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# Identification of Road Safety Risk Factors in Africa

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**Abstract**

The paper presents the results of the analysis of road safety data, collected within the research project "SaferAfrica - Innovating dialogue and problems appraisal for a safer Africa", aiming to support policy makers and stakeholders with evidence on critical risk factors, related actions and good practices drawn from high quality data and knowledge. The project is funded by the European Union's Horizon 2020 research and innovation programme. The overall objective is to identify key risk factors affecting road safety in African countries. More specifically, a data organisation and analysis system was developed for the data gathered in order to produce indicators and define critical areas and challenges per topic and region of Africa. The analysis of the data for identifying key risk factors was performed on 5 different topics and priority areas for road safety actions and interventions were highlighted.

*Keywords:* road safety; SaferAfrica; risk factors; priority areas

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## 1. Introduction

In the European Union, during the past two decades a substantial progress has been achieved in improving road safety and reducing traffic fatalities. Unfortunately, this is not the case for Africa, where the number of road fatalities (26.6 fatalities/$10^5$ population) is almost three times that of Europe's. In addition, Africa has the highest proportion of pedestrian and cyclist mortalities with 44% of deaths (WHO, 2018). However, the most disturbing concern in Africa, is that road trauma is expected to worsen further, with fatalities per capita projected to double from 2015 to 2030.

In order to improve road safety performance in African countries, many barriers need to be overcome. Among them stands the substantial lack of detailed knowledge on road casualties in terms of their number as well as associated factors leading to road accidents or affecting their consequences.

However, the serious lack of road safety data is not the only problem compromising the understanding of the road safety issue in Africa. Even when data are available [e.g. through the reports of WHO, 2018; IRF - World Road Statistics, 2017, etc.], data are not always comparable among the countries due to different definitions of the variables, collection methodologies, etc.

Such considerations are addressed through the SaferAfrica project (www.saferafrica.eu), an Horizon 2020 Coordination and Concerted Action; a joint effort between 16 partners from Europe and Africa, aiming to create favorable conditions and opportunities for the effective implementation of road safety and traffic management actions in the African countries by setting up a Dialogue Platform between Africa and Europe.

The paper aims to analyse road safety data collected within the SaferAfrica project and identify key risk factors affecting road safety in African countries. More specifically, a data organisation and analysis system was developed for the data gathered in order to produce indicators and define critical areas and challenges per topic and region of Africa.

On that purpose, data were mainly collected either from international databases (e.g. WHO, 2018; IRF World Road Statistics, 2017; etc.) or via questionnaires distributed to national experts within the context of the SaferAfrica project, the input of which was found very useful. Moreover, in certain cases, preliminary results of data analysis conducted within other tasks of the SaferAfrica project were exploited as well in order to identify main road safety problems and particularities for specific countries and regions.

The analysis of the data on the basis of the established literature findings related to road safety risk factors highlighted the following topics to be further explored for the identification of key risk factors in the African region:

- Road user behaviour
- Infrastructure
- Vehicle
- Post-crash care
- Road Safety Management

Each of the aforementioned topics was examined for the whole African continent in order to define the effects of specific factors on road safety performance and identify priority areas or countries for road safety action and intervention.

## 2. Identification of Priority Areas for Road Safety Actions and Interventions

The analysis of the available data combined with literature findings led to the identification of specific characteristics and particularities affecting road safety in Africa for each of the topics explored. However, due to data limitations, it was very difficult to draw robust conclusions about the extent of the risk associated to the identified factors in individual countries and in Africa as a whole. The main findings for each area are outlined in the following sub-sections.

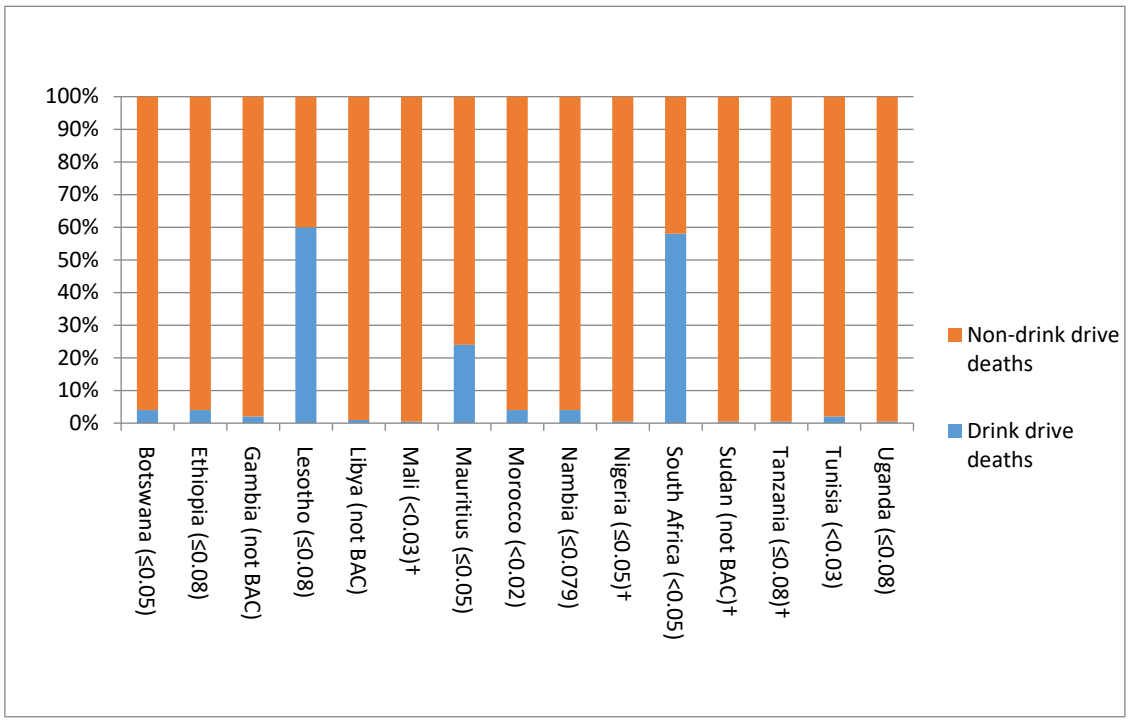
*2.1. Road User Behaviour*

The key risk factors identified in this topic concerned speed, alcohol, helmet use, seatbelt use and child restraint use, which were explored by using available data on Safety Performance Indicators (SPIs), as well as legislative and traffic law enforcement information.

Certain groups in the road traffic system are more at risk of injury from a collision than others. The mix and volume of traffic in a country also influences this risk and the consequences of certain types of behaviour, e.g. speeding or not wearing a seatbelt/helmet. Therefore, knowing the mix of road user types in a country is useful background when examining the risk of certain behaviours. Such data were extracted from the WHO (2018) report as well as from the SaferAfrica survey results.

Regarding speeding, more than half of the 44 countries with available data met the WHO best practice guidance for the speed limit at least as far as urban roads are concerned. A small reduction in speed could have a relatively large reduction in casualties especially in collisions involving vulnerable road users.

The most frequently available SPI data were for seatbelt and helmet use. The rates of wearing protective devices varied greatly from country to country with some having high wearing rates and other countries having low wearing rates. It is noted, however, that data regarding the use of child restraints were not available. Moreover, data on the number of drivers offending the national drink-driving law were not available as well, while the percentage of road fatalities attributed to drink-driving, which can be used as a proxy, was available for a small number of countries. Three out of the 15 countries with available data had a relatively large percentage of alcohol related fatalities, but it is not clear whether the low numbers in other countries are due to low consumption of alcohol in those countries or due to under-reporting or even religious practices (Figure 1). As far as speeding is concerned, data were available only for three African countries, in which 50% or more of drivers were observed speeding.




Note: BAC in parenthesis; †<1% drink drive deaths

Fig. 1 Percentage of alcohol involved deaths out of total fatalities [WHO (2018)]

With the exception of child restraints, a large proportion of countries had laws relating to the key road user behaviour related risk factors. Since the existence of traffic legislation cannot by itself deter road traffic violations and contribute to an overall better road user behaviour, the assessment of traffic law enforcement was also considered in the examination of the impact of the risk factors in Africa.

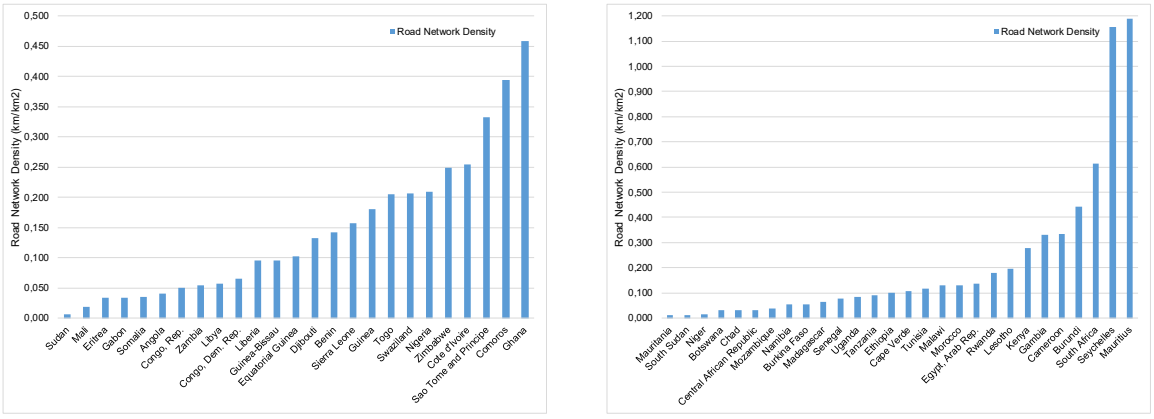
In general, enforcement was found rather low meaning that citizens may not have the motivation to follow laws. Enforcement appears to be best for seatbelts, then helmet wearing followed by speed and then drink-driving with the enforcement of using child restrains being very low for the few countries with relevant legislation (WHO, 2018). Improving enforcement and law compliance would reduce the impact of these risk factors.

### *2.2. Infrastructure*

The identification of the related to infrastructure risk factors was performed by exploiting data from WHO (2018) and IRF World Road Statistics (2017).

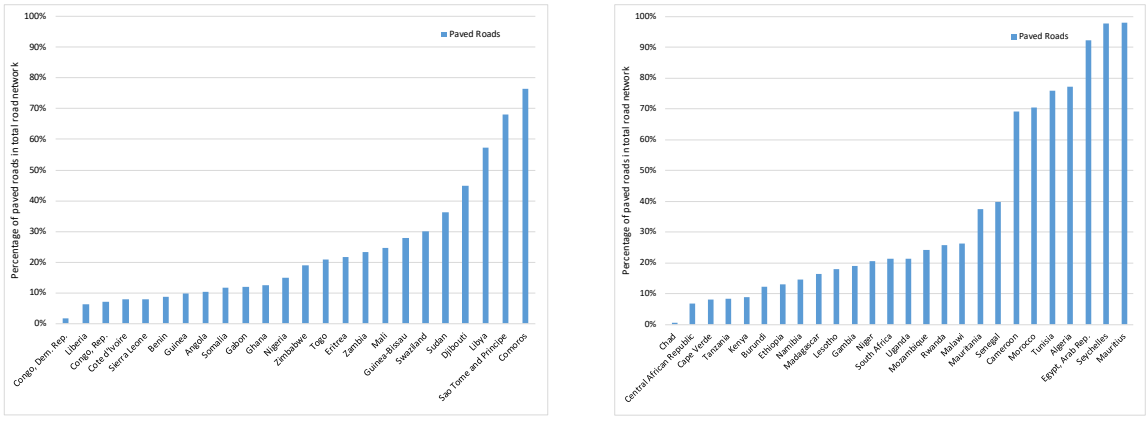
A weak but existent relationship between road network density and fatality rates in Africa was found. Regarding road type, there is some inconsistency, as some studies suggest that highways are associated with more injuries, whilst other studies show that rural roads are more dangerous. Moreover, when the WHO mortality data were exploited, a strong declining trend was present when examining the relationship between fatality rates and percentage of paved roads. It should be noted, however, that the vast majority of African countries have less than 40% of their roads paved.

In Figure 2 and Figure 3 countries divided in two groups (a, b) are shown depending on the year of available data on road network characteristics; namely, road network density and percentage of paved roads in total road network by country respectively [CIA (2018), IRF (2017)]. The first group (a) includes countries with available data before 2009 and the second (b) includes countries with available data after 2009.




(a) (b)

Fig. 2 Road network density by country: (a) 2009 or latest available year; (b) 2018 or latest available year [CIA (2018), IRF (2017)]




(a) (b)

Fig. 3 Percentage of paved roads in total road network by country: (a) 2009 or latest available year; (b) 2018 or latest available year [CIA (2018), IRF (2017)].

Although some research has been carried out on infrastructure risk factors and road safety, the major issue identified is the absence of appropriate data. This is observed mainly by the fact that many technical reports propose guidelines based on international studies, without having previously evaluated the suggested risk factors and countermeasures in the African context. Additionally, no specific infrastructure risk factors for vulnerable road users could be identified, since no related data or published studies were available.

### *2.3. Vehicle*

In order to identify risk factors related to vehicle in Africa, the utilised indicator was traffic fatalities per 1,000 vehicles. The span of its values is particularly high, from 0.34 fatalities/1,000 vehicles in Mauritius to 94.6 fatalities/1,000 vehicles in Guinea, reflecting the great variability both in motorization level and vehicle safety among African countries. At regional level, in the countries of Northern and Southern Africa the relevant indicator was found to be lower compared to the Western, Central and Eastern African regions. The relation between traffic fatalities per 1,000 vehicles and vehicles per 1.000 inhabitants revealed a great variability between countries (Figure 4).

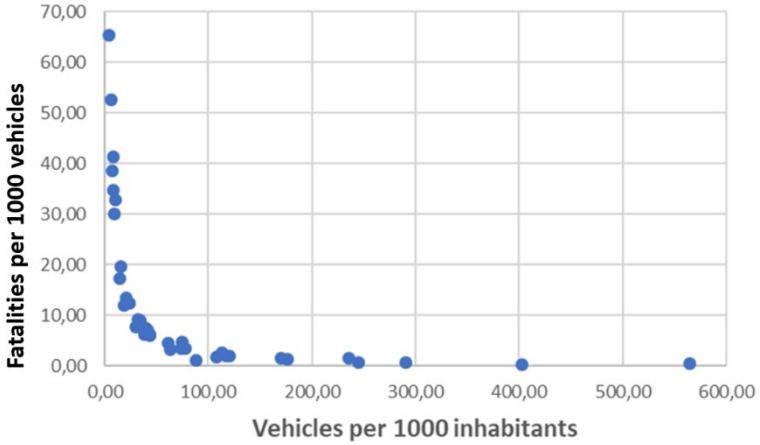



Fig. 4 Fatalities per 1000 vehicles versus vehicle rate population [WHO (2018)]

It was also found that traffic fatalities per 1,000 vehicles are related to the Gross National Income (GNI), with the countries with GNI higher than 2,000 USD presenting lower fatalities. However, this relationship was not further examined in terms of type among vehicle fleet. Possible relationships are also recommended to be examined between fatalities per 1,000 vehicles and fleet age, when such data will be available. Furthermore, data concerning the suitability of the vehicles in the different stages of their life would be useful to be gathered and further analysed.

### *2.4. Post-crash care*

Concerning the identification of risk factors related to post-crash care, key performance indicators within the four domains of post-crash care management (i.e. emergency care management, incident management, cost management and rehabilitation) were explored by exploiting data form international databases (e.g. WHO, 2018) and literature findings.

Emergency care in Africa has to deal with a lot of challenges. The lack of resources probably - being the most important one - affects not only the medical staff, but also the equipment which is often not available in the necessary quantity, if available at all. Infrastructure is another important challenge for emergency services.

Although most African countries are gradually developing or have already developed medical health infrastructure (from sanatoria, over small local or regional hospitals to university hospitals) the post-crash care is still poor, with ambulance services being available only in cities, most caretakers not being specialized and having access to limited resources only. Additionally, in rural areas, the road infrastructure and the more isolated conditions make it almost impossible in some cases to develop a well-organized emergency system.

In almost half of the countries the percentage of traffic victims being transported by ambulance is lower than 11%, while in most African countries injured persons may be transported to hospitals by either volunteer drivers or police. Transport of injured victims to medical institutions and professional care is in some cases achieved with the use of motorbikes. On that purpose, in some countries first-aid courses are mandatory in schools or are a prerequisite to get a drivers' license. This type of training could be improved for specific professionals, like truck and bus drivers as well as police officers, who are more frequently confronted with accidents.

While bystanders could give the necessary first aid care, it is also important to improve professional care. The surgical workforce by country seems rather insufficient as seen through Figure 5. One national number to get the right assistance also for coordinating the different emergency services (police, ambulances, and fire departments), is a necessity and could improve the current situation.

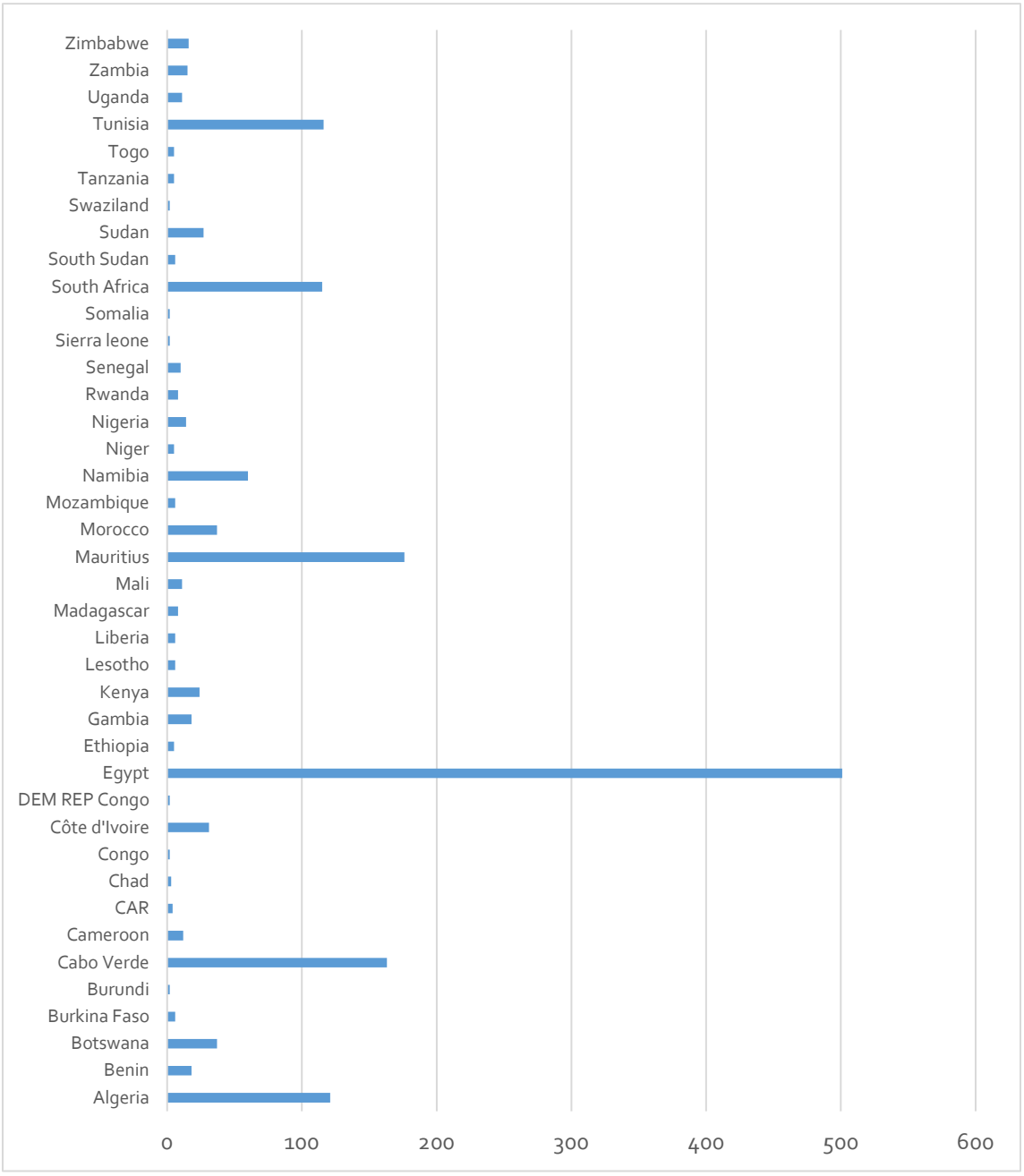



Fig. 4 Fatalities per 1000 vehicles versus vehicle rate population [WHO (2015)]

### *2.5. Road Safety Management*

The existence of a lead agency, the mobilization of resources, the access to good data and information recording are probably among the most crucial issues for obtaining some progress towards a better design and implementation of an effective road safety policy, which in turn requires management capacities, and when lacking, management capacity building.

A very broad majority of countries declares the existence of a national lead agency for road safety. Among the fifty countries having a lead agency, thirty-seven assert a dedicated funding for the agency and only thirteen having not such a funding.

Moreover, thirty-five countries assert they implemented a national road safety strategy, only six of them declare they dedicated the necessary funding for the implementation of this strategy, whereas twenty-six countries allocate a partial funding. The fatalities target reduction for various African countries based on their national road safety plans can be seen in Table 1.

The improvement of the road safety figures requires a true political commitment coming from the top of government as well as the implementation and the intervention of a lead agency and a national road strategy resting upon accurate data as far as possible.

Table 1. Fatalities target reduction in the national road safety plans from different African countries.
Note. Source: WHO (2018), * WHO (2015)

| | Death reduction target |
|---|---|
| Algeria* | 10% (2013-2018) |
| Botswana | 50% (2011-2020) |
| Burkina Faso | 25% (2011-2020) |
| Cabo Verde | 50% (2011-2020) |
| Chad | From 4,4% to 2% (by 2018) |
| Congo | 20% (2017-2018) |
| Ivory Coast | 50% (2016-2020) |
| Egypt | 2-5% (2011-2020) |
| Eritrea | 5% (2012-2016) |
| Ethiopia | 50% (2011-2020) |
| Ghana | 50% (2011-2020) |
| Libya | 3-5% (2008-2010, renewable every 3 years) |
| Madagascar | 5% (2015-2017) |
| Malawi | 20% (2015-2020) |
| Mali | 50% (2011-2020) |
| Mauritania | 25% (2012-2016) |
| Mauritius | 50% (2016-2025) |
| Morocco | 20% / 50 % (2017-2020 / 2017 - 2026) |
| Namibia | 50% (2011-2020) |
| Nigeria | 25% (2014-2018) |
| Senegal | 35% (2011-2020) |
| Sierra Leone* | 50% (2013-2015) |
| South Africa | 50% (2010-2020) |
| Sudan | 20% (2017-2020) |
| Uganda | 50% (2014-2022) |
| Zambia* | 50% (2014-2020) |

## 3. Discussion

Road safety in Africa is poor and is expected to worsen further. Besides lack of knowledge on road casualties in terms of their number as well as associated factors leading to road accidents, a serious deficiency of road safety data is also perceived. Even when data are available, they are not always comparable among countries due to different definitions of the variables, collection methodologies etc.

On that purpose, safety data should be enhanced through additional data and indicators, which may be available at the individual country level but are not currently published (e.g. exposure data, road safety performance indicators, road safety management, etc.). These, data should be further analysed to provide a factual appraisal of road safety levels in Africa, to reveal critical issues and to indicate priority areas with high potential for road safety improvements.

Reliable and accurate data are a fundamental prerequisite to understand the magnitude of road safety problems in Africa and convince stakeholders to take proper actions. Reliable and accurate data are also needed to identify problems, priority areas and mostly risk factors in order to formulate strategies, set targets and monitor performance.

The paper, based on existing data, either gathered by international databases or dedicated questionnaires distributed within the context of the SaferAfrica project, identified key risk factors on the following topics:

- Road user behaviour
- Infrastructure
- Vehicle
- Post-crash care
- Road Safety Management

As a general remark, due to data limitations, it was very difficult to draw robust conclusions about the extent of the risk associated to the identified factors in individual countries and in Africa as a whole.

As far as road user behaviour is concerned, the key risk factors assessed were speed, alcohol, helmet use, seatbelt use and child restraint use. Most available data on safety devices usage were on seatbelt and helmet wearing rates, which vary greatly among the countries. No related data for the use of child restraint systems were available. Data on the drivers exceeding the BAC limits while driving were not available, while data on the percentage of alcohol related road fatalities were available only for very few African countries. Except for child restraints systems, a large proportion of countries have established legislation concerning the aforementioned key risk factors. In general, enforcement is assessed as low in most African countries. Therefore, by improving both enforcement and legislation compliance, the impact of the examined risk factors will be reduced.

Although some research has been carried out on the field of infrastructure risk factors and road safety, the major issue identified is low data availability. This is observed mainly by the fact that a lot of technical reports propose guidelines on the basis of international studies without having evaluated the suggested risk factors and countermeasures before in an African context. Therefore, it is strongly suggested to move towards this direction, i.e. validating empirical findings with real African data. However, at present such an effort is increasingly taking place in academia, as some high-quality scientific papers have been identified.

The key risk factors from the vehicle assessment point of view revealed that the improvement of vehicles' fitness has an enormous potential to reduce the impact of vehicles in crashes. The utilized indicator (traffic fatalities per 1,000 vehicles) revealed that even the best performing country in Africa (Mauritius with 0.34 fatalities/1,000 vehicles) is by far below the relevant value of a European country (e.g. Switzerland with 0.05 fatalities/1,000 vehicles). Moreover, any initiative related to the enforcement of vehicle requirements, regardless of the stage in the life of the vehicle, should consider its impact in the transports economics to ensure its suitability.

Post-crash care activities should take place at local, national and regional levels. Within the legal constructs of national and local governments, countries are encouraged to implement activities that increase responsiveness to post-crash emergencies and improve the transport system ability to provide appropriate emergency response and longer-term rehabilitation for crash victims.

Road safety management consists in the mobilization of policies, organization and tools for making effective and efficient the measures taken to improve the health burden associated with road fatalities and injuries. At institutional level, road safety management rests upon a system associating functions, interventions and results. From the data gathered and the analysis that followed, it was shown that the African countries have good performance concerning the establishment and the strengthening of a lead agency and some management and evaluation tools exist already. However, some weaknesses were identified, such as partial or lacking dedicated funding for the implementation of road safety strategies and a poor system for data registration and monitoring road safety performance.

Through this process, critical road safety areas were defined and even highlighted per region in order to take into account geographic characteristics and potential road safety performance heterogeneities. This analysis aimed to allow the identification of priority areas for road safety action and intervention in each region, with emphasis being given on those with high road safety improvement potential. On that purpose for those risk factors that sufficient data were available, further analyses were performed for the African regions, as defined within the SaferAfrica project.

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