	Ibadan University College Hospital Mortuary
Sub-Saharan Africa, East	Sudan	Omdurman Khartoum	Omdurman Hospital Mortuary Khartoum Teaching Hospital Mortuary
Sub-Saharan Africa, East	Uganda	Kampala	Mulago Teaching Hospital and Kampala City Mortuary
Sub-Saharan Africa, South	Zambia	Lusaka	Lusaka Burial Permit Registry at University Teaching Hospital

Table 2.1 Location of the mortuaries in seven countries in sub-Saharan Africa that contributed data to GBD-2010

Country	Period	Dates	Cases
Ethiopia	1 year	Jul 2006 - Jun 2007	1,114
Ghana	2 years	2005 – 2006	1,545
Mozambique	10 years	1994 – 2003	12,354
Nigeria	3 years	2007- 2009	1,045
Sudan	4 months	2010	255
Uganda	6 months	Jul - Dec 2007	757
Zambia	13 months	Nov 2007 - Dec 2008	594

Table 2.2 Duration and case counts for mortuary data from sub-Saharan Africa

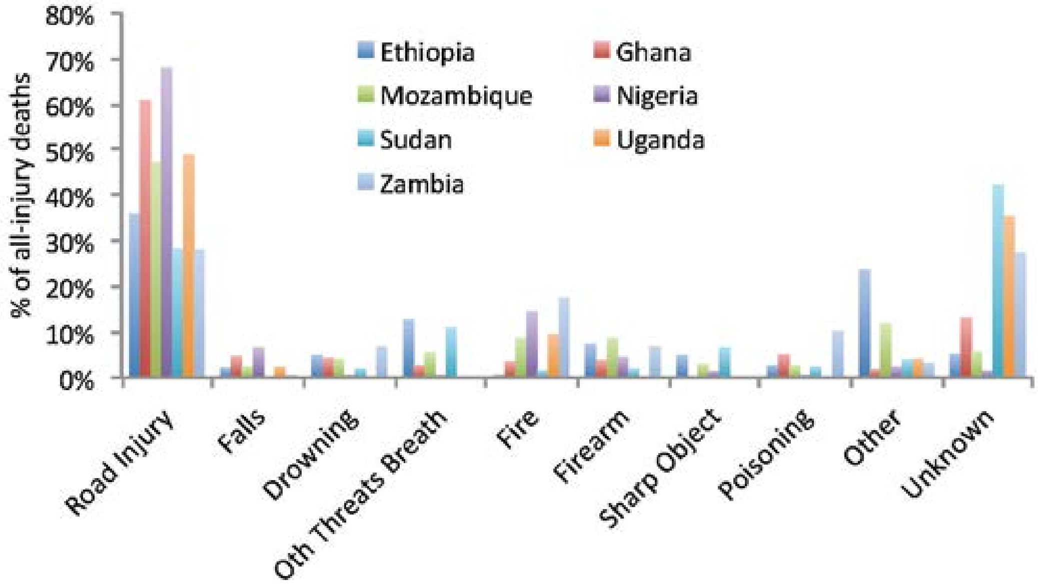


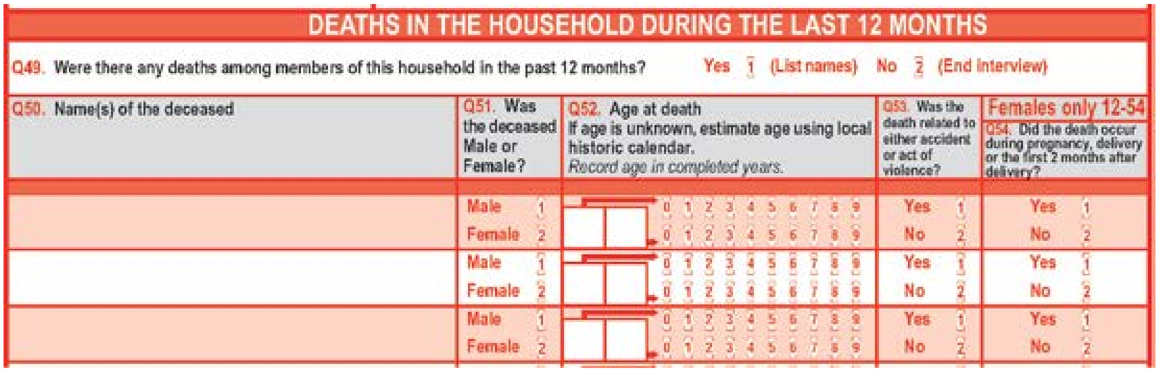
Figure 2.7 External causes of injury deaths recorded in mortuaries in sub-Saharan Africa

National population censuses and large sample surveys

Censuses are conducted decennially in most countries to generate information on the size and distribution of national population for planning and administration. A census, which in principle involves canvassing all households, may be followed by a large post-census nationally representative sample survey. In recent years, such surveys in many countries have included questions about household deaths in the previous year with the aim of estimating adult mortality and maternal mortality. Further, in order to improve estimates of maternal mortality, these surveys often include a "weed-out" question asking if the death was due to injury or violence. Figure 2.8 illustrates the mortality module from a typical questionnaire that was used in the 2008 census in Sudan. In such cases, the census data are a useful source of information for constructing national estimates of deaths that occur from external causes. Although road injuries are not specifically identified in most censuses, the accurate estimates of injury totals derived from census data, substantially reduces uncertainty in estimates of all sub-categories of injuries, including road injuries.

We checked the questionnaires for all household censuses conducted in sub-Saharan Africa in the last three decades and identified those that include questions that could be used to estimate injury mortality rates. Table 2.3 lists the country-year for which census data was available to GBD-2010. Next, we identified organizations that held the data for these censuses and worked with them to acquire tabulations of injury mortality disaggregated by age-, sex- and urban-rural.

Since census data has never before been used to estimate injury mortality pattern, we tested the face validity of the results in one country. South Africa is the only country in sub-Saharan Africa with a relatively complete death registration system. The 2001 census in South Africa included questions on injury mortality. Similarly, a large nationally representative community survey in South Africa in 2007 also included questions that allowed measurement of injury mortality. Thus, we compared the age-sex- specific injury death fractions (i.e. the fraction of all-cause deaths that are due to injuries) from the census and the death registration system for these two years (Figure 2.9). We found that in both cases the estimates based on census data closely tracked those based on vital registration providing important face-validity to censuses as a data source for estimating injury mortality rates in sub-Saharan Africa.



DEATHS IN THE HOUSEHOLD DURING THE LAST 12 MONTHS

Q49. Were there any deaths among members of this household in the past 12 months? Yes 1 (List names) No 2 (End interview)

Q50. Name(s) of the deceased	Q51. Was the deceased Male or Female?	Q52. Age at death If age is unknown, estimate age using local historic calendar. *Record age in completed years.*	Q53. Was the death related to either accident or act of violence?	Females only 12-54 Q54. Did the death occur during pregnancy, delivery or the first 2 months after delivery?
	Male 1 Female 2	0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9	Yes 1 No 2	Yes 1 No 2
	Male 1 Female 2	0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9	Yes 1 No 2	Yes 1 No 2
	Male 1 Female 2	0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9	Yes 1 No 2	Yes 1 No 2

Figure 2.8 Questions related with injuries in the mortality module of a typical census
Source: 2008 Census Questionnaire, Sudan Central Bureau of Statistics

Census/Survey Country-year	Type of Information Available
South Africa – 2001	Deaths due to accident or violence
South Africa–2007*	Natural and un-natural deaths by age, sex
South Sudan – 2008	Deaths due to accident or violence
North Sudan – 2008	Deaths due to accident or violence
Sierra Leone – 2004	Cause-specific deaths by age, sex. However, injuries are included in "Other causes"
Lesotho-2006	Cause-specific deaths by age, sex
Malawi-2008	Deaths due to accident/injury question for women 15-49 years old
Mozambique – 2007*	Deaths due to accident or violence

Table 2.3 Census datasets from sub-Saharan Africa that were used to estimate injury mortality in GBD-2010
** Large nationally representative household surveys*

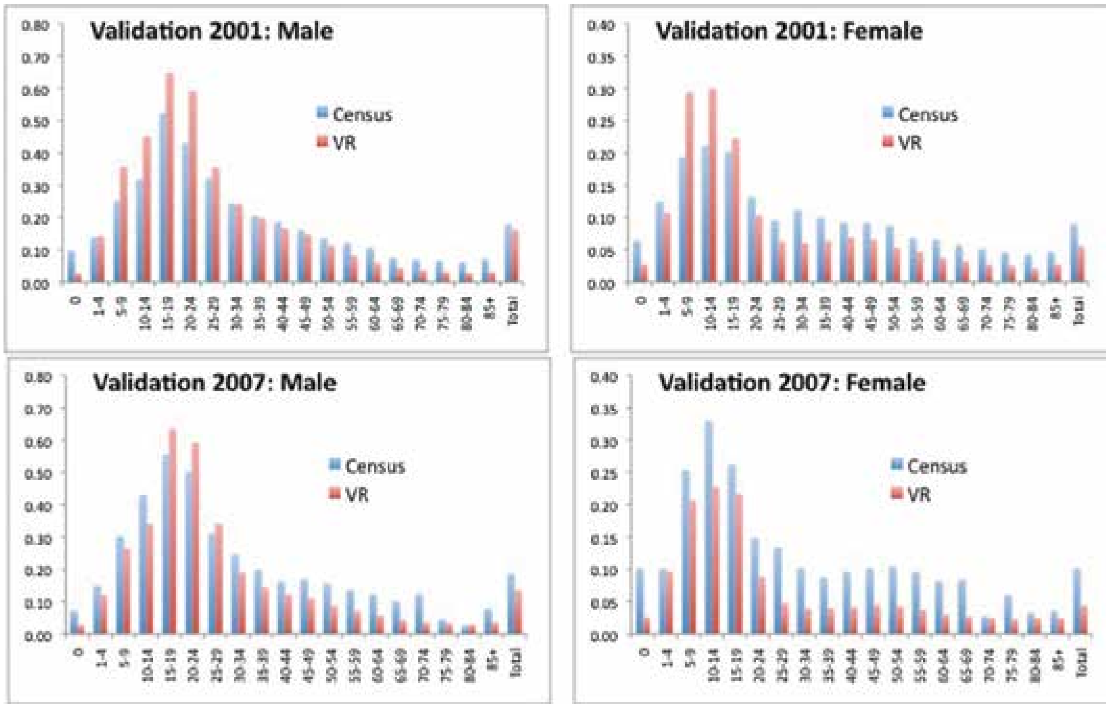


Figure 2.9 Injury death fractions measured in the 2001 South African Census and the 2007 South African Community Survey compared with estimates from national death registration data from the same years.

Sibling mortality surveys

Several health survey programs, notably including the World Health Surveys and Demographic and Health Surveys, include sibling mortality modules that aim to estimate adult mortality by asking respondents about sibling survival. As with the post-census surveys discussed above, these surveys occasionally include weed-out questions aimed at improving estimates of maternal mortality. In addition, some surveys, such as the WHS, include a verbal autopsy module asking about causes-of-death (Figure 2.10). Thus, we undertook a systematic search for surveys that included sibling mortality questions in sub-Saharan Africa and extracted estimates of injury and road injury mortality, wherever possible. Figure 2.11 shows the global distribution of these surveys and highlights the availability of such information from countries in sub-Saharan Africa.

For each sibling death recorded in Section B-1, answer the following questions.

		a. Sibling 1		b. Sibling 2		c. Sibling 3		d. Sibling 4		e. Sibling 5		f. Sibling 6		g. Sibling 7	
Q5200	If deceased, a woman aged 15-49, was she pregnant when she died?	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5
Q5201	If deceased, a woman aged 15-49 did she die during childbirth?	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5
Q5202	If deceased, a woman aged 15-49 did she die within 2 months after the end of pregnancy or childbirth?	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5
Q5203	Was the death associated with injury?	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5	Yes 1	No 5
Q5204	Was it due to 1. Accident 2. Suicide 3. Murder 4. War 5. Natural disaster														

Figure 2.10 Example of questions related with injuries in the sibling mortality section of a health survey
Source: 2003 World Health Surveys Questionnaire

Figure 2.11 Sibling mortality surveys that were used in our analysis of global road injury mortality

Traffic police reports

In most countries, statistics of deaths from road injuries are available from national traffic police. These statistics are usually the basis of official government statistics of national road injury deaths. We obtained traffic police data from the 2009 WHO Global Status Report on Road Safety, which provides a systematic compilation of official statistics from almost all countries in sub-Saharan Africa. Our initial assessment of these official statistics suggested dramatic underreporting of road deaths especially in the most information-poor regions. Thus, the primary use of the police reports in our analysis was to estimate the proportions of total road injury deaths that correspond to the various sub-categories of road users.

Data sources for estimating road injury morbidity

While road crashes are the external cause of health loss, the morbidity itself is due to the resulting sequelae, i.e. the nature of injuries (e.g. spinal cord injury, traumatic brain injury) resulting from the crash. Thus, measuring the burden of non-fatal road injuries has three key aspects. First, we need to estimate the incidence of non-fatal road crashes. Since the incidence of crashes depends on local transport characteristics, it can vary substantially across countries and regions. Thus, it was important for this project to acquire population-based estimates of the incidence of road crashes from household surveys from as many countries in sub-Saharan Africa as possible. Second, we need to convert incidence of road crashes into estimates of the incidence of the various sequelae of road crashes. Characterizing this relationship of external causes to sequelae requires high-quality hospital databases. To a large extent, the distribution of the nature of injuries resulting from a road crash is independent of country and region. Thus, regional diversity in data sources was considered less important for hospital databases used in this aspect of the project than geographic diversity in data sources for estimating incidence of road crashes. Finally, we need to estimate the short-term and long-term disability due to these sequelae. This information is available from studies that track the health of patients over the months and years following an injury. In the following sections, we describe the key data sources that we used for each of these aspects of estimating the burden of non-fatal road injuries.

National and community household surveys

The primary use of survey data in our models is to construct estimates of the incidence of non-fatal road injuries in the four sub-Saharan African regions (East, West, South, and Central). As with other data sources, we conducted an extensive search for survey data via snowball literature searches and direct communications with injury researchers. Once a household survey was identified, the owner of the data was contacted and access to raw data was requested. If they could not provide raw data, we requested access to specific tabulations of measurements to GBD definitions. When no data was available from the researcher or agency that conducted the survey, we extracted data from any publications (journal articles, reports, web-tables) that reported results from the survey.

While all of these household surveys included the measurement of road injury incidence as one of their aims, they nevertheless used widely varying instruments (questionnaires) to conduct such measurements. This variation in survey instruments reflects the lack of consensus among researchers about how the incidence of injuries should be measured in the field. Web-Appendix 1 includes the survey questionnaires from all surveys analyzed and Figure 2.12 illustrates a typical injury module.

Table 2.4 lists household injury surveys from Africa and identifies those surveys for which we had access to survey microdata. In order to standardize the estimates across the wide range of survey instruments, we developed methods for mapping across varying definitions. In particular, we used the World Health Surveys to estimate a recall curve for injury surveys and used the US National Health Interview Surveys to estimate the fraction of injury events that result in disability exceeding one-day. We mapped measurements of incidence of various medical care categories used in the surveys to the following three types: hospital admissions; care provided at a formal medical institution; all injuries regardless of care. The estimates of incidence extracted from this collection of surveys after these adjustments are shown in Web-Appendix 1.

CARE FOR ROAD TRAFFIC AND OTHER INJURIES ***(Questions to be asked to all respondents)***

Q6800	In the past 12 months, have you been involved in a road traffic accident where you suffered from bodily injury? *PROBE:* This could have been an accident in which you were involved either as the occupant of a motor vehicle, or when you were riding a motorcycle or bicycle, or walking.	1. Yes			5. No		
Q6801	When (in the last 12 months) did the accident happen?	1. Within the last 30 days	2. 1-2 months ago	3. 3-5 months ago	4. 6-12 months ago	8. DK	
Q6802	Did you receive any medical care or treatment for your injuries?	1. Yes			5. No		
Q6803	Where did you first receive care? ***READ CHOICES*** ***If care received from ambulance, hospital or outpatient facility, ask if it was government operated or private.***	1. On-site, ambulance	2. Hospital	3. Outpatient facility	4. Private physician	5. Traditional healer	6. Other
Q6804	Was it government operated or private?	1. Government operated	2. Private (including for-profit and not-for-profit)	8. DK			

Figure 2.12 Questions related with non-fatal road injuries in a typical household health survey
Source: 2003 World Health Surveys Questionnaire

No.	GBD REGION	COUNTRY	NAME OF SURVEY OR STUDY (YEAR)*	MICRODATA/ LIT REVIEW**
1	Sub-Saharan Africa, Central	Congo	WHS-COG (2003)	MICRODATA
2	Sub-Saharan Africa, East	Comoros	WHS-COM (2003)	MICRODATA
3		Djibouti	GSHS-11 (2007)	MICRODATA
4		Ethiopia	Ethiopia-CBIS (2006)	MICRODATA
5		Ethiopia	WHS-ETH (2003)	MICRODATA
6		Kenya	GSHS-3 (2003)	MICRODATA
7		Kenya	Nordberg et al. (2000)	LIT REV
8		Kenya	WHS-KEN (2003)	MICRODATA
9		Malawi	WHS-MWI (2003)	MICRODATA
10		Mozambique	Injury module in DHS (2003)	MICRODATA
11		Sudan	Sudan-SHHS (2010)	MICRODATA
12		Tanzania	GSHS-8 (2006)	MICRODATA
13		Tanzania	Moshiro et al. (2005)	LIT REV
14		Uganda	GSHS-7 (2003)	MICRODATA
15		Uganda	Kobusingye et al. (2008)	LIT REV
16		Zambia	GSHS-9 (2004)	MICRODATA
17		Zambia	WHS-ZMB (2003)	MICRODATA
18	Sub-Saharan Africa, South	Botswana	GSHS-1 (2005)	MICRODATA
19		Namibia	GSHS-5 (2003)	MICRODATA
20		Namibia	WHS-NAM (2003)	MICRODATA
21		South Africa	South Africa DHS (1998)	MICRODATA
22		South Africa	S. Africa WHS Sage (2008)	MICRODATA
23		South Africa	WHS-ZAF (2003)	MICRODATA
24		Swaziland	GSHS-6 (2003)	MICRODATA
25		Swaziland	WHS-SWZ (2003)	MICRODATA
26		Zimbabwe	GSHS-10 (2003)	MICRODATA
27		Zimbabwe	WHS-ZWE (2003)	MICRODATA
28	Sub-Saharan Africa, West	Burkina Faso	CWIQ (2003)	MICRODATA
29		Burkina Faso	WHS-BFA (2003)	MICRODATA
30		Chad	WHS-TCD(2003)	MICRODATA
31		Cote d'Ivoire	WHS-CIV (2003)	MICRODATA
32		Ghana	AMEND (2009)	LIT REV
33		Ghana	Ghana GSS5 (2006)	MICRODATA
34		Ghana	Ghana WHS Sage (2008)	MICRODATA
35		Ghana	Ghana-CWIQ (2003)	MICRODATA
36		Ghana	Ghana Mock (1995)	MICRODATA
37		Ghana	GSHS-2 (2007)	MICRODATA
38		Ghana	WHS-GHA (2003)	MICRODATA
39		Mali	WHS-MLI (2003)	MICRODATA
40		Mauritania	WHS-MRT (2003)	MICRODATA
41		Mauritius	GSHS-4 (2003)	MICRODATA
42		Nigeria	Nigeria Injury Survey (2006)	MICRODATA
43		Nigeria	Olawale et al. (2007)	LIT REV
44		Senegal	WHS-SEN (2003)	MICRODATA

Table 2.4 Household surveys of injury incidence in sub-Saharan Africa

** WHS: World Health Survey; GSHS: Global School-based Health Survey; DHS: Demographic and Health Survey; CWIQ: Core Welfare Indicators Questionnaire*

*** Indicates if microdata was available to us for analysis or if data extracted from published tables*

Hospital records

Hospital databases rarely cover entire national populations making them a poor source for estimating the population incidence of injuries. However, they contain detailed medical descriptions of the sequelae of road crashes, which are needed for estimating the disability burden of injuries. In our analysis of the burden of injuries, the primary use of hospital databases was to convert estimates of the incidence of external causes of injuries (e.g. road injury, drowning) into estimates of the incidence of sequelae of injuries (e.g. traumatic brain injury, hip fracture). In order to construct this mapping from external cause to sequelae, we needed access to hospital databases that track both external causes of injuries as well as sequelae. Further, in order to be able to construct age- and sex- specific mappings of external causes to sequelae, we needed access to these data at the level of unit records (microdata). Figure 2.13 shows the global availability of hospital records for such analysis. Most countries in this hospital database were from Western Europe, North America and from Latin America. However, the database included three sub-national hospital injury surveillance datasets from sub-Saharan Africa, one hospital each from Maputo city, Mozambique, Kampala, Uganda, and Lusaka, Zambia.

Figure 2.13 Geographic distribution of hospital datasets that were used for mapping estimates of non-fatal road injury incidence into estimates of the incidence of the injury sequelae in GBD-2010

Prospective studies on long-term disability following injuries

Most past work aimed at estimating the global and regional burden of injuries has relied on ad hoc assumptions about the long-term disability outcomes of injuries. However, recent studies that conducted prospective follow-up of victims make it possible to generate empirical evidence of health outcomes. We relied on four such studies (Table 2.5) to estimate the probability that an injury results in permanent reduction of functional capabilities. None of these studies were from sub-Saharan Africa or from developing countries. The use of disability outcomes data from high-income countries to estimate the burden of non-fatal injuries in developing countries is an important source of uncertainty in the GBD-2010 analysis.

The Medical Expenditure Panel Survey (MEPS) is a large-scale overlapping continuous panel survey of United States non-institutionalized population. The primary purpose of MEPS is to collect information on the use and cost of healthcare. Panels are two years long and are conducted in 5 rounds, which are conducted every 5 to 6 months. A new panel begins every year, while the last panel is in its second year. Each panel typically contains about 30-35 thousand individual respondents. In 2000, MEPS began collecting responses using the 12-Item Short Form Health Survey (SF-12) that assesses health related quality of life. We used pooled MEPS data from 2000 to 2009 for our analysis.

The Dutch Injury Surveillance System data come from a sample of injured patients who visited emergency departments in the Netherlands between 8 October 2001 and 31 December 2002. Follow-up data were collected via postal questionnaire at 2½, 5, 9, and 24 months after the injury. 10,612 individuals were included in the dataset from all ages. Health status was recorded using the EQ-5D form, which is a standardized instrument developed by the EuroQol group for clinical and economic appraisal of health status. The EQ-5D form has 5 questions with 3 levels of response, and therefore allows 243 possible health states.

The South Carolina Traumatic Brain Injury Follow-up Registry (SCTBIFR) includes a sample of South Carolina residents, age 15 or older, that were discharged from an acute care hospital in South Carolina between 1 January 1999 and 30 June 2002 with a traumatic brain injury-related hospitalization. 2118 individuals were included in the dataset. Follow-up was done one, two, and three years after the injury, and health status was recorded using the 36-Item Short Form Health Survey (SF-36), of which SF-12 is a shorter adaption. Conditions in SCTBIFR were recorded using ICD-9CM abstracted from medical records.

The National Study on Costs and Outcomes of Trauma (NSCOT) is a prospective study that examines the outcomes of trauma patients followed-up at 3 and 12 months. Original data included 5,191 patients with complete baseline data, of which 3,151 were interviewed at 12 months. SF-12 summary scores were given for both follow-ups. ICD-9CM codes were abstracted from medical records and pre-existing comorbidities were abstracted from medical records, the Charleston Comorbidity Questionnaire, and Medicare claims. The NSCOT included only patients with a diagnosis with a score 3 (severe) or higher on the Abbreviated Injury Scale (AIS).

Dataset	Country	Years	Follow-up	Health Measure Used
MEPS	USA	2000-2009	2 year panel survey in 5 rounds. Follow-up time from injury varies. SF-12 at rounds 2 and 4.	SF-12, EQ-5D
NSCOT	USA	2001-2002	3 month and 12 month	SF-12
DUTCH	NLD	2001-2004	2.5, 5,9,24 months	EQ-5D
SCTBIFR	USA	1995-2001	12, 24, 36 months.	SF-36

Table 2.5 Follow-up studies that were used in GBD-2010 to characterize the duration of disability following injuries

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Chapter 3: Methods

Definitions

The definition of what is an injury, and what is not, poses a theoretical challenge that can have important implications for estimating the burden of injuries. The conception of injuries most commonly used by public health professionals refers to sudden and discernable damage to the body due to energy exchange. However, as discussed by Langley and Brenner (2004), this description leaves several issues unresolved. For instance, what constitutes damage to body, what is the threshold of energy exchange rate that separates a disease from an injury, should surgical incisions be considered injuries, and should body damage include psychological harm? Clearly, the answers to these questions can have a large effect on the public health burden attributed to injuries.

Although GBD-2010 aimed to use an energy definition of injuries, what is included in the definition is best understood by the operational decisions in the study. Following the most common approach in the injury community, GBD-2010 operationalized injuries as all of the pathologies that are included in the ICD-9 and ICD-10 chapters that bear the name of injury. Further, GBD-2010 defined a lower threshold of injury severity and restricted the scope of the definition to events that impeded usual activities for one day or longer. This injury threshold was operationalized by modeling three types of injuries: deaths due to injury, non-fatal injuries warranting hospitalization ("injury warranting hospital care") and non-fatal injuries warranting treatment by a health care professional but not hospitalization ("injury warranting other health care"). In this definition, an injury warranting care is an injury that would have received care if adequate medical facilities had been available. Thus, the injury thresholds used are an indicator of injury severity and not whether the cases in fact led to hospitalization or other health care.

The ICD-based external cause definitions of road injuries used in GBD-2010 are shown in Table 3.1. Note that our definitions do not distinguish between traffic and non-traffic injuries. Instead our definitions follow the logic that a road injury is one that involves a collision with a vehicle intended for use in road transportation. Thus, this definition of road injuries excludes injuries that involve vehicles not intended for road use, such as farm tractors and snowmobiles, even if such injuries occur while these vehicles are being operated on a road.

GBD Category	ICD10 Code	ICD9 Code
Road injury	V01-V04, V06, V09, V10-V19, V20-V29, V30-V79, V87.2-V87.3, V80, V82	E811.7, E812.7, E813.7, E814.7, E815.7, E816.7, E817.7, E818.7, E819.7, E822.7, E823.7, E824.7, E825.7, E826.0, E827.0, E828.0, E829.0 E800.3, E801.3, E802.3, E803.3, E804.3, E805.3, E806.3, E810.6, E811.6, E812.6, E813.6, E814.6, E815.6, E816.6, E817.6, E818.6, E819.6, E820.6, E821.6, E822.6, E823.6, E824.6, E825.6, E826.1 E810.2-E810.3, E811.2-E811.3, E812.2-E812.3, E813.2-E813.3, E814.2-E814.3, E815.2-E815.3, E816.2-E816.3, E817.2-E817.3, E818.2-E818.3, E819.2-E819.3, E820.2-E820.3, E821.2-E821.3, E822.2-E822.3, E823.2-E823.3, E824.2-E824.3, E825.2-E825.3 E810.0-E810.1, E811.0-E811.1, E812.0-E812.1, E813.0-E813.1, E814.0-E814.1, E815.0-E815.1, E816.0-E816.1, E817.0-E817.1, E818.0-E818.1, E819.0-E819.1, E820.0-E820.1, E821.0-E821.1, E822.0-E822.1, E823.0-E823.1, E824.0-E824.1, E825.0-E825.1 E810.4, E810.5, E811.4, E811.5, E812.4, E812.5, E813.4, E813.5, E814.4, E814.5, E815.4, E815.5, E816.4, E816.5, E817.4, E817.5, E818.4, E818.5, E819.4, E819.5, E820.4, E820.5, E821.4, E821.5, E822.4, E822.5, E823.4, E823.5, E824.4, E824.5, E825.4, E825.5, E826.3, E826.4, E827.3, E827.4, E828.4, E829.4
Pedestrian injury by road vehicle	V01-V04, V06, V09	E811.7, E812.7, E813.7, E814.7, E815.7, E816.7, E817.7, E818.7, E819.7, E822.7, E823.7, E824.7, E825.7, E826.0, E827.0, E828.0, E829.0
Pedal cycle vehicle	V10-V19	E800.3, E801.3, E802.3, E803.3, E804.3, E805.3, E806.3, E810.6, E811.6, E812.6, E813.6, E814.6, E815.6, E816.6, E817.6, E818.6, E819.6, E820.6, E821.6, E822.6, E823.6, E824.6, E825.6, E826.1
Motorized vehicle with two wheels	V20-V29	E810.2-E810.3, E811.2-E811.3, E812.2-E812.3, E813.2-E813.3, E814.2-E814.3, E815.2-E815.3, E816.2-E816.3, E817.2-E817.3, E818.2-E818.3, E819.2-E819.3, E820.2-E820.3, E821.2-E821.3, E822.2-E822.3, E823.2-E823.3, E824.2-E824.3, E825.2-E825.3
Motorized vehicle with three or more wheels	V30-V79, V87.2-V87.3	E810.0-E810.1, E811.0-E811.1, E812.0-E812.1, E813.0-E813.1, E814.0-E814.1, E815.0-E815.1, E816.0-E816.1, E817.0-E817.1, E818.0-E818.1, E819.0-E819.1, E820.0-E820.1, E821.0-E821.1, E822.0-E822.1, E823.0-E823.1, E824.0-E824.1, E825.0-E825.1
Road injury other	V80, V82	E810.4, E810.5, E811.4, E811.5, E812.4, E812.5, E813.4, E813.5, E814.4, E814.5, E815.4, E815.5, E816.4, E816.5, E817.4, E817.5, E818.4, E818.5, E819.4, E819.5, E820.4, E820.5, E821.4, E821.5, E822.4, E822.5, E823.4, E823.5, E824.4, E824.5, E825.4, E825.5, E826.3, E826.4, E827.3, E827.4, E828.4, E829.4

Table 3.1 ICD-based operational definition of road injuries in GBD-2010

Pre-analysis of Input Data

We undertook a substantial effort to harmonize the vast variety of data sources described in the previous chapter. Most of the data sources used in GBD-2010 are secondary data that were not originally collected for estimating the global incidence and burden of injuries. As a result, the data sources were provided to the project in a wide range of formats – including unit-record, detailed tabulations, summary tables, among others. Furthermore, many of the datasets were from administrative data systems not intended for health surveillance and had poorly coded information. For these reasons, it was essential to clean the data and map them to a common set of definitions prior to analysis.

A detailed description of how the data was pre-processed prior to analysis has been reported elsewhere (Lozano et al. 2012, and Vos et al. 2012). In summary, we undertook the following six steps to harmonize the collected data:

1. Assessing completeness of mortality data sources

We assessed the completeness of vital registration and sample registration data points using the most accurate variants of death distribution methods: synthetic extinct generations, the generalized growth balance method, and a hybrid of the two, as described in Wang et al (2012). Among adults, i.e. the age group most at risk of road injuries, there were few vital registration or sample registration data points with completeness below 70% in our data collection.

For small-scale studies that collect data through household recall (e.g. verbal autopsy studies), past work has shown that there is a substantial undercount of deaths. For our work, the parameter of primary interest was the proportion of deaths by various causes and we assumed that the patterns of recalled deaths are the same as deaths that are not recalled.

2. Mapping across different coding schemes used in the underlying data

Many of the data sets used in our analysis were coded using various revisions of ICD, which have evolved from ICD8 to ICD10 during the study period of 1980-2010. In addition there are national variants and condensed lists of ICD (such as the ICD-9 Basic Tabulation List) that were commonly used in the data. It should be noted that many of the variants and condensed versions of ICD do not code the subtypes of road injuries shown in Table 3.1. We developed mapping from these various classification schemes to the GBD-cause list.

3. Reattribution of poorly specified cause codes in mortality data

The various ICD revisions include many codes that should not be identified as underlying causes of death but are commonly used as the underlying cause of death on death certificates. In addition, there are commonly used ICD codes that have less specificity than the GBD-cause list. For instance, road injuries could be assigned to ICD10-X59 ("Accidental exposure to other and unspecified factors"). GBD-2010 addressed this issue by identifying causes that should not be assigned as underlying cause of death, including 2759 codes in ICD10 and 3382 codes in ICD9, and identifying potential underlying causes based on pathophysiology. Deaths coded to these were then reallocated based on published literature, expert judgment, statistical analysis, and proportionate allocation across target causes.

4. Age- and sex- splitting of data

Although GBD-2010 produced estimates for 40 age- sex groups, data was often provided to us in more aggregate age groups and with different age categories. In such cases, the data was split using the global observed pattern of relative risks of death for a cause by age and the local distribution of the population by age. Relative risks of death by age were computed for each cause using the entire pooled dataset on medically certified causes of death. Similarly, where studies report deaths for both sexes combined, a similar approach was used to allocate these deaths to age-sex groups.

5. Smoothing

When data are disaggregated by country, age-, sex- and cause-, the number of cases in some cells can be very low and have relatively large stochastic fluctuations. Therefore, in cases where multiple years for a country-cause-age group were observed with zero deaths, we used a standardized smoothing algorithm, essentially a type of moving average.

6. Outlier detection

Data from some sources appeared implausible when compared with the bulk of other available information. Such outliers can have substantial effects on time series estimates. Therefore, we identified outliers that met the following criteria: large inconsistency with other data for the same cause in the same country at the same time; large inconsistency with other data for similar countries; or disproportionate effect on time series estimation. Observations that were identified as outliers were excluded from subsequent analysis.

7. Adjusting for measurement biases in survey data

Household surveys that ask respondents about past injury events are framed in a variety of ways that can result in biases in the estimate. We adjusted for these definitional differences by constructing adjustment factors. For instance, surveys are known to underestimate incidence of non-fatal road injuries depending on the duration of the recall period. Therefore, we constructed a correction function for recall bias using data from the World Health Surveys, which included a question asking respondents about when the injury occurred. We applied this correction to standardize incidence estimates across the wide range of recall periods used in household surveys.

Analytical Strategy

Overall

GBD-2010 used six different modeling strategies for estimating mortality from various causes depending on the cause and the strength of the available data. We used Cause of Death Ensemble Modeling (CODEm) to estimate deaths from road injuries and the various road-user subtypes disaggregated by age, sex, country, and year for all countries from 1980 to 2010.

To estimate the burden of non-fatal outcomes of road injuries, we first constructed estimates of the incidence of injuries using household survey data, hospital data, and road injury mortality estimates. Further, we used hospital data to construct matrices mapping the proportion of cases of road injuries that resulted in a particular nature-of-injury, allowing us to estimate incidence by nature-of-injury. We constructed estimates of prevalence using estimated durations and proportions of cases that experience long-term disability and computed estimates of years lived with disability by applying disability weights.

The following sections provide more details of the modeling strategy of each of these aspects.

Mortality

Our estimates of deaths due to road injuries (and the road-user sub-categories) were constructed using the modeling tool CODEm, which has been used extensively in the GBD-2010 project for most major causes of death. In recent studies, the CODEm model has been used to analyze maternal mortality (Hogan et al. 2010), breast and cervical cancer mortality (Forouzanfar et al. 2011), and malaria mortality (Murray et al. 2012). The CODEm methodology has been described in detail by Foreman et al. (2012) and a detailed application to GBD-2010 is described by Lozano et al. (2012). In the following section, we summarize and highlight some key aspects that are relevant to the estimates of road injury mortality.

The CODEm modeling strategy is based on the following three steps. First, a large range of plausible statistical models is developed for each cause. All possible permutations of selected covariates are tested and only models where the sign on the coefficient for a covariate is in the expected direction are retained. Note that for n covariates, this requires testing 2n models. In addition, four families of statistical models are developed using covariates: mixed effects linear models of the log of the death rate, mixed effects linear models of the logit of the cause fraction, spatial-temporal Gaussian process regression (ST-GPR) models of the log of the death rate, and ST-GPR of the logit of the cause fraction. Following this, ensemble models, or blends of these various component models, are developed. Next, the validity of all component models and ensembles is evaluated by doing out-of-sample predictions. Thus, part of the data is excluded from the initial models and predicted values for the withheld data are compared with the actual observed data. The model or ensemble that performs best on such validations is finally selected.

Our mortality models are single-cause fraction models where the sum of estimated cause-specific mortality may not equal the all-cause mortality envelope. Thus, we re-scale deaths from all causes to match the all-cause envelope using a simple algorithm called CoDCorrect. The algorithm functions at the level of each draw from the posterior distribution of each cause, and accounts for uncertainty such that causes known with higher precision are affected less by the re-scaling than causes with large uncertainty. Each cause is processed by CodCorrect to fit in the mortality series of its parent cause at each level. Thus, for instance road injury subtypes are rescaled to fit within the estimates of the road injury envelope, which in turn is rescaled to fit within the transport injury envelope.

The choice of covariates and priors and road injuries were based on expert consultation and a review of the literature. A covariate that is suitable for these statistical models has a set of important characteristics: First, there should be a theoretical reason to expect a relationship between the covariate and road injuries. Second measurements of the covariate at the national level should be available for most countries. Finally, data for the covariate should be available for most country-years from 1980 to 2005.

Covariates were classified by level based on their causal distance between the covariate and the cause. Thus covariates that are the most proximal, such as alcohol, which directly influences the rate of road crashes, were considered as level 1 covariates. However, education is more distally related with road injury rates and was classified as a level 3 covariate. Covariate priors indicated the predicted direction in which a given covariate will be predictive. For example, it is expected that increased alcohol consumption will be associated with increased mortality rates from road crashes, so the prior direction is specified as positive. Based on these considerations, eleven covariates were used to model the mortality rate of road injuries and the road-user subtypes. These covariates, level and assumed direction for CODEm modeling are listed in Table 3.2. Lozano et al. (2012) have provided more details of the mortality analysis method as well as statistical performance metrics for the road injury models.

Finally, we convert the age- and sex- specific road injury mortality estimates produced by CODEm into years of life lost by multiplying deaths at each age by the age-specific reference standard life expectancy developed by Murray et al. (2012).

Cause name	Level	Covariate	Direction
Road injury	1	Alcohol (liters per capita)	Positive
	1	Health System Access 2	Negative
	1	Vehicles - 2 wheels (per capita)	Positive
	1	Vehicles - 2 wheels fraction (proportion)	Positive
	1	Vehicles - 2+4 wheels (per capita)	Positive
	1	Vehicles - 4 wheels (per capita)	Positive
	2	Log LDI (I$ per capita)	-
	2	Log Log LDI Squared Squared	-
	2	Population 15 to 30 (proportion)	Positive
	2	Population Density (300-500 ppl/sqkm, proportion)	-
	2	Population Density (500-1000 ppl/sqkm, proportion)	-
	3	Education (years per capita)	Negative
	3	Rainfall Quintile 5 (proportion)	Positive
RTI - Pedestrian	1	Alcohol (liters per capita)	Positive
	1	Health System Access 2	Negative
	1	Vehicles - 2 wheels fraction (proportion)	Positive
	1	Vehicles - 2+4 wheels (per capita)	Positive
	2	Log LDI (I$ per capita)	-
	2	Log Log LDI Squared Squared	-
	2	Population 15 to 30 (proportion)	Positive
	2	Population Density (300-500 ppl/sqkm, proportion)	-
	2	Population Density (500-1000 ppl/sqkm, proportion)	-
	3	Education (years per capita)	Negative
	3	Rainfall Quintile 5 (proportion)	Positive

Continued next page

Cause name	Level	Covariate	Direction
RTI - Bicyclist	1	Alcohol (liters per capita)	Positive
	1	Health System Access 2	Negative
	1	Vehicles - 2 wheels fraction (proportion)	Positive
	1	Vehicles - 2+4 wheels (per capita)	Positive
	2	Log LDI (I$ per capita)	-
	2	Log Log LDI Squared Squared	-
	2	Population 15 to 30 (proportion)	Positive
	2	Population Density (300-500 ppl/sqkm, proportion)	-
	2	Population Density (500-1000 ppl/sqkm, proportion)	-
	3	Education (years per capita)	Negative
	3	Rainfall Quintile 5 (proportion)	Positive
RTI - motorized two-wheeler rider	1	Alcohol (liters per capita)	Positive
	1	Health System Access 2	Negative
	1	Vehicles - 2 wheels (per capita)	Positive
	2	Log LDI (I$ per capita)	-
	2	Log Log LDI Squared Squared	-
	2	Population 15 to 30 (proportion)	Positive
	2	Population Density (300-500 ppl/sqkm, proportion)	-
	2	Population Density (500-1000 ppl/sqkm, proportion)	-
	3	Education (years per capita)	Negative
	3	Rainfall Quintile 5 (proportion)	Positive
RTI - occupant in motorized vehicle with 3 or more wheels	1	Alcohol (liters per capita)	Positive
	1	Health System Access 2	Negative
	1	Vehicles - 4 wheels (per capita)	Positive
	2	Log LDI (I$ per capita)	-
	2	Log Log LDI Squared Squared	-
	2	Population 15 to 30 (proportion)	Positive
	2	Population Density (300-500 ppl/sqkm, proportion)	-
	2	Population Density (500-1000 ppl/sqkm, proportion)	-
	3	Education (years per capita)	Negative
	3	Rainfall Quintile 5 (proportion)	Positive
RTI - other	1	Alcohol (liters per capita)	Positive
	1	Health System Access 2	Negative
	1	Vehicles - 2 wheels fraction (proportion)	Positive
	1	Vehicles - 2+4 wheels (per capita)	Positive
	2	Log LDI (I$ per capita)	-
	2	Population 15 to 30 (proportion)	Positive
	3	Rainfall Quintile 5 (proportion)	Positive

Table 3.2 Candidate covariates, level and assumed direction for CODEm modeling of road injuries and their road-user subtypes

Morbidity

Vos et al. (2012) provide a detailed description of the methods used for estimating the burden of non-fatal health outcomes. Figure 3.1 provides a schematic illustration of the steps followed in estimating the burden of non-fatal injuries. In the following section, we summarize and highlight key aspects of the methods relevant to estimating the burden of road injuries in GBD-2010.

The analysis of the morbidity resulting from non-fatal road injuries poses a special challenge because although road injuries and their subtypes are defined by the external cause (e.g. pedestrian struck by motorized vehicle), the functional limitations are determined by the nature of the injury, such as traumatic brain injury or long bone fractures. Thus, estimating the burden of non-fatal road injuries involves constructing estimates of the incidence of road injuries and the incidence of nature-of-injury. We accomplished this and constructed estimates of years lived with disability from road injuries in the following steps:

1. We estimated the incidence of external causes (road injuries and road-user subtypes) of non-fatal injuries using available incidence data from household surveys and hospital databases using DISMOD-MR (Box-1).

2. We constructed estimates of the incidence of road injury sequelae (i.e. nature-of-injury) using mappings developed from hospital data.

3. We estimated the probability of developing long-term functional impairment based on pooled data from four follow-up studies and constructed equivalent disability weights for each individual at 12 months after injury.

4. We estimated prevalence of injuries by accounting for duration and computed burden of non-fatal road injury estimates.

Estimating incidence of non-fatal road injuries

Our first step in assessing the burden of non-fatal road injuries was to construct estimates of the country-, year-, age-, sex-specific incidence of non-fatal road injury. We accomplished this using DisMod-MR, an integrative systems model of disease in a population that generates consistent estimates of injury prevalence, incidence, remission, and mortality for each cause of injury.

The primary source of our data for constructing these estimates was point estimates of road injury hospitalizations as reported in hospital databases and household surveys, and road injuries that did not receive medical care as reported in household surveys. In addition, we used mortality from road injuries estimated as described above, as a covariate in DisMod MR. In essence this introduces an injury pyramid approach to estimating non-fatal injuries from deaths, as is commonly done in the injury literature.

In order to characterize the entire spread of injury severity, we estimated the incidence of two types of non-fatal road injuries:

- *road injury warranting hospital admission*, i.e. road injury that would have been hospitalized had such medical facilities been available; and

- *road injury warranting other health care*, i.e. road injury that would have warranted health care but not hospitalization had such health care been available.

It is important to note that these estimates do not refer to actual care received for injuries. Instead they refer to injuries that would have received health care had there been no barriers to health care in the particular setting. In other words, these are injuries that would have received health care had they occurred in a society with full health system access.

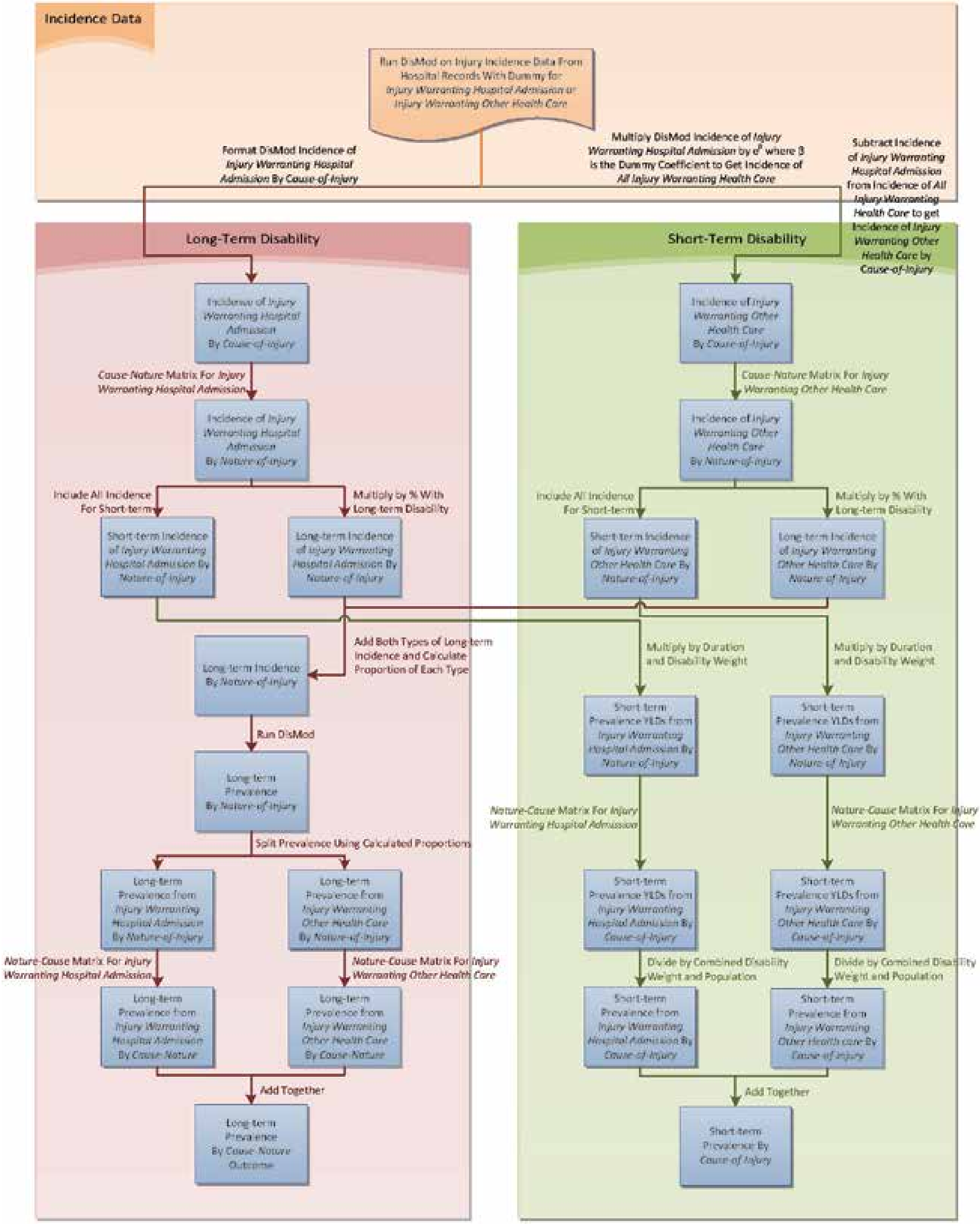

Figure 3.1 Schematic description of the steps followed in the analysis of the burden of non-fatal road injuries in GBD-2010

In order to produce estimates for these two types of injury severity, we included a “health care” dummy variable indicating whether a given data point for incidence represented cases resulting in hospitalization (dummy = 0) or cases seeking other health care (dummy = 1). Using the coefficient on the health care dummy and the incidence estimations from DisMod MR, we calculated incidence of road injury warranting hospital admission and incidence of *road injury warranting other health care*.

Box–1 DISMOD-MR

DisMod-MR is a Bayesian meta-regression tool developed specifically for GBD-2010. DisMod-MR estimates a generalized negative binomial model for all epidemiological data with two types of covariates (one set that predicts variation in true rates and one set related to measurement bias); super-region, region, and country random intercepts; and age-specific fixed effects. In cases where it is appropriate, one can assume that the incidence, remission, and excess mortality rates have been constant overtime, which allows data on incidence, prevalence, excess mortality, and cause-specific mortality to inform prevalence estimates.

The differential equations governing the relationship between the parameters of incidence, remission, mortality, prevalence, and duration are well characterized and have been used in previous rounds of the GBD.

DisMod-MR integrates over any observed age range so that data reported for any age group can inform the maximum likelihood estimate. In addition, there are study-level covariates that allow estimation from within the data of the relationship between different case definitions, data sampling, or other methodological variations. The analyst can set a reference value for these covariates so that DisMod-MR predictions are for the desired reference category. Study level covariates can also be included in the parameters of the gamma distribution of the negative binomial. As with any meta-regression tool, country-level covariates can be included that relate to variation in prevalence or other epidemiological parameters across countries.

DisMod-MR also allows the analyst to set prior distributions for the ranges of epidemiological parameters, the first derivative of parameters with respect to age over different age intervals, and the smoothness of estimates with respect to age. Estimation of posterior distributions at the region-sex-time period level allows for the regional age-sex pattern to vary if the data are strong.

Vos et al. (2012) provide more details about DisMod-MR.

Estimating incidence of road injury sequelae (nature-of-injury)

In order to construct the incidence of sequelae we used hospital data from 28 countries (from Southeast Asia; Central, Eastern, and Western Europe; Central, Southern, and Tropical Latin America; North Africa/Middle East; North America High Income; and East Sub-Saharan Africa) with dual coding of discharges by external cause and nature-of-injury following ICD9 and ICD10. We mapped ICD nature-of-injury codes in the hospital data to a summary list of GBD categories shown in Table 3.3.

We used negative binomial models to estimate the probability that a road injury would result in a particular sequela as a function of age, sex, and an indicator variable for developed versus developing countries. We created separate models for road injury warranting hospital admission and road injury warranting other health care. While the former relied on the full list of hospital databases, the latter relied on the US State Emergency Department Databases (SEDD) with data on ER discharges in Arizona, California, Florida, Iowa, Massachusetts, North Carolina, New Jersey, and Wisconsin from 2003 to 2008.

The result of this step in the analysis was a series of matrices, two for each age-sex-region corresponding to the need for hospital or other care. Each cell in this matrix gives the fraction of incident cases for each external injury cause that has a particular nature-of-injury. We multiplied these fractions by incidence estimates of road injuries to obtain the incidence of nature-of-injury resulting from road injury.

Estimating incidence of permanent and short-term disability

We estimated the proportion of each road injury sequelae that go on to have long-term disability in the following steps. First, we produced a pooled dataset of health status measures gathered from four prospective follow-up surveys: the Dutch Injury Surveillance System, (Melse et al., 2000) South Carolina Traumatic Brain Injury Follow-up Registry, (SCTBIFR, 2012), the National Study on Costs and Outcomes of Trauma, (Mackenzie et al. 2007), and the Medical Expenditure Panel Survey 2000-2009 (MEPS, 2012). These data allowed us to track the relative health of individuals suffering different injuries with a one-year follow-up.

The analysis was complicated by the need to crosswalk between the health status measures used in the four surveys. We accomplished this using the 2000-2003 MEPS, which included EQ-5D responses in addition to the SF-12 measures. Also, in order to properly compare these measures with the nature-of-injury disability weights to be used in YLD calculation, it was necessary to further crosswalk to disability weight space. Therefore, we estimated the effect of each injury on disability after a year using a regression and comorbidity correction utilizing uninjured individuals from MEPS as a baseline population. The disability weights evaluated by the GBD Disability Weight Survey (Salomon et al. 2011) for each type of injury were assumed to be the "full" disability after a year. The model estimated disability weight after a year was then divided by this "full" disability, which resulted in the estimated probability of long-term impairment.

	Sequelae Name	ICD10	ICD9
N1	Open wound, superficial injuries and dislocations	S00-S01, S03-S03.5, S05, S08-S10, S11.1-S11.9 S13, S15-S16, S19-S21 S23, S29.0, S30-S31 S32.2 S33, S39.0 S40-S41 S45-S46 S50-S51 S53.0-S53.4 S55-S56 S60-S61, S63 S65-S66, S70-S71, S73.1, S75-S76, S80-S81, S85-S86, S90-S91, S93.0-S93.6, S95-S96, S99(ex S99.7), T00-T01, T03, T06.3-T06.4, T09.0-T09.2, T09.5, T11.0-T11.2 T11.4-T11.5, T13.0-T13.2,T13.5,T14.0-T14.1,T14.3, T14.5-T14.6 T15-T17,T33-T35,T90.1, T90.4,T92.0,T92.3,T92.5, T93.0,T93.3, T93.5	830-8301 832-83412 837-83952 83969 83979-840 8403 8405-843 845-848 86401 86411 8700-87362 87364-87372 87374-8739 8742-884 890-894 900-9009 903-9049 9056-9058 9060-9063 9104-9249 930-9349 950 9910-9913
N2	Injury Requiring Urgent Care	S07, S17, S38.0-S38.3, S47, S57, S67, S77, S87, S97, T04, T14.7 T18-T19, T36-T65, T67-T70, T73-T74, T75.0 T75.2-T75.8, T78-T85, T88, T91.5,T92.6,T93.6, T96-T97	9064 925-929 9350-9399 960-990 9914-9940 9942-9946 9948-9999
N3	Injury Requiring Emergency Care	S35-S37, S39.6-S39.9, T27.0-T27.7, T71, T75.1	863-86400 86402-86410 86412-8691 902-9029 9471 9941 9947
N4	Fracture of clavicle, scapula, humerus, or skull	S02.0-S02.1, S02.7, S02.9, S42, S49.7, T02.0, T90.2	800-801 8030 8035 8040 8045 810-812
N5	Fracture of sternum, rib, or face bone	S02, S02.2-S02.6, S02.8, S22, S22.2-S22.3, S22.8-S22.9	802 80701-80711 8072-8073 825-826 87363 87373
N6	Fracture of wrist,other distal hand, foot except ankle	S62, S69, S69.7-S69.9, S92, S99.7, T92.2	814-8191 827-8271
N7	Fracture of radius or ulna	S52, S59.7-S59.9 T02.2, T02.4, T10, T92.1	813 9052
N8	Fracture of femur	S72, S72.3-S72.9	821
N9	Fracture of Hip	S72.0-S72.2, T93.1	820 9053
N10	Fracture of patella, tibia, fibula, or ankle	S82, S89.7, T02.3, T02.5-T02.6, T12, T12.0-T12.1	822-824 9054
N11	Fracture of pelvis	S32.1, S32.3-S32.8	8056-8057 808-8091
N12	Long term outcome of dislocation of hip/knee/shoulder	S43 S730 S83	831 835-836 83961 83971 8400-8402 8404 844
N14	Burns, <20% total burned surface area without lower airway burns	T20-T27 T28-T30 T310-T311 T320-T321	9100-9103 940-9470 9472-9481 949
N16	Burns, ≥ 20% TBSA or ≥ 10% TBSA if incl. head/neck or hands/wrist	T312-T319 T322-T329 T66 T95	9065-9069 9482-9489
N17	Amputation of both lower limbs or both upper limbs	T050-T055	8876-8877 8962-8963 8976-8977
N19	Amputation of one lower limb or one upper limb	S48 S58-S589 S68 S683-S689 S78 S88 S98-S980 S983-S984 T056 T116 T136	8870-8875 8960-8961 8970-8975
N20	Amputation of finger(s) (with/without thumb or toe)	S680-S682 S981-S982	885-886 895
N21	Injured nerves	S04 S44 S54 S64 S74 S84 S94 T062 T113 T133 T144 T903 T924 T934	9073-9079 951 953-957
N22	Spinal cord lesion neck lvl	S14 T060	8060-8061 9520
N23	Fracture of vertebral column	S12 S220-S221 S320 T911	805-8055 8058-8059 9051
N24	Spinal cord lesion below neck level	S24 S34 T061 T08 T913	8062-8069 9072 9521-9529
N27	Severe traumatic brain Inj	S06 T905	9070
N28	Severe chest injury	S110 S224-S225 S25-S28 S297 T914	80700 80712-80719 8074-8076 860-862 8740-8741 901 9080

Table 3.3 ICD codes corresponding to GBD-2010 sequelae of injuries

Next, we multiplied the incident nature-of-injury cases by the probabilities of long-term injury for *injury warranting hospital admission* and *injury warranting other health care* by *nature-of-injury* category, to construct estimates of long-term injury.

For short-term incidence by nature-of-injury, we included all cases of *injury warranting hospital admission* and *injury warranting other health care*. Dividing cases by population gave us our short-term incidence, which we kept divided between short-term incidence of *injury warranting hospital admission* and short-term incidence of *injury warranting other health care*. This was necessary so that we could later use type-specific disability weights and nature-cause matrices to more accurately estimate short-term prevalent YLDs.

Computing burden estimates (YLD)

Finally, with estimates of short-term and long-term nature-of-injury incidence, we proceeded towards estimating their associated burden in YLDs. We summed both types of long-term incidence and applied DisMod-MR to estimate long-term nature-of-injury prevalence, assuming remission was equal to 0 and using relative-risk of mortality and standardized mortality ratio data from literature reviews, as available.

For short-term disabilities, we directly calculated prevalent YLDs arising from both *injury warranting hospital admission* and *injury warranting other health care* for each nature-of-injury category by first multiplying short-term nature-of-injury duration in years to get prevalence. We then multiplied prevalence by population to get prevalent cases and multiplied prevalent cases by short-term nature-of-injury disability weights to get prevalent YLD.

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Chapter 4: Results

Burden of road injuries compared with other diseases

Road injuries killed an estimated 231,000 (95%UI: 180,000-306,000) people in sub-Saharan Africa in 2010, accounting for almost one-fifth of the global road injury death toll (Table 4.1). The road injury death rate in sub-Saharan Africa, 27.0 per 100,000 people, was 40% higher than the global road injury death rate. In addition to deaths, there were over 8 million non-fatal injuries, of which 885,000 were severe enough to warrant hospital admission if adequate access to medical care were available to the victims. The combined burden of non-fatal road injuries in sub-Saharan Africa exceeded 14 million healthy life years lost.

Approximately half of the road injury death toll of sub-Saharan Africa occurred in the Western region (Table 4.1). This is partly because it is the most populous sub-region. More importantly, the Western region had a substantially higher road injury rate of 34.4 per 100,000, 27% higher than the sub-Saharan Africa average and 78% higher than the global average. The Southern region had the lowest road injury death rate. However, we expect that the road injury burden in this region has been substantially underestimated in the GBD-2010 analysis because of methodological difficulties in processing the vital registration data available from the region.

		Sub-Saharan Africa				
	Global	**Central**	**Eastern**	**Southern[3]**	**Western**	**Total**
Deaths [95% UI]	1,328,535 [1.0M-1.7M]	22,761 [13k-54k]	83,614 [67k-112k]	8,962 [6k-11k]	115,680 [88k-138k]	231,017 [180k-306k]
Death rate (per 100k)	19.3	23.6	23.6	12.8	34.4	27.0
% of all-cause deaths	2.6%	2.0%	2.8%	1.2%	3.4%	2.8%
Severe non-fatal inj.[1]	9,150,864	109,601	355,719	69,126	350,870	885,316
Total non-fatal inj.[2]	78,163,025	964,848	3,267,240	584,499	3,369,311	8,185,898
DALYs [95% UI]	76,755,034 [62M-95M]	1,582,391 [0.9M-3.1M]	4,697,452 [3.7M-6.2M]	605,172 [0.4M-0.7M]	7,271,493 [5.5M-8.7M]	14,156,508 [11M-18M]
DALYs rate (per 100k)	1114	1640	1322	859	2164	1652
% of all-cause DALYs	3.0%	2.2%	2.3%	1.4%	2.9%	2.5%

Table 4.1 Deaths and healthy life years lost (DALYs) due to road injuries in sub-Saharan Africa in 2010

[1] *Non-fatal injuries severe enough to warrant hospital admission if adequate access to medical care was available.*

[2] *Non-fatal injuries severe enough to warrant any medical care if adequate access to care was available.*

[3] *Our estimates of road injury deaths in Southern SSA are likely too low. For instance, in South Africa, which has 71% of the regional population, the road injury death rate based on national traffic police statistics is 2.3 times our estimate. See also footnote on Page 72.*

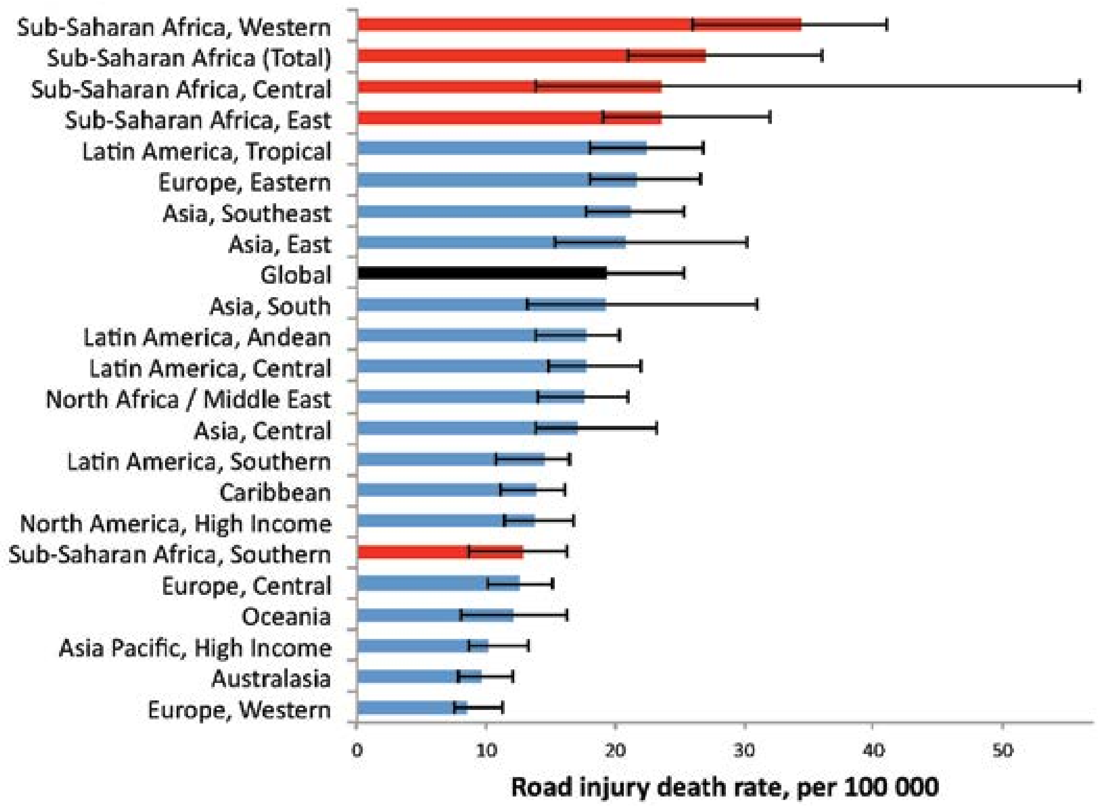


Figure 4.1 Road injury death rates in 2010 in the four regions of sub-Saharan Africa compared with other global regions.
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

In fact, sub-Saharan Africa has the highest road injury death rate of all regions in the world (Figure 4.1). Western, Central and Eastern sub-Saharan Africa are the three least safe regions of the world. The road injury death rates in Western sub-Saharan Africa are more than four times that in Western Europe, which is the region with the lowest road injury death rate globally.

The relative importance of road injuries to health in sub-Saharan Africa is similar to the global importance of the problem. Road injuries accounted for 2.5% of the total healthy life lost in the region, slightly less than the global average of 3.0% (Table 4.1). On the other hand, they accounted for 2.8% of all deaths in sub-Saharan Africa, slightly more than the global average of 2.6%. In the Western region, they accounted for 3.4% of all deaths, substantially higher than the global average.

Figure 4.2 illustrates the ranking of road injuries as a public health issue relative to other diseases in sub-Saharan Africa. Road injuries are the 8th leading cause of death in sub-Saharan Africa. They are also the 8th leading cause of death globally, and in developing countries. In contrast, road injuries are the 17th leading cause of death in developed countries even though they have dramatically higher motorization rates. Road injuries rank among the top 10 cause of death in the Western and Eastern regions, ranking relatively low only in the Southern region, where our models underestimate road injury deaths.

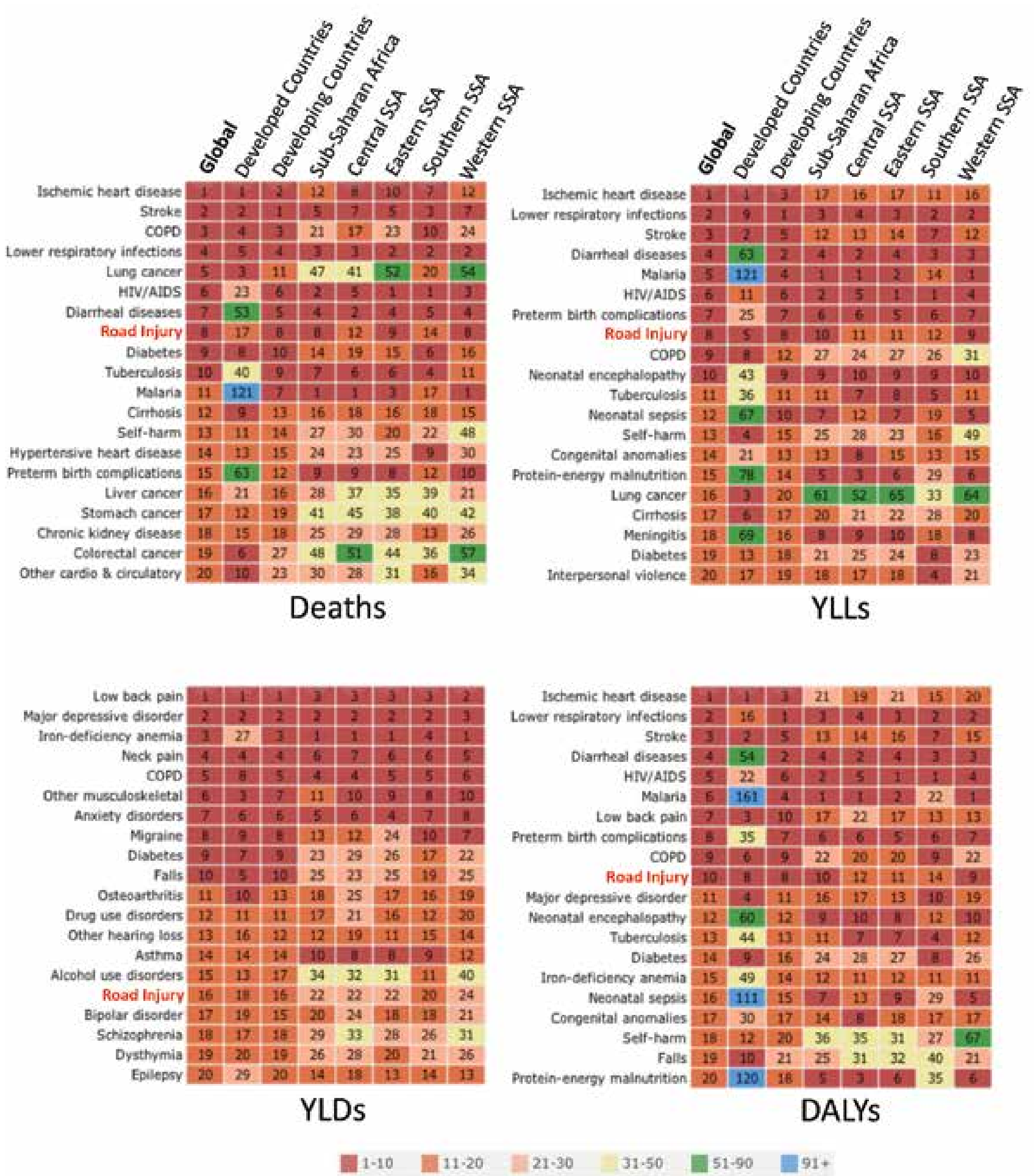


Figure 4.2 Rankings of causes of death, premature mortality (YLL), years lived with disability (YLD), and healthy life lost (DALYs) in sub-Saharan Africa regions in 2010. Colors in the heat map show how high a cause ranks in a region.
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

Notably, the health loss due to road injuries in sub-Saharan Africa exceeds that from tuberculosis and maternal disorders, two conditions that receive substantial attention from the global health and development community. As Figure 4.2 illustrates, road injuries are the 10th leading cause of healthy life years lost (DALYs) in sub-Saharan Africa ahead of tuberculosis, ranked 11th, and maternal disorders, ranked 15th (not shown in Figure 4.2 because it only includes the top 20 global causes). Similarly, road injuries are the 10th leading cause of premature mortality (YLLs) in sub-Saharan Africa, ahead of tuberculosis, ranked 11th, and maternal disorders, ranked 14th. Among leading causes of death, road injuries rank one place behind tuberculosis with a death toll that is only about 20% smaller, but seven places ahead of maternal disorders with almost twice as many deaths.

Transition in health and the growing importance of road injuries

Road injuries are emerging as a leading public health problem in sub-Saharan Africa against the backdrop of an ongoing transition in population health, away from mostly infectious disease in children to non-communicable disease and injuries that affect adults. Figure 4.3 shows the ranking of causes of death in 1990 in sub-Saharan Africa. Comparing this with Figure 4.2 shows that over the last two decades, road injuries have risen substantially in the cause rankings. In 1990, road injuries were among the top 10 causes of death in global rankings as well as in developing countries. However, road injuries were not among the top 10 causes of death in any of the sub-Saharan Africa regions in 1990. In contrast, over the same period, several other diseases, such as tuberculosis, malaria, and diarrheal diseases show substantial declines in the rankings.

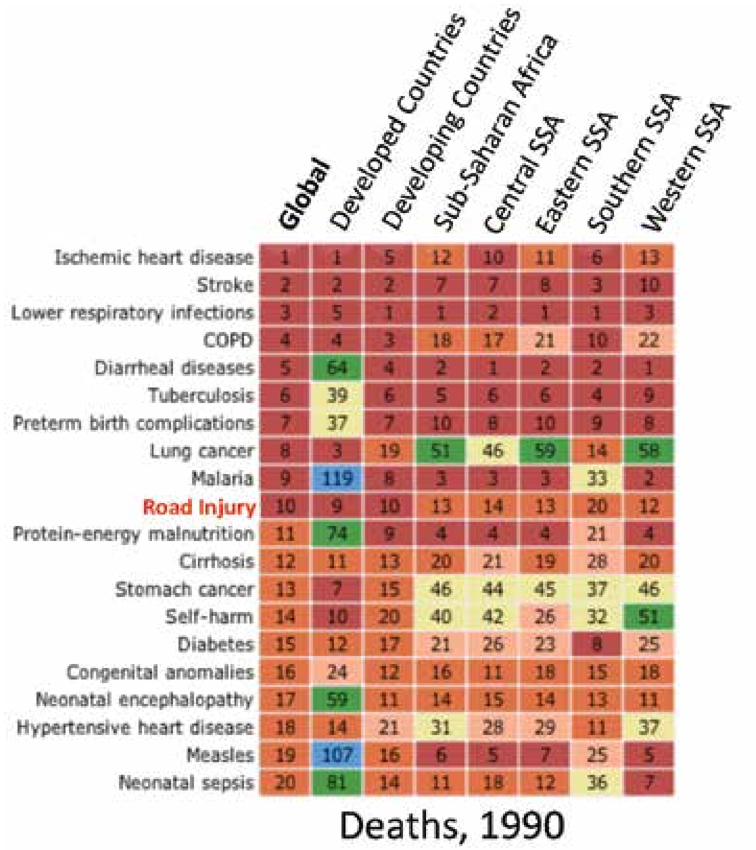


Figure 4.3 Ranking of cause of death in sub-Saharan Africa regions in 1990

Figure 4.4 illustrates the shifting disease pattern and its links with economic development by comparing four regions that have substantially different levels of industrialization – sub-Saharan Africa, India, China and economically developed countries. The figure is a tree map, which is essentially a square pie chart. The area of the rectangles is proportional to deaths due to a particular cause group. The figure broadly illustrates that as regions industrialize, the proportion of deaths due to communicable, maternal and nutritional disorders (i.e. Group A diseases, shown in red) steadily declines. Simultaneously, the proportion of deaths due to non-communicable diseases (Group B, blue) and Injuries (Group C, green) increases. Therefore, while Group A diseases comprise 66% of all deaths in sub-Saharan Africa and 35% in India, they only comprise 6% of all deaths in China and developed countries. In contrast, Groups B and C comprise 34% (9% injuries) of all deaths in sub-Saharan Africa, 65% (11% injuries) in India, 94% (10% injuries) in China, and 94% (7% injuries) in developed countries. However, it is important to note that the relative proportion of injuries, especially road injuries, varies comparatively less through the health transition. Road injuries comprise 2.8% of all deaths in Africa, 2.8% in India, 3.4% in China, and only 1.2% in developed countries. Thus, the relative importance of road injuries to the health agenda in sub-Saharan Africa is similar to that in India and China, which are already devoting substantial attention to road safety policy.

Road injury deaths now comprise a relatively large proportion of all deaths in sub-Saharan Africa partly because road deaths in the region are rapidly increasing (Figure 4.5). The global road death toll has risen by 46% over the last two decades. However, road deaths in sub-Saharan Africa grew almost twice as fast, rising by 84%. The Western and Southern regions of sub-Saharan Africa experienced the highest increases of all regions in the world with a rise of 111% and 102%, respectively. It should be noted that a substantial portion of these increases are simply a result of population growth. Road injury death rates in sub-Saharan Africa rose only by 10% over this period, from 24.4 to 26.9 per 100,000. Thus, the rapid increase in the road death toll is partly due to successes in controlling diseases of childhood resulting in an increasing number of young adults who are most vulnerable to injuries in road traffic crashes.

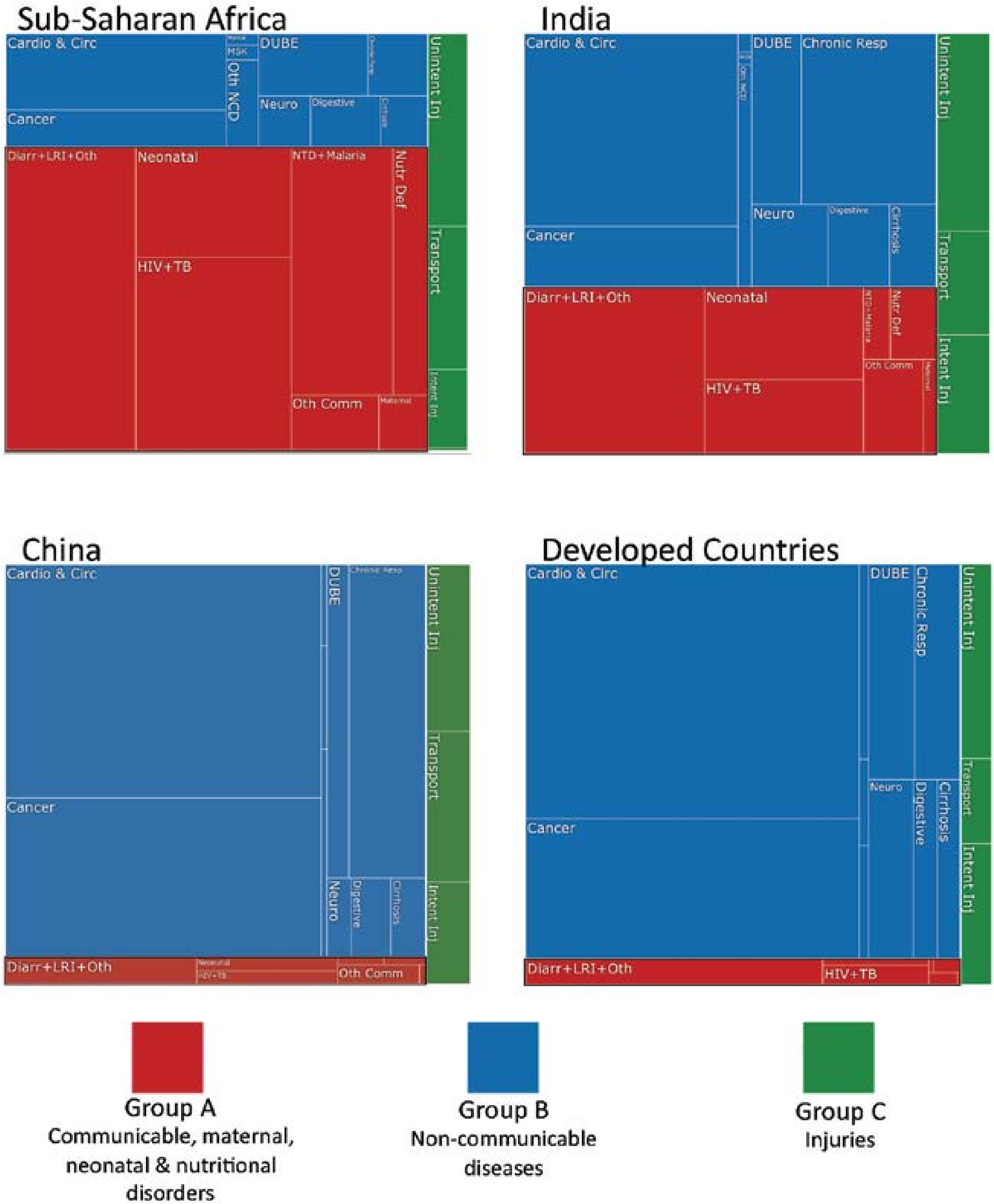


Figure 4.4 Tree map illustrating the transition in causes of death that occurs with economic development. The area of the rectangles represents the relative proportion of deaths that are due to various cause groups in each country or region in 2010.

Figure 4.5 Regional trends in road injury deaths in the four regions of sub-Saharan Africa over the last two decades compared with other global regions

In contrast to the rising death toll in sub-Saharan Africa, road deaths in all high-income regions have declined substantially over the last two decades. In Western Europe, road injury death toll declined by 43%, with a similar decline in death rates. In fact, road injury death rates have been declining in most developed countries since the early 1970s, when most Western nations established road safety agencies that instituted road safety programs targeting vehicles, highways, and road users using a broad safe systems approach for safety management.

Uncertainty in estimates of burden and cause rankings of road injuries

Figures 4.6 illustrate the uncertainty in our estimates of the burden of road injuries relative to other causes in sub-Saharan Africa. 95% uncertainty intervals are shown for deaths and healthy life lost for each cause in 2010, ordered by the mean rank of every cause. The two leading causes of death and DALYs (malaria and HIV/AIDS) have substantial overlap in their uncertainty intervals. The top four causes (i.e. also including lower respiratory infections and diarrheal diseases) are separated by a substantial gap from the next eight causes. Uncertainty in our estimates of deaths from road injuries in sub-Saharan Africa in 2010 ranges from 180,000 to 306,000 deaths. This range overlaps substantially with deaths from stroke (ranked 5th), protein-energy malnutrition, tuberculosis, preterm birth complications, meningitis, and ischemic heart disease (ranked 12th). Similarly, uncertainty in our estimates of healthy life years lost due to road injuries ranges from 11.2 million to 18.2 million DALYs. This range overlaps substantially with DALYs from protein-energy malnutrition (ranked 5th), neonatal sepsis, meningitis, preterm birth complications, neonatal encephalopathy, tuberculosis, and iron-deficiency anemia (ranked 12th).

The implications of the relative uncertainty in estimates on cause ranks are illustrated in Figure 4.7. Road injuries are the 8th leading cause of death in sub-Saharan Africa and the 95% uncertainty interval in the cause rank ranges from 7 to 12. Similarly, road injuries are the 10th leading cause of DALYs in sub-Saharan Arica and the 95% uncertainty interval in the cause rank ranges from 7 to 12.

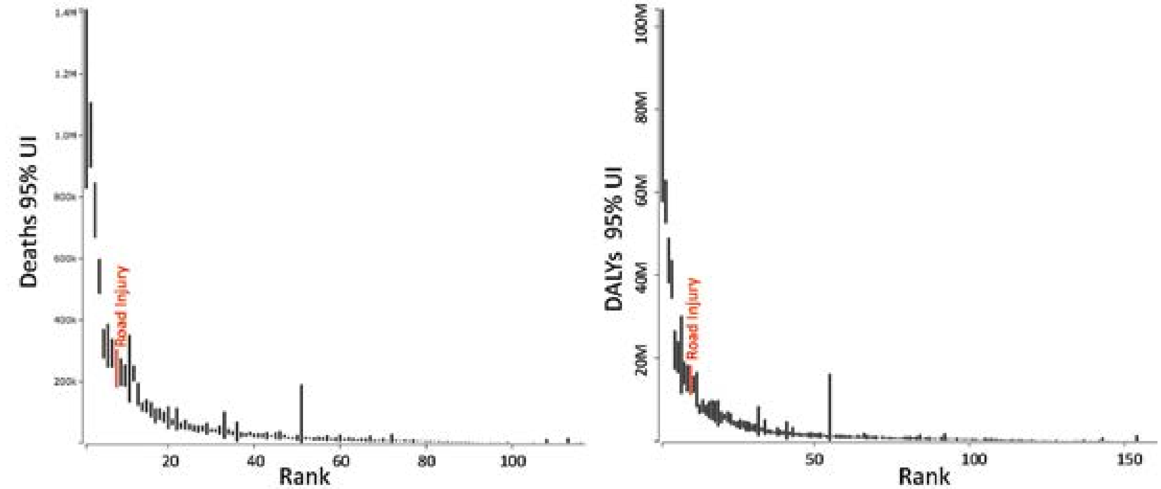


Figure 4.6 Deaths and DALYs with 95% uncertainty intervals versus rank by cause in sub-Saharan Africa in 2010

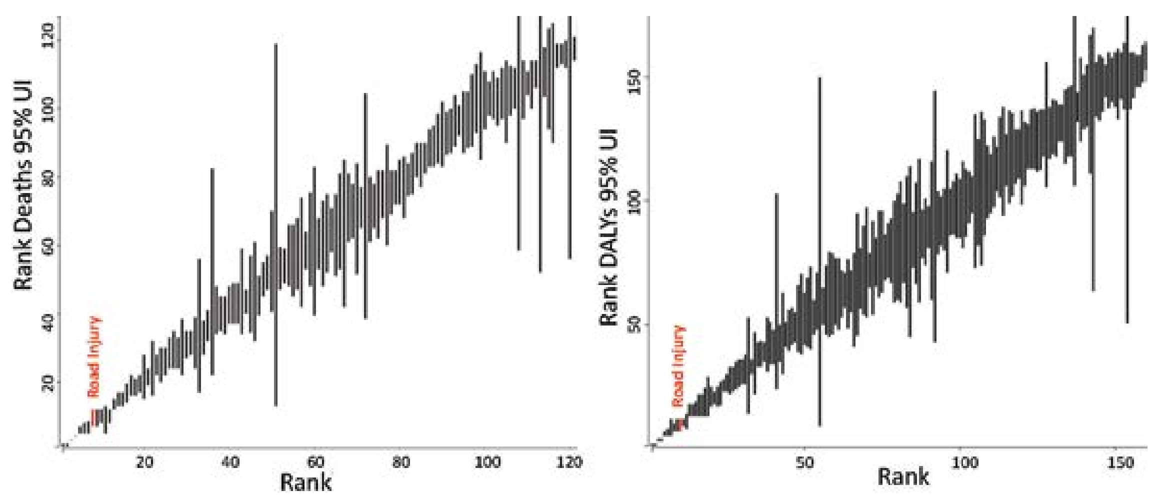
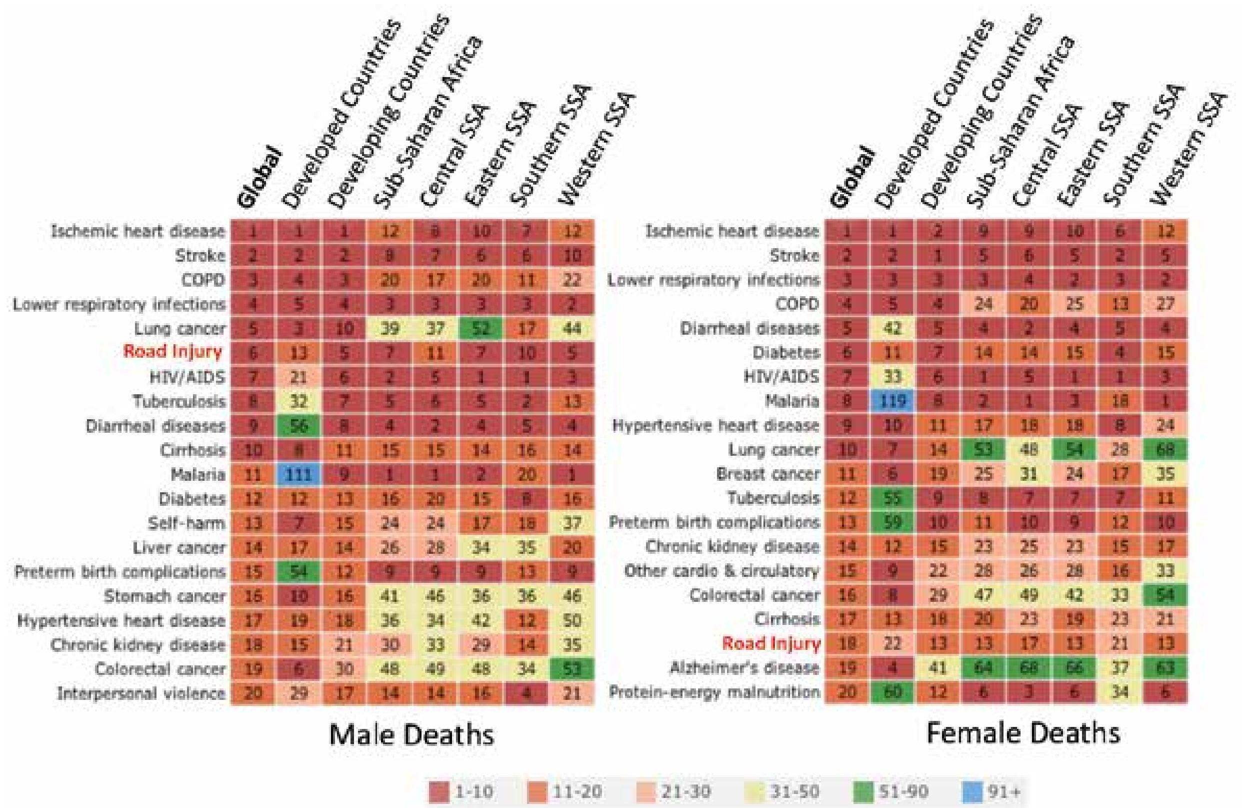


Figure 4.7 Uncertainty in rank of deaths and DALYs with 95% uncertainty intervals versus mean rank by cause in sub-Saharan Africa in 2010

Relative burden of road injuries among males and females

Road injuries kill more men than women, and hence the problem ranks as a higher priority for male health, in all regions of the world. Road injuries are the 7th leading cause of death for males in sub-Saharan Africa compared with 13th for females. They are a top-10 cause of death for males in all sub-regions of sub-Saharan Africa, with the exception of the Central region, where they rank 11th. In the Western region, which has the highest road injury death rate globally, road injuries are the 5th leading cause of death among males. Overall, road injuries kill more than twice as many men in sub-Saharan Africa than interpersonal violence (ranked 14th, 67,000 deaths).

However, among female deaths, road injuries rank substantially higher in sub-Saharan Africa than globally. They are the 13th leading cause of death for females in sub-Saharan Africa overall and in the Western and Eastern regions. However, globally, road injuries are the 18th leading cause of death for females. The high relative rank of road injuries for females in sub-Saharan Africa is partly due to high female road injury death rates in the region (Figure 4.9). For instance the road injury death rate for females in Western sub-Saharan Africa (22.5 per 100,000) is more than twice the global average for females (9.6 per 100,000) and almost five times the female road injury rate in Western Europe (4.6 per 100,000). The importance of road safety as a health priority for women in sub-Saharan Africa has received relatively little policy attention.



Male Deaths

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
Ischemic heart disease	1	1	1	12	8	10	7	12
Stroke	2	2	2	8	7	6	6	10
COPD	3	4	3	20	17	20	11	22
Lower respiratory infections	4	5	4	3	3	3	3	2
Lung cancer	5	3	10	39	37	52	17	44
Road Injury	6	13	5	7	11	7	10	5
HIV/AIDS	7	21	6	2	5	1	1	3
Tuberculosis	8	32	7	5	6	5	2	13
Diarrheal diseases	9	56	8	4	2	4	5	4
Cirrhosis	10	8	11	15	15	14	16	14
Malaria	11	111	9	1	1	2	20	1
Diabetes	12	12	13	16	20	15	8	16
Self-harm	13	7	15	24	24	17	18	37
Liver cancer	14	17	14	26	28	34	35	20
Preterm birth complications	15	54	12	9	9	9	13	9
Stomach cancer	16	10	16	41	46	36	36	46
Hypertensive heart disease	17	19	18	36	34	42	12	50
Chronic kidney disease	18	15	21	30	33	29	14	35
Colorectal cancer	19	6	30	48	49	48	34	53
Interpersonal violence	20	29	17	14	14	16	4	21

Female Deaths

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
Ischemic heart disease	1	1	2	9	9	10	6	12
Stroke	2	2	1	5	6	5	2	5
Lower respiratory infections	3	3	3	3	4	2	3	2
COPD	4	5	4	24	20	25	13	27
Diarrheal diseases	5	42	5	4	2	4	5	4
Diabetes	6	11	7	14	14	15	4	15
HIV/AIDS	7	33	6	1	5	1	1	3
Malaria	8	119	8	2	1	3	18	1
Hypertensive heart disease	9	10	11	17	18	18	8	24
Lung cancer	10	7	14	53	48	54	28	68
Breast cancer	11	6	19	25	31	24	17	35
Tuberculosis	12	55	9	8	7	7	7	11
Preterm birth complications	13	59	10	11	10	9	12	10
Chronic kidney disease	14	12	15	23	25	23	15	17
Other cardio & circulatory	15	9	22	28	26	28	16	33
Colorectal cancer	16	8	29	47	49	42	33	54
Cirrhosis	17	13	18	20	23	19	23	21
Road Injury	18	22	13	13	17	13	21	13
Alzheimer's disease	19	4	41	64	68	66	37	63
Protein-energy malnutrition	20	60	12	6	3	6	34	6

1-10 | 11-20 | 21-30 | 31-50 | 51-90 | 91+

Figure 4.8 Ranking of cause of death for males and females in sub-Saharan African regions in 2010
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

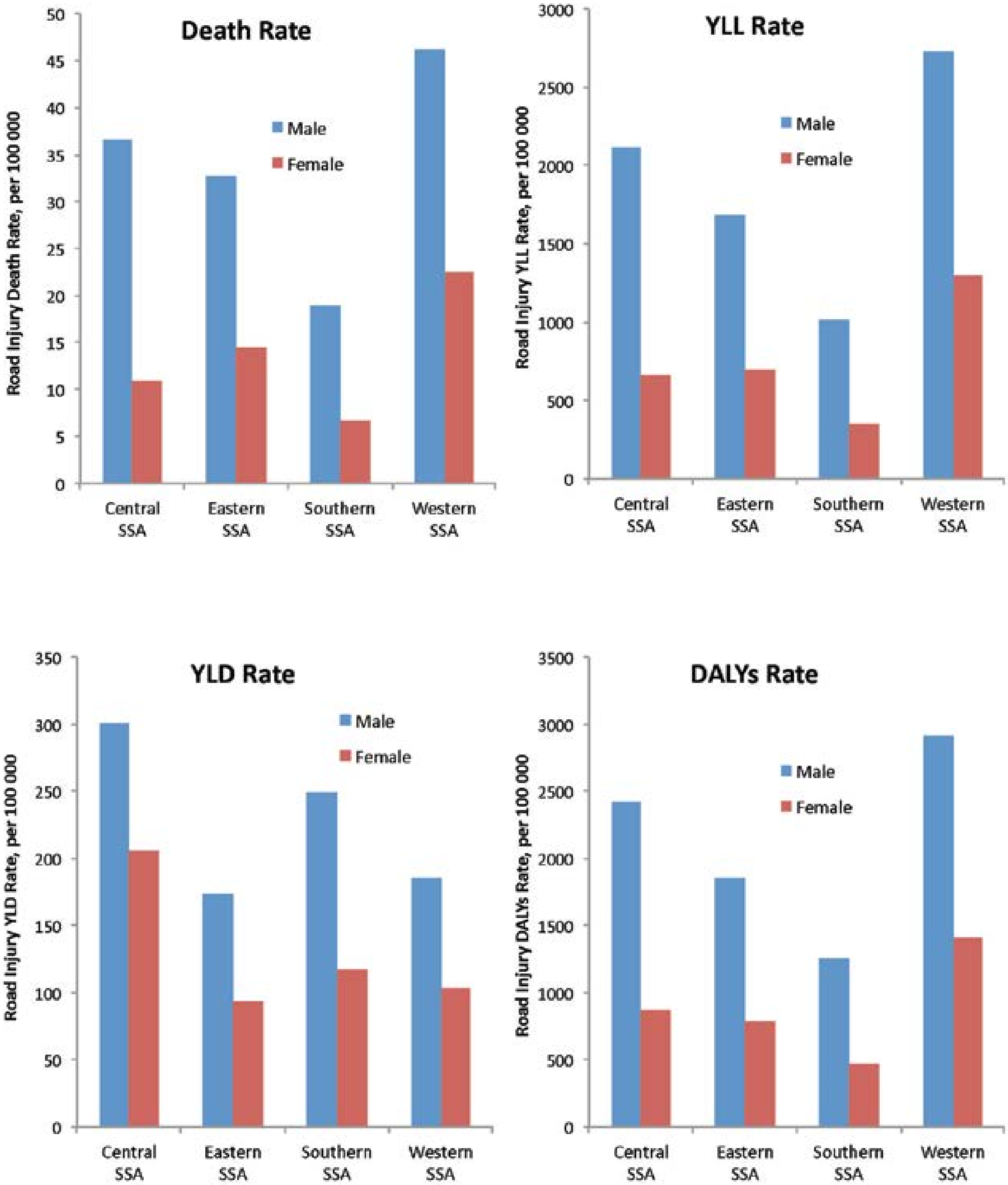


Figure 4.9 Rate of deaths, premature mortality, years lived with disability, and healthy life years lost among men and women in sub-Saharan African regions in 2010
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

Figure 4.9 illustrates the relative risk of male and female deaths and disability from road injuries in the regions of sub-Saharan Africa. The ratio of male to female deaths varies from 2.0 in the Western region to 3.4 in the Central region, compared with 3.0 globally. The ratio of premature mortality, YLLs, varies similarly from 2.1 in the Western region to 3.2 in the Central region. In contrast, the male-female difference is comparatively smaller for years lived with disability, varying from 1.5 in the Central region to 2.1 in the Southern region. Finally, the ratio of male to female healthy life years lost, DALYs, varies from 2.1 in the Western region to 2.8 in the Central region.

Relative burden of road injuries by age group

Road injuries are widely recognized to be a leading health problem for young adults worldwide. Among children aged 5-14 years, road injuries are the 3rd leading cause of death globally, the 4th leading cause in sub-Saharan Africa, and a top 10 cause in all its sub-regions (Figure 4.10). Among adults aged 15-49 years, road injuries are the 2nd leading cause of death globally, the 5th leading cause in sub-Saharan Africa, and a top-10 cause in all its sub-regions. Among older adults aged 50-69 years, road injuries rank comparatively lower, ranking 11th globally as well as in sub-Saharan Africa.

Figure 4.10 also demonstrates the importance of road injuries as a health issue for young children. Road injuries are the 14th leading cause of death among children under 5 years globally, 13th leading cause in sub-Saharan Africa, and a top-20 cause in all of its sub regions. In fact, road injuries emerge as a leading cause after the first year of life in sub-Saharan Africa. Road injuries are the 8th leading cause of deaths among children 1-4 years old in sub-Saharan Africa, ranking as high as 6th in the Western region. Similarly, road injuries are the 9th leading cause of healthy life years lost among children in sub-Saharan Africa. Although improving the health of children is a priority for international development efforts and one of the United Nations Millennium Development Goals, road safety has largely been ignored in the global child health agenda.

Road injuries are not usually considered a leading health issue for the elderly because they rank low in rankings of causes in most global regions. They do not appear in the top 20 global causes listed in Figure 4.10 for adults aged 70+ years. However, this is because Figure 4.10 shows causes sorted by their global ranking. Figure 4.11 shows causes for death and DALYs sorted by their ranking in sub-Saharan Africa for this age group. Remarkably, road injuries are the 12th leading cause of death among the elderly in sub-Saharan Africa, compared with 26th globally. Similarly, they are the 14th leading cause of DALYs among the elderly in sub-Saharan Africa, compared with 23rd globally. The importance of road safety for the health of the elderly in sub-Saharan Africa has not been acknowledged in the past.

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
Preterm birth complications	1	1	2	4	5	4	4	5
Lower respiratory infections	2	4	1	2	3	2	3	2
Malaria	3	80	3	1	1	1	15	1
Diarrheal diseases	4	13	4	3	2	3	1	3
Neonatal sepsis	5	6	5	5	9	5	7	4
Neonatal encephalopathy	6	3	6	7	7	6	5	7
Congenital anomalies	7	2	7	10	6	11	6	10
Protein-energy malnutrition	8	30	8	6	4	7	8	6
Meningitis	9	10	9	8	8	9	10	8
HIV/AIDS	10	20	10	9	10	8	2	9
Syphilis	11	28	11	11	11	10	9	13
Measles	12	53	12	14	20	12	11	14
Drowning	13	8	13	17	12	16	17	21
Road Injury	14	7	14	13	14	15	20	11
Fire	15	11	15	12	13	13	14	12

Under 5 Deaths

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
Diarrheal diseases	1	34	1	3	1	3	2	4
HIV/AIDS	2	17	2	1	2	1	1	2
Road Injury	3	1	3	4	7	4	6	3
Malaria	4	88	4	2	3	2	7	1
Lower respiratory infections	5	8	5	5	6	5	4	5
Drowning	6	2	6	11	8	10	3	14
Meningitis	7	19	8	6	5	7	9	6
Typhoid fevers	8	46	7	10	14	8	5	10
Congenital anomalies	9	5	9	16	16	14	15	18
Protein-energy malnutrition	10	41	10	7	4	6	22	9
Fire	11	9	11	8	11	12	11	7
Leukemia	12	4	14	36	29	26	21	40
Forces of nature	13	89	12	92	92	93	92	91
Tuberculosis	14	54	13	12	10	13	8	13
Falls	15	12	15	15	22	24	37	11

5-14 Years

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
HIV/AIDS	1	4	1	1	1	1	1	1
Road Injury	2	3	2	5	7	5	6	3
Self-harm	3	1	4	14	14	10	8	23
Ischemic heart disease	4	2	5	15	13	16	15	13
Tuberculosis	5	16	3	3	2	3	3	6
Interpersonal violence	6	6	6	8	8	8	2	11
Stroke	7	7	7	12	11	14	7	12
Lower respiratory infections	8	12	8	6	9	6	5	5
Cirrhosis	9	5	11	13	12	13	18	9
Maternal disorders	10	52	9	4	5	4	9	4
Malaria	11	117	10	2	4	2	11	2
Diarrheal diseases	12	54	12	7	3	7	10	7
Drowning	13	17	14	18	17	15	19	25
Fire	14	28	13	16	20	17	16	16
Liver cancer	15	27	15	23	35	33	34	15

15-49 Years

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
Ischemic heart disease	1	1	1	5	3	6	5	4
Stroke	2	3	2	1	1	1	2	3
COPD	3	6	3	12	11	13	8	15
Lung cancer	4	2	4	25	18	29	9	28
Cirrhosis	5	4	7	9	10	9	14	8
Diabetes	6	11	5	7	9	8	3	6
Tuberculosis	7	37	6	4	2	3	4	5
Lower respiratory infections	8	12	8	2	6	2	6	1
Liver cancer	9	13	9	15	15	19	25	11
Stomach cancer	10	9	11	22	24	21	27	22
Road Injury	11	15	10	11	16	11	22	10
Colorectal cancer	12	5	17	30	28	27	21	33
Hypertensive heart disease	13	19	12	14	12	16	7	18
Self-harm	14	8	16	29	29	18	31	37
Chronic kidney disease	15	22	14	17	17	17	11	16

50-69 Years

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
Ischemic heart disease	1	1	2	3	2	3	2	3
Stroke	2	2	1	2	1	2	1	2
COPD	3	3	3	9	7	9	6	9
Lower respiratory infections	4	4	4	1	3	1	3	1
Lung cancer	5	6	7	28	23	39	13	32
Diabetes	6	9	5	5	9	8	4	5
Hypertensive heart disease	7	10	6	10	10	10	5	10
Other cardio & circulatory	8	8	10	13	11	14	10	16
Alzheimer's disease	9	5	23	33	35	38	17	30
Colorectal cancer	10	7	16	29	27	30	16	33
Chronic kidney disease	11	11	11	14	13	13	11	19
Stomach cancer	12	12	12	23	20	19	24	25
Diarrheal diseases	13	42	8	6	6	7	8	6
Cirrhosis	14	17	14	11	12	12	18	12
Tuberculosis	15	52	9	7	8	6	7	7

70+ Years

	Global	Developed Countries	Developing Countries	Sub-Saharan Africa	Central SSA	Eastern SSA	Southern SSA	Western SSA
Ischemic heart disease	1	1	2	12	8	10	7	12
Stroke	2	2	1	5	7	5	3	7
COPD	3	4	3	21	17	23	10	24
Lower respiratory infections	4	5	4	3	3	2	2	2
Lung cancer	5	3	11	47	41	52	20	54
HIV/AIDS	6	23	6	2	5	1	1	3
Diarrheal diseases	7	53	5	4	2	4	5	4
Road Injury	8	17	8	8	12	9	14	8
Diabetes	9	8	10	14	19	15	6	16
Tuberculosis	10	40	9	7	6	6	4	11
Malaria	11	121	7	1	1	3	17	1
Cirrhosis	12	9	13	16	18	16	18	15
Self-harm	13	11	14	27	30	20	22	48
Hypertensive heart disease	14	13	15	24	23	25	9	30
Preterm birth complications	15	63	12	9	9	8	12	10

All Ages

1-10 11-20 21-30 31-50 51-90 91+

Figure 4.10 Rankings of cause of death by age group in sub-Saharan African regions in 2010

See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

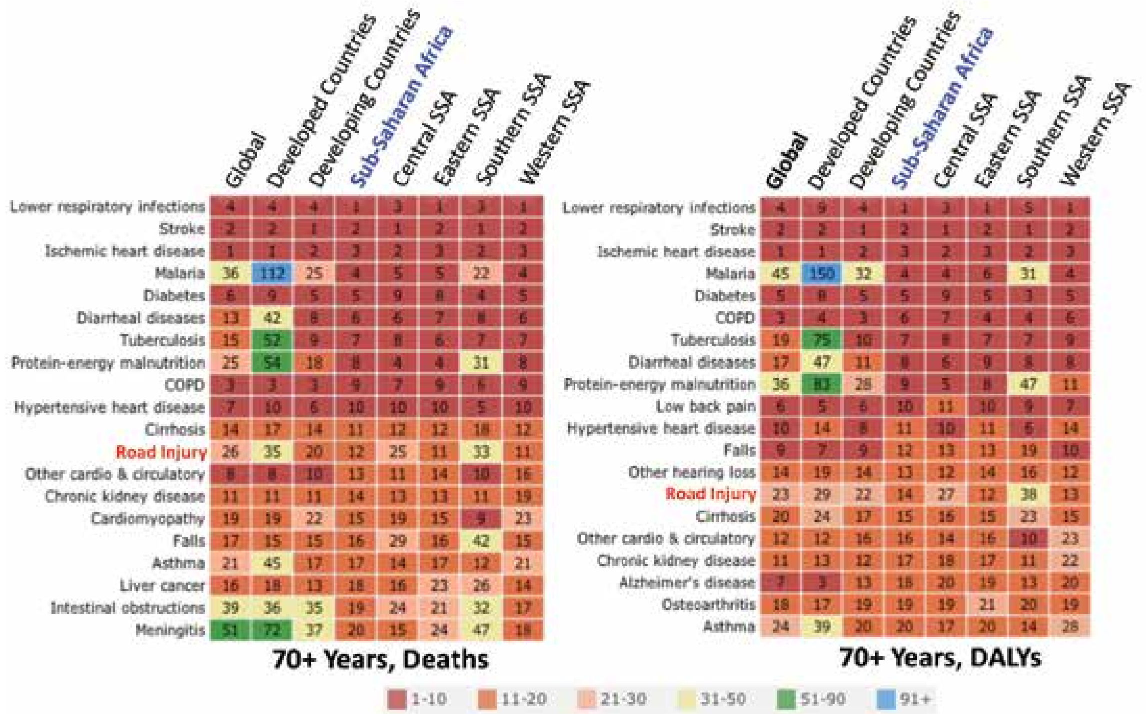
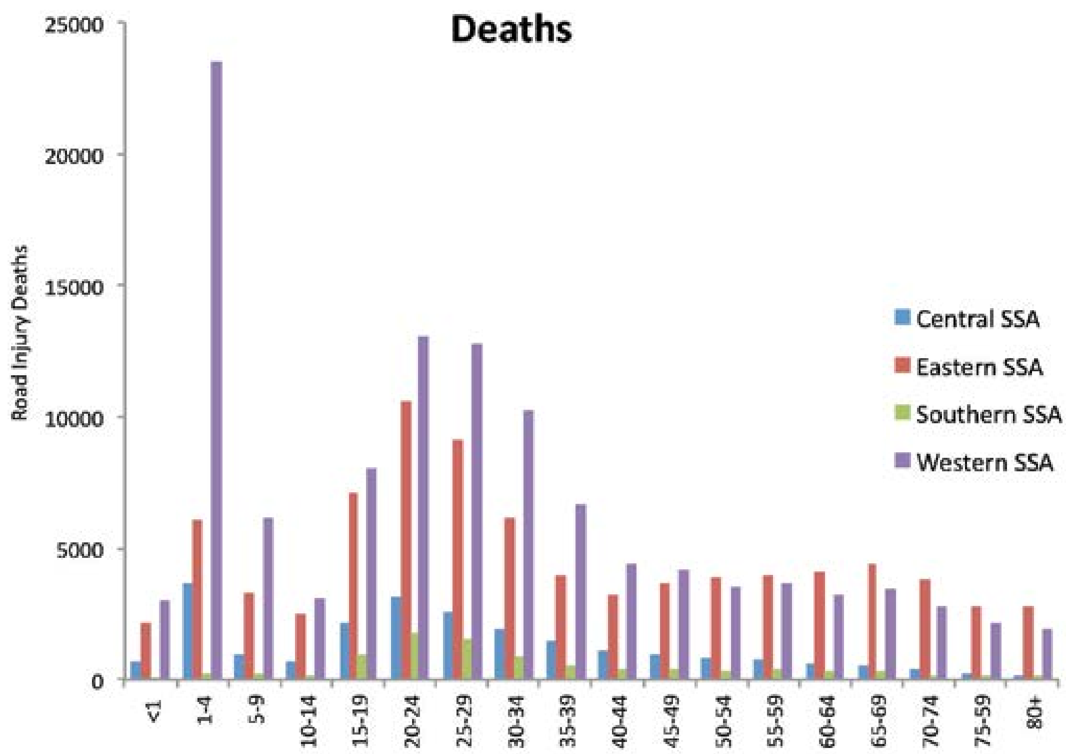


Figure 4.11 Leading causes of death and healthy life years lost among the elderly (70+ years) in sub-Saharan Africa regions
Unlike previous figures, causes in this heat map are sorted by their ranking in sub-Saharan Africa rather than by their global ranking.

Figures 4.12 through 4.15 illustrate the age distribution of the incidence and rate of deaths, YLLs, YLDs and DALYs in the sub-Saharan African regions. Broadly, the age profile of deaths and YLLs (Figure 4.12-13) is typical of the road injury burden globally. Road injury death counts in most regions have an age distribution that peaks among young adults and then declines with age. Death rates rise with age during the first two decades of life, then decline, and rise again with age. However, Figures 4.12-13 show one notable difference from the expected age profile. Road injury mortality rates among children aged 1-4 years are substantially higher in the Western region than expected. Deaths are highest in this age group and the death rate exceeds that for young adults. The high death toll explains the relatively high ranking of road injuries in the cause rankings for children in Western sub-Saharan Africa (Figure 4.10). Road injuries are the 6th leading cause among 1-4 year olds in the region, compared with 9th globally.

Figure 4.14 shows that the incidence and rate of disability from non-fatal injuries has a unimodal pattern that peaks among adults before declining with age. However, YLDs contribute a relatively small proportion to the total healthy life lost. As a result the age profile of DALYs (Figure 14) broadly resembles the age profile of YLLs (Figure 15).



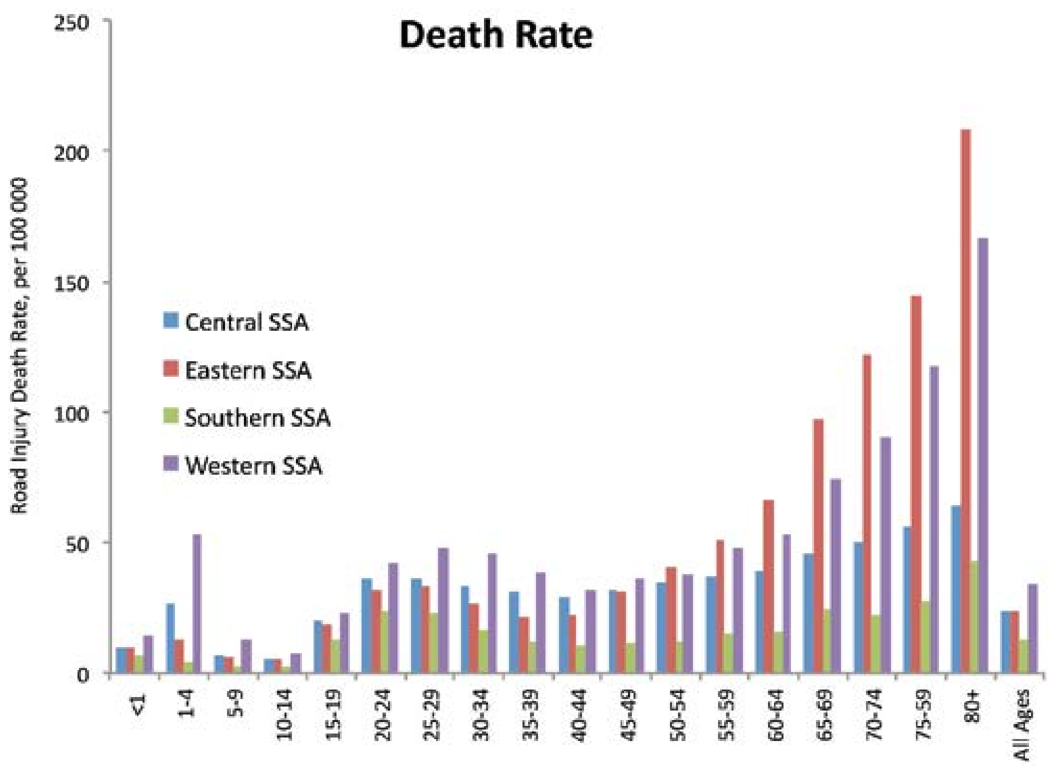
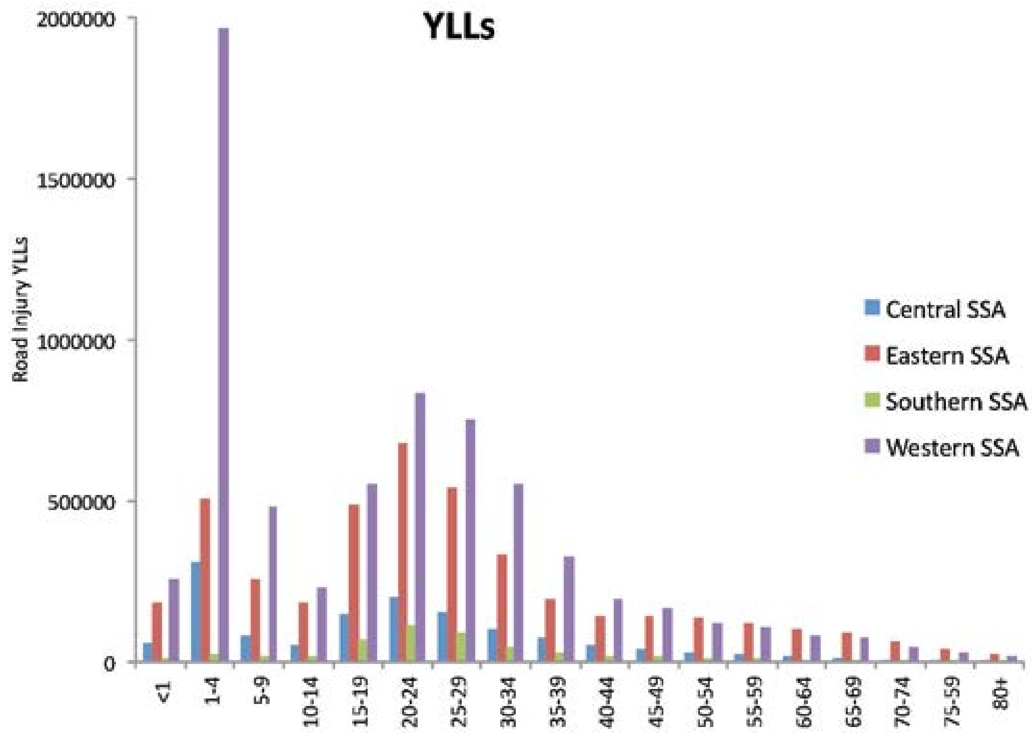


Figure 4.12 Age distribution of deaths and death rate in sub-Saharan African regions in 2010



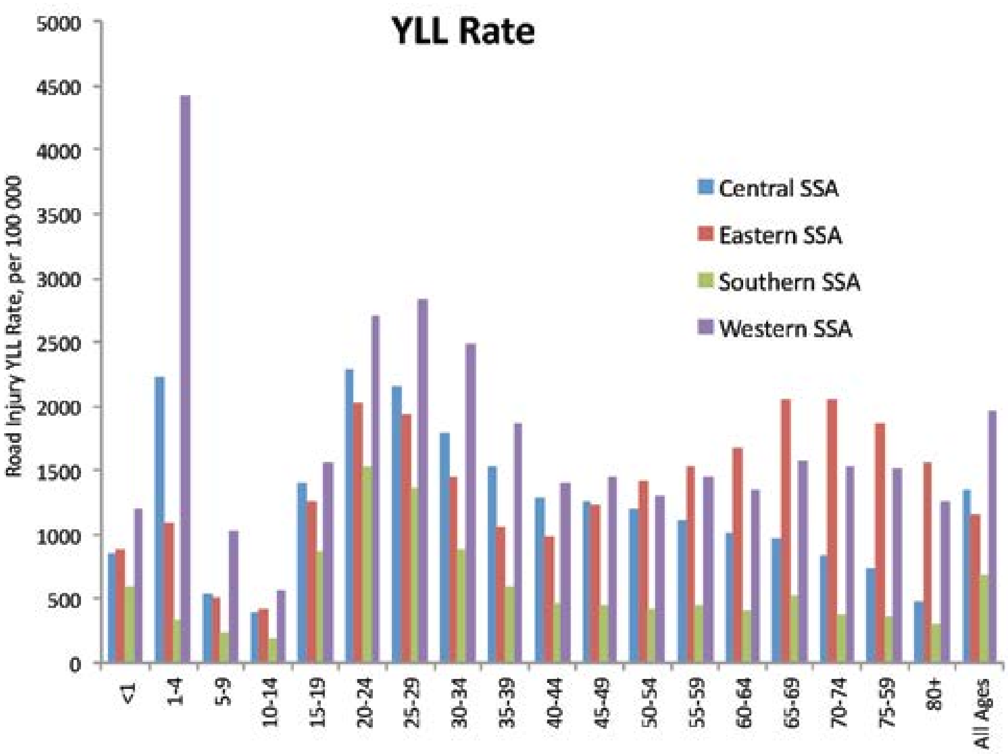


Figure 4.13 Age distribution of premature mortality and premature mortality rate in sub-Saharan African regions in 2010

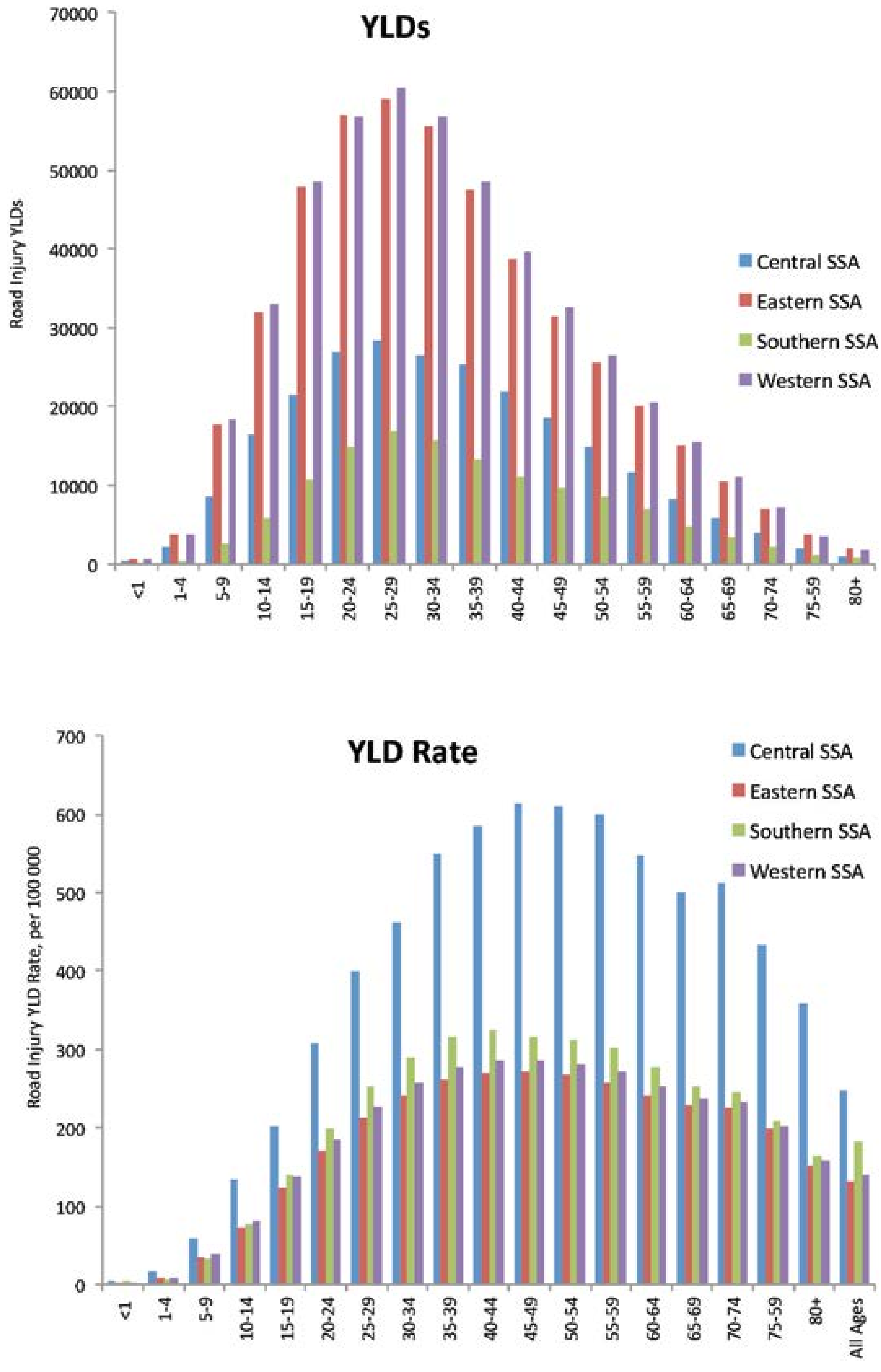


Figure 4.14 Age distribution of YLDs and YLD rate in sub-Saharan African regions in 2010
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

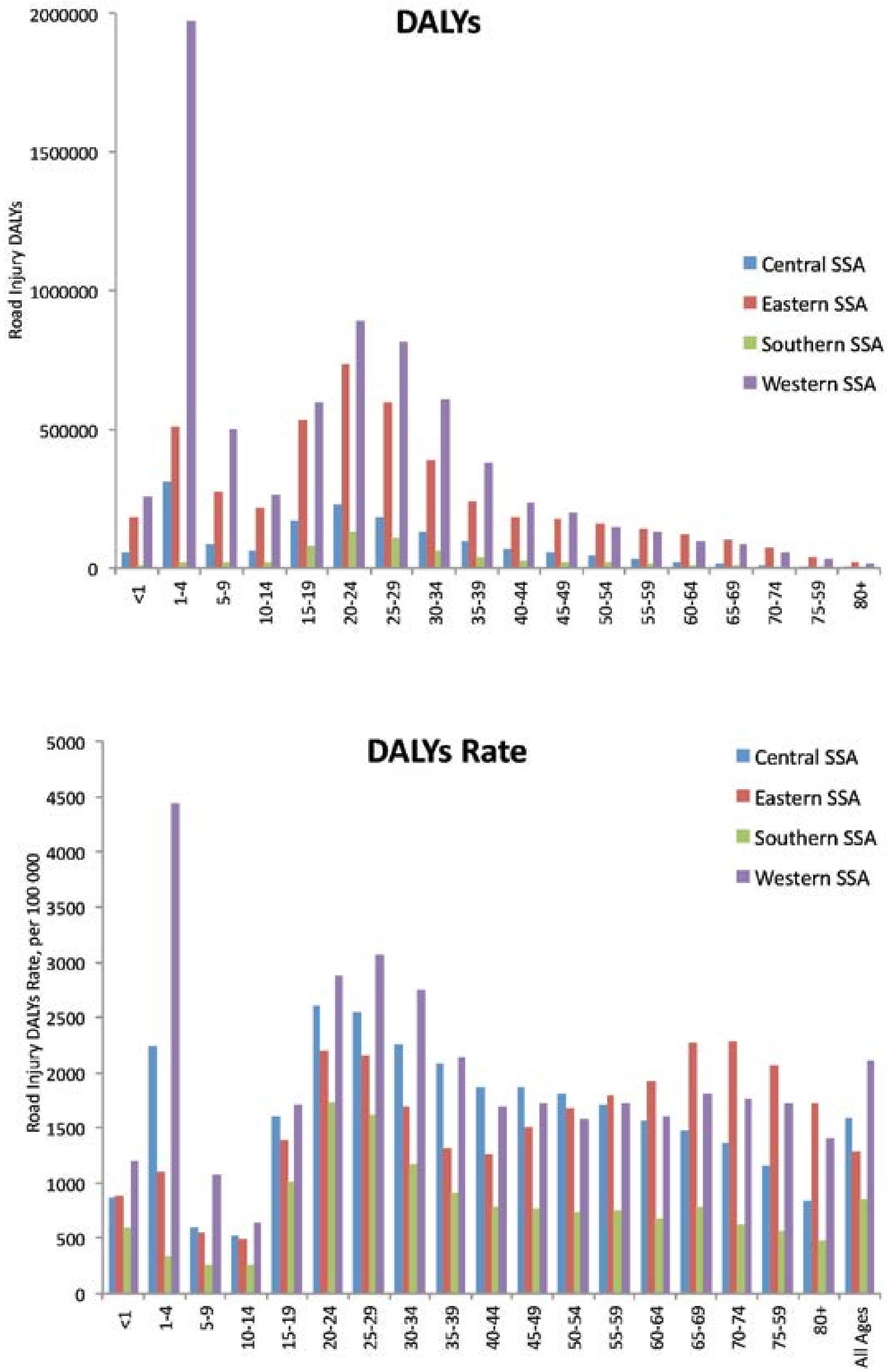


Figure 4.15 Age distribution of DALYs and DALYs rate in sub-Saharan African regions in 2010
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

Distribution of road injuries by type of road-user

Figures 4.16-4.18 illustrates the distribution of road injury deaths and burden by the victim's mode of transport. The pedestrian death rate in Western sub-Saharan Africa, 13.4 per 100,000, is the highest in the world, 8 times the rate in Western Europe (Figure 4.16). The road user distribution of deaths and DALYs varies substantially across regions. However, the distribution of deaths does not differ much from that of DALYs in any given region. Pedestrians comprise 44% of road injury deaths in sub-Saharan Africa overall, 55% in the Central region, and 50% in the Eastern region (Figure 4.17). In contrast, pedestrians account for only 35% of global road deaths. Taken together with bicyclists, non-motorized road users comprise half of all victims of fatal road injuries in sub-Saharan Africa, 60% in the Eastern region, and 58% in the Central region. Non-motorized modes comprise 42% in the Western region and 40% in the Southern region, similar to the global average of 41%. As expected from the lower level of motorization in sub-Saharan Africa, occupants of cars, buses, and trucks comprise a smaller proportion of road deaths. Vehicle occupants (3+ wheels) were victims in 30% of the fatalities in sub-Saharan Africa compared with the global average of 36%. In the Central and Southern regions, the proportion of occupants was even lower at 26%. Finally, motorcycle riders comprise 17% of deaths in the Southern and Western regions. The motorcyclist death rate in Western sub-Saharan Africa is the highest in the world, slightly higher than the rate in Southeast Asia.

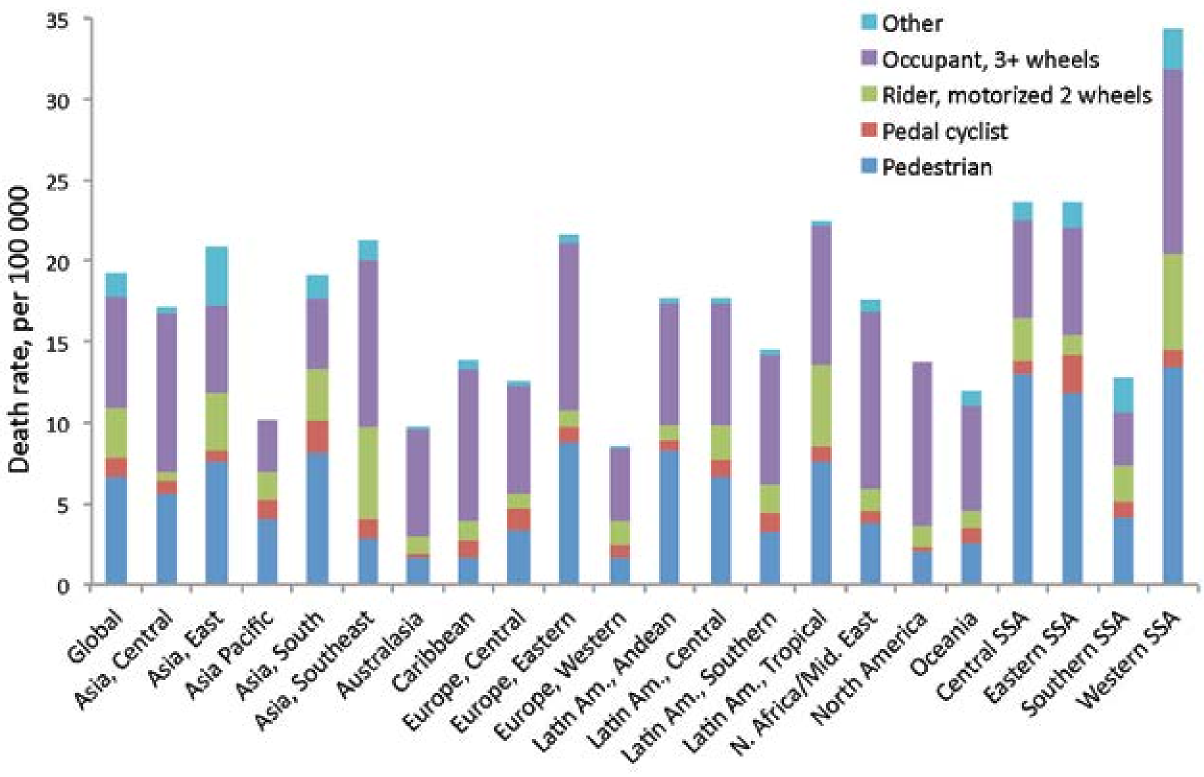


Figure 4.16 Road injury death rates in global regions in 2010 disaggregated by road-user categories
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1.

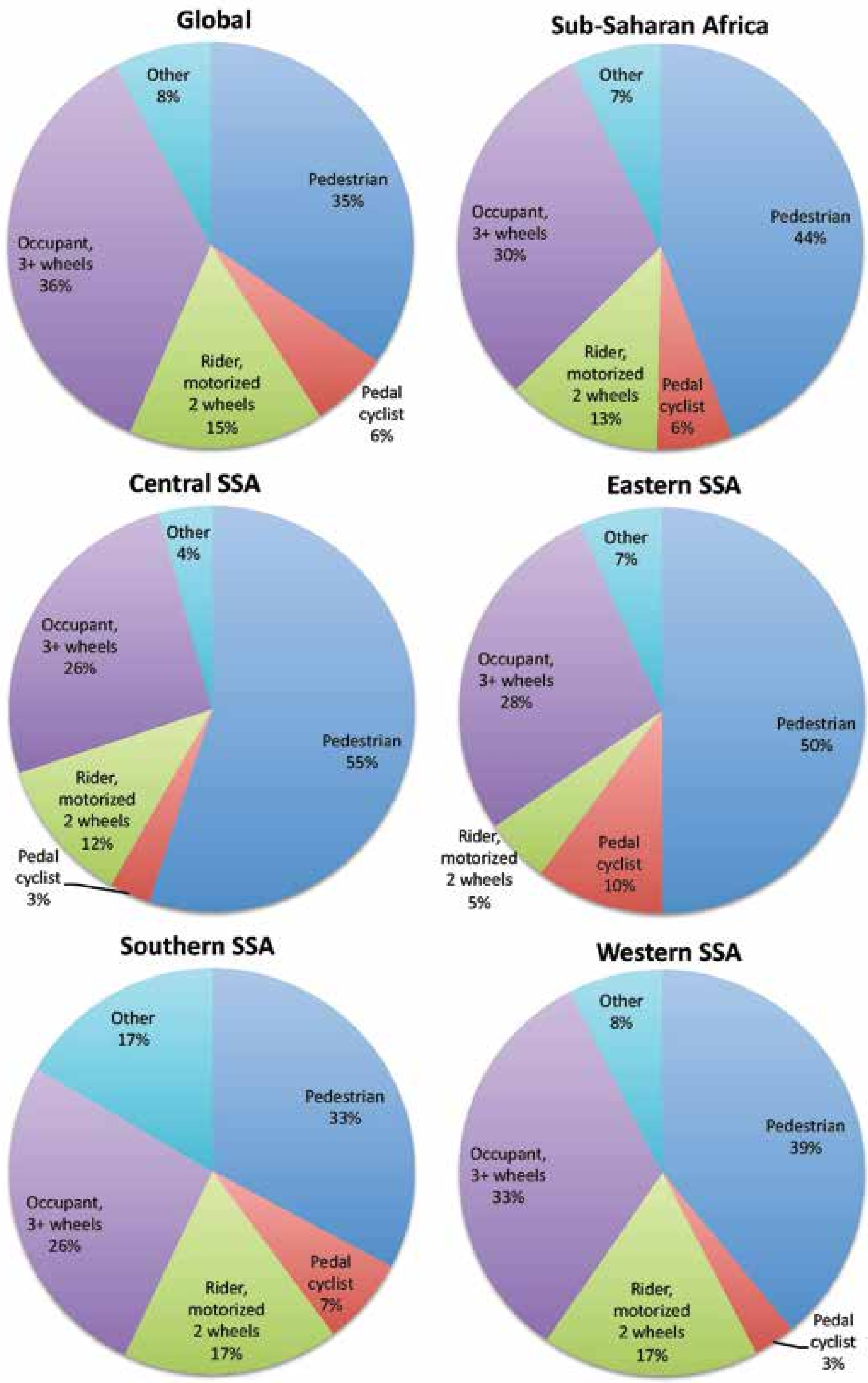


Figure 4.17 Road user distribution of road injury deaths in sub-Saharan African regions in 2010

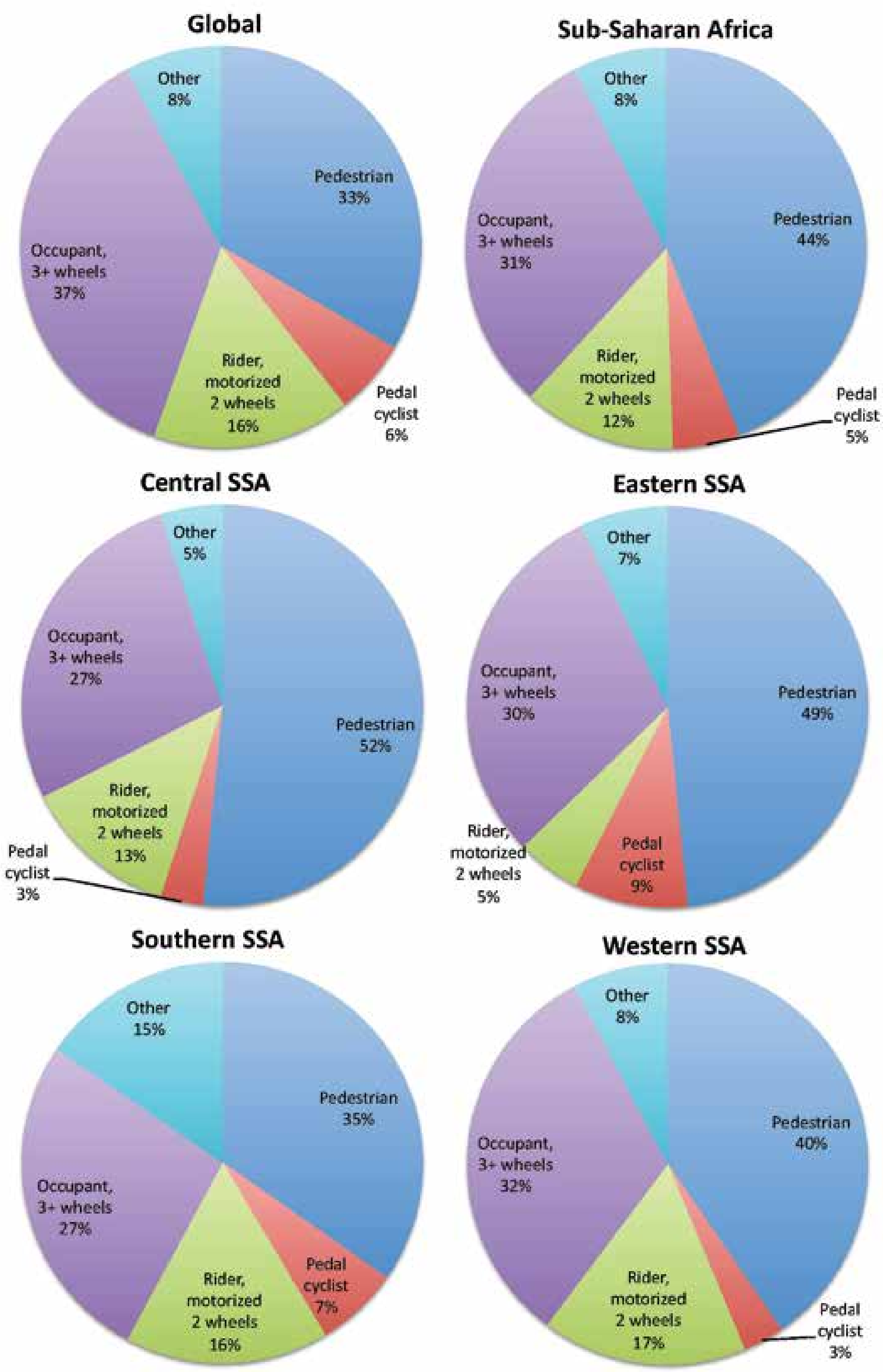


Figure 4.18 Road user distribution of road injury DALYs in sub-Saharan African regions in 2010

Country estimates of the burden of road injuries

Figures 4.19-4.20 show rankings of causes of death in countries in sub-Saharan Africa. In more than half the countries (26 of 48 countries) deaths from road injuries rank among the top 10 causes. In six countries (Botswana, Djibouti, Gabon, Mauritania, Nigeria, Zimbabwe), road injuries ranked in the top 5 causes of death.

National road injury death rates in sub-Saharan Africa are among the highest in the world (Figure 4.21). Six countries from the region are among the ten countries with the highest road injury death rates globally. These include Nigeria, which has a death rate of 52.4 per 100,000 people, the highest of any country, and Mozambique, death rate of 46.7 per 100,000, the third highest of any country. Figures 4.21 also shows the death rates among the safest countries in the world, which include Sweden, UK, and the Netherlands, whose high safety performance has been discussed extensively by road safety researchers. These countries have a death rate of approximately 3 per 100,000, 15 times smaller than that of Nigeria and Mozambique.

Four countries, Nigeria, Ethiopia, South Africa[1], and Sudan, together account for half of all road injury fatalities in sub-Saharan Africa. The importance of road safety for Nigeria, which accounts for approximately one-fifth of the population of sub-Saharan Africa, deserves particular consideration. In 2010, Nigeria had 75,000 fatalities, approximately one-third of the total for sub-Saharan Africa. Road traffic deaths in Nigeria ranked ahead of neonatal sepsis, preterm birth complications, protein-energy malnutrition, neonatal encephalopathy, and meningitis, which are among the most important causes of infant deaths. Similarly, road injury deaths in Nigeria killed more than three times as many people as maternal disorders, and almost twice as many people as tuberculosis.

The importance of road safety to the health agenda in sub-Saharan Africa has emerged in the last two decades. While road injuries are now the 8th leading cause of death in the region, they were the 13th leading cause of death in 1990. This increase in the relative rank is also evident in the country level statistics. In Nigeria, road injuries are now the 5th leading cause of death, up from 11th in 1990. In Ethiopia, they are the 9th leading cause of death, up from 13th in 1990.

1. The GBD-2010 estimates for road injury deaths in South Africa (4,500 deaths) are about one-third of the official national statistics. The GBD estimates for South Africa rely predominantly on national vital registration data. We expect that GBD-2010 underestimated road injury deaths in South Africa because of analytical problems in fitting the cause of death patterns, which are heavily biased towards deaths from HIV/AIDS. Since South Africa is the most populous country in the Southern sub-Saharan Africa and the predominant source of cause of death data in this region, we expect that the road injury deaths for the entire Southern region are underestimated in GBD-2010. In this report, whenever we present national estimates of road injury deaths and death rates for South Africa, we use the official national statistics. However, all regional estimates shown, including for the Southern region are from GBD-2010. See also note about sub-Saharan Africa South estimates accompanying Table 4.1.

	Angola	Central African Republic	Congo	Democratic Republic of the Congo	Equatorial Guinea	Gabon	Central Sub-Saharan Africa
Malaria	2	3	2	1	2	2	1
Diarrheal diseases	1	2	5	2	4	7	2
Lower respiratory infections	3	4	3	4	3	3	3
Protein-energy malnutrition	5	5	8	3	7	8	4
HIV/AIDS	4	1	1	5	1	1	5
Tuberculosis	9	6	9	6	15	13	6
Stroke	6	7	4	7	9	4	7
Ischemic heart disease	8	8	6	9	8	6	8
Preterm birth complications	10	13	10	8	10	11	9
Meningitis	11	10	12	10	11	16	10
Congenital anomalies	12	14	11	11	5	14	11
Road Injury	7	11	7	16	6	5	12
Neonatal encephalopathy	15	19	17	12	13	19	13
Maternal disorders	13	9	16	15	12	15	14
Neonatal sepsis	19	23	20	14	21	23	15
Interpersonal violence	31	21	19	13	19	17	16
COPD	16	12	13	18	14	10	17
Cirrhosis	18	16	15	17	18	9	18
Diabetes	17	18	14	19	17	12	19
Syphilis	14	15	42	21	16	38	20

Central SSA

1-10 | 11-20 | 21-30 | 31-50 | 51-90 | 91+

	Burundi	Comoros	Djibouti	Eritrea	Ethiopia	Kenya	Madagascar	Malawi	Mauritius	Mozambique	Rwanda	Seychelles	Somalia	Sudan	Tanzania	Uganda	Zambia	Eastern Sub-Saharan Africa
HIV/AIDS	2	118	1	7	8	1	8	1	5	1	3	14	6	3	1	1	1	1
Lower respiratory infections	4	1	2	1	1	2	3	2	6	3	2	2	1	1	3	3	3	2
Malaria	1	2	11	3	3	3	2	3	121	2	1	120	2	4	2	2	2	3
Diarrheal diseases	5	4	5	2	2	4	4	4	43	5	6	20	3	2	4	7	6	4
Stroke	6	3	3	5	6	6	1	5	3	6	4	3	7	5	7	6	5	5
Tuberculosis	3	5	9	4	4	7	9	6	57	4	5	48	5	12	5	4	8	6
Protein-energy malnutrition	7	8	7	6	5	5	6	7	30	12	11	33	4	7	6	12	4	7
Preterm birth complications	12	6	8	12	7	9	7	13	18	9	7	30	10	8	9	9	15	8
Road Injury	9	7	4	11	9	10	12	9	12	7	9	8	12	6	10	11	12	9
Ischemic heart disease	8	9	6	8	11	12	5	8	1	15	8	1	11	9	13	13	9	10
Meningitis	11	15	10	10	10	11	18	15	53	10	14	23	8	10	22	5	7	11
Neonatal sepsis	13	10	15	13	13	8	11	10	62	8	10	68	14	11	12	10	14	12
Neonatal encephalopathy	15	11	14	14	18	13	15	12	48	11	12	53	15	13	8	8	10	13
Maternal disorders	10	14	13	9	14	14	13	11	77	14	19	67	9	14	11	16	22	14
Diabetes	14	13	12	15	15	15	14	17	2	16	15	9	16	15	15	17	16	15
Cirrhosis	16	23	16	18	12	19	17	16	8	20	16	6	18	20	18	14	17	16
Syphilis	37	12	63	29	26	22	10	27	99	13	21	82	36	21	14	15	11	17
Fire	17	18	19	17	20	20	25	18	32	21	18	31	17	22	17	19	18	18
Epilepsy	19	17	17	16	21	18	23	21	42	18	17	29	19	19	20	22	19	19
Self-harm	18	21	21	21	22	17	27	19	16	17	22	11	24	16	16	23	23	20

Eastern SSA

Figure 4.19 Rankings of cause of death in countries in Central and Eastern sub-Saharan Africa in 2010

Figure 4.20 Rankings of cause of death in countries in Southern and Western sub-Saharan Africa in 2010
See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1 and footnote on Page 72.

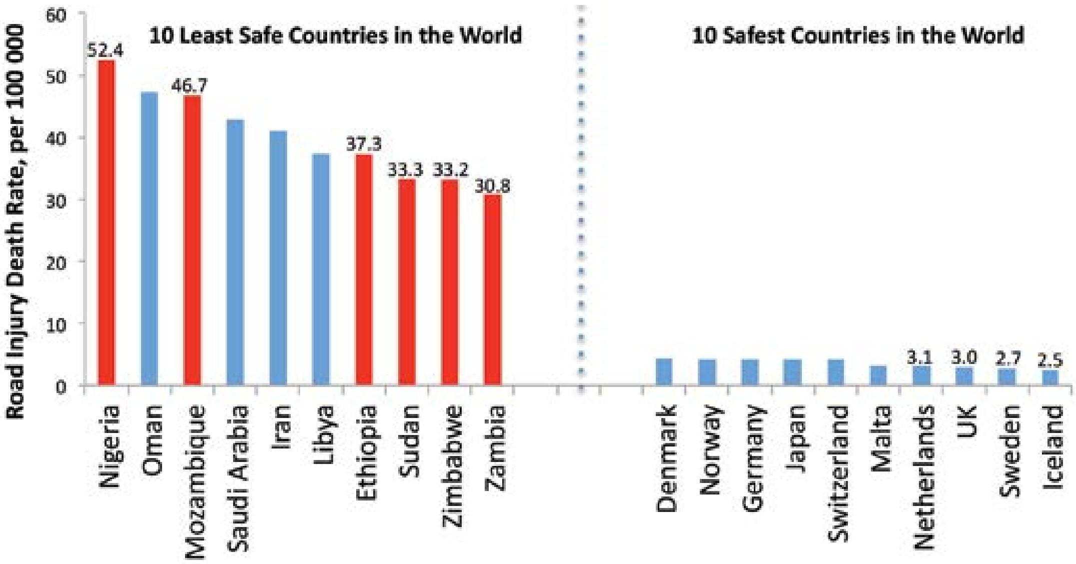


Figure 4.21 Safest and most dangerous countries in the world in 2010

Note: Only countries with at least three local measurements of road traffic injury incidence were included in this figure. A few countries (such as Angola, Equatorial Guinea, and Gabon) have higher estimates but were excluded from this figure because of insufficient data. Estimates shown are from GBD-2010 except for countries that report to the International Road Traffic Accident Database (IRTAD).

Our estimates of the national road injury deaths in sub-Saharan Africa are substantially higher than official government statistics (Figure 4.22). Underreporting in many countries in sub-Saharan Africa exceeds 500%. In Nigeria, for instance, official government statistics only reported 4,065 deaths in 2010. The official statistics for Nigeria correspond to a death rate of 2.5 per 100,000, which is the same as that of Iceland, the safest country in the world (Figure 4.21). Since the national Federal Road Safety Corps (FRSC) only reports deaths that occur within 24 hours of the crash, the 2013 WHO Global Status Report on Road Safety corrected this estimate to 5,279 deaths to account for deaths that occur after this period. However, even this figure is 14 times smaller than our estimate of 75,000 deaths.

Underreporting of road deaths is getting increase attention in global road safety efforts. However, much of this work focuses on standardizing definitions, such as counting all deaths that occur within 30 days of a crash. However, our results highlight that definitions account for a small fraction of the deaths that are missed in official statistics. Instead, it is likely that most countries in sub-Saharan Africa simply do not have the capacity to know about most crashes.

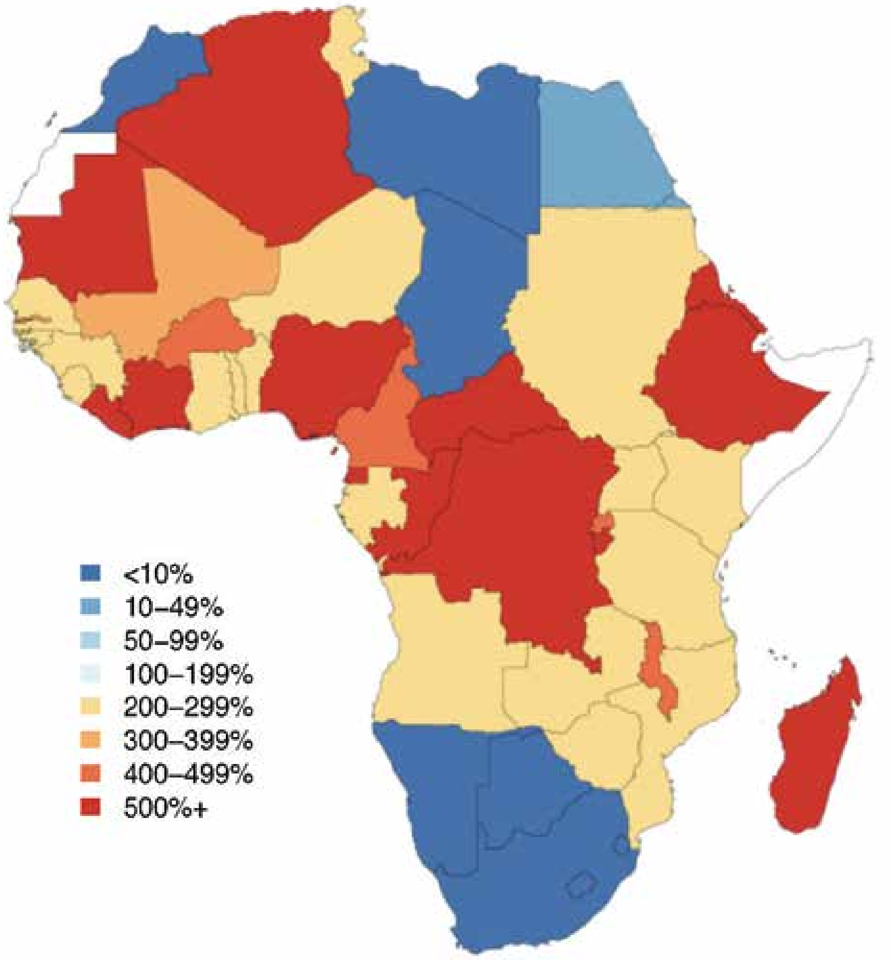


Figure 4.22 Underreporting of deaths from road injuries in official government statistics in sub-Saharan Africa in 2010

- *Percent underreporting is calculated as 100*(Our estimate-official statistics)/(official statistics).*
- *Official statistics are the 30-day adjusted country reported statistics from the 2013 World Health Organization's Global Status Report on Road Safety.*
- *See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1 and footnote on Page 72.*

Chapter 5: Discussion

Results from the GBD project are the only systematic and scientific accounting of the health impact of road crashes relative to other diseases and health risk factors in sub-Saharan Africa and globally. Our current update, GBD-2010, represents a dramatic improvement over past work in road injury metrics. Several other studies (e.g. Jacobs et al., 2000, Kopits & Cropper, 2005, WHO, 2009a, WHO, 2013) have attempted to estimate the global and regional incidence of deaths from road injuries in isolation from other diseases. Such work is problematic for various reasons. First, one important purpose of such analysis is to highlight the magnitude of the problem of road safety and, hence, to bring attention to it. However, in a world where we grapple with many hazards to our health, the incidence of road injuries needs to be described relative to other health threats as discussed in this report.

Second, other studies often rely primarily on national official statistics of road traffic deaths reported by traffic police. We show that police reports in sub-Saharan African countries often have underreporting that exceeds 500%. More recent studies recognize the problem of underreporting in police data and thus have also attempted to construct estimates using national vital registration statistics. The 2009 and 2013 WHO Global Status Reports are two notable examples of such work. However, since high quality vital registers do not exist in sub-Saharan Africa, these studies have few data sources from the region, relying instead on statistical models to estimate deaths for most countries in the region. In contrast, our work uncovered and incorporated vast amounts of information that have not been used previously in constructing estimates of the burden of road injuries. This required the development of many new tools for analysis that we have described in this report.

Finally, past work has made meager, if any, attempts to estimate the incidence of non-fatal road injuries. This is primarily because such estimations require substantial efforts in acquiring data sources that are difficult to access, and developing analytical models to construct meaningful estimates. Our work is the first attempt at producing estimates of non-fatal injury incidence in sub-Saharan Africa and globally.

Implications for road safety policy in sub-Saharan Africa

The UN Decade of Action for Road Safety calls for a transition to a decade of investments in safer road systems in low- and middle- income countries. Our analysis supports this call by providing evidence of the importance of road safety to population health, which is arguably the most pressing developmental issue for sub-Saharan Africa.

We show that road injury has risen substantially in the health priorities for sub-Saharan Africa over the last two decades and now ranks within the top 10 causes of death and ill health. The current ranking of road injuries in Sub-Saharan African countries is similar to those for other developing countries, which have already begun to prioritize road safety in their development agenda through increased political attention and financial commitments. This is not the case yet in sub-Saharan Africa. Instead, the health agenda in sub-Saharan Africa remains focused primarily on infectious diseases, maternal health, and childhood diseases. However, our findings show that more people die in road crashes in Africa than from tuberculosis and maternal disorders. Among children, road injuries rank in the top 10 causes of death after the first year of life.

In fact, we show that road injury death rates in sub-Saharan Africa are amongst the highest in the world. Six countries from the region rank among the ten least safe countries in the world. Three regions of sub-Saharan Africa (Western, Eastern and Central) have the highest death rates of any regions in the world. In two regions (Western and Southern), the road death toll has more than doubled since 1990.

The UN Decade of Action aims to reverse this trend by focusing on five pillars of safety – road safety management, safer roads and mobility, safer vehicles, safer road users, and post-crash response. The dividends of such an approach are clear from looking at the experience of the high-income regions that have walked this path. Our analysis shows that the road death toll has declined by 43% in Western Europe since 1990. However, a longer historical analysis shows that road safety has steadily improved since the early 1970s in most high-income countries despite increasing vehicle ownership rates and continued expansion of highway infrastructure. The policy history of these countries suggests that starting in the late 1960s, they established national road safety agencies with legislative powers and a mandate to manage safety in the transport system (Wegman et al., 2008). These agencies instituted a long series of interventions that targeted highway infrastructure (e.g., by requiring median barriers, guard rails, and traffic calming designs), vehicle safety (e.g., by requiring airbags, seatbelts, child seats, crashworthiness standards, and crash avoidance technologies), and road users (e.g., by enforcement and campaigns to encourage seat-belt use, helmet use, and drink driving). Countries in sub-Saharan Africa now need to walk on a similar path as they develop their transport systems by building highways that incorporate safety infrastructure, acquiring vehicle fleets that integrate safety technology, and deploying enforcement technologies that encourage safe road use, using a results-oriented safe system approach.

Implications for future research in road injury metrics

We believe that this report presents enough evidence about the burden of road injuries in sub-Saharan Africa for policy makers to begin investing in road safety immediately. Managing these investments will require a road safety measurement framework that can be used to identify cost-effective interventions, define benchmarks, set achievable targets, and monitor progress towards achieving them. Continued improvements and refinements of road safety metrics should be an ongoing process that should evolve as the Decade of Action unfolds. Our work suggests that such work should simultaneously focus on strengthening local information systems and the continued development of analytical methods for generating information that can guide policy.

Our work highlights the availability of a large number of data systems in sub-Saharan Africa that have been underutilized in policy relevant analysis. Strengthening these existing data systems is an efficient way to rapidly improve the availability of road injury statistics in the region (Bhalla et al. 2012). For instance, we relied extensively on mortuary data systems, which can provide valuable information about the distribution of injury deaths in urban settings. The existence of a legal framework for investigating causes of unnatural deaths creates an opportunity to develop mortuary-based surveillance systems especially in sub-Saharan Africa where vital registrations systems are particularly weak. Thus, the widespread implementation of the new WHO mortuary surveillance guidelines (Bartolomeos et al., 2012) coupled with periodic studies to validate data quality could bring vast amounts of reliable data to road injury metrics. In the longer term, such infrastructure can be used for monitoring and evaluation of road safety interventions and programs in the regions.

Similarly, our work relied on data from a vast network of health and demographic surveillance sites in sub-Saharan Africa. These sites typically monitor morbidity (via periodic surveys) and mortality (via continuous verbal autopsy) in selected rural populations. Although many of these sites have been collecting data for decades, the data have rarely been used to monitor trends in road injuries. Partly as a result, the injury data available from these sites was often poorly coded, with injury deaths often being ascribed to nature-of-injuries (e.g., head injury) rather than external causes (e.g., pedestrian crash), which are more relevant for policy analysis. Strengthening this existing infrastructure by improving coding procedures could substantially improve knowledge of injury statistics in these regions.

We also found that many countries conduct periodic national health surveys that often include questions about non-fatal injury involvement and medical care received. Despite the readily available data, such surveys have received little attention from the injury research community. Partly for this reason, the survey instruments (i.e. survey questions) are not standardized and often fail to incorporate well-established advice about measuring injuries (e.g. use of appropriate recall periods, Mock et al. 2012). A shortened version of the WHO guidelines for injury community surveys (WHO, 2006) designed for use as an injury module in national health surveys can provide useful guidance to national agencies conducting such surveys and make the findings directly useful for policy making.

In addition to strengthening data systems, we need continuing and concerted research focused on improving methods that can effectively utilize existing data infrastructure to derive metrics that can help road safety policy makers. Our work makes many simplifying assumptions that need to be addressed in future work. Such work should include the development of methods for assessing and correcting misclassification in surveillance systems, reattribution of injuries coded to partially specified causes, and biases in the population that gets included in incomplete surveillance systems.

While the GBD project is unique in estimating the incidence and burden of non-fatal road injuries, such research is in its infancy leaving substantial room for improving analytical methods and conducting empirical measurements. This includes improving measurement of the incidence of non-fatal injuries from household surveys through the development of better methods for addressing such measurement issues as differential item functioning, telescoping and recall biases. Road injuries typically result in injuries to multiple regions of the body but the implication of multiple injuries on health outcomes remains poorly understood. Finally, the bulk of the burden of non-fatal injuries is a result from long-term disabling outcomes. There are few studies that have followed-up victims to track their recovery over the long-term. At present, such studies are only available from regions with relatively good access to medical care, and they used differing health state measures, which required analytical mappings to GBD health states. Such work will benefit substantially from more and comparable measurements, particularly in low-income regions, and improved analytical methods for characterizing the evolution of disability following road injury.

An important stream of future work emanating from this project should explicitly consider the needs of different policy makers and parse the results appropriately. Thus, for instance, this may require constructing estimates of the economic burden of injuries rather than the public health burden of injuries. A robust literature on health costing (WHO, 2009b; Bloom et al. 2011) provides guidance on converting burden estimates measured in this study into economic losses using fairly simple analytical methods. Similarly, in addition to quantifying the public health burden of road injuries, policy makers need guidance on which risk factors matter most. This can be addressed by attributing the burden of road injuries to the various risk factors that a policy maker could address. Such an approach is also easily extended beyond road injuries to model the multiple health impacts of transport policy, including physical inactivity and vehicular air pollution, in a health impact assessment framework.

Conclusions

Improving access to jobs, health care, and education is an important priority for sub-Saharan Africa. However, unmanaged expansion of the transport sector has resulted in many parts of the region becoming the most dangerous in the world. Road injuries now rank among the leading health concerns in the region. National governments and the international development community need to prioritize road safety in the region and implement the recommendations of the 2004 World Report on Road Traffic Injury Prevention.

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Appendix A1: Regional Results

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	8		1	3	1	13
	7-27 D	10		1	6	1	18
	28-364 D	182		20	92	13	307
	1-4	2352	69	103	296	45	2865
	5-9	422	26	27	60	11	546
	10-14	251	23	26	46	9	355
	15-19	574	35	118	176	19	922
	20-24	864	39	186	301	25	1415
	25-29	735	33	139	233	24	1164
	30-34	606	25	83	167	17	898
	35-39	491	20	62	128	13	714
	40-44	382	16	35	89	10	532
	45-49	342	15	30	76	9	472
	50-54	302	13	22	61	7	405
	55-59	261	12	17	50	8	348
	60-64	225	10	13	40	7	295
	65-69	187	8	10	31	5	241
	70-74	132	6	6	21	4	169
	75-79	81	4	3	12	2	102
	80+	53	2	2	8	1	66
	All ages	8460	356	904	1896	231	11847
Female	0-6 D	1		1	5		7
	7-27 D	1		1	9	2	13
	28-364 D	22		19	131	16	188
	1-4	384	38	106	733	86	1347
	5-9	66	12	19	118	19	234
	10-14	39	11	18	78	17	163
	15-19	45	14	68	195	24	346
	20-24	34	9	56	172	18	289
	25-29	26	7	37	125	13	208
	30-34	24	6	28	91	12	161
	35-39	25	6	24	84	11	150
	40-44	18	5	16	56	9	104
	45-49	20	5	13	50	9	97
	50-54	22	6	13	55	11	107
	55-59	24	6	11	51	12	104
	60-64	28	6	10	50	13	107
	65-69	28	6	8	49	11	102
	70-74	24	5	6	34	11	80
	75-79	20	3	3	20	7	53
	80+	13	2	2	10	5	32
	All ages	864	147	459	2116	306	3892
Both	**All ages**	**9324**	**503**	**1363**	**4012**	**537**	**15739**

Table A1.1 Road Injury Deaths in Central Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	10		2	4	1	17
	7-27 D	10		2	7	1	20
	28-364 D	205		35	115	22	377
	1-4	1933	68	159	313	59	2532
	5-9	480	37	54	89	20	680
	10-14	280	33	48	65	15	441
	15-19	842	65	299	314	39	1559
	20-24	1336	77	484	557	59	2513
	25-29	1205	67	371	451	60	2154
	30-34	977	49	214	323	42	1605
	35-39	777	35	140	227	28	1207
	40-44	638	26	82	156	20	922
	45-49	580	24	65	133	20	822
	50-54	522	21	46	103	14	706
	55-59	429	19	36	80	15	579
	60-64	356	15	26	60	12	469
	65-69	295	13	22	48	9	387
	70-74	215	9	14	32	9	279
	75-79	137	6	7	21	5	176
	80+	106	3	4	14	3	130
	All ages	11333	567	2110	3112	453	17575
Female	0-6 D	1		1	7		9
	7-27 D	2		1	8	3	14
	28-364 D	29		15	138	24	206
	1-4	331	31	71	604	103	1140
	5-9	93	15	21	143	37	309
	10-14	55	13	18	94	30	210
	15-19	96	21	90	337	47	591
	20-24	89	17	99	370	51	626
	25-29	65	13	62	265	37	442
	30-34	52	9	41	179	27	308
	35-39	48	8	26	131	20	233
	40-44	37	6	16	88	17	164
	45-49	39	6	14	75	14	148
	50-54	40	6	12	68	15	141
	55-59	42	6	11	65	17	141
	60-64	41	6	9	56	18	130
	65-69	43	6	10	62	16	137
	70-74	38	5	6	40	15	104
	75-79	32	4	4	25	11	76
	80+	25	3	3	15	9	55
	All ages	1198	175	530	2770	511	5184
Both	**All ages**	**12531**	**742**	**2640**	**5882**	**964**	**22759**

Table A1.2 Road Injury Deaths in Central Sub-Saharan Africa in 2010

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	29.9		4	12	3.2	49.1
	7-27 D	13.3		1.9	8.3	1.1	24.6
	28-364 D	16		1.8	8.1	1.1	27
	1-4	57.2	1.7	2.5	7.2	1.1	69.7
	5-9	10.5	0.7	0.7	1.5	0.3	13.7
	10-14	7.7	0.7	0.8	1.4	0.3	10.9
	15-19	21.3	1.3	4.4	6.5	0.7	34.2
	20-24	38.4	1.7	8.3	13.4	1.1	62.9
	25-29	39.2	1.7	7.4	12.4	1.3	62
	30-34	39.2	1.6	5.4	10.8	1.1	58.1
	35-39	38.7	1.6	4.8	10.1	1	56.2
	40-44	36.8	1.5	3.4	8.6	0.9	51.2
	45-49	39.7	1.7	3.5	8.8	1.1	54.8
	50-54	43.3	1.9	3.2	8.8	1	58.2
	55-59	47.2	2.2	3.1	9	1.5	63
	60-64	53	2.4	3.2	9.3	1.5	69.4
	65-69	61.5	2.7	3.2	10.2	1.7	79.3
	70-74	67.4	3.2	3.3	10.6	2.3	86.8
	75-79	76.2	3.3	3	11.6	2.3	96.4
	80+	88.3	3.1	3	13	2.3	109.7
	All ages	31.9	1.3	3.4	7.2	0.9	44.7
Female	0-6 D	3.2		3.1	21.4		27.7
	7-27 D	1.9		1.8	11.8	3.2	18.7
	28-364 D	2		1.7	11.8	1.4	16.9
	1-4	9.5	0.9	2.6	18.1	2.1	33.2
	5-9	1.7	0.3	0.5	3	0.5	6
	10-14	1.2	0.3	0.6	2.4	0.5	5
	15-19	1.7	0.5	2.5	7.2	0.9	12.8
	20-24	1.5	0.4	2.5	7.6	0.8	12.8
	25-29	1.4	0.4	2	6.6	0.7	11.1
	30-34	1.5	0.4	1.8	5.8	0.7	10.2
	35-39	1.9	0.4	1.8	6.4	0.8	11.3
	40-44	1.7	0.4	1.4	5.2	0.9	9.6
	45-49	2.1	0.5	1.4	5.4	1	10.4
	50-54	2.9	0.7	1.7	7	1.5	13.8
	55-59	3.7	0.9	1.7	8	1.8	16.1
	60-64	5.5	1.2	2	9.7	2.6	21
	65-69	7.4	1.6	2.1	12.9	2.9	26.9
	70-74	9.4	1.9	2.2	13	4.2	30.7
	75-79	13.3	2.1	2.2	13.2	4.6	35.4
	80+	13.5	2.1	2	10	5.5	33.1
	All ages	3.2	0.5	1.7	7.8	1.1	14.3
Both	**All ages**	**17.4**	**0.9**	**2.5**	**7.5**	**1**	**29.3**

Table A1.3 Road Injury Deaths Rates (per 100,000) in Central Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	25.5		4.6	10.6	3.3	44
	7-27 D	9.2		1.4	5.8	0.9	17.3
	28-364 D	11.6		2	6.5	1.3	21.4
	1-4	27.8	1	2.3	4.5	0.8	36.4
	5-9	6.6	0.5	0.7	1.2	0.3	9.3
	10-14	4.5	0.5	0.8	1.1	0.2	7.1
	15-19	16	1.2	5.7	6	0.7	29.6
	20-24	30.5	1.8	11.1	12.7	1.3	57.4
	25-29	34	1.9	10.5	12.7	1.7	60.8
	30-34	34.2	1.7	7.5	11.3	1.5	56.2
	35-39	33.8	1.5	6.1	9.9	1.2	52.5
	40-44	34.3	1.4	4.4	8.4	1.1	49.6
	45-49	38.7	1.6	4.3	8.9	1.3	54.8
	50-54	44.1	1.8	3.9	8.7	1.1	59.6
	55-59	46.2	2	3.8	8.7	1.7	62.4
	60-64	50.5	2.2	3.7	8.4	1.7	66.5
	65-69	57	2.5	4.2	9.3	1.8	74.8
	70-74	63.1	2.8	4.1	9.5	2.5	82
	75-79	72	3	3.8	10.9	2.4	92.1
	80+	93.1	2.9	3.9	12.7	2.5	115.1
	All ages	23.6	1.2	4.4	6.5	0.9	36.6
Female	0-6 D	3.6		2.3	18.5		24.4
	7-27 D	1.5		0.7	7.3	2.4	11.9
	28-364 D	1.7		0.9	8	1.4	12
	1-4	4.8	0.5	1	8.8	1.5	16.6
	5-9	1.3	0.2	0.3	2	0.5	4.3
	10-14	0.9	0.2	0.3	1.5	0.5	3.4
	15-19	1.8	0.4	1.7	6.4	0.9	11.2
	20-24	2	0.4	2.3	8.4	1.2	14.3
	25-29	1.8	0.4	1.7	7.4	1	12.3
	30-34	1.8	0.3	1.4	6.2	0.9	10.6
	35-39	2.1	0.3	1.1	5.7	0.9	10.1
	40-44	2	0.3	0.9	4.7	0.9	8.8
	45-49	2.5	0.4	0.9	4.8	0.9	9.5
	50-54	3.2	0.5	1	5.4	1.2	11.3
	55-59	4.1	0.6	1.1	6.4	1.7	13.9
	60-64	5	0.7	1.2	6.9	2.2	16
	65-69	7	1	1.5	9.9	2.7	22.1
	70-74	8.8	1.2	1.4	9.4	3.6	24.4
	75-79	12.5	1.4	1.6	9.7	4.2	29.4
	80+	14.3	1.5	1.5	8.4	5	30.7
	All ages	2.5	0.4	1.1	5.7	1.1	10.8
Both	**All ages**	**13**	**0.8**	**2.7**	**6.1**	**1**	**23.6**

Table A1.4 Road Injury Death Rates (per 100,000) in Central Sub-Saharan Africa in 2010

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	51		4	68	14	137
	7-27 D	19		3	58	7	87
	28-364 D	315		22	507	59	903
	1-4	2935	423	120	1567	218	5263
	5-9	1194	252	44	492	72	2054
	10-14	755	206	40	462	53	1516
	15-19	1363	385	97	929	93	2867
	20-24	1446	435	179	1609	116	3785
	25-29	1362	334	240	936	121	2993
	30-34	879	252	154	696	76	2057
	35-39	649	229	138	367	57	1440
	40-44	622	189	101	354	41	1307
	45-49	706	261	81	404	45	1497
	50-54	719	244	59	512	34	1568
	55-59	627	301	45	446	33	1452
	60-64	709	263	62	333	33	1400
	65-69	756	276	96	316	23	1467
	70-74	606	393	102	156	22	1279
	75-79	266	177	57	101	14	615
	80+	236	127	105	82	10	560
	All ages	16215	4747	1749	10395	1141	34247
Female	0-6 D	51		7	33		91
	7-27 D	53		5	20	47	125
	28-364 D	197		40	227	200	664
	1-4	1059	54	181	1049	723	3066
	5-9	535	24	52	276	225	1112
	10-14	466	29	69	224	242	1030
	15-19	339	29	191	262	271	1092
	20-24	274	21	179	195	233	902
	25-29	235	16	107	220	162	740
	30-34	196	12	91	161	139	599
	35-39	228	12	67	147	128	582
	40-44	204	12	57	129	137	539
	45-49	252	13	49	132	134	580
	50-54	315	15	50	160	152	692
	55-59	373	13	35	218	179	818
	60-64	506	16	39	183	185	929
	65-69	359	13	25	321	140	858
	70-74	386	12	21	128	155	702
	75-79	472	9	15	84	114	694
	80+	363	7	11	52	89	522
	All ages	6863	307	1291	4221	3655	16337
Both	**All ages**	**23078**	**5054**	**3040**	**14616**	**4796**	**50584**

Table A1.5 Road Injury Deaths in Eastern Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	57		4	73	10	144
	7-27 D	14		2	43	4	63
	28-364 D	350		17	540	44	951
	1-4	2195	285	65	1171	118	3834
	5-9	1245	245	32	547	53	2122
	10-14	783	202	30	478	38	1531
	15-19	2449	648	148	1664	118	5027
	20-24	3243	916	340	3515	185	8199
	25-29	3520	802	479	2269	210	7280
	30-34	2264	573	280	1645	130	4892
	35-39	1509	439	208	728	79	2963
	40-44	1229	320	136	607	49	2341
	45-49	1343	448	112	701	59	2663
	50-54	1405	426	86	906	43	2866
	55-59	1204	521	65	774	43	2607
	60-64	1427	450	86	576	40	2579
	65-69	1529	478	145	561	29	2742
	70-74	1289	726	162	302	31	2510
	75-79	633	351	97	215	20	1316
	80+	637	292	207	207	18	1361
	All ages	28325	8122	2701	17522	1321	57991
Female	0-6 D	71		5	34		110
	7-27 D	60		3	15	27	105
	28-364 D	319		31	252	166	768
	1-4	1054	32	79	650	384	2199
	5-9	675	21	37	243	179	1155
	10-14	530	24	47	189	194	984
	15-19	828	49	277	512	422	2088
	20-24	967	48	352	530	508	2405
	25-29	760	31	188	583	315	1877
	30-34	536	20	138	357	223	1274
	35-39	468	16	77	241	162	964
	40-44	404	16	66	209	181	876
	45-49	518	18	60	215	177	988
	50-54	569	18	55	216	159	1017
	55-59	763	18	45	335	218	1379
	60-64	968	22	48	271	215	1524
	65-69	845	19	36	583	189	1672
	70-74	871	18	29	211	200	1329
	75-79	1178	14	22	146	140	1500
	80+	1112	14	22	121	142	1411
	All ages	13496	398	1617	5913	4201	25625
Both	**All ages**	**41821**	**8520**	**4318**	**23435**	**5522**	**83616**

Table A1.6 Road Injury Deaths in Eastern Sub-Saharan Africa in 2010

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	57.6		4.8	75.7	15.2	153.3
	7-27 D	7.2		1.1	22.1	2.5	32.9
	28-364 D	7.9		0.5	12.7	1.5	22.6
	1-4	19.6	2.8	0.8	10.5	1.5	35.2
	5-9	7.7	1.6	0.3	3.2	0.5	13.3
	10-14	5.7	1.6	0.3	3.5	0.4	11.5
	15-19	12.3	3.5	0.9	8.4	0.8	25.9
	20-24	15.9	4.8	2	17.7	1.3	41.7
	25-29	18.4	4.5	3.2	12.6	1.6	40.3
	30-34	14.6	4.2	2.5	11.5	1.3	34.1
	35-39	13.1	4.6	2.8	7.4	1.1	29
	40-44	15.2	4.6	2.5	8.6	1	31.9
	45-49	21.6	8	2.5	12.3	1.4	45.8
	50-54	27	9.2	2.2	19.3	1.3	59
	55-59	28.7	13.8	2.1	20.4	1.5	66.5
	60-64	41.9	15.6	3.7	19.7	1.9	82.8
	65-69	62.1	22.7	7.9	25.9	1.9	120.5
	70-74	76.5	49.7	12.9	19.7	2.8	161.6
	75-79	60.3	40.1	12.9	22.8	3.2	139.3
	80+	90.6	48.8	40.5	31.5	3.9	215.3
	All ages	15.7	4.6	1.7	10.1	1.1	33.2
Female	0-6 D	58.3		8.3	37.9		104.5
	7-27 D	20.7		1.9	7.8	18.2	48.6
	28-364 D	5		1	5.8	5.1	16.9
	1-4	7.1	0.4	1.2	7.1	4.9	20.7
	5-9	3.5	0.2	0.3	1.8	1.5	7.3
	10-14	3.5	0.2	0.5	1.7	1.8	7.7
	15-19	3.1	0.3	1.7	2.4	2.5	10
	20-24	3	0.2	2	2.1	2.5	9.8
	25-29	3.1	0.2	1.4	2.9	2.1	9.7
	30-34	3.1	0.2	1.5	2.6	2.2	9.6
	35-39	4.4	0.2	1.3	2.8	2.5	11.2
	40-44	4.7	0.3	1.3	3	3.2	12.5
	45-49	7.2	0.4	1.4	3.8	3.9	16.7
	50-54	11	0.5	1.7	5.6	5.3	24.1
	55-59	15.6	0.6	1.5	9.1	7.5	34.3
	60-64	27	0.8	2.1	9.7	9.9	49.5
	65-69	25.9	0.9	1.8	23.1	10.1	61.8
	70-74	41.5	1.3	2.2	13.8	16.7	75.5
	75-79	86	1.7	2.7	15.3	20.9	126.6
	80+	98	1.8	3	14.1	24	140.9
	All ages	6.5	0.3	1.2	4	3.5	15.5
Both	**All ages**	**11.1**	**2.4**	**1.5**	**7**	**2.3**	**24.3**

Table A1.7 Road Injury Death Rates (per 100,000) in Eastern Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	44.6		2.8	57.1	7.8	112.3
	7-27 D	3.8		0.4	11.4	0.9	16.5
	28-364 D	6		0.3	9.2	0.7	16.2
	1-4	9.3	1.2	0.3	5	0.5	16.3
	5-9	4.9	1	0.1	2.1	0.2	8.3
	10-14	3.5	0.9	0.1	2.1	0.2	6.8
	15-19	12.7	3.4	0.8	8.6	0.6	26.1
	20-24	19.4	5.5	2	21	1.1	49
	25-29	25.3	5.8	3.4	16.3	1.5	52.3
	30-34	19.6	5	2.4	14.3	1.1	42.4
	35-39	16.5	4.8	2.3	8	0.9	32.5
	40-44	17.2	4.5	1.9	8.5	0.7	32.8
	45-49	23.7	7.9	2	12.3	1	46.9
	50-54	30.9	9.4	1.9	19.9	0.9	63
	55-59	32.8	14.2	1.8	21.1	1.2	71.1
	60-64	49.1	15.5	3	19.8	1.4	88.8
	65-69	72.8	22.8	6.9	26.7	1.4	130.6
	70-74	90.1	50.8	11.3	21.2	2.1	175.5
	75-79	73.1	40.5	11.2	24.8	2.3	151.9
	80+	113.7	52.1	37	37	3.2	243
	All ages	16	4.6	1.5	9.9	0.7	32.7
Female	0-6 D	57.1		4	27.1		88.2
	7-27 D	16.4		0.7	4.1	7.2	28.4
	28-364 D	5.6		0.5	4.4	2.9	13.4
	1-4	4.6	0.1	0.3	2.8	1.7	9.5
	5-9	2.7	0.1	0.1	1	0.7	4.6
	10-14	2.4	0.1	0.2	0.9	0.9	4.5
	15-19	4.3	0.3	1.4	2.7	2.2	10.9
	20-24	5.8	0.3	2.1	3.2	3	14.4
	25-29	5.5	0.2	1.4	4.2	2.3	13.6
	30-34	4.7	0.2	1.2	3.1	1.9	11.1
	35-39	5.1	0.2	0.8	2.7	1.8	10.6
	40-44	5.6	0.2	0.9	2.9	2.5	12.1
	45-49	8.8	0.3	1	3.6	3	16.7
	50-54	11.5	0.4	1.1	4.3	3.2	20.5
	55-59	18.5	0.4	1.1	8.1	5.3	33.4
	60-64	29.3	0.7	1.4	8.2	6.5	46.1
	65-69	34.6	0.8	1.5	23.8	7.7	68.4
	70-74	50.8	1	1.7	12.3	11.7	77.5
	75-79	109.2	1.3	2	13.6	13	139.1
	80+	144.4	1.9	2.8	15.7	18.5	183.3
	All ages	7.6	0.2	0.9	3.3	2.4	14.4
Both	**All ages**	**11.8**	**2.4**	**1.2**	**6.6**	**1.6**	**23.6**

Table A1.8 Road Injury Death Rates (per 100,000) in Eastern Sub-Saharan Africa in 2010

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	1		0	4	1	6
	7-27 D	0		0	4	1	5
	28-364 D	8		6	26	8	48
	1-4	71	12	17	67	16	183
	5-9	102	16	23	36	22	199
	10-14	61	22	16	27	17	143
	15-19	81	29	53	75	39	277
	20-24	80	26	76	135	51	368
	25-29	79	34	71	84	64	332
	30-34	84	25	46	84	56	295
	35-39	72	25	51	91	34	273
	40-44	54	14	18	69	26	181
	45-49	48	12	23	75	24	182
	50-54	59	17	23	63	11	173
	55-59	48	25	20	50	19	162
	60-64	41	17	14	45	12	129
	65-69	19	11	11	38	8	87
	70-74	15	7	10	30	8	70
	75-79	8	6	6	21	4	45
	80+	7	4	6	17	4	38
	All ages	938	302	490	1041	425	3196
Female	0-6 D	0		2	4		6
	7-27 D	0		1	3	1	5
	28-364 D	6		6	16	5	33
	1-4	45	6	11	28	16	106
	5-9	63	8	17	34	15	137
	10-14	40	8	11	21	10	90
	15-19	27	9	14	26	13	89
	20-24	16	7	14	17	15	69
	25-29	13	8	14	10	14	59
	30-34	14	7	12	8	14	55
	35-39	18	7	11	15	9	60
	40-44	20	5	6	20	8	59
	45-49	21	4	8	20	6	59
	50-54	13	4	7	28	4	56
	55-59	14	4	6	39	5	68
	60-64	18	6	8	36	5	73
	65-69	14	4	8	31	6	63
	70-74	13	5	9	27	5	59
	75-79	15	3	7	13	4	42
	80+	15	4	6	30	4	59
	All ages	385	99	178	426	159	1247
Both	**All ages**	**1323**	**401**	**668**	**1467**	**584**	**4443**

Table A1.9 Road Injury Deaths in Southern Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	1		0	4	1	6
	7-27 D	0		0	3	1	4
	28-364 D	11		7	21	10	49
	1-4	59	10	22	35	27	153
	5-9	73	7	15	17	17	129
	10-14	53	12	13	14	15	107
	15-19	240	59	125	124	78	626
	20-24	450	74	306	337	173	1340
	25-29	432	105	265	282	214	1298
	30-34	244	51	125	185	138	743
	35-39	138	31	85	112	54	420
	40-44	99	20	38	82	38	277
	45-49	91	14	41	84	30	260
	50-54	106	22	54	75	24	281
	55-59	78	26	50	59	37	250
	60-64	67	20	31	49	25	192
	65-69	42	19	28	53	18	160
	70-74	37	9	22	37	16	121
	75-79	25	7	16	28	9	85
	80+	28	8	13	25	10	84
	All ages	2274	494	1256	1626	935	6585
Female	0-6 D	0		2	3		5
	7-27 D	0		0	2	2	4
	28-364 D	5		4	15	10	34
	1-4	28	5	10	20	32	95
	5-9	44	4	8	22	18	96
	10-14	31	5	7	23	17	83
	15-19	102	19	43	113	59	336
	20-24	105	25	67	131	118	446
	25-29	52	20	42	52	85	251
	30-34	31	10	19	32	45	137
	35-39	30	7	11	22	19	89
	40-44	28	4	6	27	15	80
	45-49	34	4	8	31	13	90
	50-54	16	3	7	21	11	58
	55-59	22	5	8	48	20	103
	60-64	22	6	9	32	17	86
	65-69	47	7	14	70	27	165
	70-74	22	5	9	23	15	74
	75-79	23	4	8	15	12	62
	80+	24	6	8	38	13	89
	All ages	666	139	290	740	548	2383
Both	**All ages**	**2940**	**633**	**1546**	**2366**	**1483**	**8968**

Table A1.10 Road Injury Deaths in Southern Sub-Saharan Africa in 2010

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	3.4		2.5	24.5	4.2	34.6
	7-27 D	0.6		0.8	7.4	1.1	9.9
	28-364 D	1.1		0.8	3.5	1	6.4
	1-4	2.3	0.4	0.5	2.1	0.5	5.8
	5-9	2.8	0.4	0.6	1	0.6	5.4
	10-14	1.9	0.7	0.5	0.8	0.5	4.4
	15-19	2.9	1	1.9	2.6	1.4	9.8
	20-24	3.3	1.1	3.2	5.6	2.1	15.3
	25-29	3.8	1.6	3.5	4.1	3.1	16.1
	30-34	4.7	1.4	2.6	4.7	3.2	16.6
	35-39	4.8	1.7	3.4	6.1	2.3	18.3
	40-44	4.7	1.2	1.5	6.1	2.2	15.7
	45-49	5	1.2	2.4	7.9	2.5	19
	50-54	7.8	2.2	3.1	8.3	1.5	22.9
	55-59	7.8	4.2	3.3	8.1	3.1	26.5
	60-64	8.9	3.6	3.1	9.8	2.6	28
	65-69	6.3	3.7	3.7	12.3	2.5	28.5
	70-74	7.8	3.5	4.9	15.1	3.9	35.2
	75-79	7.8	5.5	6	20.9	3.5	43.7
	80+	11.8	7.1	9.9	26.9	6.7	62.4
	All ages	3.6	1.2	1.9	4	1.6	12.3
Female	0-6 D	2.6		13.3	24.2		40.1
	7-27 D	0.8		1.3	6.5	2.7	11.3
	28-364 D	0.8		0.8	2.2	0.7	4.5
	1-4	1.5	0.2	0.4	0.9	0.5	3.5
	5-9	1.8	0.2	0.5	0.9	0.4	3.8
	10-14	1.2	0.3	0.3	0.6	0.3	2.7
	15-19	0.9	0.3	0.5	0.9	0.4	3
	20-24	0.6	0.3	0.6	0.7	0.6	2.8
	25-29	0.6	0.4	0.7	0.5	0.7	2.9
	30-34	0.8	0.4	0.7	0.5	0.8	3.2
	35-39	1.2	0.5	0.7	1	0.6	4
	40-44	1.7	0.4	0.5	1.7	0.7	5
	45-49	2.1	0.4	0.8	2	0.6	5.9
	50-54	1.7	0.4	0.9	3.4	0.4	6.8
	55-59	2.2	0.6	0.9	5.9	0.8	10.4
	60-64	3.4	1.1	1.5	6.9	1	13.9
	65-69	3.5	1.1	2	7.7	1.6	15.9
	70-74	4.6	1.7	3.3	9.3	1.8	20.7
	75-79	8.6	2	3.8	7.9	2.2	24.5
	80+	11	2.8	4.2	22.1	2.9	43
	All ages	1.5	0.4	0.7	1.6	0.6	4.8
Both	**All ages**	**2.5**	**0.8**	**1.3**	**2.8**	**1.1**	**8.5**

Table A1.11 Road Injury Death Rates (per 100,000) in Southern Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	4		2.9	22.5	6.2	35.6
	7-27 D	0.6		0.9	5.9	1.7	9.1
	28-364 D	1.5		0.9	2.8	1.3	6.5
	1-4	1.9	0.3	0.7	1.1	0.9	4.9
	5-9	1.9	0.2	0.4	0.4	0.4	3.3
	10-14	1.4	0.3	0.3	0.4	0.4	2.8
	15-19	6.4	1.6	3.3	3.3	2.1	16.7
	20-24	12.1	2	8.2	9.1	4.7	36.1
	25-29	12.7	3.1	7.8	8.3	6.3	38.2
	30-34	8.7	1.8	4.4	6.6	4.9	26.4
	35-39	6.2	1.4	3.8	5	2.4	18.8
	40-44	5.7	1.1	2.2	4.8	2.2	16
	45-49	6.3	1	2.9	5.8	2.1	18.1
	50-54	8.4	1.7	4.3	6	1.9	22.3
	55-59	7.5	2.4	4.8	5.6	3.5	23.8
	60-64	8.6	2.5	4	6.3	3.3	24.7
	65-69	7.5	3.4	5	9.4	3.2	28.5
	70-74	10.4	2.6	6.1	10.5	4.4	34
	75-79	12.8	3.8	8.1	14	4.3	43
	80+	21.8	5.8	10.4	19.5	7.7	65.2
	All ages	6.5	1.4	3.6	4.7	2.7	18.9
Female	0-6 D	2.3		9.8	19.4		31.5
	7-27 D	0.7		0.7	4.4	3.8	9.6
	28-364 D	0.7		0.5	2.1	1.4	4.7
	1-4	0.9	0.2	0.3	0.6	1	3
	5-9	1.2	0.1	0.2	0.6	0.5	2.6
	10-14	0.8	0.1	0.2	0.6	0.5	2.2
	15-19	2.7	0.5	1.1	3	1.6	8.9
	20-24	2.8	0.7	1.8	3.6	3.2	12.1
	25-29	1.6	0.6	1.3	1.6	2.6	7.7
	30-34	1.2	0.4	0.7	1.2	1.8	5.3
	35-39	1.5	0.3	0.6	1.1	1	4.5
	40-44	1.6	0.2	0.3	1.5	0.9	4.5
	45-49	2.1	0.2	0.5	1.9	0.8	5.5
	50-54	1	0.2	0.4	1.4	0.7	3.7
	55-59	1.7	0.4	0.7	3.7	1.6	8.1
	60-64	2.2	0.6	0.9	3.3	1.7	8.7
	65-69	6.2	1	1.9	9.3	3.6	22
	70-74	4.2	0.9	1.8	4.4	2.8	14.1
	75-79	6.8	1.2	2.4	4.3	3.7	18.4
	80+	8.7	2.1	2.8	13.8	4.6	32
	All ages	1.9	0.4	0.8	2.1	1.5	6.7
Both	**All ages**	**4.2**	**0.9**	**2.2**	**3.4**	**2.1**	**12.8**

Table A1.12 Road Injury Death Rates (per 100,000) in Southern Sub-Saharan Africa in 2010

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	11		5	20	7	43
	7-27 D	6		6	28	5	45
	28-364 D	266		70	420	130	886
	1-4	4907	212	592	1998	479	8188
	5-9	979	129	249	587	231	2175
	10-14	520	83	176	308	99	1186
	15-19	750	147	714	657	206	2474
	20-24	855	166	1071	1138	278	3508
	25-29	627	129	1081	904	282	3023
	30-34	606	101	798	873	232	2610
	35-39	433	70	625	767	141	2036
	40-44	345	55	490	573	110	1573
	45-49	366	51	539	493	82	1531
	50-54	299	44	419	416	73	1251
	55-59	386	47	364	427	75	1299
	60-64	437	46	285	322	69	1159
	65-69	331	41	207	389	62	1030
	70-74	330	36	170	269	55	860
	75-79	268	24	58	183	33	566
	80+	165	15	39	183	20	422
	All ages	12887	1396	7958	10955	2669	35865
Female	0-6 D	8		2	15		25
	7-27 D	8		3	18	10	39
	28-364 D	200		43	241	94	578
	1-4	2640	107	323	1034	410	4514
	5-9	648	41	82	280	95	1146
	10-14	321	31	54	198	72	676
	15-19	377	55	218	269	205	1124
	20-24	289	43	185	460	146	1123
	25-29	162	39	200	389	147	937
	30-34	181	28	157	250	129	745
	35-39	208	31	140	374	99	852
	40-44	198	22	166	255	116	757
	45-49	265	26	93	400	63	847
	50-54	358	28	93	407	67	953
	55-59	416	32	85	396	85	1014
	60-64	411	28	73	370	74	956
	65-69	472	31	64	293	73	933
	70-74	441	26	48	233	68	816
	75-79	294	19	35	173	47	568
	80+	171	11	20	202	33	437
	All ages	8068	598	2084	6257	2033	19040
Both	**All ages**	**20955**	**1994**	**10042**	**17212**	**4702**	**54905**

Table A1.13 Road Injury Deaths in Western Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	22		8	35	13	78
	7-27 D	12		8	43	10	73
	28-364 D	529		103	720	244	1596
	1-4	9336	336	860	3493	821	14846
	5-9	1805	209	366	1086	428	3894
	10-14	885	125	233	548	150	1941
	15-19	1750	297	1354	1577	371	5349
	20-24	2393	404	2571	3342	621	9331
	25-29	2076	373	3419	3227	764	9859
	30-34	1925	282	2442	3056	622	8327
	35-39	1138	162	1493	2089	292	5174
	40-44	743	103	891	1203	204	3144
	45-49	749	91	849	950	145	2784
	50-54	595	79	654	785	134	2247
	55-59	695	79	513	728	120	2135
	60-64	763	77	390	532	110	1872
	65-69	624	70	324	673	97	1788
	70-74	634	64	267	474	92	1531
	75-79	537	43	97	333	57	1067
	80+	412	34	81	392	44	963
	All ages	27623	2828	16923	25286	5339	77999
Female	0-6 D	19		3	29		51
	7-27 D	17		3	29	14	63
	28-364 D	496		54	468	147	1165
	1-4	5512	174	392	1925	605	8608
	5-9	1404	63	96	529	134	2226
	10-14	637	46	60	327	93	1163
	15-19	1064	117	368	707	401	2657
	20-24	1071	112	410	1749	365	3707
	25-29	563	105	452	1431	383	2934
	30-34	535	61	284	716	261	1857
	35-39	434	47	174	704	137	1496
	40-44	413	34	209	461	157	1274
	45-49	521	37	103	669	75	1405
	50-54	559	34	81	522	72	1268
	55-59	736	42	92	556	99	1525
	60-64	686	35	71	472	78	1342
	65-69	967	47	89	488	90	1681
	70-74	799	34	57	321	78	1289
	75-79	618	30	48	266	64	1026
	80+	455	22	34	376	49	936
	All ages	17506	1040	3080	12745	3302	37673
Both	**All ages**	**45129**	**3868**	**20003**	**38031**	**8641**	**115672**

Table A1.14 Road Injury Deaths in Western Sub-Saharan Africa in 2010

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	12.9		6.3	23.1	8.1	50.4
	7-27 D	2.5		2.3	11.2	2.2	18.2
	28-364 D	7		1.8	11	3.4	23.2
	1-4	34.6	1.5	4.2	14.1	3.4	57.8
	5-9	6.5	0.9	1.6	3.9	1.5	14.4
	10-14	4.1	0.7	1.4	2.4	0.8	9.4
	15-19	7.1	1.4	6.8	6.2	2	23.5
	20-24	10	2	12.6	13.4	3.3	41.3
	25-29	8.8	1.8	15.1	12.6	3.9	42.2
	30-34	10.2	1.7	13.5	14.8	3.9	44.1
	35-39	8.9	1.4	12.8	15.7	2.9	41.7
	40-44	8.3	1.3	11.8	13.8	2.7	37.9
	45-49	10.3	1.4	15.1	13.9	2.3	43
	50-54	10.4	1.5	14.5	14.4	2.5	43.3
	55-59	16.8	2	15.8	18.5	3.2	56.3
	60-64	24.5	2.6	16	18	3.9	65
	65-69	25.6	3.1	16	30	4.8	79.5
	70-74	39.7	4.4	20.4	32.4	6.6	103.5
	75-79	60.9	5.4	13.2	41.5	7.5	128.5
	80+	68.6	6.1	16.3	75.9	8.3	175.2
	All ages	12.8	1.4	7.9	10.9	2.6	35.6
Female	0-6 D	9.2		2.7	17.8		29.7
	7-27 D	3.4		1.3	7.4	4.1	16.2
	28-364 D	5.4		1.2	6.5	2.6	15.7
	1-4	19.2	0.8	2.3	7.5	3	32.8
	5-9	4.4	0.3	0.6	1.9	0.6	7.8
	10-14	2.6	0.2	0.4	1.6	0.6	5.4
	15-19	3.6	0.5	2.1	2.6	2	10.8
	20-24	3.4	0.5	2.2	5.4	1.7	13.2
	25-29	2.3	0.6	2.8	5.5	2.1	13.3
	30-34	3	0.5	2.6	4.2	2.2	12.5
	35-39	4.2	0.6	2.8	7.6	2	17.2
	40-44	4.8	0.5	4	6.1	2.8	18.2
	45-49	7.3	0.7	2.6	11.1	1.8	23.5
	50-54	12	0.9	3.1	13.6	2.2	31.8
	55-59	17	1.3	3.5	16.2	3.5	41.5
	60-64	21.2	1.5	3.8	19.1	3.8	49.4
	65-69	32.6	2.2	4.4	20.2	5.1	64.5
	70-74	45.6	2.7	5	24.1	7.1	84.5
	75-79	54.4	3.5	6.4	31.9	8.7	104.9
	80+	50.7	3.4	5.9	60	9.7	129.7
	All ages	8	0.6	2.1	6.2	2	18.9
Both	**All ages**	**10.4**	**1**	**5**	**8.6**	**2.3**	**27.3**

Table A1.15 Road Injury Death Rates (per 100,000) in Western Sub-Saharan Africa in 1990

Sex	Age Group	Pedestrian	Pedal cyclist	Rider motorcycle	Veh. occup. 3+ wheels	Other	Total
Male	0-6 D	16.9		6.2	27.2	10.1	60.4
	7-27 D	3.1		2	11.6	2.7	19.4
	28-364 D	9.1		1.8	12.4	4.2	27.5
	1-4	41.4	1.5	3.8	15.5	3.6	65.8
	5-9	7.5	0.9	1.5	4.5	1.8	16.2
	10-14	4.3	0.6	1.1	2.7	0.7	9.4
	15-19	9.8	1.7	7.6	8.8	2.1	30
	20-24	15.4	2.6	16.5	21.5	4	60
	25-29	15.5	2.8	25.6	24.2	5.7	73.8
	30-34	17.3	2.5	21.9	27.4	5.6	74.7
	35-39	12.8	1.8	16.8	23.5	3.3	58.2
	40-44	10.7	1.5	12.8	17.3	2.9	45.2
	45-49	13.2	1.6	14.9	16.7	2.5	48.9
	50-54	12.9	1.7	14.2	17.1	2.9	48.8
	55-59	19	2.2	14	19.9	3.3	58.4
	60-64	26.3	2.6	13.4	18.3	3.8	64.4
	65-69	28.4	3.2	14.7	30.6	4.4	81.3
	70-74	43.9	4.4	18.5	32.8	6.4	106
	75-79	66.4	5.3	11.9	41.1	7	131.7
	80+	84	6.9	16.5	79.9	9	196.3
	All ages	16.3	1.7	10	14.9	3.2	46.1
Female	0-6 D	15.7		2.3	24		42
	7-27 D	4.8		0.9	8.1	4	17.8
	28-364 D	8.9		1	8.4	2.6	20.9
	1-4	25.3	0.8	1.8	8.8	2.8	39.5
	5-9	6	0.3	0.4	2.3	0.6	9.6
	10-14	3.2	0.2	0.3	1.6	0.5	5.8
	15-19	6.1	0.7	2.1	4.1	2.3	15.3
	20-24	7	0.7	2.7	11.4	2.4	24.2
	25-29	4.3	0.8	3.4	10.9	2.9	22.3
	30-34	4.9	0.6	2.6	6.6	2.4	17.1
	35-39	5	0.5	2	8.1	1.6	17.2
	40-44	6	0.5	3	6.7	2.3	18.5
	45-49	9.1	0.6	1.8	11.6	1.3	24.4
	50-54	11.6	0.7	1.7	10.8	1.5	26.3
	55-59	18.6	1.1	2.3	14.1	2.5	38.6
	60-64	21.8	1.1	2.3	15	2.5	42.7
	65-69	39.6	1.9	3.6	20	3.7	68.8
	70-74	48.2	2.1	3.5	19.3	4.7	77.8
	75-79	63.8	3.1	5	27.5	6.6	106
	80+	70.2	3.3	5.3	58	7.6	144.4
	All ages	10.5	0.6	1.8	7.6	2	22.5
Both	**All ages**	**13.4**	**1.1**	**6**	**11.3**	**2.6**	**34.4**

Table A1.16 Road Injury Death Rates (per 100,000) in Southern Sub-Saharan Africa in 2010

Appendix A2: Country Results

Country	1990			2000			2010				Road Users (%)				
	Road Injury Deaths	Rate per 100k	Cause of Death Rank	Road Injury Deaths	Rate per 100k	Cause of Death Rank	Road Injury Deaths	Uncertainty [95% CI]	Rate per 100k	Cause of Death Rank	Pedestrian	Bicyclist	Motorcycle	Occupants	Other
Angola	6563	69.7	10	6495	52.5	12	9408	[2450-31110]	63.1	7	69	2	4	24	1
Benin	982	24.7	14	1434	27.3	13	1726	[1245-2155]	26.2	12	36	5	16	39	4
Botswana	155	12.7	13	505	27.6	7	283	[191-484]	13.2	9	36	7	14	38	5
Burkina Faso	2844	35.0	10	4004	38.1	8	5585	[4271-7113]	39.4	7	34	3	14	33	15
Burundi	2097	47.0	11	2026	43.5	11	2534	[812-5044]	41.0	10	35	16	12	25	12
Cameroon	4051	43.5	9	5422	42.6	9	6951	[4682-9920]	43.2	7	41	4	13	37	4
Cape Verde	45	16.1	12	50	15.2	11	80	[36-177]	19.1	7	44	7	10	35	4
Central Afr. Rep.	916	36.2	14	1225	38.3	15	1911	[899-3835]	49.7	11	47	4	15	26	9
Chad	954	19.8	20	1628	24.5	17	2765	[2144-3536]	30.6	12	38	4	16	36	7
Comoros	143	46.9	9	164	44.4	9	213	[122-411]	43.8	8	49	18	5	24	4
Congo, Rep.	1005	52.9	10	1742	63.3	8	1916	[633-5519]	56.4	8	65	2	5	27	1
Congo, Dem. Rep.	6497	18.1	18	5169	11.0	22	7733	[5107-11060]	12.4	19	35	5	23	28	8
Cote d'Ivoire	3383	35.8	12	6237	47.7	8	6536	[4232-8893]	40.9	9	37	4	17	39	4
Djibouti	303	72.7	5	268	50.9	7	345	[167-723]	51.3	5	65	8	3	22	2
Eq. Guinea	178	50.8	12	277	55.3	10	524	[109-1855]	83.2	6	68	2	3	26	1
Eritrea	682	31.1	13	954	38.0	11	1202	[898-1673]	34.0	11	41	14	7	31	8
Ethiopia	15103	42.0	13	15513	34.0	12	21520	[16689-27821]	37.3	9	47	11	4	30	9
Gabon	586	72.5	7	872	86.4	6	1267	[340-3485]	99.5	5	68	2	5	25	1
Gambia	223	31.9	13	291	30.8	12	387	[283-519]	30.7	9	37	4	15	38	6
Ghana	2053	18.8	16	3157	21.0	14	4844	[3267-6097]	24.8	10	38	5	7	46	4
Guinea	1019	21.2	18	1572	22.6	16	1869	[1409-2305]	23.5	14	33	5	17	39	6
Guinea-Bissau	309	37.9	13	399	39.4	12	443	[288-600]	36.1	11	30	4	22	38	6
Kenya	3648	21.6	13	7016	26.6	11	7820	[5183-13628]	25.1	10	51	12	4	29	3
Lesotho	76	6.2	36	150	9.4	28	232	[106-405]	12.4	23	26	8	18	37	11
Liberia	428	23.0	17	375	16.1	20	561	[199-983]	16.9	18	23	5	29	35	9
Madagascar	2891	33.6	12	2782	26.1	13	3405	[2631-4846]	24.1	11	48	11	5	30	6
Malawi	2722	34.6	13	4285	47.4	10	4867	[3293-6560]	44.3	9	43	12	7	32	6

Continued next page

Country	1990			2000			2010				Road Users (%)				
	Road Injury Deaths	Rate per 100k	Cause of Death Rank	Road Injury Deaths	Rate per 100k	Cause of Death Rank	Road Injury Deaths	Uncertainty [95% CI]	Rate per 100k	Cause of Death Rank	Pedestrian	Bicyclist	Motorcycle	Occupants	Other
Mali	1813	25.5	18	2561	26.4	16	3133	[2379-3924]	25.7	13	35	4	17	38	5
Mauritania	514	34.0	10	770	36.0	8	1016	[743-1383]	36.2	6	35	5	15	40	5
Mauritius	107	12.0	14	123	11.3	12	123	[79-151]	9.3	13	8	10	13	63	6
Mozambique	2264	23.5	16	3819	30.3	13	7154	[5493-11166]	46.7	9	41	11	8	30	10
Namibia	111	11.1	25	221	15.6	19	222	[157-385]	12.8	19	32	9	11	42	6
Niger	1496	21.3	19	1666	17.4	19	2078	[1412-2821]	16.6	16	30	5	19	39	7
Nigeria	32606	39.9	11	51858	45.7	9	74548	[55477-91154]	52.4	5	41	3	18	30	8
Rwanda	2885	59.8	9	2862	47.5	9	2492	[1431-5488]	34.3	10	53	13	5	23	6
Sao Tome & Prin#							33		20.0	14	38	4	14	40	4
Senegal	392	8.8	30	511	8.8	27	645	[307-1406]	9.4	24	48	5	16	26	5
Seychelles	8	16.2	9	10	19.3	8	12	[8-18]	20.8	9	16	6	17	61	1
Sierra Leone	951	29.9	15	785	24.4	17	1095	[627-1505]	26.1	13	29	5	24	36	6
Somalia	1898	37.8	12	1752	33.2	13	2083	[1509-3255]	32.3	13	43	10	7	29	12
South Africa#							14804		29.5	17	50	5	7	36	1
Sudan	5511	29.9	12	7238	29.8	10	10278	[7877-13730]	33.3	6	65	7	3	22	3
Swaziland	53	9.1	28	137	17.0	18	218	[127-346]	23.2	14	33	7	14	40	5
Tanzania	4857	25.3	12	7048	25.8	11	9404	[6482-14042]	27.7	9	53	7	5	29	6
Togo	835	28.8	12	1089	28.0	13	1401	[966-1733]	27.1	11	28	5	20	38	9
Uganda	3185	22.9	17	5944	33.7	13	7365	[5368-10509]	36.5	10	54	10	7	24	5
Zambia	2276	38.1	11	3207	40.7	11	2798	[2077-3955]	30.8	12	53	8	5	30	4
Zimbabwe	1453	18.4	12	3903	36.3	7	3527	[1375-5853]	33.2	10	11	10	31	11	38

Table A2.1 Road Injury Deaths in Countries in sub-Saharan Africa from 1990 to 2010

#Official government statistics for road deaths and death rates are shown for two countries, South Africa and Sao Tome & Principe, where GBD-2010 estimates were lower than official statistics. However, the cause of death rank and the road-user distribution for these countries are from GBD-2010. See also note about Southern sub-Saharan Africa estimates accompanying Table 4.1 and footnote on Page 72.