

# COVID-19

## MagicBox report

*10 October 2020*

**Understanding the effects of physical distancing measures on human behavior using near-real-time mobility data**

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More info at: <https://www.unicef.org/innovation/magicbox/covid>

# Why this report?

**UNICEF** has focused, since the beginning of the pandemic, on understanding the **socioeconomic impacts** of **COVID** and how it **affect** the **most vulnerable children**. Special attention has been put on **mitigating** the **effects** of **non-pharmaceutical interventions** on areas such as: education, non-COVID vaccination campaigns, access to healthcare, mental health, nutrition, and poverty.

These efforts require **fine-grained** and **up-to-date data** on important **indicators** alongside better **tools** to **untangle** their complex **interrelationships** to **COVID-19** (see [Tracking the situation of children during COVID-19](#)).

**Human mobility data** from [MagicBox](#) allows us to study the direct **impacts** of **physical distancing policies**. We do this across multiple dimensions, from how socio-economic inequalities result in unequal changes in daily travel patterns, to the effectiveness of policies, and their sustainability over time.

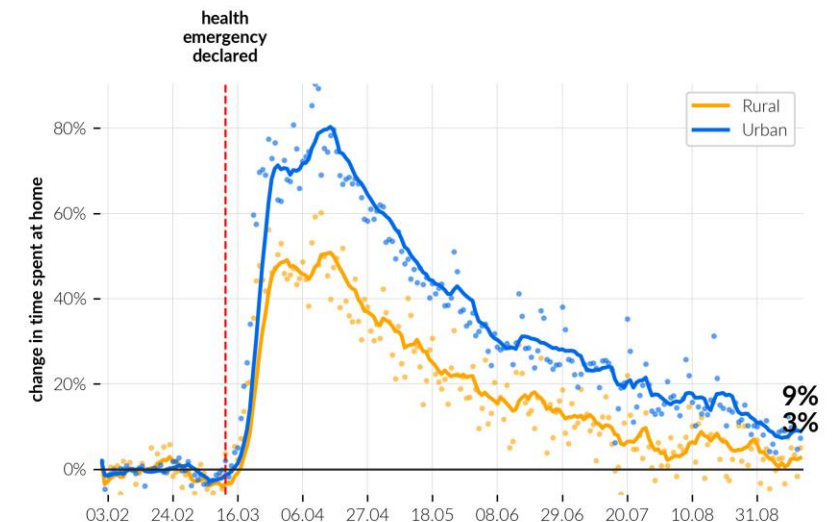
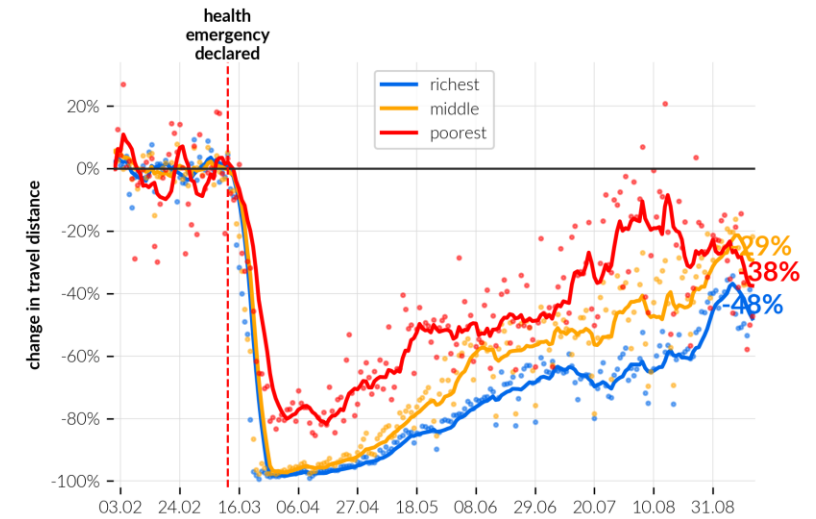
Mobility data is also used as a key layer to better understand the special needs that communities may have in access to services or support, and in order to ultimately develop more targeted, efficient and context-aware control measures for COVID-19.

# Recap – Socioeconomic differences

In [previous reports](#), we **analyzed mobility data** to quantify the relationship between peoples living conditions and their **reduction** in travel. We focused on two dimensions: **socio-economic status** and **rural/urban context**.

Our findings highlight that the **poorest** have a lower capacity to **change** their **behavior** (e.g. by travelling less and staying more at home). Similarly, people living in **rural** areas have a lower capacity to change their behavior. As an example, figures show the change in travel distance (top) and time spent at home (bottom) for Colombia.

These differences offer **empirical quantification** on how **vulnerable communities** are **less able** to **change** their **behavior** in response to government policies on physical distancing.



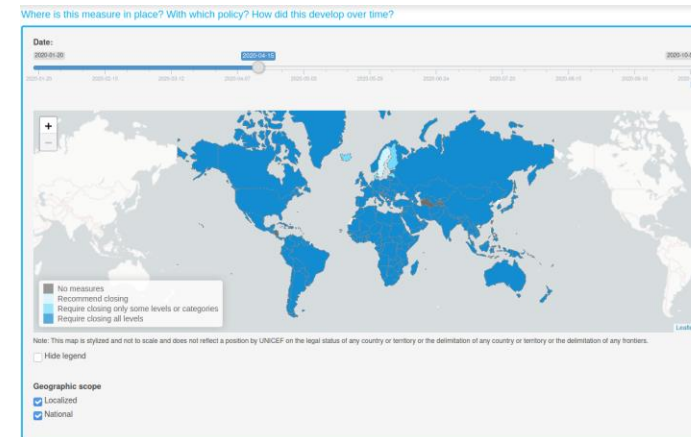
# Recap – Effects on children

Many **governments** have introduced **physical distancing measures** to fight the transmission of COVID-19, including **schools closures** (see top figures from UNICEF's Data & Analytics Platform [1]). For many **children**, especially in low- and middle-income contexts, these **restrictions** affect not only their **education** but their access to **health** services and **nutrition**. Closing school has a plethora of **other side effects** as well, e.g. an higher drop-off rate and the increase of early pregnancy and child labour [1, 2, 3].

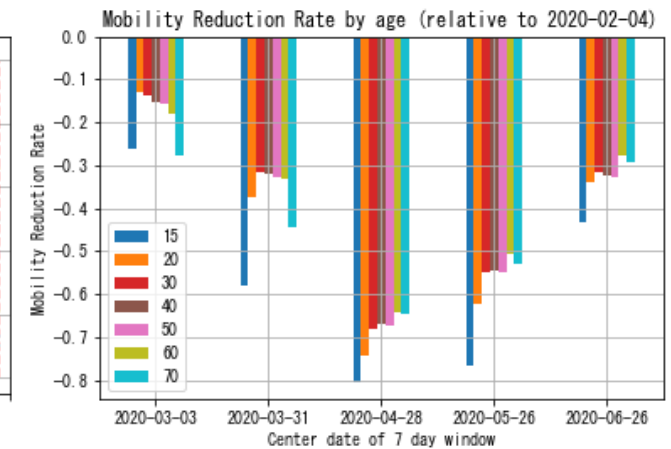
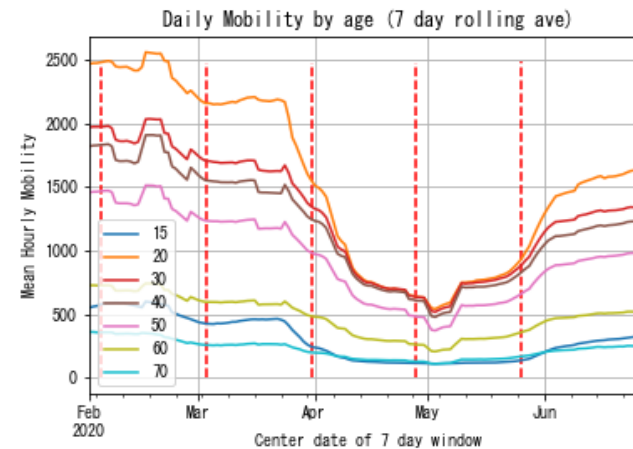
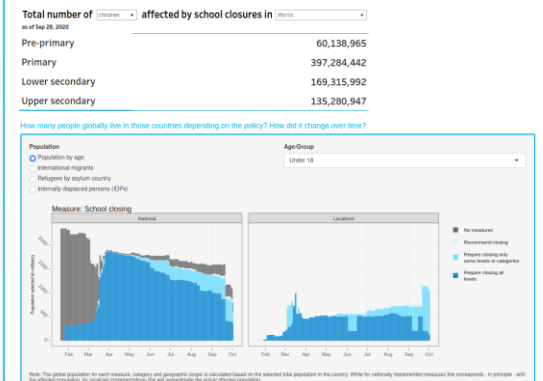
A study from Tokyo [4] (see bottom figures) shows that **mobility restrictions** have the **highest impact** on **children under 15**.

**Near-real-time mobility** is therefore a **valuable indicator** to assess the **impacts** of **government policies** on different **societal groups**.

School closures by country on 15 April 2020.



Number of children affected by school closures worldwide per educational stage as of 28 Sept. 2020 (top) and its variation over time (bottom)



[1] UNICEF, [Government responses to COVID-19 and affected populations](#).

[2] UNICEF, [Tracking the situation of children during COVID-19](#).

[3] UNICEF, [COVID-19 and children](#).

[4] [C-19 Global Data Science Project](#). Research paper: <https://arxiv.org/pdf/2006.05573.pdf>.

# Introduction

Assessing the impact of governmental physical distancing policies on people's mobility at the scale of a whole country is challenging since traditional methods like surveys may not provide timely and accurate information. For this purpose, the use of big data from connected devices may offer an alternative source to monitor near-real-time changes in mobility, possible in part thanks to globally available datasets like those released by [Google](#) or [Apple](#). Many governments have embraced this opportunity as a key tool for COVID-19 response [1].

Empirical insights on how human mobility patterns change due to COVID-19 and associated response efforts is critical to better understand risk, improve forecasting models, assess possible socioeconomic impacts and to identify potential vulnerabilities. Two essential ingredients to accomplish this is the availability of high-resolution data, and the technical capacity to analyze it.

UNICEF Country Offices are already using mobility data to help governments with COVID-19 response, examples include:

- **Indonesia**: Using insights from mobility data at the level of single towns/villages to help inform decisions on when to ease or tighten restrictions and to balance the social, economic and educational realities with public health risks [2].
- **Colombia**: Supporting the Ministry of Health and the Ministry of Education with insights to mitigate the impacts of physical distancing measures, assess the risk at school level after reopening, and feed epidemiological models to inform preventive actions.
- **Sierra Leone**: Supporting the development of a tool to estimate movements between locations to assist with predicting disease spread, inform decisions on lockdown characteristic, and assess the success of lockdown measures.

[1]: [Spain](#), [Italy](#), [Germany](#).

[2]: [Indonesia](#).

# Report overview

This report examines the effects that **governmental policies** on physical distancing have on **human mobility** through the reduction of people's daily travel distances, and their influence on **COVID-19 cases**. It analyzes data from **10 programme countries** and **2 high-income countries**, aiming to understand the impact of timing on policy implementation on COVID-19 cases.

This deck shows insights for 10 programme countries (listed alphabetically):

**Colombia, Cote d'Ivoire, India, Indonesia, Malaysia, Mexico, Mozambique, Myanmar, Nigeria and Ukraine.**

Moreover, this deck includes a comparison of mobility indicators from two data sources for 2 non-programme countries in Annex II:

**Germany and United Kingdom.**

# Some highlights

**Most countries introduced physical distancing measures at the same time** (mid-March) despite very different epidemic contexts.

*More research is needed to understand influence effects in adopting preventive policies versus reactive ones.*

**Physical distancing policies remain high in most countries.**

1. **Policies resulted in an actual reduction of people's movement**, but:

- Countries with the most stringent policies do not necessarily show the biggest reduction in human mobility.
- **Mobility drop is maximal within a week after policies implementation but decays over time to slowly return to normal.**

*More research is needed to understand applicability and sustainability of control measures, especially in the most vulnerable contexts.*

2. **Policies effect on the epidemic seems unequal.** The **timing in their application (reactive vs preventive)** can be one key factor:

- Policies were able to "**bend the curve**" of the epidemic in countries that had a **peak in mid-March**.
- **Unclear/dubious effect** on the **epidemic evolution** for countries that **applied** them in **mid-March** while they still **not** had a clear **ongoing wave**.

*Further research is needed to assess the causal relationship between timing of measures and future development of cases. Other factors that could explain it include people relaxing their behavior in respecting protection measures (interpersonal distance, wearing masks, hand hygiene) as well as their perception of social relationships and trust in others and institutions.*

# What data are we using

## **Mobility**

We use aggregated mobility data provided by [Cuebiq](#), which collects first-party data from anonymized users who have opted-in to provide access to their location data through a GDPR-compliant framework. Additionally, anonymized and aggregated mobility data from [Vodafone](#) is used for comparison purposes.

## **COVID-19**

New confirmed cases and deaths worldwide are provided by the European Centre for Disease Prevention and Control (ECDC) and are publicly available at <https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide>.

## **Government policies**

Public health, socio-economic and physical distancing policies are collected by implementation date and updated weekly by ACAPS at <https://www.acaps.org/covid19-government-measures-dataset>. The Blavatnik School of Government, Oxford University provides several indicators including a stringency index that quantifies the strictness of physical distancing and mobility restriction policies implemented by governments. See more at <https://www.bsg.ox.ac.uk/research/research-projects/oxford-covid-19-government-response-tracker>.

# Limitations of current approach

## Mobility

The data presented here is collected through smartphones, **but not everybody has a smartphone**. Especially the **most vulnerable are not represented** in phone and smartphone datasets. Through a data partnership with Vodafone, we can compare data from different technologies, allowing us to shed some initial light on potential representativeness and bias.

*To make mobility analysis more representative we need:*

- *Additional data partnerships with local mobile network operators.*
- *More research and collaborations with local academics and data science groups to adapt the analysis to the local context: e.g. large cities, socioeconomic impacts and causalities, epidemic risk.*

## COVID-19

The case numbers we use are officially reported numbers, however, these are lower than the actual numbers of infected, especially in the first phase of the epidemic and for countries with limited testing capacity.

# Government policies indicator

In the following slides, we present a side-by-side comparison of 3 indicators for different countries, as described below.

- **Stringency Index** (top graph in **black**):

It quantifies the stringency of governmental physical distancing policies. Data includes: the limitation of public gatherings, travel bans, movement restrictions, closure of public services and non-essential businesses, shelter-in-place measures and lockdowns. Each of these is weighted with a given score.

The index goes from 0 (low strictness) to 100 (max stringency), which is attained only by 15 countries.

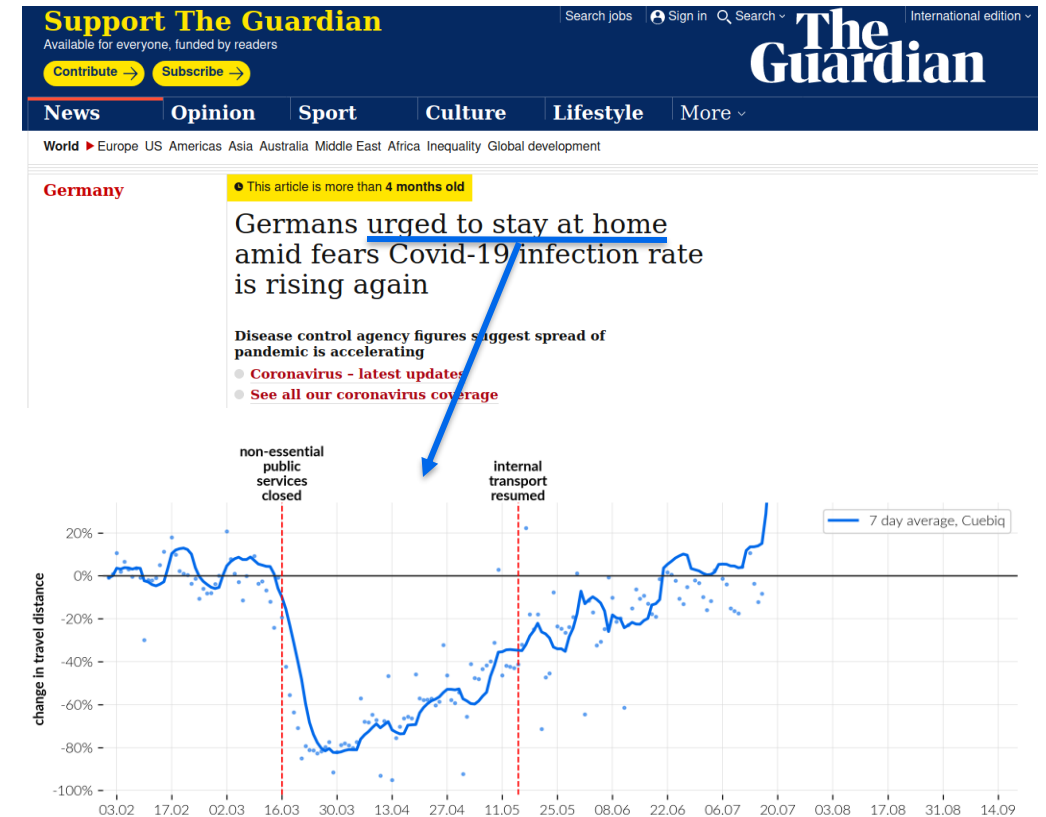


# Mobility indicator

## ○ Changes in travel distance (middle graph in blue):

Changes are calculated for each day with respect to a baseline from February 2020 considered as the 'normal'. Dots represent daily values while the line is the average over the past 7 days.

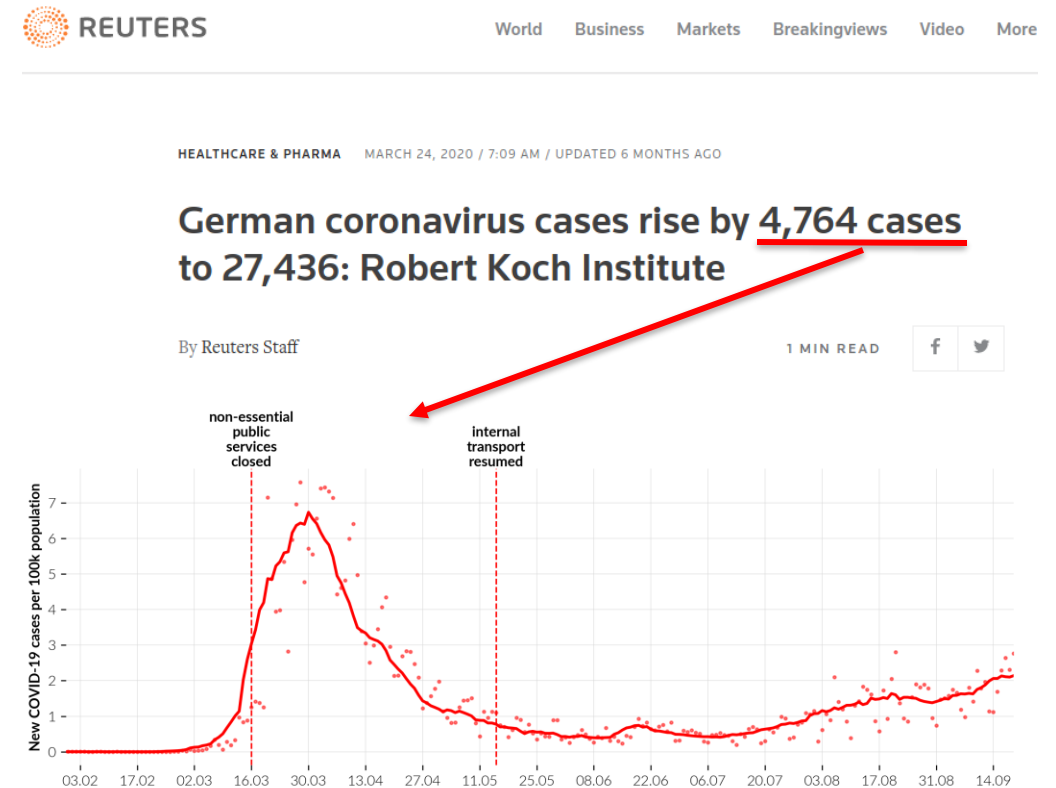
When the actual travel distance is zero, the indicator equals -100%.



# COVID-19 cases indicator

- **New COVID-19 cases per 100k population** (bottom graph in red):

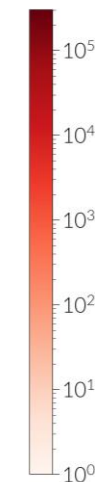
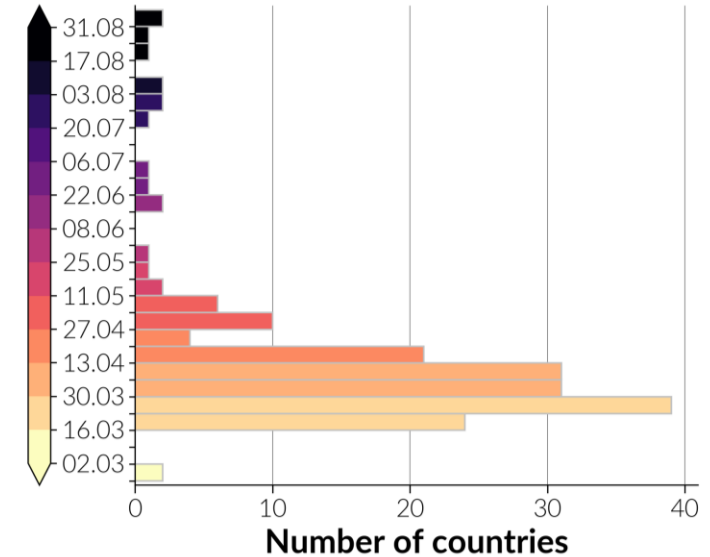
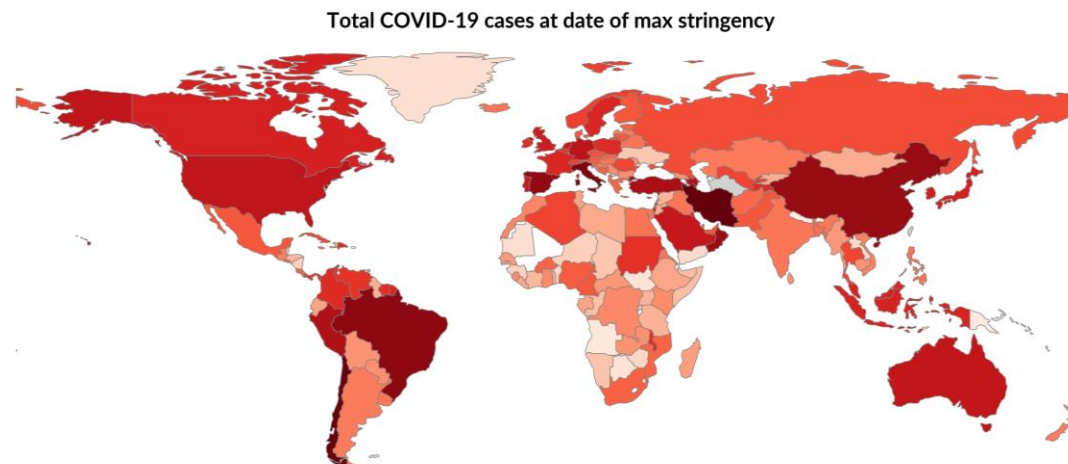
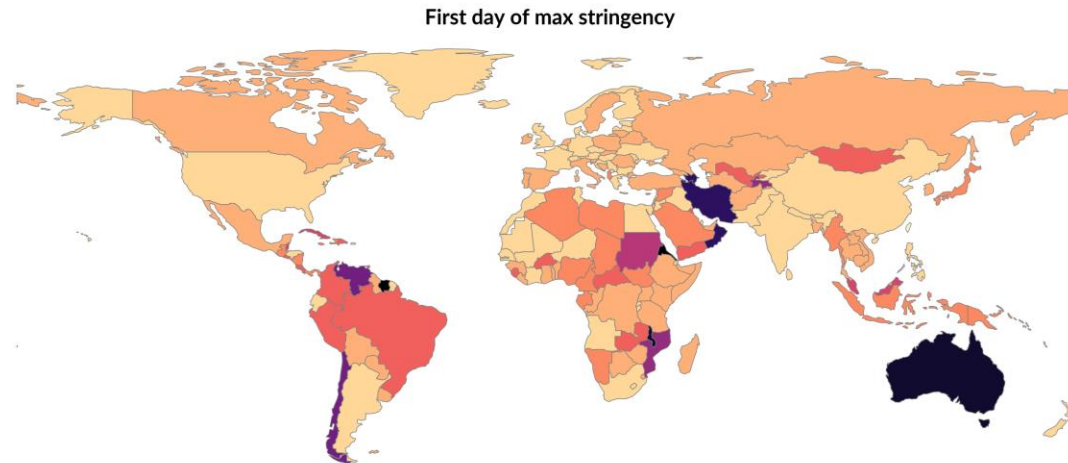
Number of reported cases from official sources per 100k inhabitants in the country. Dots represent the daily value while the line is the average over the past 7 days.



# When were the strictest policies implemented?

In the map, countries are colored according to when they reached their period of **maximum stringency**, grouped in periods of two weeks.

Most **governments** implemented their **strictest measures** on physical distancing between **16 of March** and **20 of April**, despite the **number of cases** reported on that date **varies across countries**, as shown in the bottom map.



# Timings and effects - Countries comparison

Note: **case** graphs have **different scales**. See the Annex I for a detailed country-level analysis.

10 Oct 2020

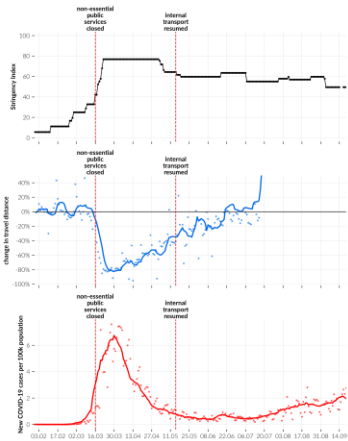
Data from: **Blavatnik School of Government, Cuebig, ECDC.**

Analysis from: **UNICEF MagicBox**

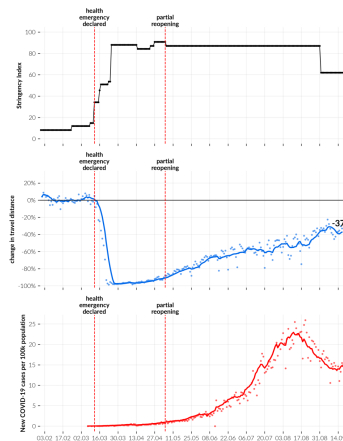
## Non-programme

## Programme

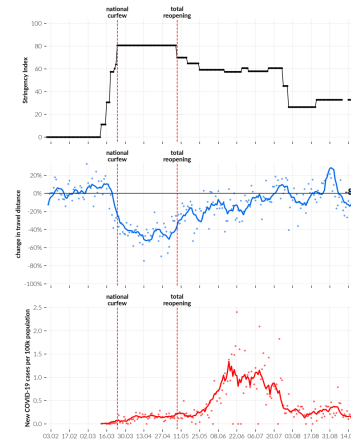
### Germany



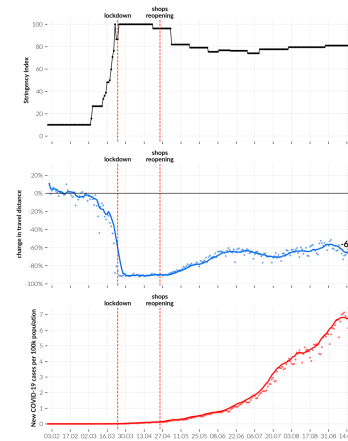
### Colombia



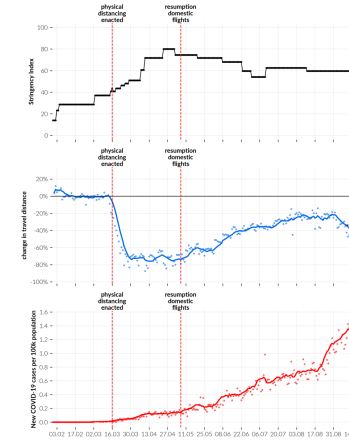
### Cote d'Ivoire



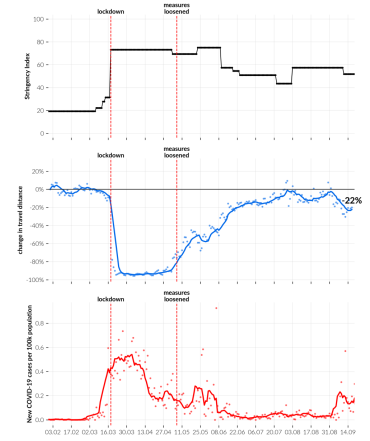
### India



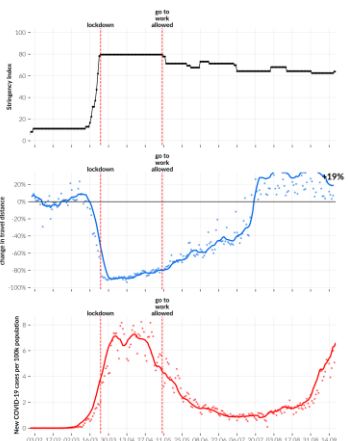
### Indonesia



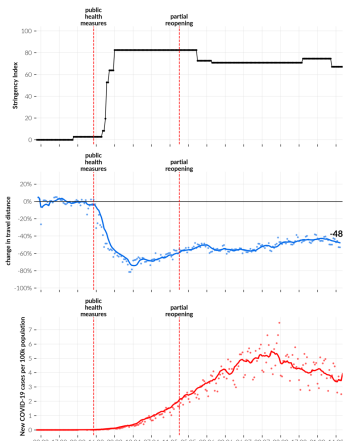
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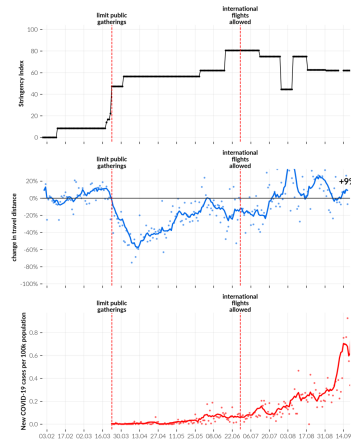
### UK



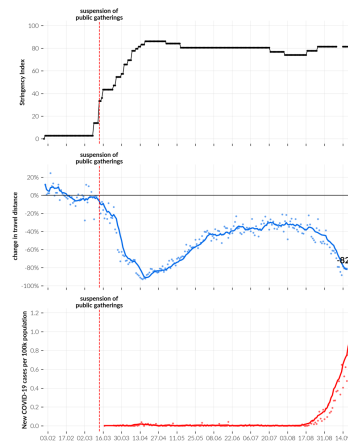
### Mexico



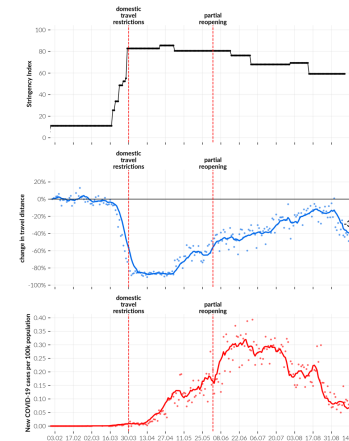
### Mozambique



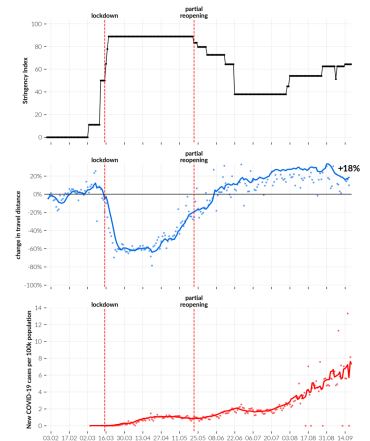
### Myanmar



### Nigeria



### Ukraine



# Timings and effects - Countries comparison

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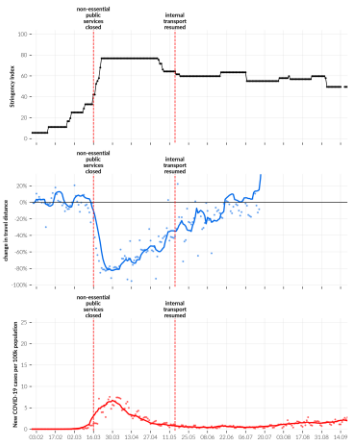
Data from: **Blavatnik School of Government, Cuebig, ECDC.**

Analysis from: **UNICEF MagicBox**

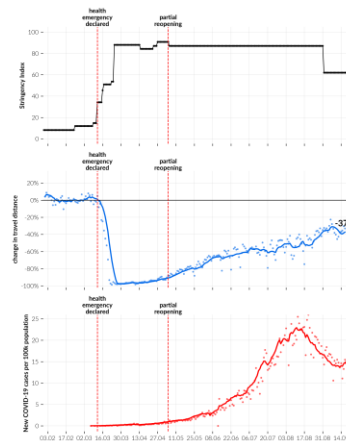
## Non-programme

## Programme

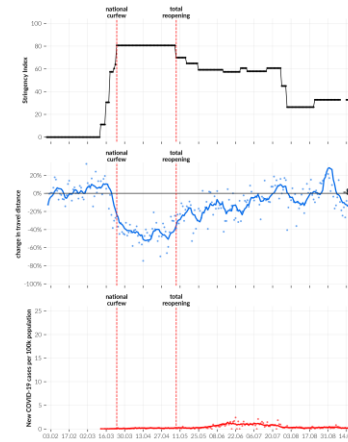
### Germany



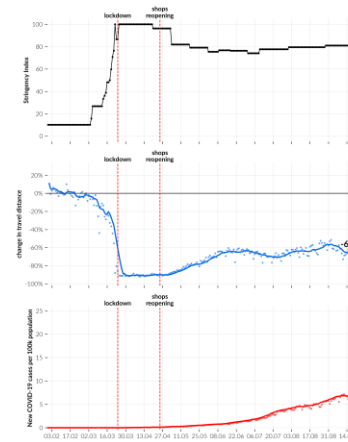
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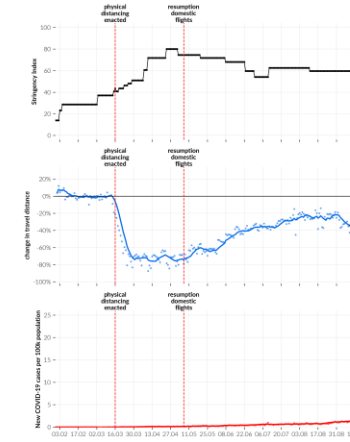
### Cote d'Ivoire



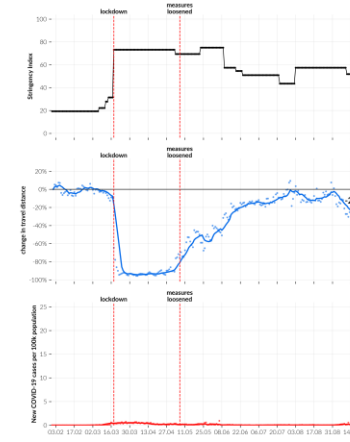
### India



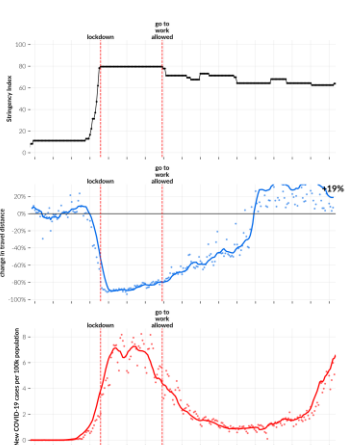
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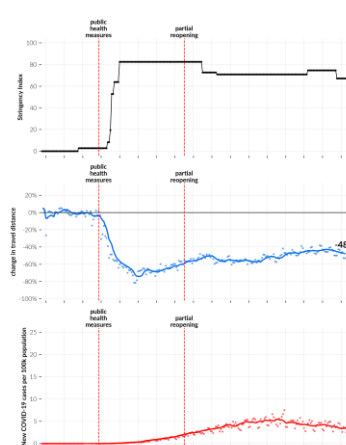
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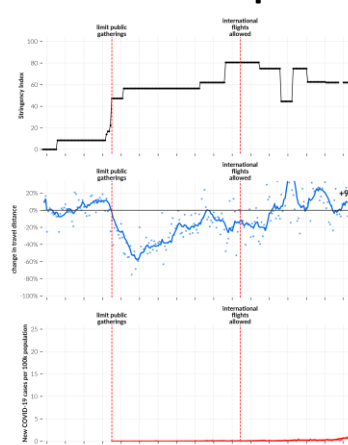
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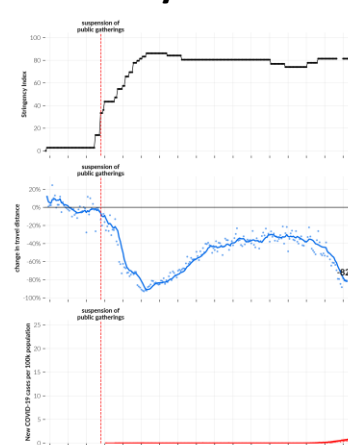
### Mexico



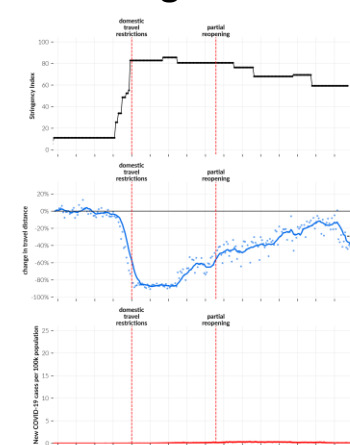
### Mozambique



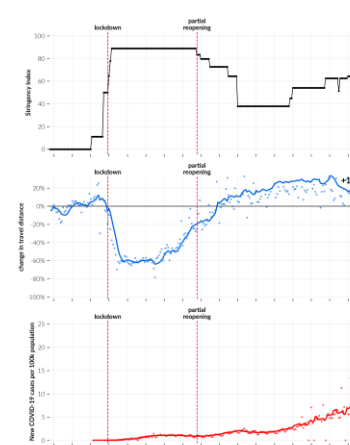
### Myanmar



### Nigeria



### Ukraine



# Policy stringency across countries

10 Oct 2020

Data from: *Blavatnik School of Government.*

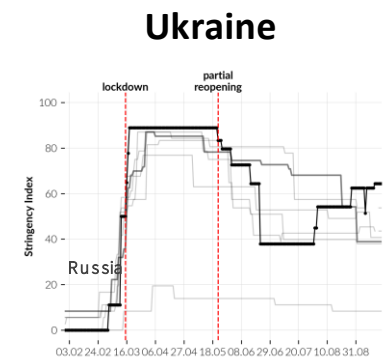
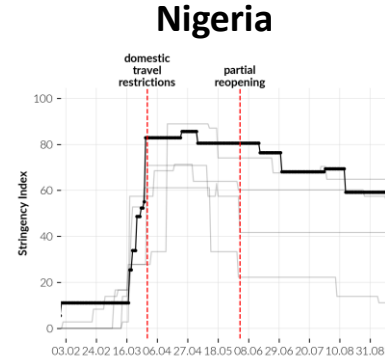
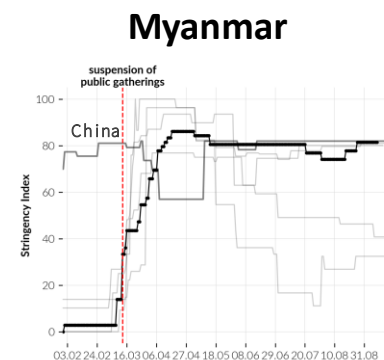
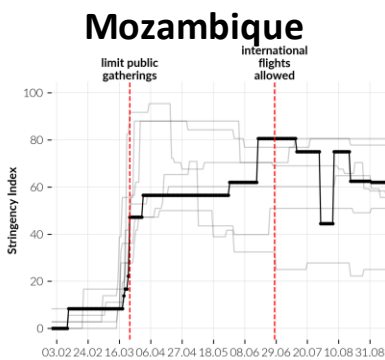
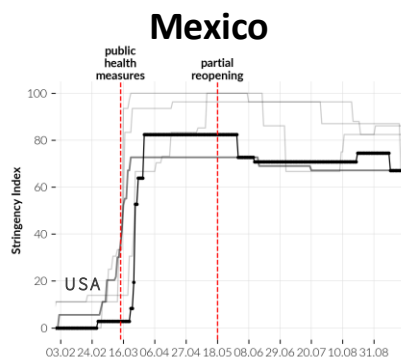
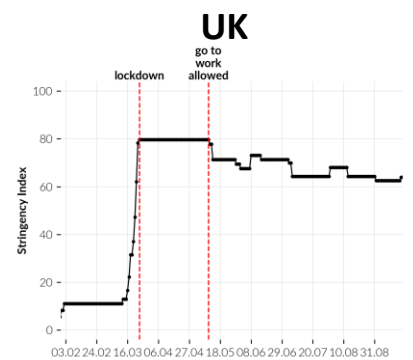
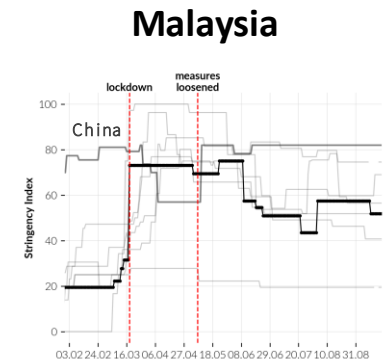
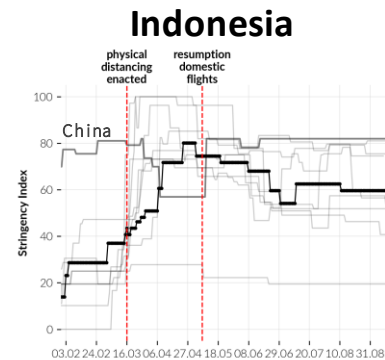
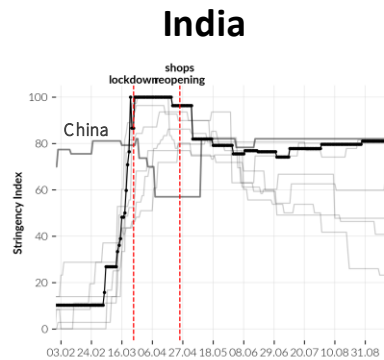
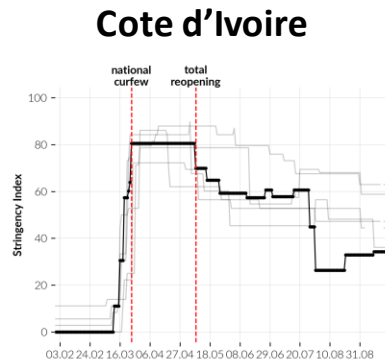
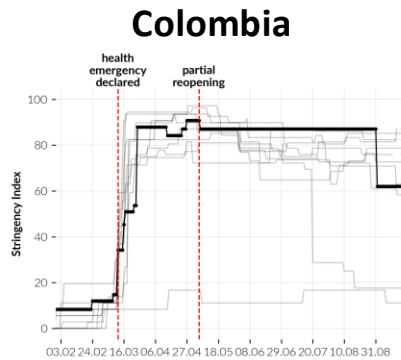
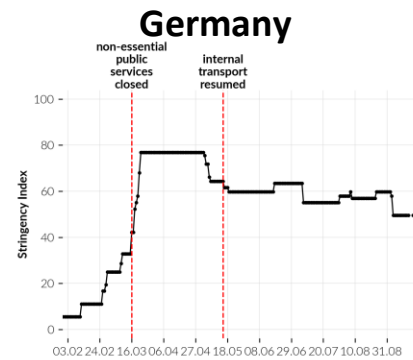
Analysis from: *UNICEF MagicBox*

For each country, the **stringency index** is the black line, while the grey lines represent neighboring countries.

All countries analyzed except Indonesia, Myanmar and Mozambique introduced the highest policy restrictions around mid-March, independent on the number of reported cases (high or low). This suggests that actions in non-programme countries influenced policy implementations in countries with few cases. In some countries (**Colombia, India, Mexico, and Myanmar**) **policies stringency** remains **high**, while in others (**Cote d'Ivoire, Indonesia, Mozambique, Malaysia, Nigeria, and Ukraine**) has been **relaxed**.

## Non-programme

## Programme



# Summary

- In the absence of a vaccine, reducing the virus transmission rate is a challenging and critical component of COVID response. Information campaigns on safe practices like hand washing or proper mask wearing etiquette have been coupled with policies aimed at reducing human contacts, from closing schools to lockdown policies.
- Our analysis shows that governmental policies related to mobility restrictions and physical distancing has dramatically reduced people's movements but their impact on COVID transmission vary across countries. Although some countries still have highly stringent measures, they seems to not have served the purpose as the number of cases are still increasing.
- Timing of interventions is vital in order to control the evolution of the epidemic. However, it is unclear what impact testing strategies have on the reported number of cases and how this relates to the implementation of policy measures. In particular, countries with low testing capacity may dramatically underestimate the number of actual cases.

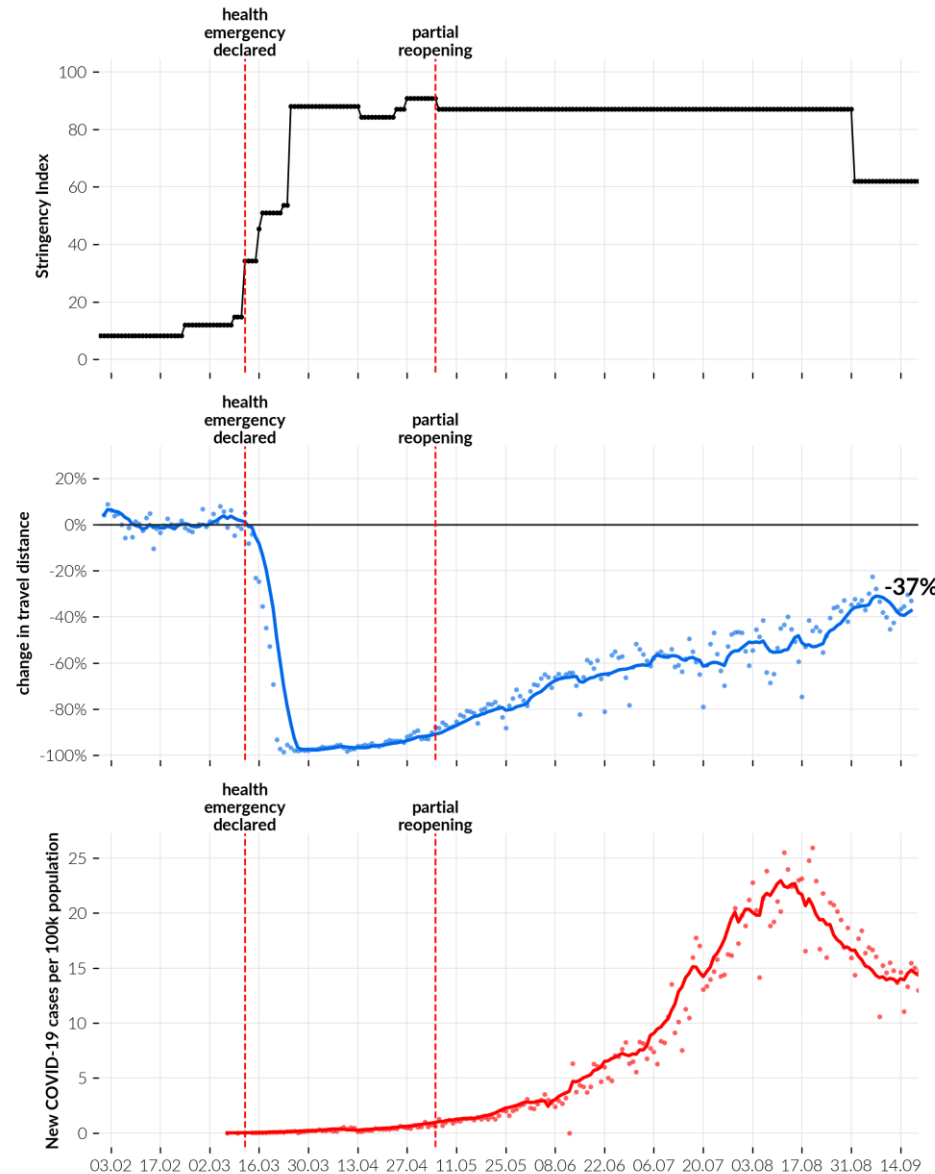
# Annex I

*Country level analysis*

# Comparison between stringency, mobility and cases

## Colombia

- Increasingly **strict measures** have been introduced since **mid of March** to reduce COVID-19 transmission.
- The measures drastically **reduced mobility** by up to **95%**. After re-opening mobility is slowly returning to normal, and at the end of August was 37% below normal.
- New **COVID-19 cases** show a **delayed peak** at the **beginning of August**, four and a half months after the health emergency was declared. At present, policy stringency remains high, but mobility is returning to normal.



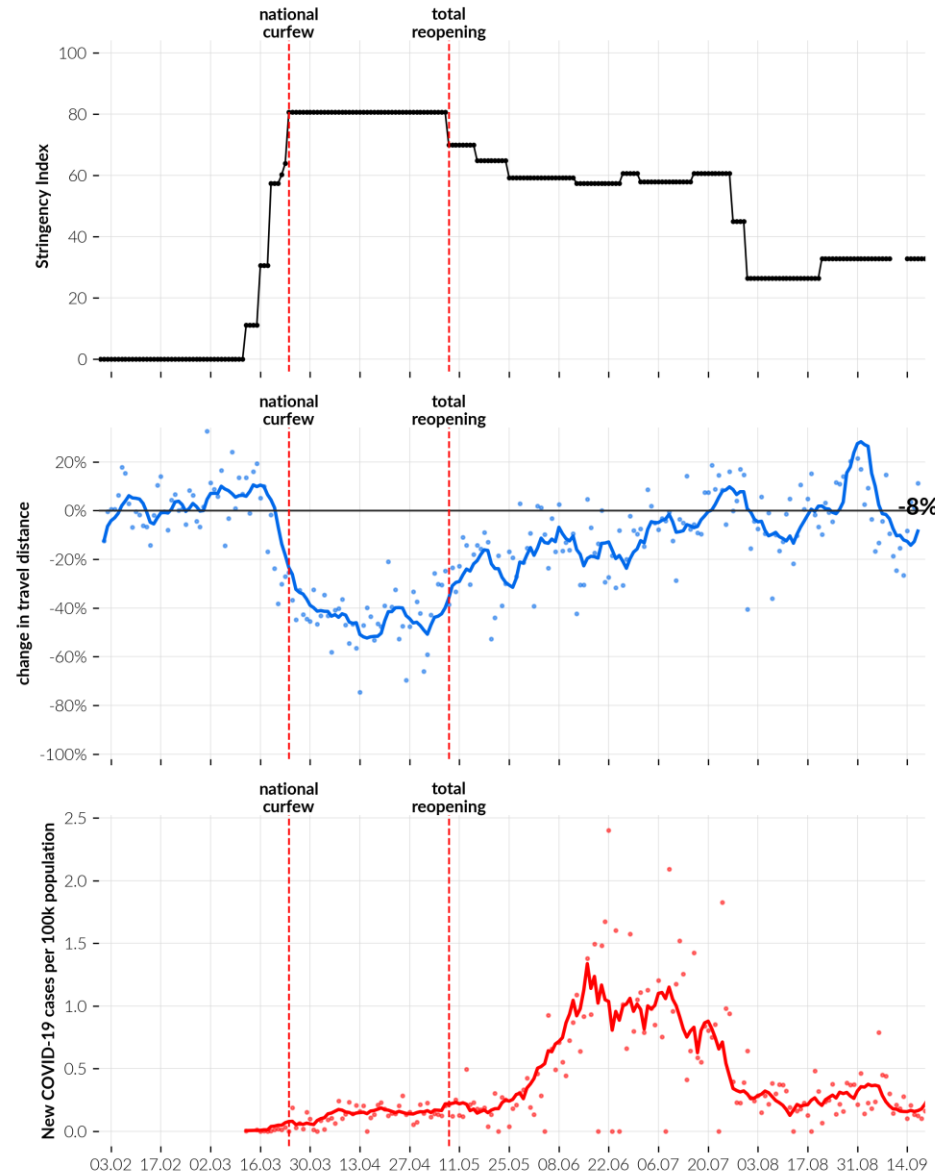
Data from: **Blavatnik School of Government, Cuebiq, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Cote d'Ivoire

- **Strict measures** were introduced **mid-March** to reduce COVID-19 transmission but have slowly been lifted since May.
- Government measures drastically **reduced mobility** to around **50%** of normal. Since the re-opening, mobility has steadily increased up to pre-curfew level at the beginning of August.
- New **COVID-19 cases** do not show a **peak** during the period of most stringent policies but one and a half month later, from mid of June to beginning of August, where **policy stringency** was reduced.



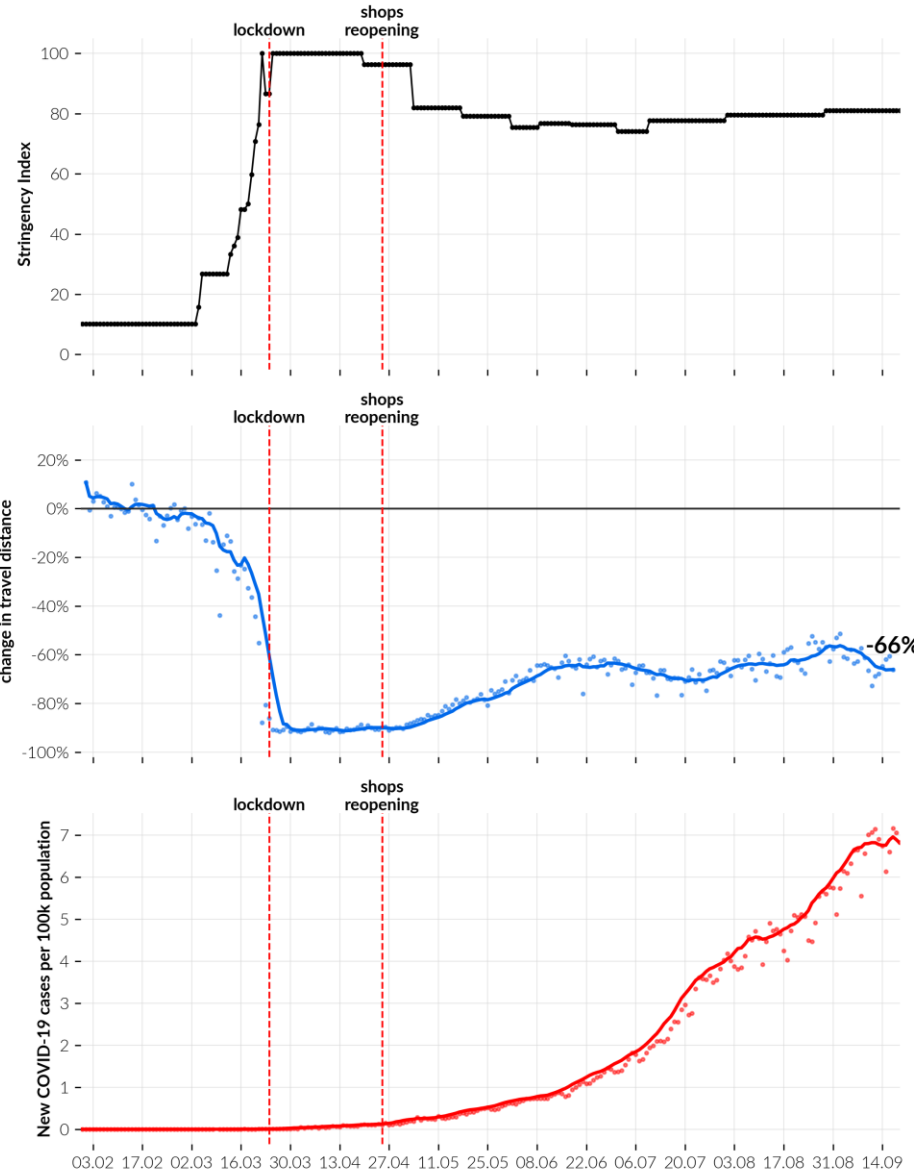
Data from: **Blavatnik School of Government, Cuebiq, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## India

- Increasingly **strict measures** have been introduced since **beginning of March** to reduce COVID-19 transmission, reaching the highest possible stringency index of 100 (the highest seen across all countries). Partial lifting of measures occurred at the beginning of May.
- Government measures drastically **reduced mobility** to around **90%** with a plateau until measures were partially lifted at the beginning of May.
- New **COVID-19 cases** do not show a peak during the period of strictest policies but, at present, the curve is **still increasing**.



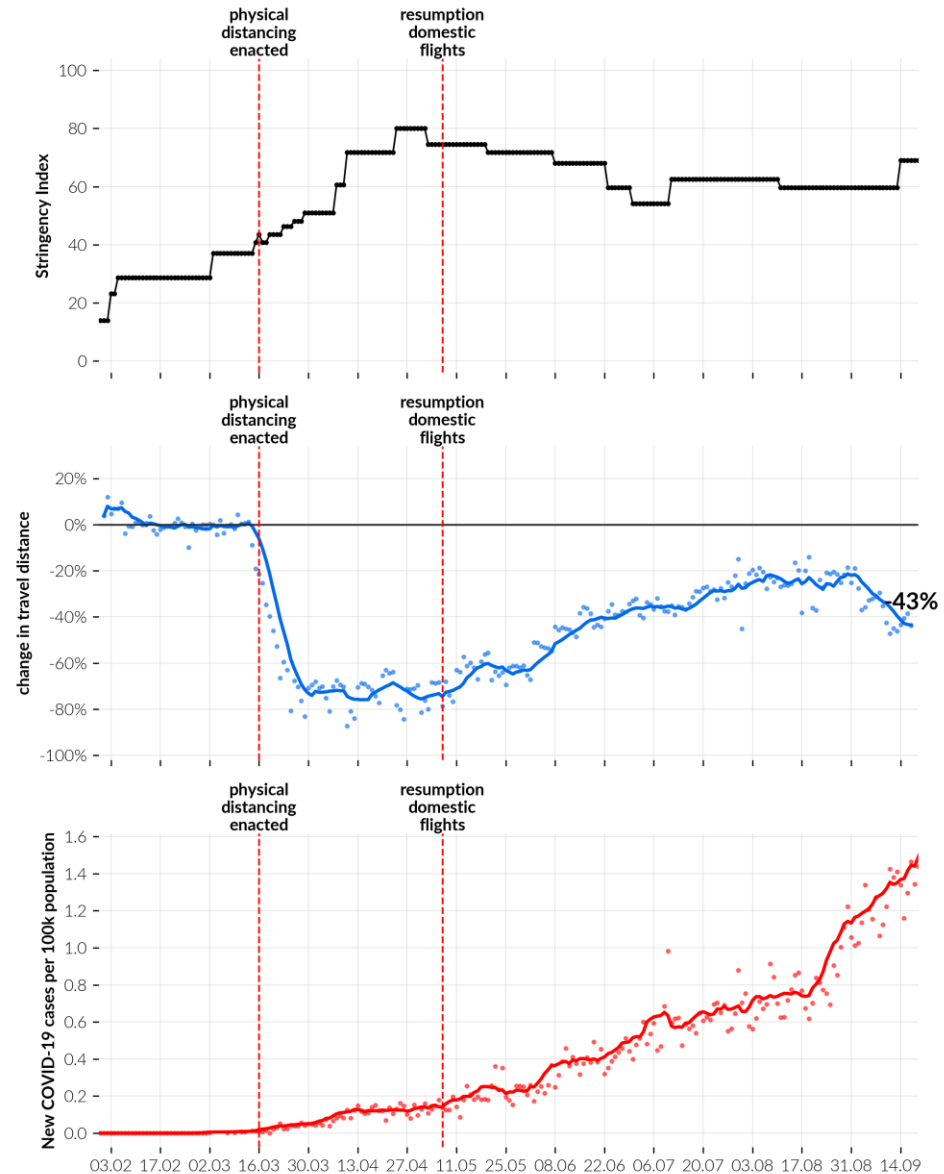
Data from: **Blavatnik School of Government, Cuebiq, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Indonesia

- **Measures** have been slowly introduced since the **beginning of March** to reduce COVID-19 transmission. In comparison to other countries, the **stringency index is the lowest**.
- Government measures drastically **reduced mobility** up to **70%** below the normal. The reduction remained constant until the measures were lifted. Since then mobility has steadily increased.
- New **COVID-19 cases** do not show a peak during the period of most stringent policies. Instead the number of new cases has continually been **growing**.



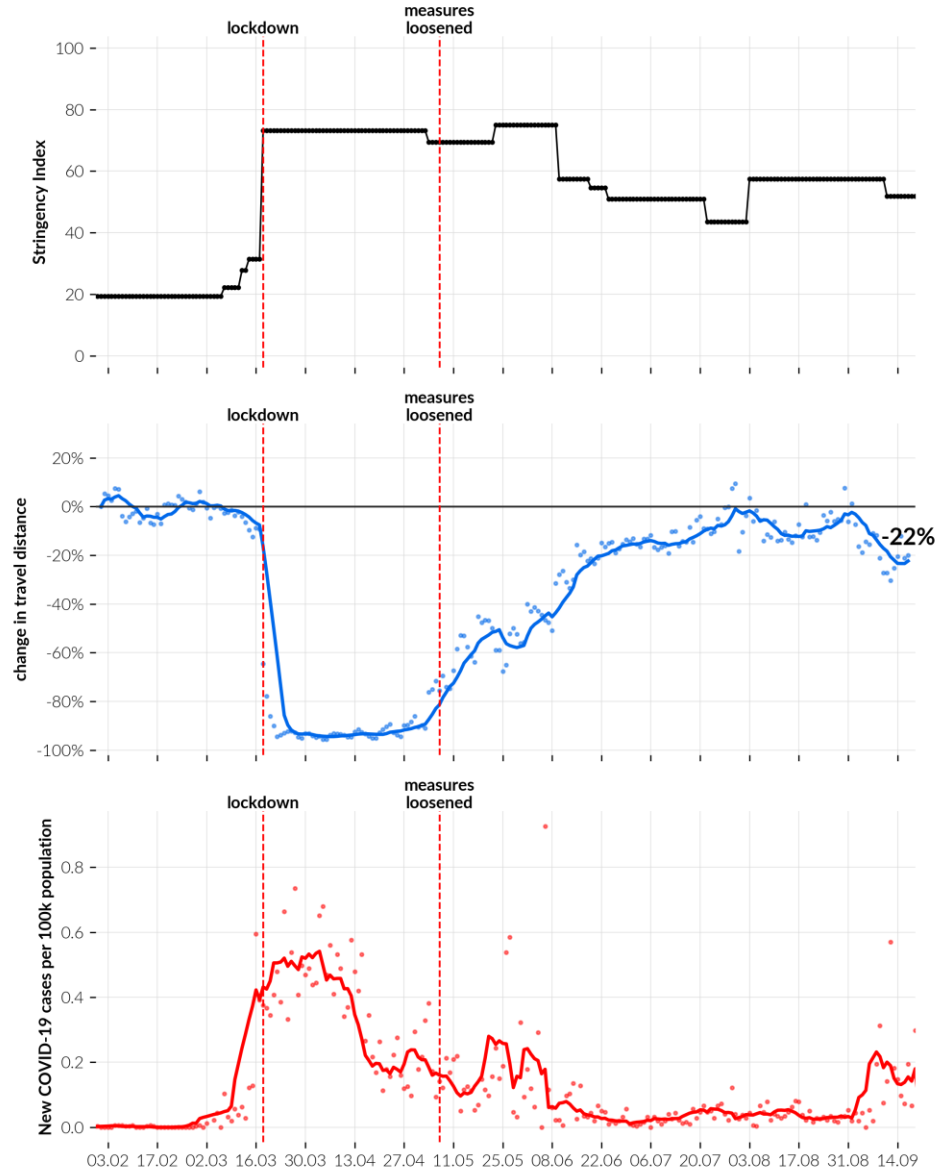
Data from: **Blavatnik School of Government, Cuebiq, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Malaysia

- **Strict measures** were introduced **mid-March** to reduce COVID-19 transmission, but the **stringency** is **lower** than other countries.
- Government measures drastically **reduced mobility** to around **90%** below normal. The reduction was constant until measures were loosened. Since then, mobility has slowly recovered and is back to near normal values
- New **COVID-19 cases peak** right **after the lockdown** but have decreased since mid-April. The number of new cases **reached a steady level in June** (where stringency was reduced).



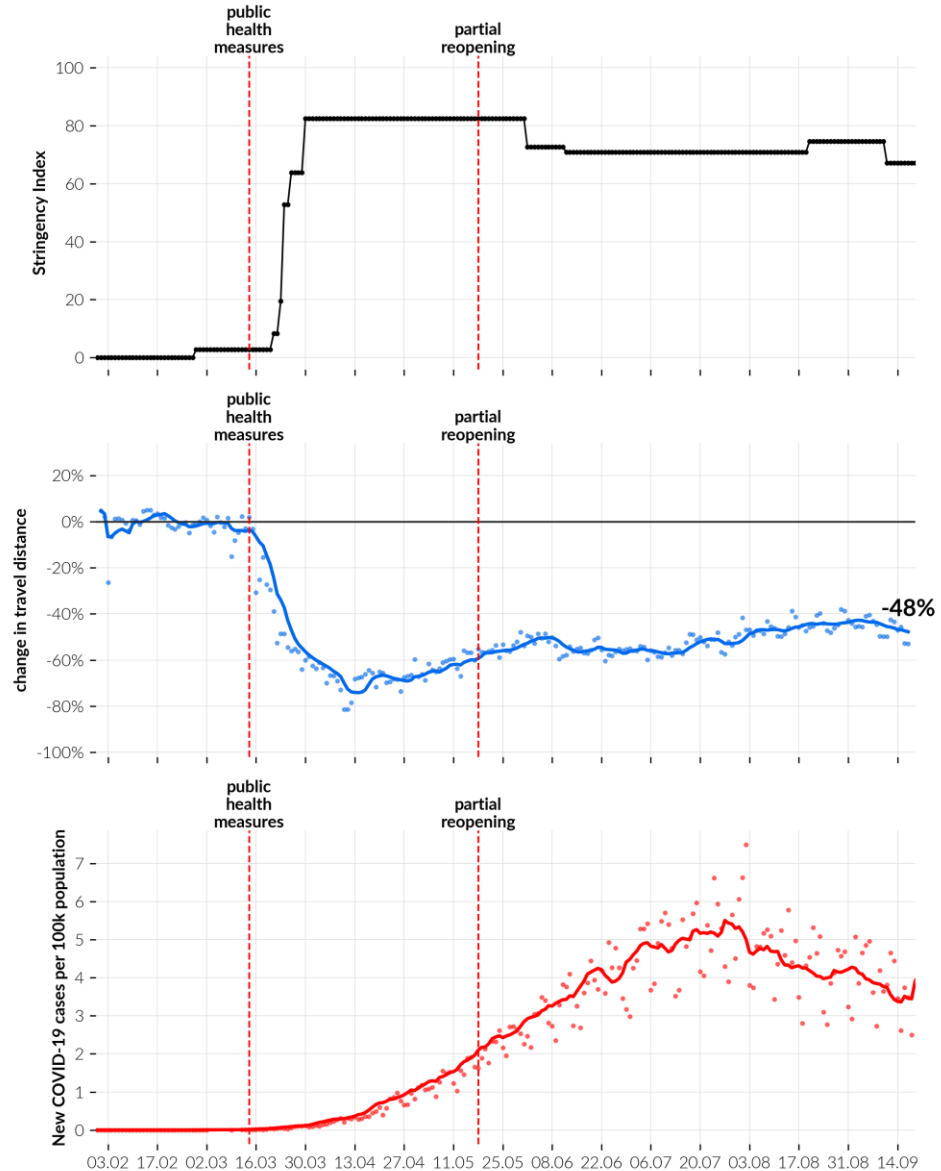
Data from: **Blavatnik School of Government, Cuebig, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Mexico

- **Strict measures** were introduced in **March** to reduce COVID-19 transmission and have since remained high.
- Government measures drastically **reduced mobility** to around **70%** below normal. Since the partial reopening mobility has been slowly rising and is currently **48%** below normal.
- New **COVID-19 cases** did not peak during the period of most stringent policies. Instead, they have **steadily been rising**, potentially peaking in **end July**.



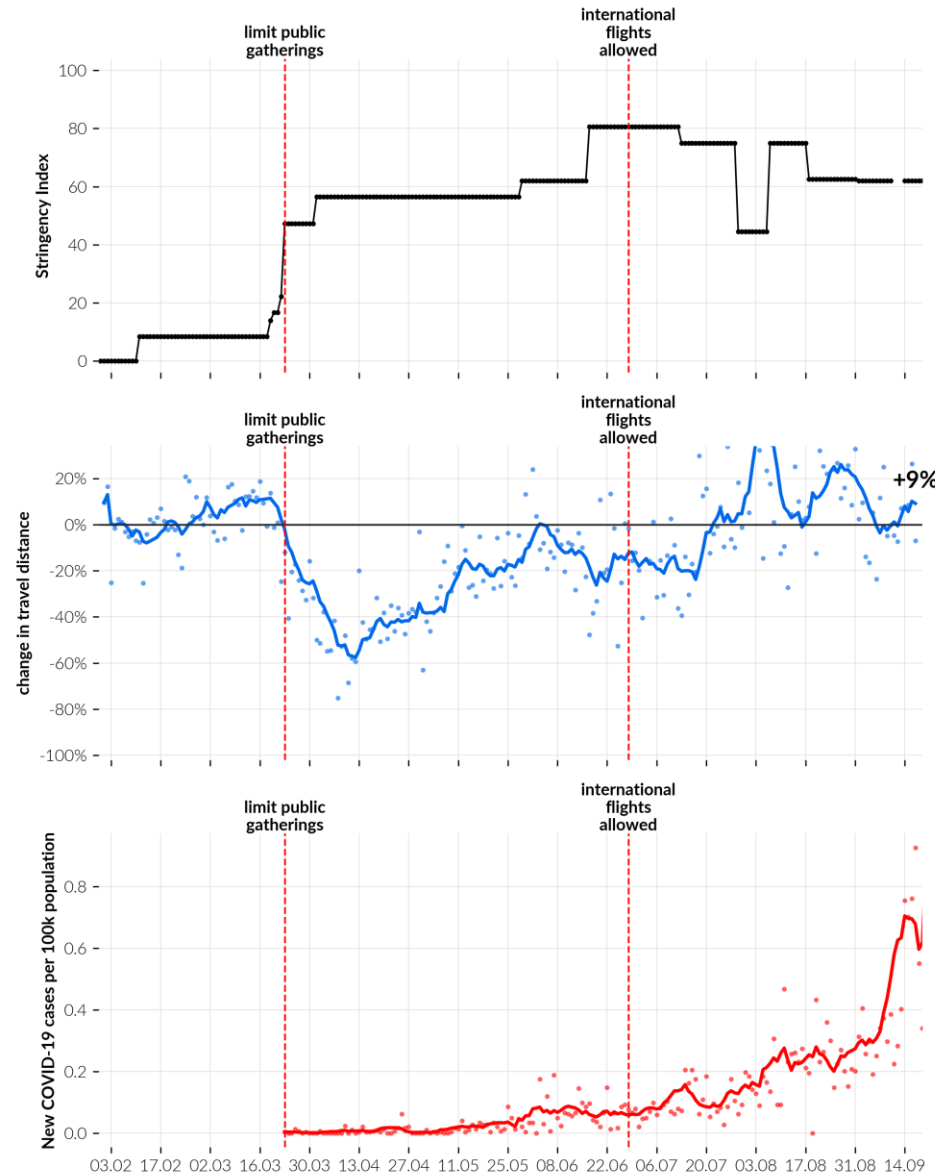
Data from: **Blavatnik School of Government, Cuebig, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Mozambique

- **Measures** were initially introduced in **mid-March** to reduce COVID-19 transmission. In June they were further increased, but later relaxed. Overall, the stringency index is the **second lowest** after Indonesia.
- Government measures initially **reduced mobility** to around **50%** of normal. But mobility has steadily been rising to levels above normal, despite the stringency index being high.
- New **COVID-19 cases** does not show a peak during the period of most stringent policies but have been **steadily increasing**.



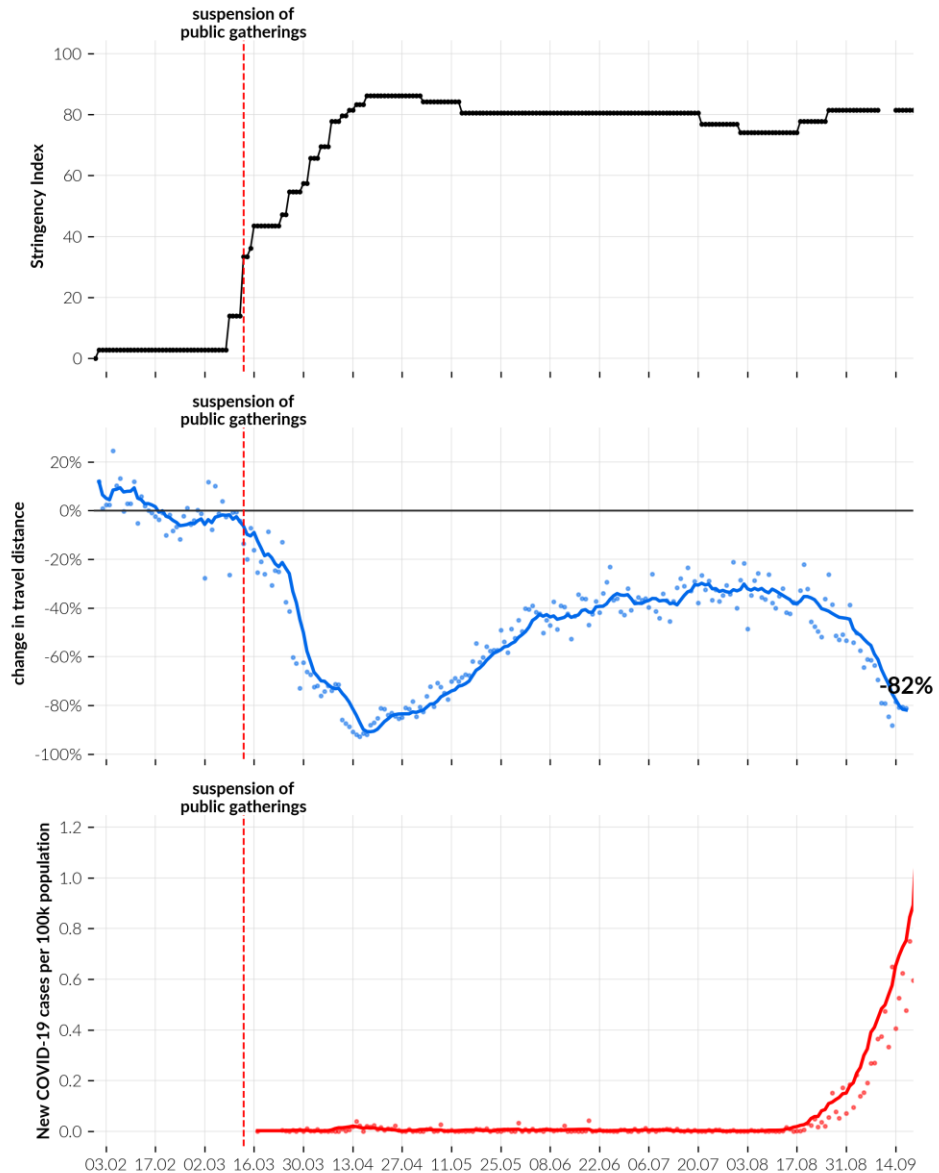
Data from: **Blavatnik School of Government, Cuebiq, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Myanmar

- **Measures** were slowly introduced since **end-March** to reduce COVID-19 transmission and have been increased till mid-April. Since then, the stringency index has remained high.
- Government measures **reduced mobility** to initially **90%** below normal (aligned with the period of strictest measures). Since then mobility has increased again from mid-April till beginning of June when it stabilized around a constant level at 40% below normal. From end-August, it decreased again to a value around 80% below normal, similar to the one of mid-March.
- New **COVID-19 cases** remained low before and during the lockdown. Instead, Myanmar shown an **abrupt increase** in **mid-August**, despite high policy stringency and low mobility. It is unclear if spike in cases is linked to better testing in the country.



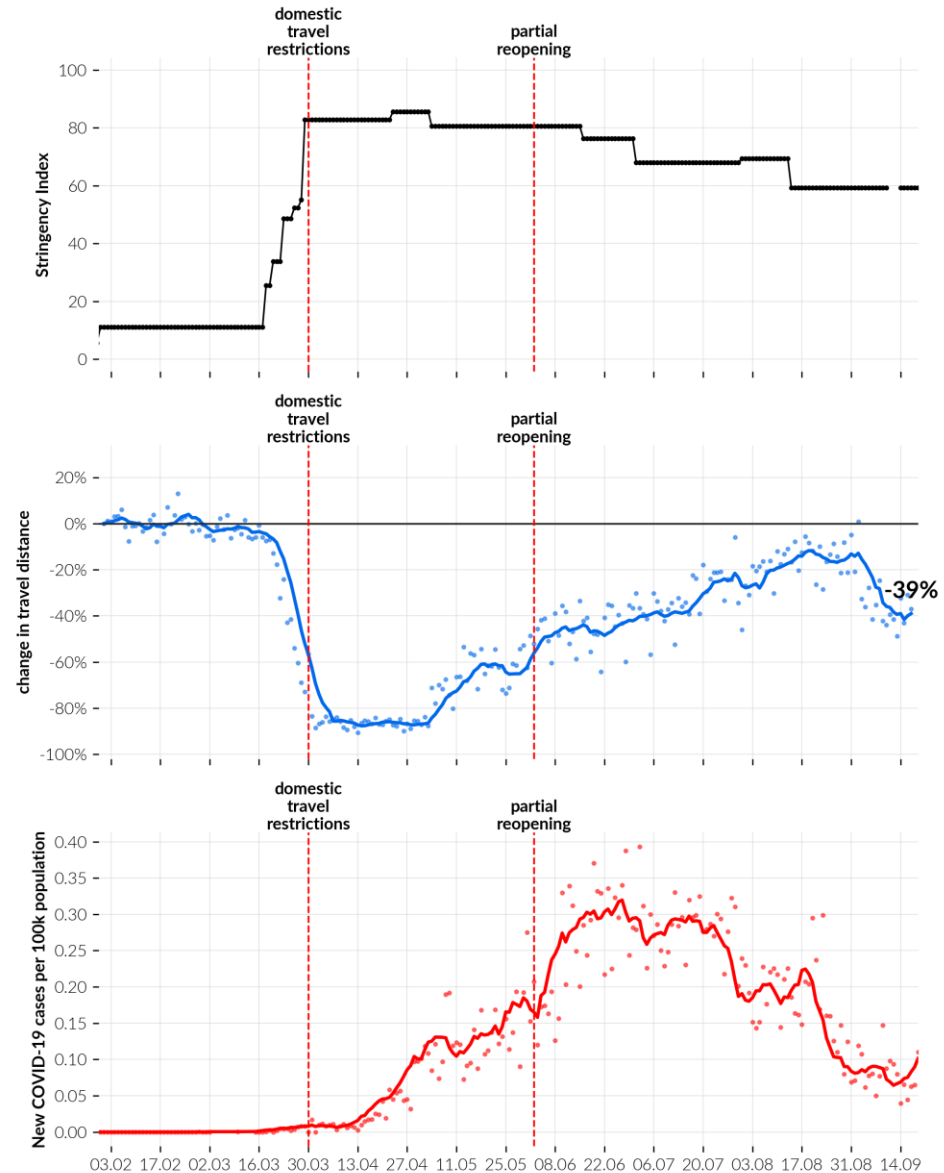
Data from: **Blavatnik School of Government, Cuebig, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Nigeria

- **Strict measures** were introduced **end-March** to reduce COVID-19 transmission. Starting June, measures have been gradually relaxed.
- Initial measures drastically **reduced mobility** to approx. **85%** below normal. Since May mobility has been rising constantly till end-August when it started to decrease again up to 39% below normal.
- New **COVID-19 cases** do not show a peak during the period of most stringent restrictions. Instead cases peak from **beginning of June** and remain high until **end of July** when they decreased.



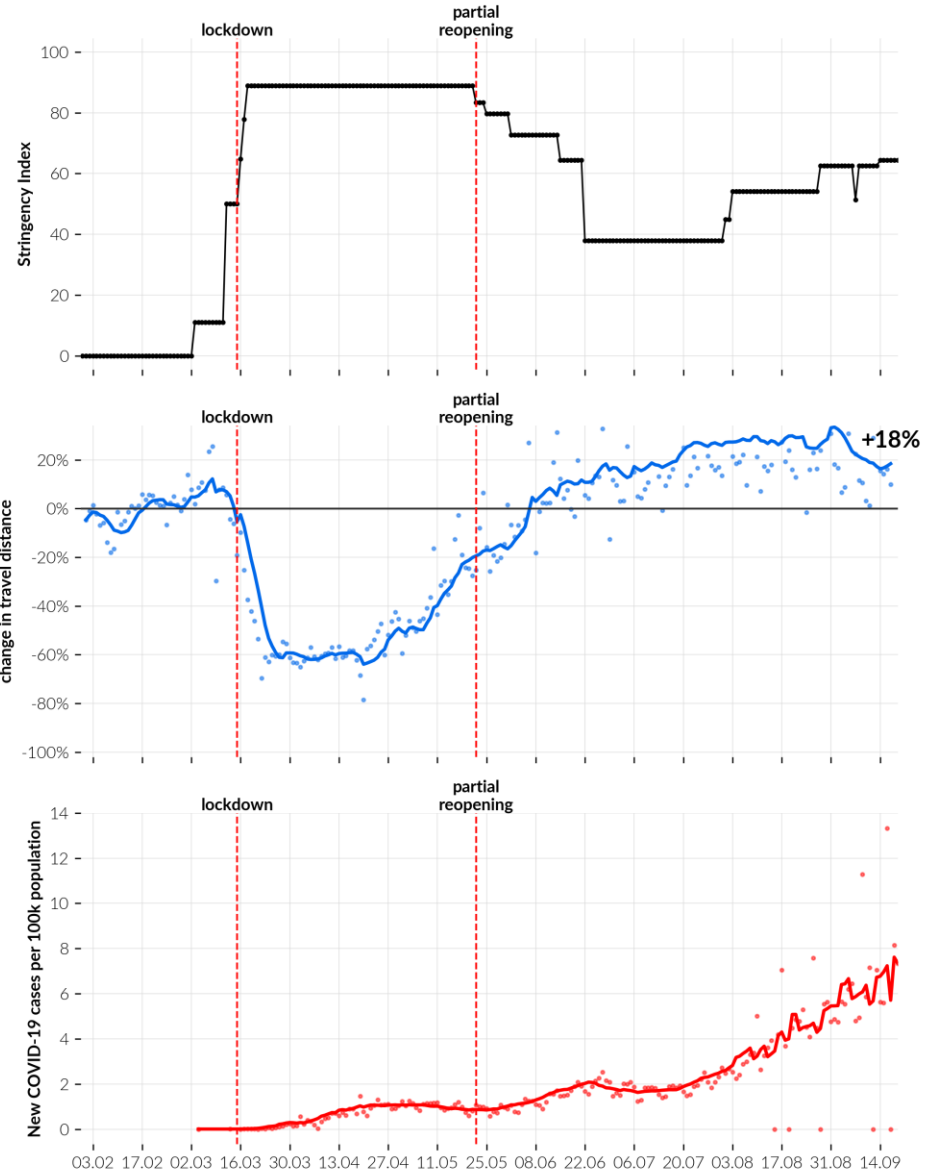
Data from: **Blavatnik School of Government, Cuebiq, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## Ukraine

- **Strict measures** were implemented **mid-March** to reduce COVID-19 transmission, and lasted until June where the country was partially re-opened
- Government measures drastically **reduced mobility** to around **60%** below normal. Since re-opening mobility has **increased to above normal levels**. This is because “normal behavior” is defined as movements in February, and mobility is different during summer months.
- The number of new **COVID-19 cases** does not peak during the period of most stringent measures, however, it is likely the lockdown prevented a large-scale outbreak. Cases have **increased** at a **faster pace** after the partial reopening.



Data from: **Blavatnik School of Government, Cuebig, ECDC.**

Analysis from: **UNICEF MagicBox**

# Annex II

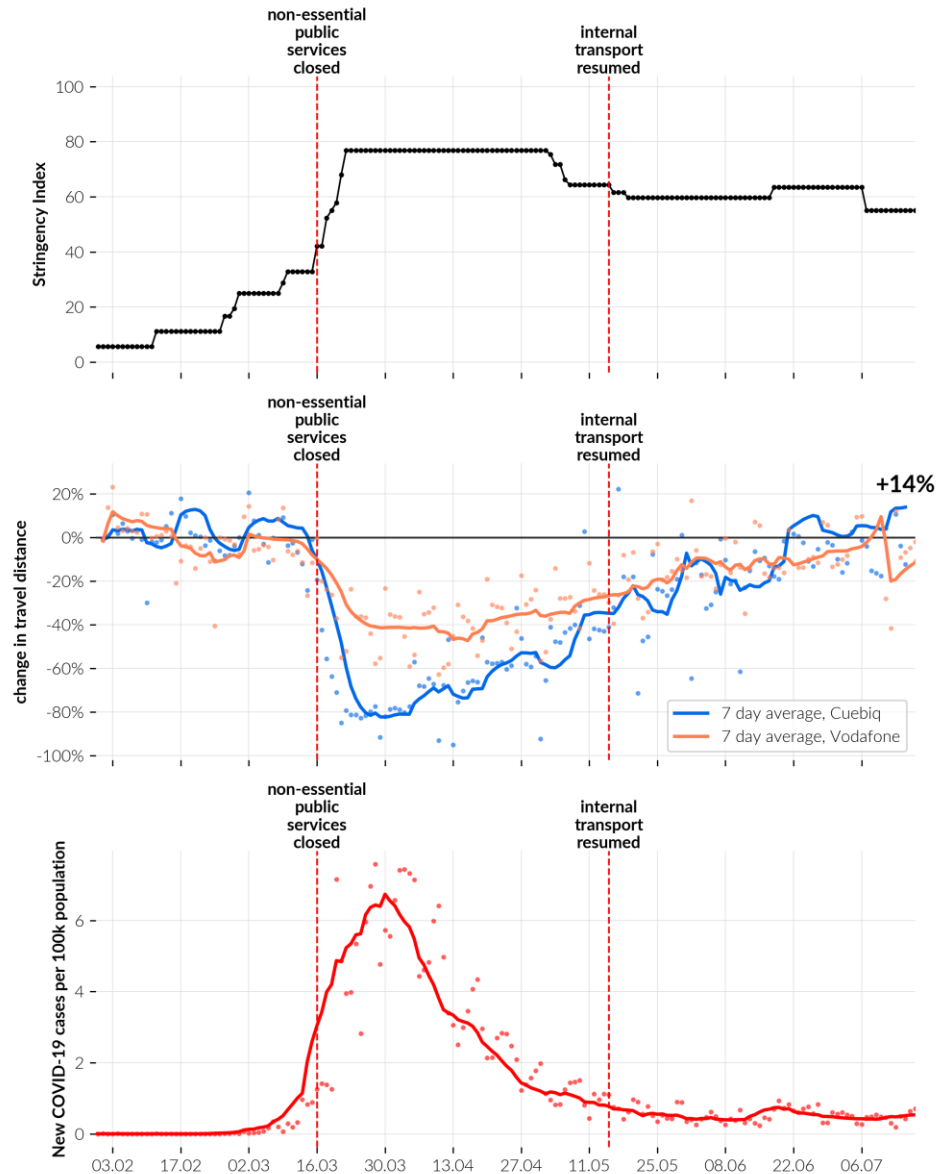
## *Comparison of data sources*

- For some countries we have multiple data sources obtained from different data sharing partnerships. A recent agreement with Vodafone allows for the comparison of smartphone (Cuebiq) mobility indicators with those provided by the mobile network operator.
- Similar trends are observed in the decrease of travel distance and the increase of time spent at home as a consequence of mobility restrictions.
- For those countries with low smartphone penetration or limited 4G connectivity, data from mobile network operators may be the most representative in terms of coverage, especially for areas far from main cities.

# Comparison between stringency, mobility and cases

## Germany

- **Strict measures** were introduced **mid-March** to reduce COVID-19 transmission.
- These measures **drastically reduced mobility**. Comparing mobile phone data (**Vodafone**) to smartphone data (**Cuebiq**) we find that the drop in mobility was **40%** and **80%** below normal, respectively. The difference between the values is due to different data collection mechanisms and aggregation procedures. For instance, Vodafone data underestimates the number of short trips as data is collected at antenna level.
- The number of **COVID-19 cases peaks** around the **day with highest mobility reduction**, approx. 2 weeks after lockdown.



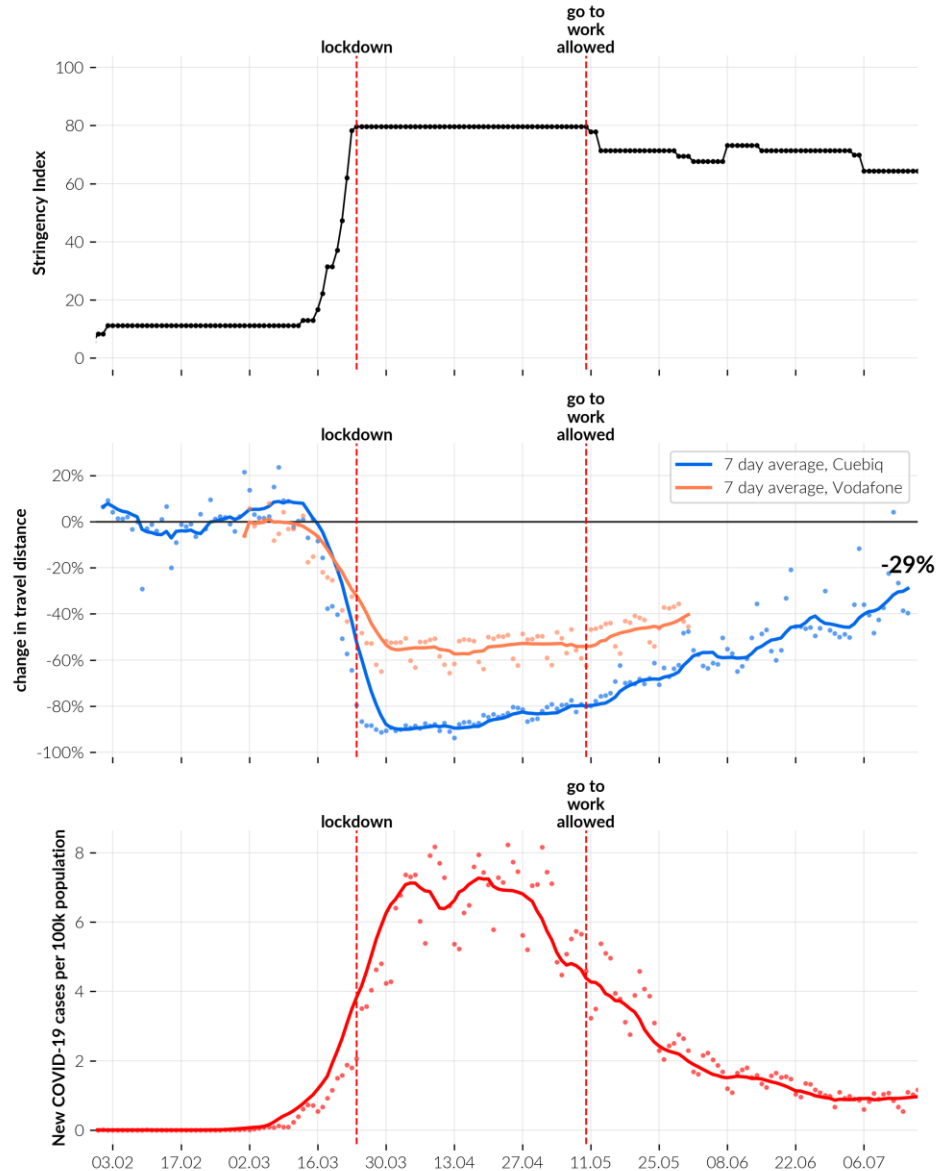
Data from: **Blavatnik School of Government, Cuebiq + Vodafone, ECDC.**

Analysis from: **UNICEF MagicBox**

# Comparison between stringency, mobility and cases

## United Kingdom

- **Strict measures** were introduced **mid-March** to reduce COVID-19 transmission.
- Containment measures **drastically reduced mobility**. Comparing mobile phone data (**Vodafone**) to smartphone data (**Cuebiq**) mobility was reduced by **55%** and **90%** below normal, respectively. Differences between values is due to different data collection mechanisms and aggregation procedures.
- The number of **COVID-19 cases** peaked in **mid-March** and remained high until May. The UK implemented a lock-down when cases were drastically rising.



Data from: **Blavatnik School of Government, Cuebiq + Vodafone, ECDC.**

Analysis from: **UNICEF MagicBox**