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GIS IN EPIDEMIOLOGY – **THE COVID-19 PANDEMIC**

LOCAN ANALYSIS, NOVEMBER 2021

Overview of COVID-19 in Kenya

CASE FATALITY RATE (CFR[1]) AND THE ATTACK RATE (AR[2]) OF COVID-19

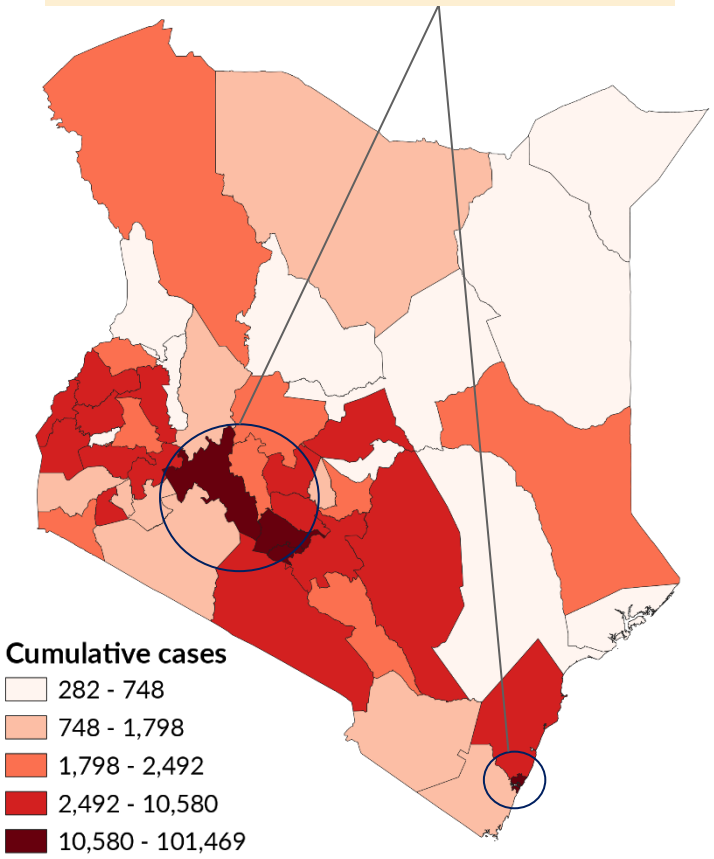
Notes: [1]The Case Fatality Rate measures the total number of deaths from COVID-19 as a proportion of the total number of confirmed cases.[2]Attack rate is defined as the proportion of the population who have tested positive for COVID-19 at a given time

Source: Ministry of Health

CUMULATIVE COVID-19 CASES

(as of Nov 01, 2021)

Nairobi, Kiambu, Nakuru and Mombasa counties lead in numbers with each recording over 10,000 confirmed cases.



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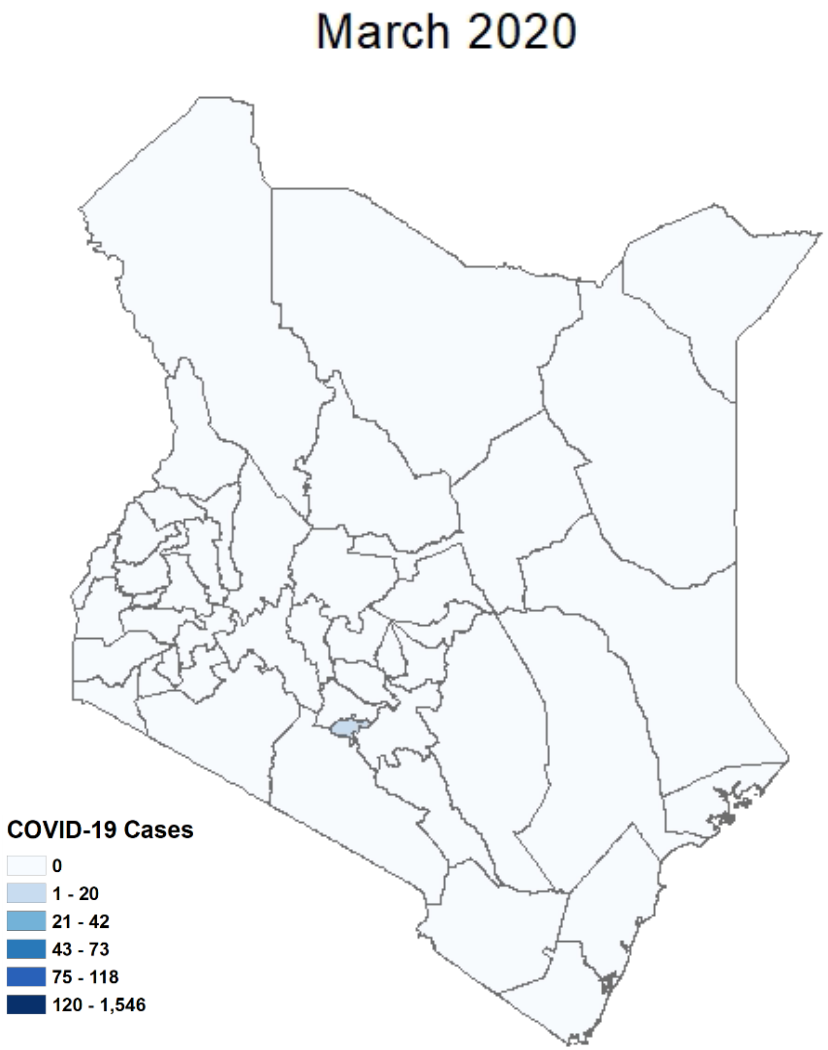
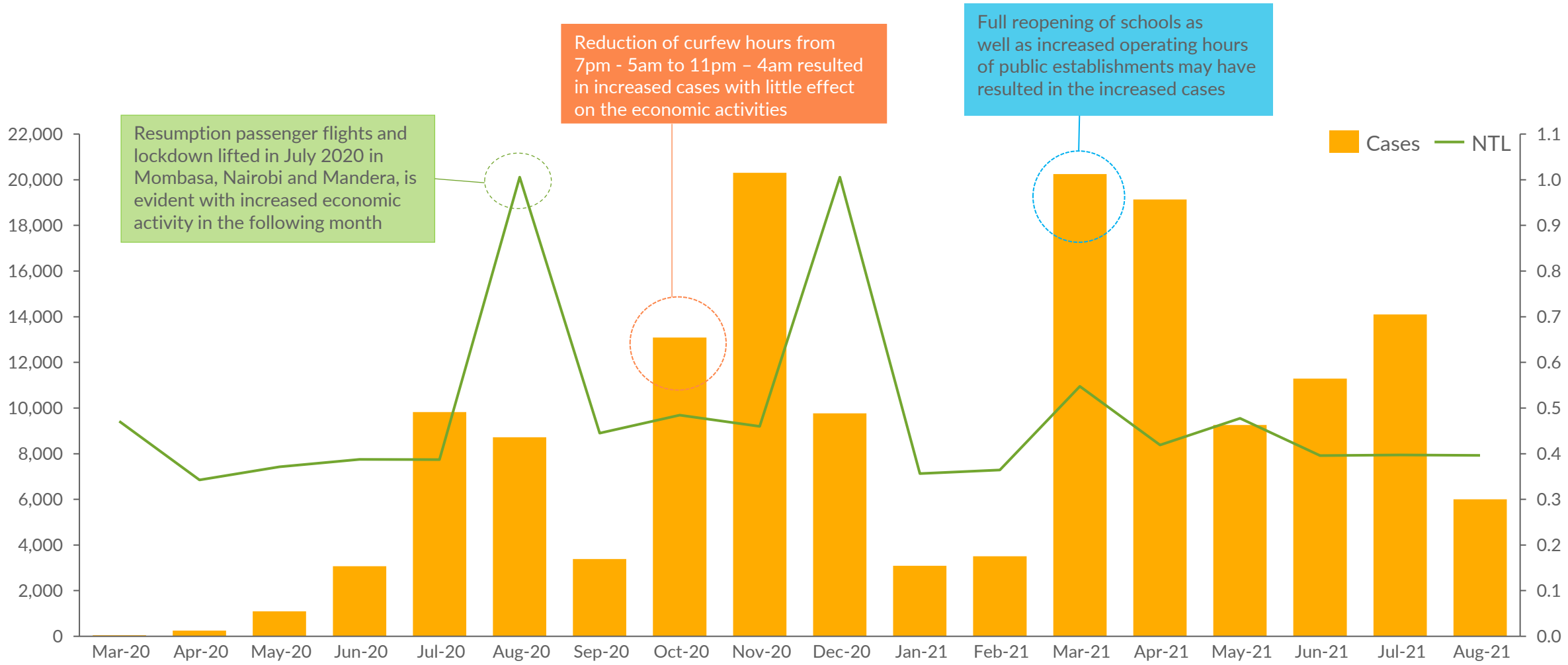
Effectiveness of the COVID-19 related policies in Kenya



1. 26th March 2020 — Curfew from 7pm to 5am cessation of movement introduced
2. 8th – 22nd April 2020 — Mandera, Mombasa, Kilifi and Kwale counties locked down
3. 6th May 2020 — Lockdown measures in Nairobi and Mombasa
4. 18th June 2020 — Busia, Vihiga, Kisii and 12 other counties declared hotspots
5. 15th July 2020 — Domestic flights restored and lockdown lifted
6. 5th October 2020 — Reopening of public universities in phases
7. 2nd March 2021 — 1.02 million doses of the Astra Zeneca Vaccine arrive
8. 23rd August 2021 — Over 800k doses of Moderna arrive in Kenya
9. 6th October 2021 — Over 250k of Johnson and Johnson vaccine arrive
10. 20th October 2021 — The nationwide curfew was lifted as infection rate ease

Source: Ministry of Health

Relationship between COVID-19 cases and economic activity (national)



Notes: Night-time Lights (NTL) is a proxy for the intensity of economic activity
Source: Ministry of Health, EARTHDATA

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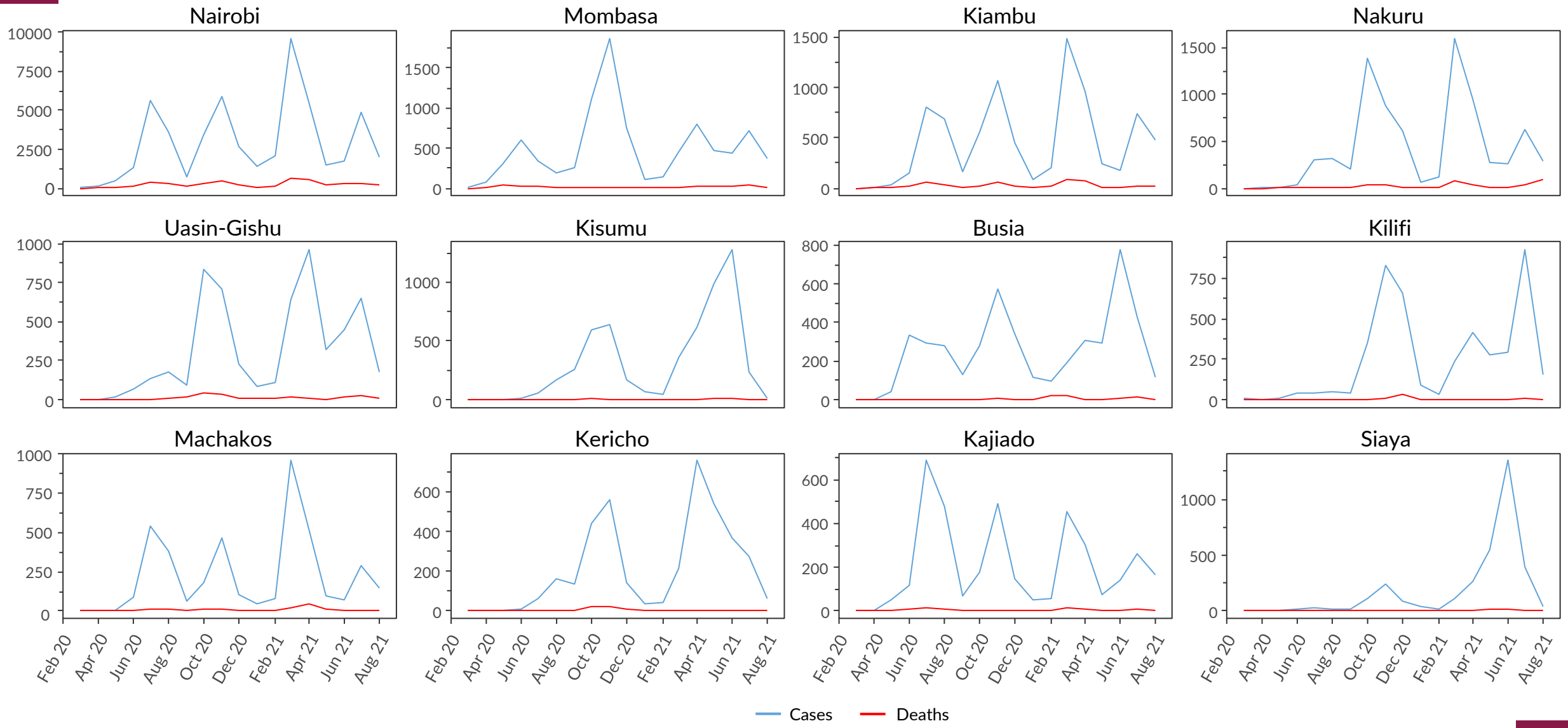
Counties with the highest observed COVID-19 cases



Source: Ministry of Health

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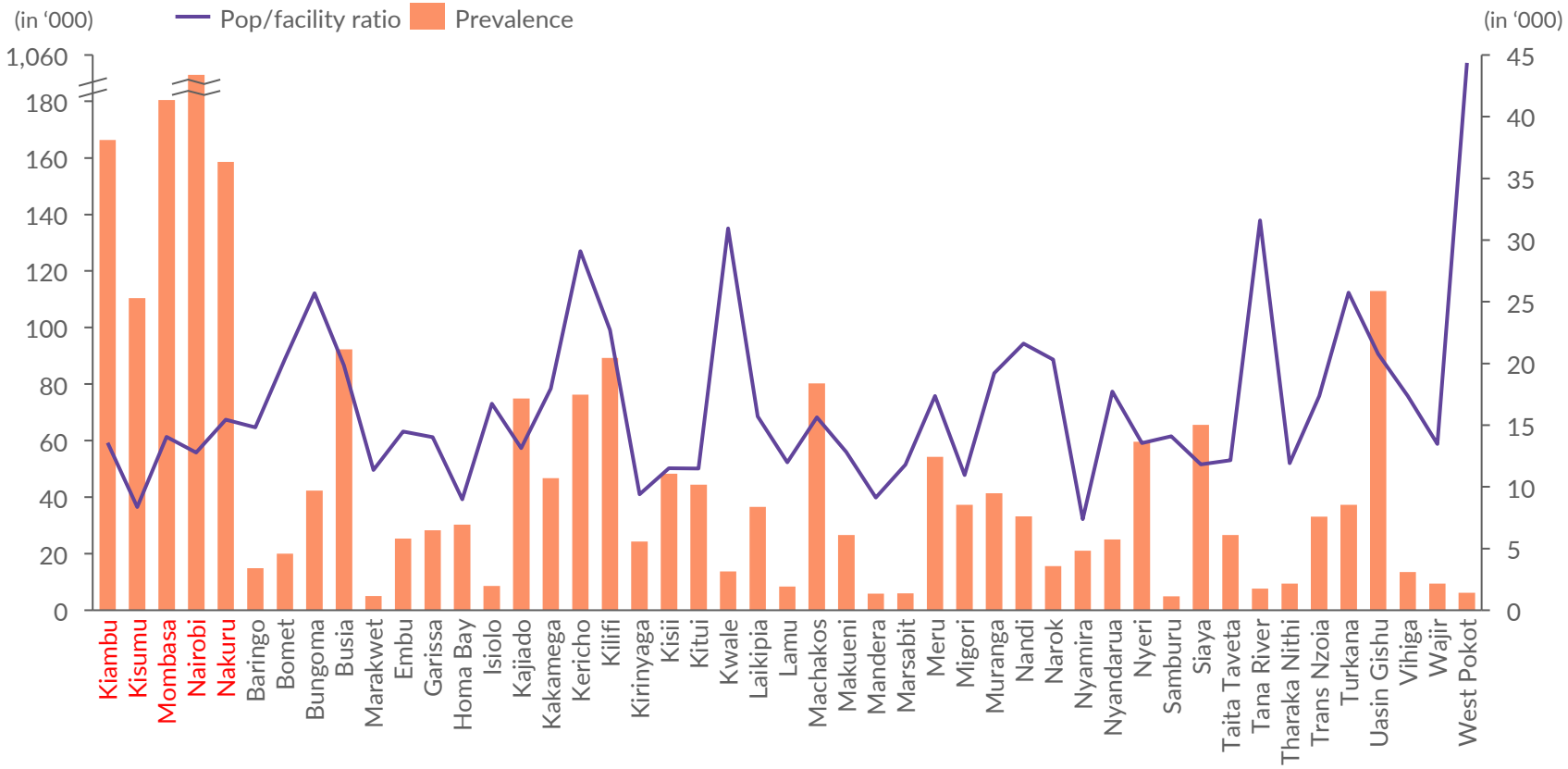
COVID-19 prevalence versus the health facilities

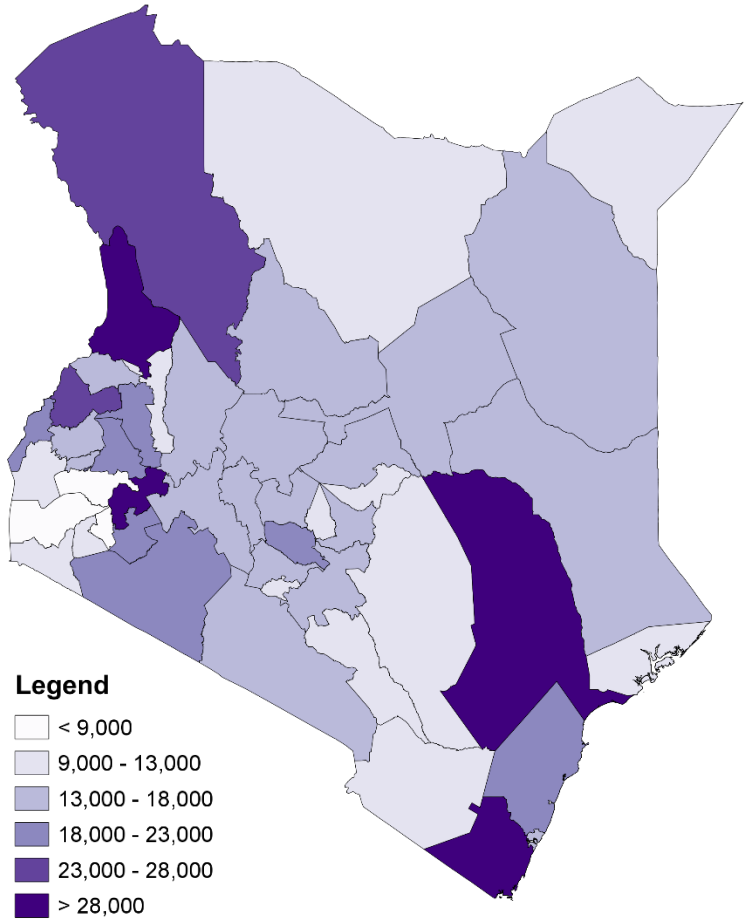
Most of the counties have a high population to health facility ratio as a result of limited hospital facilities especially in rural areas or a high population as seen in urban areas from the map.

The **disease burden** exceeded the available resources in 10 counties, most notably Kiambu, Kisumu, Mombasa, Nairobi and Nakuru.

COVID-19 PREVALENCE VERSUS POPULATION TO HEALTH FACILITY RATIO



RATIO OF POPULATION TO HEALTH FACILITY



Notes: The COVID-19 prevalence was a metric calculated using the recorded number of cases and the period of occurrence of the COVID-19 disease.
Source: Ministry of Health

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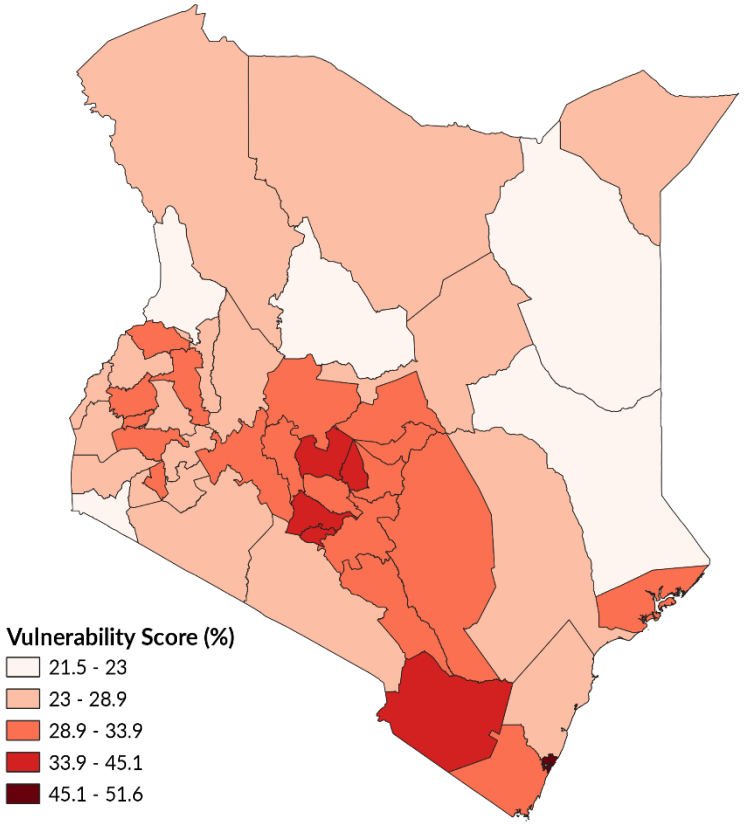
Validation of earlier predicted vulnerability map vs current case maps

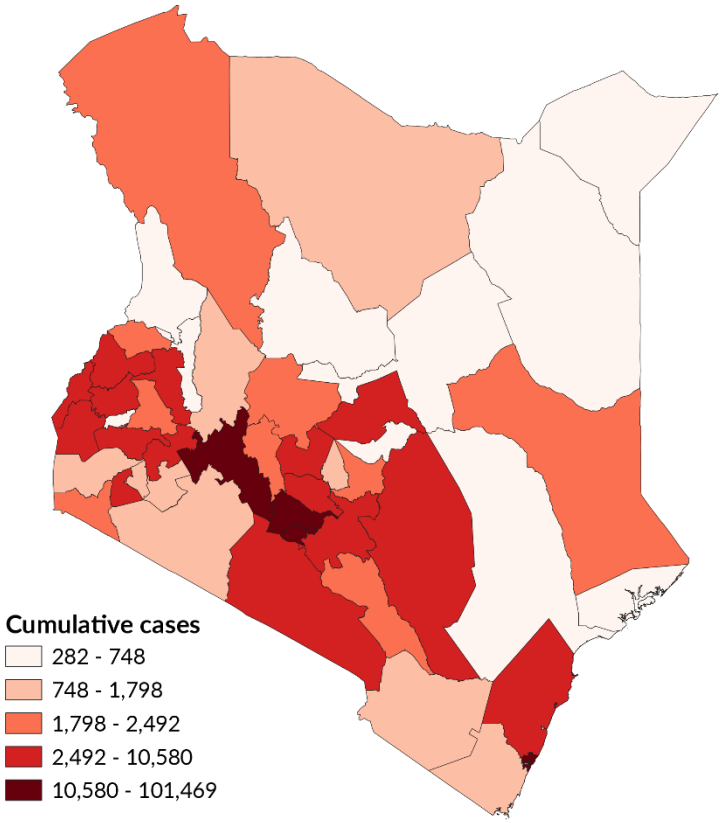
COVID-19 VULNERABILITY SCORE

(LOCAN^{SM} generated June 12, 2020)



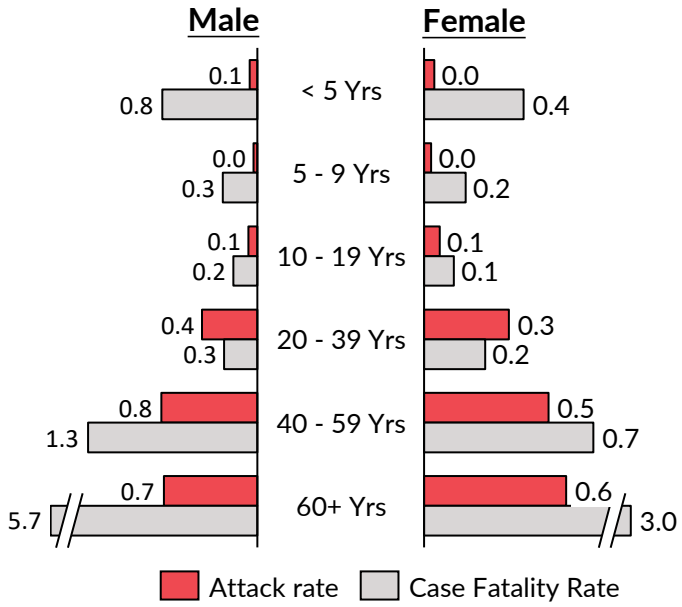
CUMULATIVE COVID-19 CASES

(as of Nov 01, 2021)



CASE DISTRIBUTION BY AGE AND GENDER

(as of Nov 01, 2021)



*An accuracy assessment of the vulnerability score (based on the actual cases) is **0.30**, which is within the acceptable range*

The vulnerability index was calculated at the county level using 2019 data on population density, economic strength index, informal employment, makeshift houses, latrine usage and households without piped water

Source: Ministry of Health & LOCAN Analysis

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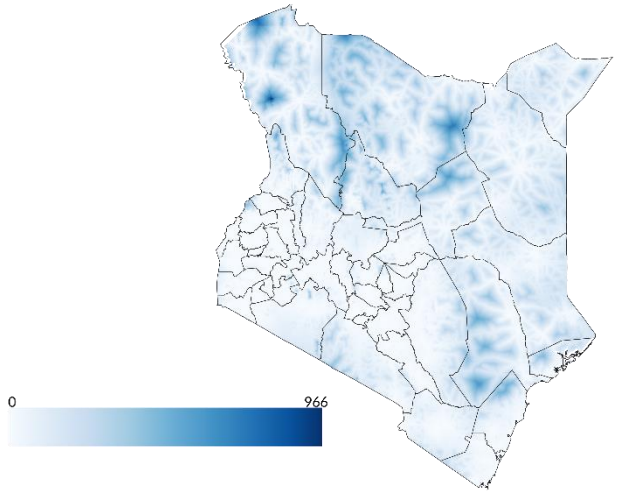
Vaccine uptake[1] versus average travel time to vaccination sites

One of the causes of vaccine hesitancy could be the **high travel time to the designated vaccination sites** as seen in the graph below. Leading counties with a high proportion of the number of fully vaccinated also have low travel time to vaccination sites. Mandera and Marsabit counties with **very low vaccine uptake** also registered longer travel time to approved vaccination sites.

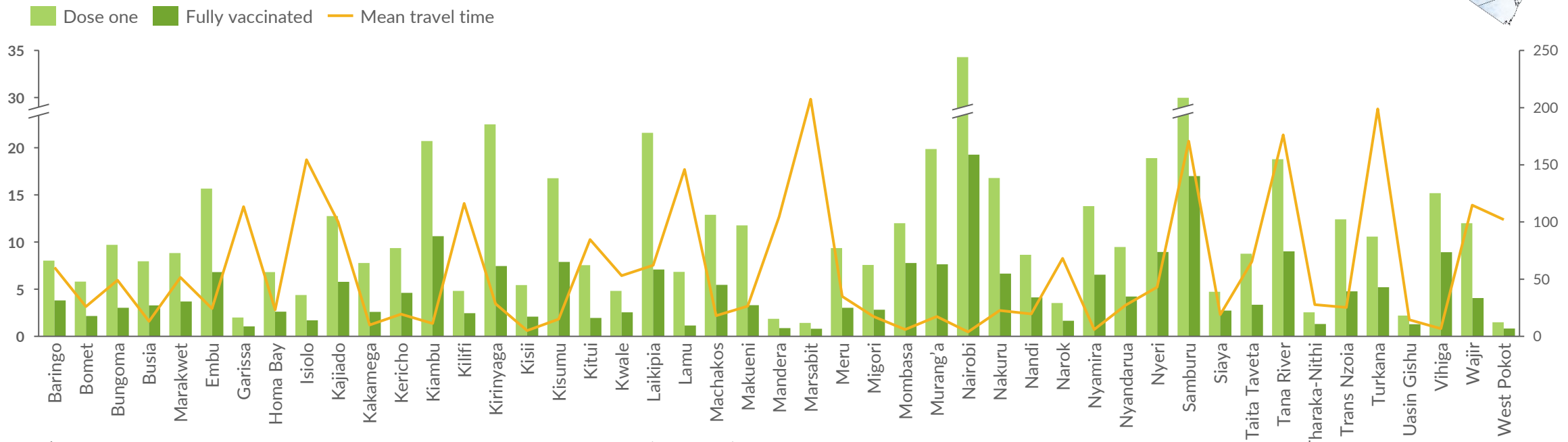
Vaccine inclusive plans could include the introduction of campaigns aimed at mitigating resistance to vaccines as well as **increasing the vaccination sites**

TRAVEL TIME TO VACCINATION SITES



VACCINE UPTAKE VERSUS THE AVERAGE TRAVEL TIME TO APPROVED VACCINATION SITES

(as of Nov 01, 2021)



Notes: [1]The vaccine uptake was calculated as a proportion of the target population (18+ years)
Source: Ministry of Health, Malaria Atlas Project (MAP), 2019 and LOCAN Analysis

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Similar COVID work quals

COVID 19 INTERVENTION, A MISSION-DRIVEN ALLIANCE* -2020

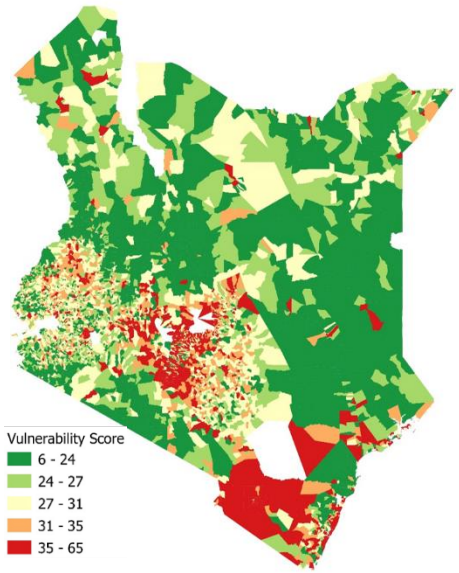
When COVID 19 hit Africa, it was unclear whether the public health systems would be overwhelmed with the rapidly rising COVID-19 cases especially in densely populated areas with **poor access to water and sanitation**

The project's mission was to deploy free soaps, handwashing stations and masks to the most vulnerable Kenyans and disinfect public spaces of low-income communities. Dalberg Research participated in **creating a solution**

Using census data, Dalberg Research calculated the vulnerability index of each sublocation and identified areas that needed to be targeted for this intervention

This intervention reached **2 million of the most vulnerable Kenyans** with products and services for rapid mass sanitation.

Kenya Vulnerability Score



CALCULATION OF VULNERABILITY:
The vulnerability index was calculated at the sublocation level using 2009 census data. Variables used: population density, economic status, informal employment, makeshift houses, latrine usage and households without piped water
Weighting was applied to each variable based on the degree of influence to risk assessment of COVID-19 and sanitation practices.

Vulnerable areas are concentrated in the central and southern parts of Kenya, with isolated areas in the north to eastern parts that could be protected through current travel restrictions

ECOWAS VULNERABILITY MAPPING-2020

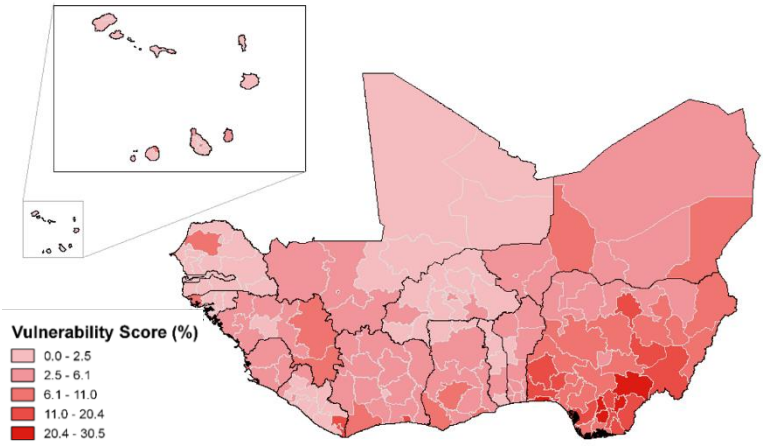
Dalberg Research assessed the landscape and needs regarding COVID 19 in Economic Community of West African States (ECOWAS)

Environmental datasets were mapped to show rainfall distribution, flood risk and drought areas in these countries. These maps provided an understanding of locations that would require additional efforts needed to manage and control the spread of COVID 19

Socio-economic variables were also mapped to identify areas at risk of COVID 19 infections and related impacts.

A vulnerability index was generated to accurately identify the most vulnerable areas which were characterised by **dense population**, **high areas of economic interaction** with **few health care facilities**

ECOWAS Vulnerability Score



The adjacent map shows the vulnerability level of regions in ECOWAS. Dark red regions had high vulnerability

The vulnerability score was generated using these weighted variables:
- Population density (30%)
- Population aged 50+ (15%)
- Health facilities (15%)
- Markets (20%)
- Agricultural productivity (5%)
- Travel time to hospital (10%)

Notes: ECOWAS countries include Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.
Sources: KNBS 2009; WorldPop 2020; Open Street Map 2020; WHO 2019; Global Health Mapping Project 2019; The Malaria Atlas Project 2015; LOCAN Analysis

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