COMPARABILITY OF COVID-19 EPIDEMIOLOGICAL DATA: A CASE STUDY OF SIX COUNTRIES

COVID-19 SITUATIONAL ANALYSIS PROJECT

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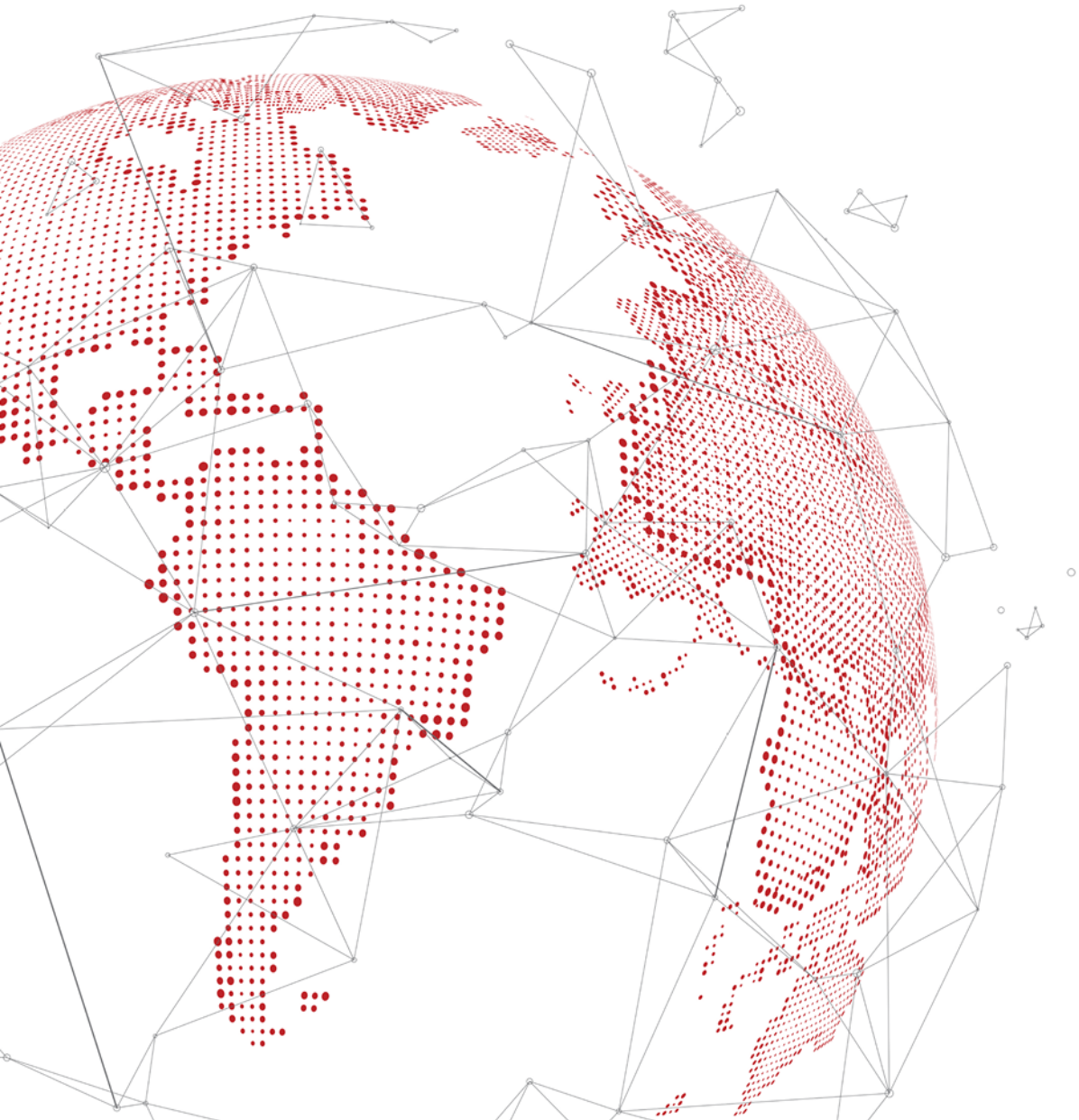

Better Data
Better Decisions
Better Outcomes

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About this project

In July 2020, iMMAP launched the Global COVID-19 Situation Analysis Project, funded by the Bureau of Humanitarian Assistance (BHA) of USAID. Implemented in Cox's Bazar, Bangladesh,1 Burkina Faso, Colombia, Democratic Republic of Congo, Nigeria, and Syria, this project has produced monthly situation analysis reports that provide humanitarian stakeholders with comprehensive information on the spread of COVID-19 and related humanitarian consequences. Data is identified from humanitarian sources and coded using the projects analytical framework, which is closely aligned with the JIAF framework. Data is stored in DEEP where it can be visualized, disaggregated and aggregated to respond to queries about humanitarian situations.

Based on Lessons Learned for the project, iMMAP commissioned a series of sector-specific lessons learned reports to assess data availability and quality, adaptations, challenges, opportunities that emerged in five humanitarian sectors: education, food security, livelihoods, protection, and water, sanitation and hygiene (WASH). Alongside this, seven thematic reports that focus on gaps in data were also commissioned.

"This report is the result of a combination of primary and secondary data review exercises that cross-analyze a number of information sources. The views expressed herein do not necessarily reflect the views of USAID, the United States Government, the humanitarian clusters or any one of their individual sources."

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Executive Summary

Rationale

Cross-country comparisons of COVID-19 data are important to understand differences in the burden of COVID-19, determine countries' relative success containing the virus and guide policies. The comparison of COVID-19 epidemiological data across countries is, however, challenging due to differences in terms of how data are collected and reported.

Research questions

The objective of this research was to assess issues associated with comparing national-level COVID-19 epidemiological data in six countries: Bangladesh Burkina Faso, Colombia, DRC, Nigeria and Syria. Specifically, this report sought to address the following questions:

What is the state of the COVID-19 pandemic in Burkina Faso, Colombia, DRC, Nigeria, Bangladesh, and Syria?

How do indicators used to measure COVID-19 testing, cases and mortality differ across the six countries?

What factors may have an impact on the accuracy of COVID-19 indicators and observed differences across countries?

What COVID-19 indicators and information should be reported to increase comparability across countries?

Methodology

This research consisted of two data collection methods: secondary data review and semi-structured key informant interviews. A review of the grey and peer-reviewed literature was conducted, and key informants were interviewed in Burkina Faso and Nigeria

Key findings: This analysis revealed that data collection, measurement and reporting practices for COVID-19 testing, case identification, and mortality vary greatly across the six countries. As a result of data availability and quality issues, COVID-19 measures often either underestimate or overestimate the number of people tested, cases identified and people dying from COVID-19 to varying degrees across countries. Factors that lead to differences in COVID-19 data comparability include: variability in testing strategies including testing availability, eligibility criteria, cost of testing and contact tracing efforts; differing case definitions and use of COVID-19 tests; and overall lack of documentation regarding how indicators are measured. Ambiguous information is particularly prevalent for mortality calculations. Cross-country comparisons are also subject to key differences in reporting practices and contextual factors that may not be documented. When they are not addressed, these country-specific biases and cross-country differences lead to biased comparisons.

Recommendations: Based on the findings, the following set of recommendations are proposed to improve the comparability of data across countries:

To countries:

Publish online and in-country bulletins the definitions of the COVID-19 measures used. Changes in definitions and measurements should also be documented and communicated.

Publish information on processes for data collection and reporting, including reporting sample and processing times. This information should be updated regularly.

Share COVID-19 data updates online using the same time interval and location (e.g., government website). Ideally, updates should be posted daily and any delay in reporting should be documented and explained.

Make COVID-19 datasets readily available online. The dataset should be updated using a defined time interval (e.g., twice a week).

Document and communicate contextual factors that may affect the interpretation of the reported data (strike by laboratory personnel or medical doctors).

Publish multiple COVID-19 data measures. For instance, both the number of tests conducted, and the number of people tested should be reported. Countries with stronger registration systems should aim to publish excess mortality in addition to other mortality measures such as case fatality ratios.

Report the number of tests and number of positive cases separately for travelers versus suspected cases.

Researchers/policy makers

When comparing data across countries, use the same data sources to minimize differences in reporting. Any differences that could affect comparisons should be documented.

International websites should specify the reason they omit data for certain countries and provide information on their data collection practices

Local, regional, and international health organizations should stress the importance of COVID-19 data quality, comprehensiveness, reliability, and timeliness and provide support and guidance to strengthen data quality. This is particularly important as these data may be used in the future to inform resource allocation such as vaccine distribution.

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Introduction

Cross-country comparisons of COVID-19 data are important to understand differences in the burden of COVID-19 and determine countries' relative success in containing the virus. These data can also guide policy decisions regarding funding and resource allocation. For instance, while vaccine donation by high-income countries to low- and middle-income countries are either based on population size or geopolitical considerations, some have argued that vaccines should be donated based on needs as measured by COVID-19 mortality data (Bollyky, Murray, Reiner, 2021; Herzog et al, 2021).

The comparison of COVID-19 epidemiological data across countries is, however, challenging due to differences regarding the data collection and reporting. Characteristics of the healthcare system, socio-cultural factors, economic and political considerations can all lead to variability in data collection, measurement and reporting of COVID-19 tests, cases and mortality across countries.

The objective of this research was to assess issues associated with comparing national-level COVID-19 epidemiological data in six countries: Bangladesh, Burkina Faso, Colombia, DRC, Nigeria and Syria. Specifically, this report seeks to address the following questions:

What is the state of the COVID-19 pandemic in Burkina Faso, Colombia, DRC, Nigeria, Bangladesh, and Syria?

How do indicators used to measure COVID-19 testing, cases and mortality differ across the six countries?

What factors may have an impact on the accuracy of COVID-19 indicators and observed differences across countries?

What COVID-19 indicators and information should be reported to increase comparability across countries?

Using data and information from the six countries, the report highlights issues and differences to consider when comparing COVID-19 data across countries and within countries over time. Potential biases resulting from cross-country differences are described based on reported differences. The report then provides recommendations regarding the measures and information that should be presented to increase the validity of cross-country COVID-19 data comparisons in the discussion section of the report.

Methodology

Study design

An exploratory design was applied to determine issues associated with comparing COVID-19 epidemiological data across the six countries. This research consisted of two data collection methods: secondary data review and semi-structured interviews with key informants.

Data collection

1. *Secondary data*

This research relied primarily on secondary data. In addition to extracting data from the DEEP platform, a grey literature search was conducted to collect COVID-19 epidemiological data and information on COVID-19-related policies and contextual factors that may affect testing, case identification, mortality data collection, measurement and reporting in each of the six countries. This included a review of non-peer reviewed publications such as technical, research and project reports, assessments and evaluations, government documents, national and international public health organizations documents, working papers, and white papers. This research also aimed to include a review of country-specific COVID-19 policies for testing, case identification, vaccination and mortality reporting on government websites or in-country through iMMAP's COVID-19 project country teams. A peer reviewed literature search was also conducted using the PubMed search engine.

2. *Semi-structured interviews*

The secondary data was complemented with brief semi-structured interviews with key informants knowledgeable about COVID-19 data collection, measurement and reporting processes and issues in- country. Key informants were identified with input from iMMAP country leads. Respondents were recruited in Bangladesh, Burkina Faso and Nigeria only. It was not possible to recruit key informants in the remaining countries due to the sensitive political nature of the topic and study time constraints. The objective of the semi-structured interviews was to gather real-life information regarding what happens in each country and determine gaps that may exist between the guidance established by government policies and actual COVID-19 related practices. These interviews shed further light on existing challenges and factors that may have had an impact on the accuracy of the COVID-19 data reported in each country. For instance, although a COVID-19 testing policy may require testing for contacts of cases or for those with COVID-19 symptoms, the policy may be not implemented if there are not enough tests available or if resources are not allocated for contact tracing. Questions covered the following topics: current practices for testing, case identification, contact tracing and mortality reporting (see Appendix A for interview guide.)

3. *Data by research question*

Research Question 1: What is the state of the pandemic in each country and observed differences across countries?

To provide a broad description of the pandemic since the first reported case in each of the six countries, data on COVID-19 testing, prevalence, and mortality was collected in each country, both in absolute numbers and per population. In addition, to conduct a more detailed analysis of trends at the time of data collection, data was collected for the period of May to July 2021 using a 7-day moving average (averaging the value of that day, the three days before and the three next). Moving averages were reported to avoid hard-to-interpret peaks and valleys often associated with reporting daily data and prevent specific events from skewing the data. For instance, a peak may appear on a Monday because cases were not processed during the weekend. Data was collected for the following indicators:

- Daily number of tests, and daily number of tests per 1,000 people
- Daily number of new cases, and daily number of new cases per million people

- Positivity ratio (number of positive tests among those tested)
- Daily number of deaths, and daily number of deaths per million people
- Number of people who received at least one dose of vaccine, and percentage of people who received at least one dose of vaccine.

Research Question 2: Are there differences in COVID-19 measures and reporting processes across countries?

The grey and peer-reviewed literature and any government-issued COVID-19 policy guidelines available online or through iMMAP's country teams were reviewed for the following information:

- Differences in testing and cases: testing policy, testing cost, policies and practices for testing travelers, geographic access to testing, contact tracing processes, case definitions, type of tests used, and other factors relevant to testing strategies.
- Differences in COVID-19 death definitions
- Differences in timing for reporting test results and indicators

Research Question 3: What factors may have an impact on the accuracy of COVID-19 indicators and observed differences across countries?

Differences found while addressing Research Question 2 were analyzed to assess likely biases when comparing data across countries.

Research Question 4: What COVID-19 indicators and information should be reported to increase comparability across countries?

Recommendations to increase comparability of COVID-19 data across countries were developed based on findings from Research Questi.ons 2 and 3.

Ethical considerations

This project is believed to be exempt from human subject oversight. The following information was clearing communicated to respondents:

- Participation is completely voluntary
- Participants are free to withdraw at any time
- Information obtained from key informants will be kept confidential
- Specific responses will not be linked to stakeholders' names and job titles in the report.

Findings

State of the COVID-19 pandemic in Bangladesh, Burkina Faso, Colombia, DRC, Nigeria, and Syria

This section provides an overview of the pandemic in the six countries as well as a description of trends for the period of May 1st to July 31st, 2021.

Overview of the pandemic

Table 1 provides an overview of COVID-19 data in the six countries. The first COVID-19 cases were reported in all six countries within a one-month period (27 February-22 March 2021). First confirmed

cases were reported around the same time (6 March – 10 March) in Bangladesh, Burkina Faso, Colombia, and DRC.

Countries vary in terms of testing, cases, mortality, and vaccination. Colombia has conducted substantially more tests per capita (448,952/million), reported more cases (94,144/million) and more deaths (2,385/million) followed by Bangladesh which has 9 times less testing per population (49,319/million) and 11 times more positive cases (8,266/million) and 17 times less deaths. Testing, cases, and deaths per population are generally considerably lower in African countries, with Nigeria reporting the highest numbers. Nigeria reports more testing per population than Syria but less cases and 10 times less deaths per million people. It should be noted that for Syria, this report uses data reported by the Government.

Vaccination started earlier in Bangladesh (January 2021) and Colombia (February 2021) and very recently in Burkina Faso (June 2021). Colombia has the highest percentage of population vaccinated (26.16% fully vaccinated and 12.97% only partially vaccinated). Vaccination is extremely low in the remaining countries where data is available.

Table 1. COVID-19 data across the six countries as of August 10th, 2021*

Country	Population	First case	Total number of tests	Tests per million	Total cases	Cases per million	Total deaths	Deaths per million	Date of first vaccine	% Population fully vaccinated/ % Population only partly vaccinated (Aug9-Aug 10)[a]
Bangladesh	166,508,818	8 March 2020	8,212,041	49,319	1,376,322	8,266	23,161	139	27 Jan 2021	2.9/5.9
Burkina Faso	21,536,453	9 March 2020	206,152	9,572	13,626	633	169	8	2 June 2021	No data
Colombia	51,484,210	6 March 2020	23,113,937	448,952	4,846,955	94,144	122,768	2,385	17 Feb 2021	26.1/13.0
Democratic Republic of Congo	92,567,191	10 March 2020	287,638	3,107	52,356	566	1,048	11	19 April 2021	0.00/0.1
Nigeria	211,786,944	27 Feb 2020	2,542,261	12,004	179,118	846	2,194	10	5 March 2021	0.7/0.5
Syria (Government data)	17,970,623	22 March 2020	103,566	5,763	26,136	1,454	1,924	107	22 April 2021 (Date doses received)	No data

*Source: Worldometer (https://www.worldometers.info/coronavirus/#countries) except where indicated.

[a] Source Our World in Data (https://ourworldindata.org/covid-vaccinations)

COVID-19 trends in the six countries

To describe COVID-19 trends at the time of data collection, charts comparing the six countries for the period of May 1st to July 31st, 2021, were produced (**Figure 1-18**). For each indicator, two separate charts were obtained to allow clearer visualization and interpretation due to substantial differences in the values of the indicators. One set of charts was obtained for Nigeria, DCR, Syria and Burkina Faso (**Figure 1**, **3**, **5**, **7**, **9**, **11**, **13**, **15**, **17**) and another set for Bangladesh and Syria (**Figure 2**, **4**, **6**, **8**, **10**, **12**, **14**, **16**, **18**). Charts were produced with Our World in Data COVID-19 Data Explorer (Richie et al., 2020) using data from Johns Hopkins University except testing data which was collected from official sources (Dong, Du and Gardner 2020). Testing data are not readily available for Burkina Faso and Syria in the international sites we searched (e.g., Hopkins, Our World in Data). International websites such as Our World in Data are likely to prioritize easy to find data that are released in predictable intervals and locations (Our World in Data, 2021). It should be noted that while the Government of Burkina Faso currently posts briefings with COVID-19 data including testing data on social media, the briefings do not appear to be posted daily and are posted with one to two days-delay (for example, official briefing for data for Wednesday, September 1st dated and posted on Friday, September 3rd). Others have noted that Burkina Faso was prone to reporting delays (Bonnet et al 2021).

Testing: COVID-19 testing is substantially higher in Colombia compared to other countries (**Figure 1-4**). Testing has been increasing in Nigeria, DRC and to a lesser extent in Bangladesh but decreasing in Colombia. The increase in testing appears particularly sharp in Nigeria. Colombia experienced a decline in testing from late June to late July 2021.

Cases: Colombia has a substantially higher number of cases/million compared to other countries, followed by Bangladesh. COVID cases have been increasing in Burkina Faso, Nigeria, Bangladesh, and Syria but sharply decreasing in Colombia. As with testing, Nigeria experienced a sharp increase in case in July 2021 (**Figure 5-8**).

Positivity ratio: Overall, the positivity ratio (or percent positive) is lowest in Nigeria (5% or less during the period of May 1st to July 31st). The daily percentage of tests that are positive has varied during the period of May-July 2021 in DRC but has experienced a downward trend during the month of July. In Bangladesh, the percentage of test positive has been increasing except for a short period in July while in Nigeria, the positivity ratio has been slightly increasing during the past few weeks. Colombia, on the other hand, has been on steady decreasing trend since late June 2021 (**Figure 9-10**).

Mortality: Colombia is the only country where mortality consistently decreased during the month of July 2021. Syria, Nigeria, and DRC experienced initial decline followed by an increase in mortality in July. Mortality has remained relatively low in Burkina Faso and has been increasing in Bangladesh (**Figure 11-14**).

Vaccination: With the exception of Colombia, the percentage of the population who are fully vaccinated is low in all countries (0-3%)[1]. Vaccination appears to be increasing in all countries except DRC (**Figure 15-18**).

[1] COVAX aims to vaccinate at least 20% of the population in lower income countries by December 2021. https://www.who.int/news/item/08-09-2021-joint-covax-statement-on-supply-forecast-for-2021-and-early-2022

Figure 1. Daily new COVID-19 tests (DRC, Nigeria

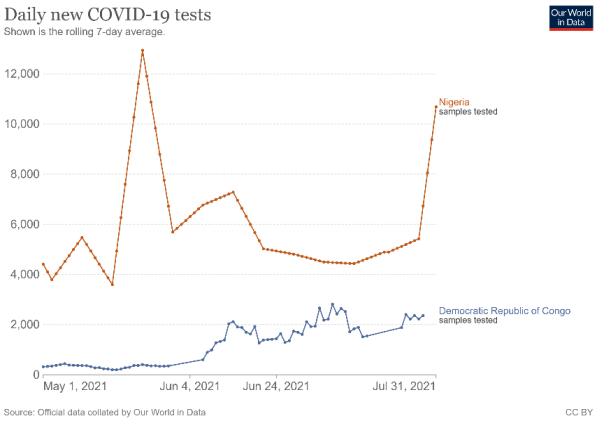


Figure 2. Daily new COVID-19 tests (Bangladesh, Colombia)

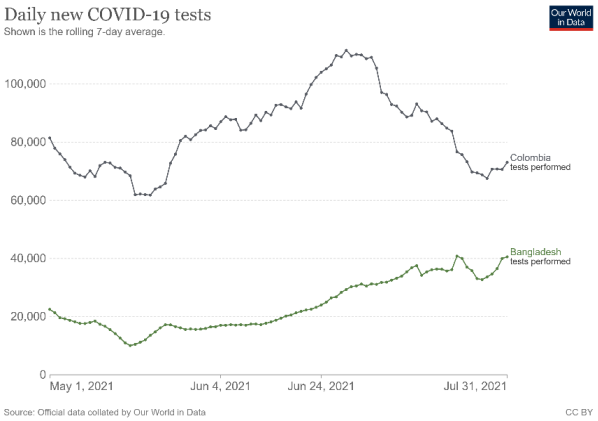
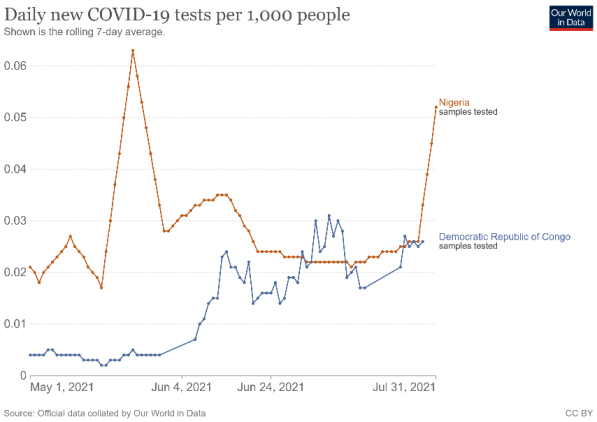


Figure 3. Daily new COVID-19 tests per 1,000 people (DRC, Nigeria)



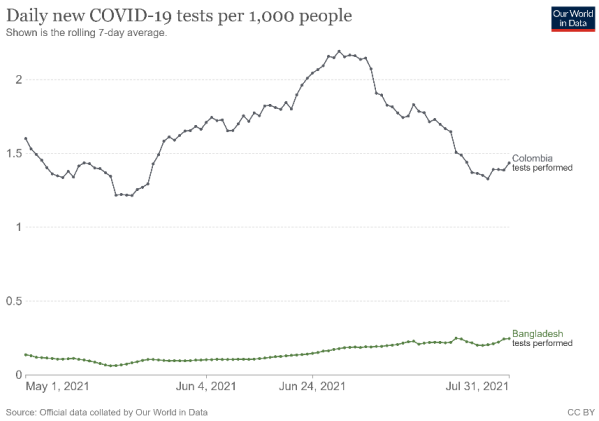


Figure 5. Daily new COVID-19 cases (Burkina Faso, DRC, Nigeria, Syria)

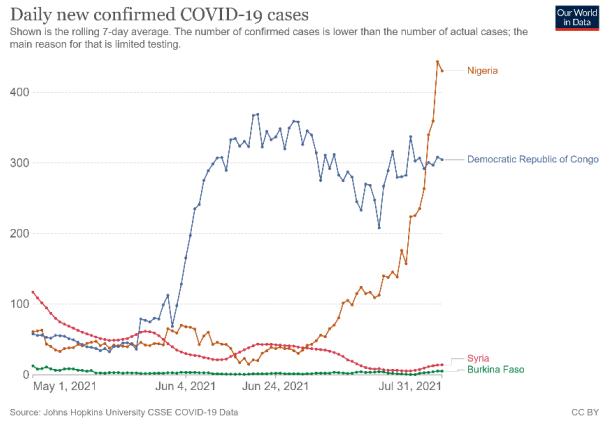


Figure 6. Daily new COVID-19 cases (Bangladesh, Colombia)

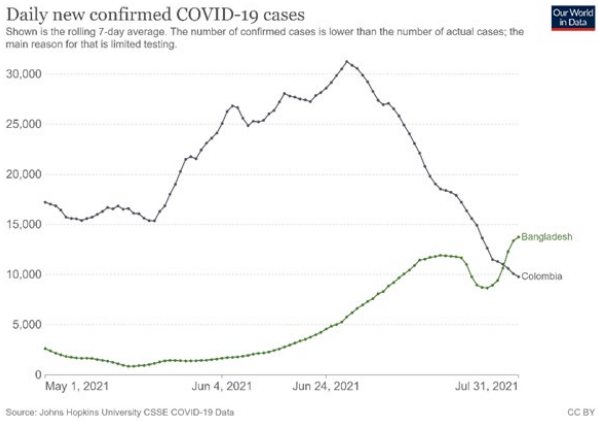


Figure 7. Daily new COVID-19 cases per million (Burkina, DRC, Nigeria, Syria)

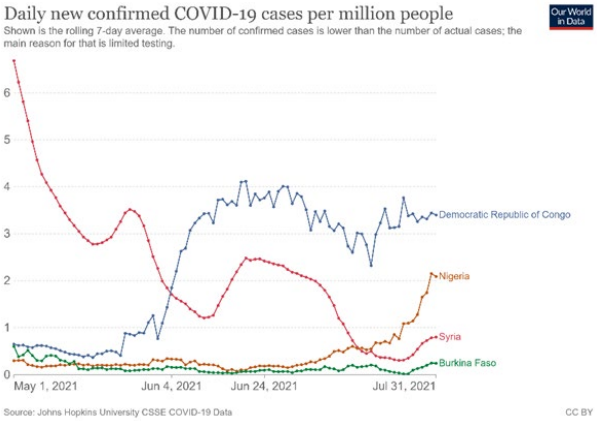


Figure 8. Daily new COVID-19 cases per million (Bangladesh, Colombia)

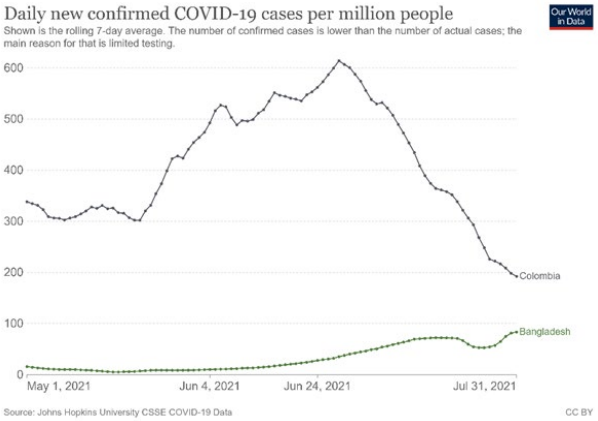


Figure 9. COVID-19 positivity ratio (DRC, Nigeria)

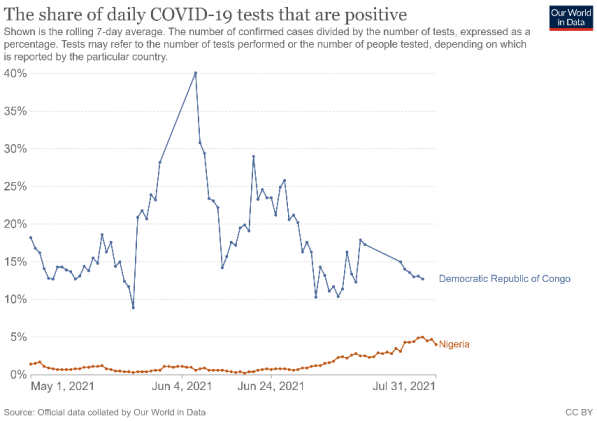


Figure 10. COVID-19 positivity ratio (Bangladesh, Colombia)

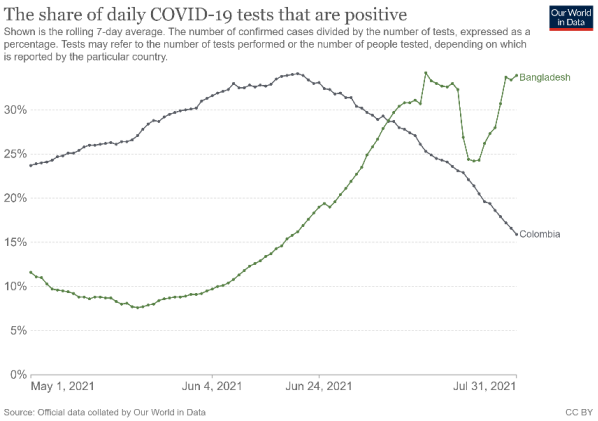


Figure 11. Daily number of COVID-19 deaths (Burkina, DRC, Nigeria, Syria)

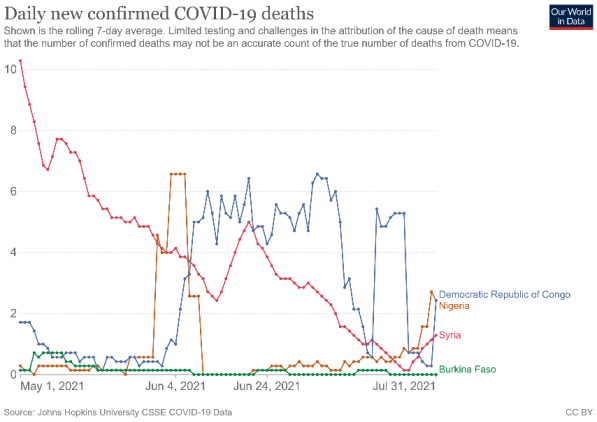


Figure 12. Daily number of COVID-19 deaths (Bangladesh, Colombia

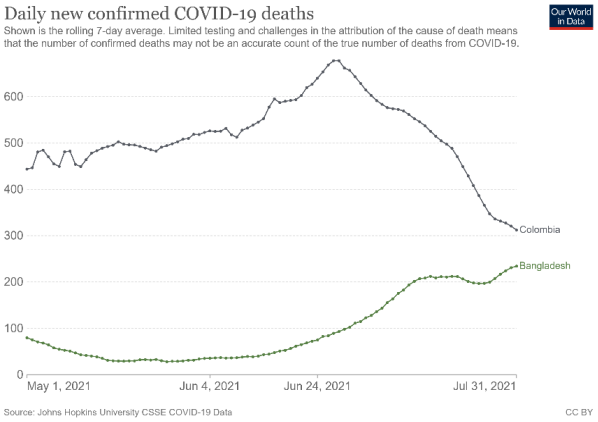


Figure 13. Daily number of COVID-19 deaths per million

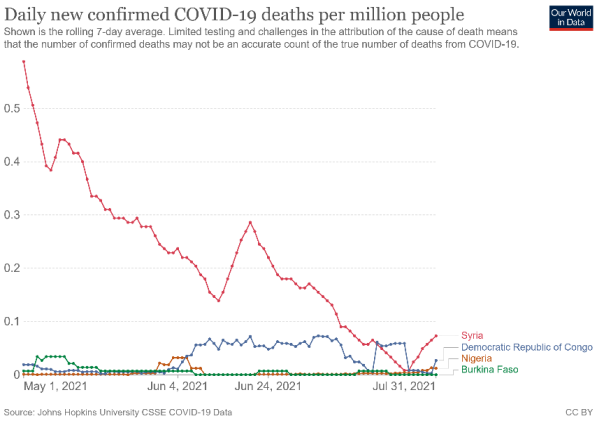


Figure 14. Daily number of COVID-19 deaths per million (Bangladesh, Colombia) (Burkina, DRC, Nigeria, Syria)

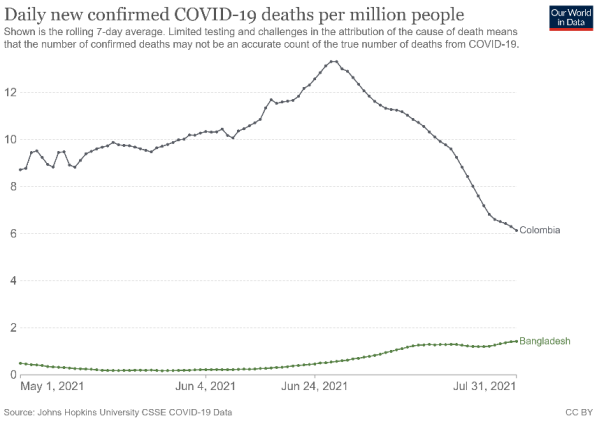


Figure 15. Number of people who received at least one dose of COVID-19 vaccine (Burkina-Faso, DRC, Nigeria, Syria)

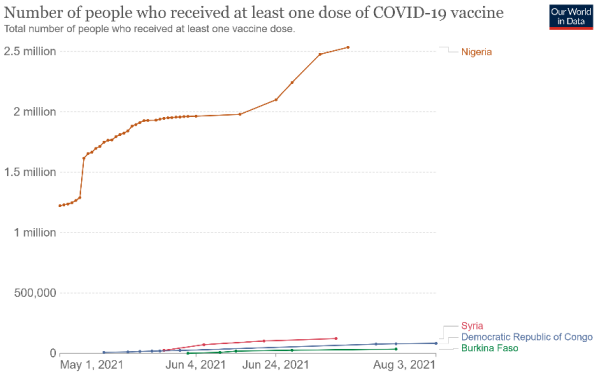


Figure 16. Number of people who received at least one dose of COVID-19 vaccine (Bangladesh, Colombia)

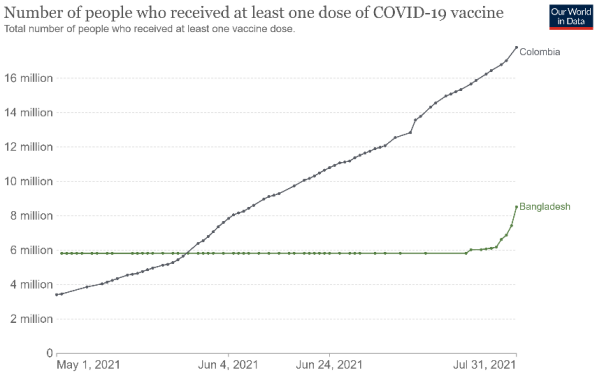


Figure 17. Percentage of people who received at least one dose of COVID-19 vaccine (Burkina-Faso, DRC, Nigeria, Syria)

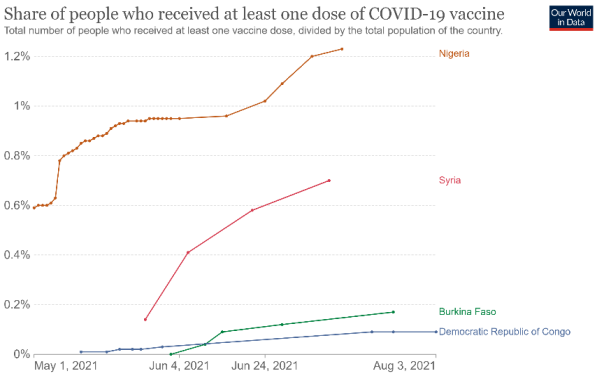
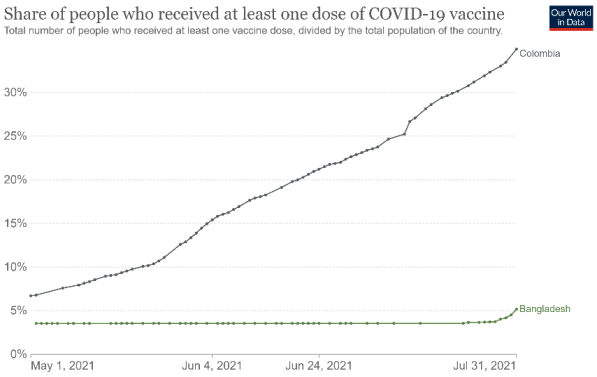


Figure 18. Percentage of people who received at least one dose of COVID-19 vaccine (Bangladesh, Colombia)



Differences in COVID-19 measures across countries

This section presents findings related to differences in testing and case identification measures across the six countries based on documents review and key informants' interviews. Key informants from Burkina-Faso and Nigeria were interviewed.

Differences in who is tested

Testing policy: Policies for testing and contact tracing vary across countries, partly due to varied capacity. **Table 2** shows the status of the government testing and tracing policies in the six countries according to the Oxford COVID-19 Government Response Tracker (OxCGRT) which collects systematic information on policy measures taken by governments in more than 180 countries (Hale et al., 2021). As of July-August 2021, of the six countries, Bangladesh is the only country with a reported open public testing policy, allowing asymptomatic people to be tested. The implementation of this open policy was confirmed by a key respondent from Bangladesh; a total of 808 public and private laboratories have been authorized to conduct COVID-19 testing by the government. While Burkina Faso and Colombia allow anyone with COVID-19-like symptoms to be tested, the remaining countries limit testing to those with symptoms who also meet specific criteria, such as history of travel or contact with known cases (Nigeria Centre for Disease Control, 2021a). A key informant in Nigeria, however, reported that health providers may decide to test a suspected case even if they do not meet any of the additional criteria. Data show that policies related to access to testing varied over time in all countries except Colombia which consistently followed a policy allowing to test anyone showing COVID-19 symptoms. In Syria, it has been reported that Polymerase Chain Reaction (PCR) tests were only administered to critical cases (Syria TV 20/12/2020).

Cost of test: Related to the issue of testing policy is that of the cost of tests which also varies across countries. In Bangladesh, fees were reportedly charged by both public and private institutions as of June 2020 (Cousins, 2020). However, a key informant interviewed in September 2021 stated that tests were free in government facilities. In Nigeria, tests are reported to be free in public health facilities, but fees are charged by private laboratories (Nigeria Centre for Disease Control, February 2021). A key informant also specified that both inbound and outbound travelers are charged fees for COVID-19 testing, which, for travellers, is conducted by specific laboratories. In DRC, tests are reported to be free except for travelers who are charged 30 US Dollars (DRC, 2021). Key informants stated that this was also the case for Burkina Faso where travelers are charged approximately 45 US Dollars. In Syria, the cost of the test was set at the equivalent of 37 USD in August 2020 by the government.[2] There have been media reports of Ministry of health staff "extorting" individuals seeking COVID-19 testing (COAR, 2021).

Testing travelers: With many countries requiring incoming passengers to show proof of COVID-negative status, the relative size of travelers among those who are tested are likely to vary by country. Of the six countries, Burkina Faso is the only one that provides the number of outgoing travelers tested in its daily COVID-19 Bulletin while Nigeria reports the number of returning passengers tested in its weekly situation analysis. Inbound passengers are required to be tested for COVID-19 seven days after they arrive in Nigeria (Nigeria Presidential Task Force on COVID-19, 2020).

[2] This is considered prohibitively expensive, especially given real wage decreases and currency devaluation. The exact US dollar equivalence depends on whether one uses the official exchange rate of the black market one.

A key informant noted that inbound passengers who do not take the required test can be subject to deportation if they are foreigners, or arrest if they are Nigerian nationals. In May 2021, 94.6% of people tested in Burkina Faso were travelers, while only 5.4% were suspected cases (iMMAP/DFS Burkina Faso, May 2021). Information on the relative proportion of travelers among the total number of persons tested is not readily available for the other countries.

Geographic access to testing: Key informants in Bangladesh, Burkina Faso and Nigeria all highlighted inequalities in terms of access to testing based on area of residence. Residents of rural areas have less access to testing compared to residents of large cities. In Nigeria, disparities in resources, including human resources vary by geographic areas. Remote areas lack facilities and there are challenges associated with transporting samples for testing. However, trainings have been conducted to train staff to collect samples. In Bangladesh, a key informant stated residents of rural areas had limited access to testing due to the insufficient number of authorized laboratories and the unavailability of services such as home testing which are offered in Dhaka but not in rural areas. The key informant further stated that testing uptake tended to be lower in rural areas due to issues related to stigma. The respondent noted that access and uptake are particularly low among children, women, and people 60 years and older.

Other considerations: There have been reports of COVID-positive individuals paying to have laboratories test others under their name so that they are able to travel in Syria (COAR, 2021). In Nigeria, access issues were reported with people being turned away from testing facilities due to limited testing capacity and "unnecessary bureaucracy" (Abaenogbe, 2021, Vanguard News Nigeria 2021). This was confirmed by a key informant who reported that some clinicians may be reluctant to have patients tested for COVID-19 because the process of collecting samples, filling out paperwork and having samples transported to laboratories is perceived as cumbersome. A key information further noted that shortages of reagents also limit the number of individuals tested. As a result, many suspected cases may not be tested. In Bangladesh, a key informant noted that access to testing was influenced by gender dynamics with men having more access to testing than women.

Analysis of potential biases: Issues related to testing strategies may lead to several biases when comparing countries:

- More restrictive testing policies lead to 1. An underestimation of the number of COVID-19 cases; 2. An overestimation of the positivity ratio; 3. A potential inflation of the reported burden of COVID-19 in groups that are tested.
- Testing large numbers of travelers may lead to an underestimation of the positivity ratio
- Geographic disparities in testing can lead to bias. The direction of the bias is unknown and will depend on the prevalence of COVID-19 cases in the omitted areas.

Differences in contact tracing efforts

As with testing, efforts to identify and follow-up individuals who may have been exposed to known cases (i.e., contact tracing) varied across countries. Data from the Oxford COVID-19 Government Response Tracker reveal that Burkina Faso and Colombia are the only countries reported to have a policy for comprehensive contact tracing for all cases (**Table 2**). Bangladesh, DRC and Nigeria are reported not to have a government policy for contact tracing while Syria has a limited contact tracing policy where contact tracing is not conducted for all cases. Among the six countries,

Bangladesh was the only one where tracing policies varied over time; a comprehensive testing policy was reported for an earlier period. A key informant called contact tracing "partially mandated" in Nigeria, with contact tracing efforts being more extensive in some states than others. Unlike at the beginning of the pandemic, the current focus is on "very close" contacts of confirmed cases. It should be noted that the Oxford COVID-19 Government Response Tracker only reports data on manual contact tracing but not contact tracing apps. It should also be noted that the definition of what constitutes a contact varied across countries, further accentuating differences.

The absence of a contact tracing policy indicates a lack of systematic effort to identify, locate and test potential cases who may have been exposed to someone with COVID. However, it does not mean that contact tracing activities are not conducted. For instance, while there is no reported official tracing policy in Bangladesh, in its 28 June - 4 July WHO's Early Warning, Alert and Response System (EWARS) reported successfully tracing 2,251 contacts, 154 of whom tested positive during the incubation period (WHO & Bangladesh Ministry of Health and Family Welfare 2021). Contact tracing activities were also confirmed by a key respondent in Bangladesh, particularly in humanitarian settings through the work of the Rapid Investigation and Response Team. The key informant further noted that contact tracing activities were also conducted by telehealth centers.

Analysis of potential biases: The lack of a comprehensive contact tracing may lead to several potential biases:

- Underestimation of cases
- Underestimation of positivity ratio if those individuals are never tested
- Underestimation of mortality if individuals end up dying of COVID-19 without being diagnosed

Table 2. Government testing and contact tracing policies across the 6 countries*

	Bangladesh	**Burkina Faso**	**Colombia**	**DRC**	**Nigeria**	**Syria**
Testing policy	Open public testing - includes asymptomatic people	Testing of anyone showing COVID-19 symptoms	Testing of anyone showing COVID-19 symptoms	Testing only those who both have symptoms AND meet specific criteria	Testing only those who both have symptoms AND meet specific criteria	Testing only those who both have symptoms AND meet specific criteria
Report data	July 28, 2021	August 8, 2021	July 25, 2021	August 2, 2021	August 2, 2021	July 12, 2021

Contact tracing after a positive diagnosis policy	No contact tracing policy	Comprehensive contact tracing policy	Comprehensive contact tracing policy	No contact tracing policy	No contact tracing policy	Limited contact tracing policy; not done for all cases
Report data	July 28, 2021)	August 8, 2021	July 25, 2021	August 2, 2021	August 2, 2021	July 12, 2021

* Source: Oxford COVID-19 Government Response Tracker

Differences in testing processes and cases definitions:

Unit of analysis: The unit used to report testing varies by country. Bangladesh and Colombia report the number of "tests" conducted while Burkina Faso, DRC and Nigeria report the number of "samples tested". It is unclear if there is any difference between "tests" and "samples" across the six countries. It appears that in both cases, however, individuals may be tested more than once since the unit of analysis is not people tested.

What tests are used: With the exception of DRC where the information is unclear, and Syria where we have no information, the remaining countries use both PCR and the less sensitive antigen tests (rapid diagnostic tests or Ag-RDTs). However, only Bangladesh and Colombia clearly use both PCR and antigen tests results in their COVID-19 case definition. The use of both PCR and antigen test per national guidelines in Bangladesh was confirmed by a key informant. While Our World in Data (OWID) reports that Nigeria only uses PCR for testing and case definition, information from the Nigeria Centre for Disease Control (NCDC) suggests that both PCR and antigen testing may be used to define cases (Guidance on the use of Antigen Rapid Diagnostic Kits in Nigeria). This was also confirmed by a key informant. The guidance states that in high-prevalence settings such as healthcare settings (i.e., testing health care workers, testing patients with COVID-19 symptoms in hospitals triage areas, testing contacts of known cases), antigen testing can be used to confirm COVID infection. However, positive antigen testing in non-symptomatic patients' needs to be confirmed with a PCR. For Burkina-Faso, Key informants stated that while antigenic tests are conducted in Burkina Faso, only PCR results are taken into account when defining COVID-19 cases.

Definition of positive case: Differences in terms of the number of the tests that are reported relative to the total number of tests conducted and reasons for lack of reporting makes testing comparisons across countries challenging. Countries varied in their definitions of confirmed, suspect and probable cases with some countries following WHO's guidance for case definitions.

Reporting samples: Not all laboratories may report testing results to the higher authorities, and the degree of omission may vary by country. Nigeria's weekly COVID-19 situation report lists the number of laboratories ``without reports on number of samples tested this week". This list appears to refer to tests for returning passengers. For the period of July 26-August 1, for instance, 46 laboratories were listed. In DRC, the August 1st 2021 epidemiological bulletin reports that data was omitted from the bulletin for patients who were recently discharged from COVID treatment centers and for home-based patients. The bulletin further notes that up-to-date data is missing from "several provinces" and that current inconsistencies between national and provincial data are being addressed.

Mortality data and data on newly discharged patients are not up to date due to a strike by medical doctors.

Analysis of potential biases: Varied case definitions for COVID-19 cases across countries can lead to the following biases:

- An underestimation of cases due the use of less sensitive antigen tests
- Underestimation of the positivity ratio
- Unknown direction of the bias due to differences between results that are reported and those that are not

Table 3. Testing and case definitions*

	Bangladesh	**Burkina Faso**	**Colombia**	**DRC**	**Nigeria**	**Syria**
Source	Bangladesh Government	Burkina Faso Government	Colombia National Institute of Health	DRC Covid-19 Pandemic Response Multisectoral Committee	Nigeria Centre for Disease Control	*
Definition of testing indicator	Number of tests performed	Number of samples tested	Number of tests performed	Number of samples tested	Number of samples tested	*
Type of tests	PCR and antigen	PCR and antigen	PCR and antigen	Unclear	PCR (and antigen in bulletin)[b]	*
Case definition	PCR and antigen	Unclear	PCR and antigen	Unclear	PCR (and antigen in bulletin)[b]	*
Positivity rate	7-day rolling average (calculated)	*	7 day rolling average (from source)	7-day rolling average (calculated)	7-day rolling average (calculated)	*
Reports number of travelers tested		Yes [a]		No [a]	Yes [a]	
Pending test results included	Unclear	Unclear	Unclear	Unclear	Unclear	*

Retrospective revisions made by source	Unclear	Unclear	Unclear	Unclear	Yes	*

*Source: Our World in Data except where indicated
[a] Source: Burkina Faso COVID-29 update and Nigeria weekly situational report
[b] Nigeria Weekly situational report

Sex and age-disaggregated data: Data collected from COVerAGE-DB, an open-source database that includes COVID-19 cases, deaths and test by age and sex deaths, revealed that while reporting by sex varies across the six countries, reporting by age is consistent. While COVerAGE-DB does not include information for Syria, information for Syria was retrieved from the WHO Dashboard. Sex-disaggregated data is reported in Burkina Faso, Colombia, Nigeria, and Syria but not for Bangladesh.

While all countries report COVID cases and deaths by age, no country reports testing by age. However, in Bangladesh, a key informant noted that testing was lower among women, children, and people 60 years and older (compared to adult men).

The availability of sex and age disaggregated data could not be verified for DRC.

Analysis of potential biases: When comparing countries, lack of demographic data may lead to erroneous conclusions due to differing age structures. The direction of the bias is difficult to predict and will depend on the specific age structures of each country and the value of the age-specific indicators.

Table 4. Availability of data by age and sex [a]

Availability of data	**Bangladesh** *(as of 29 April 2021)*	**Burkina Faso** *(as of 30 June 2020)*	**Colombia** *(as of 2 July 2021)*	**DRC**	**Nigeria** *(as of 11 April 2021)*	**Syria** [b] *(as of 15 Aug 2021)*
Sex disaggregated	no	yes	yes	*	yes	yes
Cases by age	yes	yes	yes	*	yes	yes
Deaths by age	yes	yes	yes	*	yes	yes
Tests by age	no	no	no	*	no	no

[a] Source: COVerAGE-DB where indicated.
[b] Source: WHO Dashboard for Syria.
* Data not available in COVerAGE-DB. Data by age and sex not presented in government bulletin

Differences in COVID-19 mortality

COVID-19 mortality is either expressed in terms of number of deaths per population, case fatality ratio (mortality per number of confirmed cases) or excess mortality (difference between the number of deaths in specific time and the expected numbers of deaths in the same time period based on historical trends).

While WHO has developed guidance for the certification and classification of COVID-19 as cause of death, these guidelines are not followed by all countries, and differences in COVID-19 deaths definitions affect reported deaths and the validity of cross-country mortality comparisons(WHO, 2020). Countries vary significantly in terms of the way they record deaths in general, COVID-19 deaths, and how functional their registration systems are (Mwai, 2021). For instance, a survey conducted by the Economic Commission for Africa (ECA) revealed that on average, only one in three deaths is reported in official registration systems. In addition, 18 countries report the annual number of deaths. Finally, one in three countries use the standard international form for death certification and the latest ICD-10 coding of cause of death (Economic Commission for Africa 2017).

With the exception of Bangladesh and Colombia, countries do not provide much information on how they assess and calculate COVID-19 mortality on their websites. Colombia's Ministry of Health and Social Protection provides instructions for recording and coding COVID mortality on their website. The document further states that confirmed, probable and suspect cases are defined according to the WHO guidance (Colombia Instructions for recording, coding and reporting COVID-19, 2020). Bangladesh provides less detailed information but specifies that: "COVID-19 death is defined (for surveillance purposes) as a death resulting from a clinically compatible illness in a probable or confirmed COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID-19 disease (e.g., trauma). There should be no period of complete recovery between the illness and death. All deaths should be documented and reported." (Government of the People's Republic of Bangladesh, 2020)

Interviews with key informants in Burkina Faso and Nigeria provided some information on how COVID-19 mortality is assessed in the two countries. In Nigeria, a key informant noted that a death is counted as resulting from COVID-19 in three situations: 1. COVID-19 patients who died in hospitals intensive care units (ICU); 2. Patients who were diagnosed with COVID-19 and died before being admitted to ICUs; 3. asymptomatic contacts of confirmed cases who died before being tested for COVID-19. Hospital deaths are mainly reported by public facilities where most infected people receive care. Information from the Nigeria Centre for Disease Control further states that individuals with specific COVID-19 symptoms in the last 2 weeks and died without being diagnosed with COVID-19 are considered a probable COVID-19 case (Nigeria Centre for Disease Control, January 2021)

In Bangladesh and Burkina-Faso, based on information obtained from key informants, only individuals who had been diagnosed with COVID-19 prior to death are included in the calculation of COVID-19 mortality. Key informants from Bangladesh, Burkina-Faso and Nigeria all stated that COVID-19 mortality was underestimated due to unaccounted COVID-19 deaths in the community and some health facilities. In Bangladesh, for instance, the key informant noted that only COVID-19 patients who died in health facilities or who died in the community and were successfully tracked by telehealth centers are reported as COVID-19 deaths.

It is not clear if or how any of the six countries differentiate deaths where COVID-19 is the main cause of deaths from deaths where COVID-19 contributed to deaths or was a comorbidity.

Analysis of potential biases: Comparing mortality across countries requires taking into account the following potential sources of biases:

- Overestimation of case fatality ratio due to testing strategies focusing on symptomatic cases or serious cases only
- Underestimation of mortality as a failure to detect and report all COVID-19 deaths. The specific mortality measure used also affect cross-country comparisons
- Unknown direction of bias due to failure to report age specific mortality across countries

Differences in reporting times/processes and contextual issues

In addition to variations in measures and lack of information regarding the proportion of samples reported, countries vary in terms of reporting processes and timing. While information on processing times for test-results are not readily available in government documents, information obtained from key informants indicates that the time taken to obtain results varies by country and reason for testing. A key informant in Nigeria stated that travelers receive results within 12 to 24 hours, whereas it may take more than 48 hours for suspected cases to receive results. In Burkina Faso, key informants noted that results are usually available within 72 hours. In addition to variations in tests processing times and samples of tests reported, countries vary in terms of reporting processes and timing.

Comparisons are further complicated by the fact that different actors use different sources for COVID-19 data. International websites may publish different data for the same indicators. For instance, the Epidemic Intelligence from Open Sources (EIOS) comparison from the WHO website shows that data reported by WHO, European Center for Disease Control (ECDC), Johns Hopkins University for the same indicators may not be identical. Others have reported that international websites which collect data from governments, often publish data with some delay. They suggest that international websites use the data of the announcement as the date of the event although there may be several days of delay between a positive case diagnosis and the official announcement (Bonnet et al., 2021). Within countries, there may also be internal reporting delays. For instance, Burkina Faso tends to officially report data two days after the positive diagnosis or death.

Contextual factors that may have affected COVID-19 testing and the data reported include an ongoing medical doctor strike at the time of data collection in DRC, and a reported national laboratory staff strike in Burkina Faso in May 2021 (DRC, 2021; US Embassy in Burkina Faso, 2021). Further, humanitarian settings are subject to specific data collection and reporting challenges. Key informants reported data collection/reporting issues that may be specific to humanitarian settings including weak epidemiological surveillance, difficulty accessing surveillance data, due to insecurity and poorly functional health facilities

Analysis of potential biases: Differences in reporting times and processes may lead to biased comparisons with comparisons not reflecting the same time periods. The direction of the bias will depend on the specific nature of differences and reasons for the delay.

Discussion

Data on testing is central to understanding and tackling the pandemic. While it is generally accepted that COVID-19 cases are underestimated, underreporting varies greatly by country. All else equal, a country that conducts more testing will report more cases. Differences in testing strategies, capacity and access all affect cross-country comparisons and may lead to erroneous conclusions. The estimated proportion of asymptomatic COVID-19 cases varies greatly by country and has been reported to range from 5% to 80% (Heneghan, Brassey & Jefferson, 2020; Gudbjartsson et al., 2020, Lavezzo et al., 2020; Mizumoto et al. 2020; Rahmandad, Lim, & Sterman, 2021). Several biases will occur in countries that have a policy to only test individuals with COVID-19 like symptoms and individuals who meet certain criteria, or in countries that in practice only test serious cases. First, many asymptomatic infections will be missed, leading to an underestimation of the reported number of COVID-19 cases. Second, a higher proportion of those tested will be positive, leading to a higher positivity ratio (percentage of COVID-19 tests that are positive). All else equal among the six countries, based on testing policies, Bangladesh would report the highest number of cases and lowest positivity ratio and DRC, Nigeria and Syria would report the lowest number of cases and highest positivity ratio. Burkina Faso and Colombia would report intermediate numbers. In addition, countries that charge a fee for testing are likely to miss those who need a test but may not be able to afford it. This may lead to an underestimation of the cases and positivity ratios if those who cannot afford the test are infected with COVID-19. Furthermore, countries which test large numbers of travelers are likely to report a lower positivity ratio compared to countries that mostly test suspected cases.

The extent to which pending results are included is not specified in epidemiological bulletins. Furthermore, cross-country differences regarding the relative proportion of tests reported among all tests conducted makes comparisons challenging. Some countries indicate in their COVID-19 bulletins that some laboratories do not report data or that data is not up to data, whereas others do not provide any information. The direction of the bias will depend on differences between test results that are reported and those that are not.

Similarly, contact tracing is an important component of epidemiological surveillance and infectious disease control. While contact tracing has been reported to be an "imperfect tool" for COVID-19 control, it helps slow transmission, contain the virus and reduce COVID-19 mortality (Davis et al. 2021; Vecino-Ortiz et al. 2021). The lack of a comprehensive contact tracing policy may lead to an underestimation of cases, positivity ratio and or mortality. This would be the case if these contacts do not seek testing on their own and end up dying of COVID-19 without having been diagnosed with COVID-19.

Overall, available information suggests that COVID-19 burden varies within countries and is heavier in urban centers compared to rural areas (WHO Guidance for COVID-19 response in urban and rural settings). However, data suggest that geographic disparities in testing are also likely to affect reported cases. It can therefore not be ruled out that urban-rural disparities in COVID-19 may be partly attributed to differences in access to testing. The direction of the bias will depend on the prevalence of COVID-19 cases in the omitted or neglected areas. To ensure valid comparisons, countries should aim to provide information on testing practices and reporting practices, testing access and indicators definition.

Biased testing data may also lead to biased positivity ratios, cases and mortality. The positivity ratio has been used as a proxy for current levels of transmission and to ascertain whether enough testing is conducted in a given population. In May 2020, WHO recommended that the positivity ratio should remain at 5% or lower for at least 14 days before governments consider reopening (Dowdy and D'Souza, 2020). However, the positivity ratio can only provide valuable information if testing is widely and evenly accessed and testing data is reliable.

As far as COVID-19 case identification is concerned, cross-country comparisons are subject to several biases due to variability test practices and case definitions across countries. Nucleic acid amplification tests (NAAT) such as PCR are the gold standard for COVID-19 diagnosis. While the use of antigen tests increases the availability of testing and timeliness of results, they have a lower sensitivity (i.e. ability to detect a positive case) than the PCR tests (WHO Recommendations for COVID-19 testing, 2021; WHO Antigen-detection in the diagnosis of COVID-19, 2020; WHO Guidance for Antigen Rapid tests for COVID-19). Therefore, their use can lead to an underestimation of reported cases compared to the use of PCR tests. In addition, including pending test results the number of tests conducted will artificially inflate the denominator and therefore underestimate the positivity ratio

In addition, differences in the availability of demographic data across countries limits the ability to appropriately compare the impact of COVID-19 across populations. Demographic data are important for identifying inequities and understanding the impact of COVID across populations and guiding policies and resource allocation. COVID-19 morbidity and mortality are both more important in older age groups (Pan et al, 2020; Tang et al., 2020). While country A may have a lower death rate than country B, the age of those dying is important when comparing both countries in terms of mortality and case fatality ratios. With age-specific COVID-19 data, one can adjust data for age (i.e., standardization). Direct standardization allows better comparison of groups by assuming that groups have the same age distribution. Similarly, demographic data on testing may provide information on access to testing. If for instance, country A tests a low proportion of young people than country B, but the positivity ratio is very high in that group, this indicates that the reported cases in country A may be underestimated due to testing strategies.

In terms of mortality, there is evidence that the number of deaths attributed COVID-19 is underestimated (Abir et al 2021; Kung et al, 2020). Differences in terms of mortality assessment may lead to different biases when comparing data across countries. This analysis showed that while overall there was limited information about how COVID-19 related data was collected and reported, this was particularly pronounced for mortality data. In addition, reported mortality is affected by testing and case identification and the country's ability to detect and report COVID-19 deaths. Biased testing and case identification data will therefore translate into biased mortality data. More "generous" testing policies may lead to a higher number of mild cases being captured resulting in a lower fatality ratio. Inversely, a testing strategy that focuses on serious COVID -19 cases will lead to higher case fatality ratio. In addition, the extent to which COVID-19 deaths are defined and captured is likely to vary by country and affect reported mortality. All else equal, countries that are able to capture mortality in the public and private facilities as well as in the communities will report a higher mortality than countries that are only able to capture patients who died from government COVID-19 treatment centers for example.

Furthermore, the specific mortality measures that are used also affect cross-country comparison. Due to limitations of COVID-19 mortality data, excess mortality has been proposed as the most reliable mortality measure for cross country comparisons (Sinnathamby et al., 2020; Llyod-Sherlock et al 2021; Watson et al., 2021). However, obtaining estimates of all-cause mortality are challenging in many low- and middle-income settings, as well as in humanitarian settings where vital registration systems are not well developed. Finally, it is difficult to fully interpret mortality without information on age, sex and comorbidities.

It is important to address COVID-19 data quality and availability issues as accurate data and valid cross-country comparisons are important to forecast the pandemic's spread, tackle the pandemic and inform policy decisions and resource allocation including vaccine distribution. The COVID-19 Vaccines Global Access (COVAX) Facility co-led by Gavi (the Vaccine Alliance), the Coalition for Epidemic Preparedness Innovations (CEPI), and the WHO, aims to ensure "equitable access to COVID-19 vaccines for all countries." Under this initiative, wealthy countries purchase some of their vaccines supply through COVAX, which allows the later to negotiate deals with vaccine makers and wealthy countries, businesses and nonprofit organizations provide donations to support the allocation of COVID-19 vaccines to low- and middle-income nations. The COVAX plan includes two phases. In the first phase, COVAX allocates vaccine doses to countries proportional to the size of the population. Once each country has received doses for 20% of its population, COVAX plans to initiate the second phase of the initiative. During this second phase, vaccines will be allocated to countries based on "threat – the potential impact of COVID-19 on a country, assessed using epidemiological data - and vulnerability – the vulnerability of a country based on health systems and population factors." COVAX proposes to assess threat using information such as the reproductive number, the average number of secondary cases per primary case in a given time period (WHO Fair allocation mechanism for COVID-19 vaccines through COVAX).

It should be noted that there have been increasing concerns about whether the current proportional distribution scheme proposed by COVAX is ethical given differences in COVID-19 burden across countries. Some experts have called for COVAX to implement a distribution scheme based on the severity of the epidemic using mortality measures (Bollyky et al 2021, Herzog et al 2021, Ducharme 2021). This is particularly important given the low current vaccination coverage in low-income countries and reported delays in COVAX vaccine distribution (Ducharme 2021). It should also be noted that cross-country comparisons of COVID-19 epidemiological data such as mortality data are prone to significant levels of bias, as demonstrated throughout this report.

Several research limitations should be noted. The majority of findings relies on existing documents. It was not always possible to rule out the existence of more up to date documents if they were not posted online or available to iMMAP's country teams. In addition, the availability of documents and data varied across countries. Documents were more readily available for Bangladesh, Colombia and Nigeria compared to Burkina Faso, DRC, and Syria. Similarly, despite our best efforts, we were only able to interview respondents in two out of the six countries (Burkina Faso and Nigeria). This limited our ability to conduct more thorough cross-country comparisons. Another limitation is that while key informants provided some insight regarding COVID-related practices in Burkina Faso and Nigeria, it was not always possible to verify that the policies and guidance documents provided by governments have been implemented as intended. Data collection and practices differ across countries, but it is difficult to know exactly how they are different in practice. In addition, countries

often provide regular and sometimes daily announcements regarding the state of the pandemic, none of the countries included in this research have COVID-19 data on their websites. COVID-19 data is therefore often retrieved from international websites. However, different websites may provide slightly different data for the same indicators and time periods. Testing data was not available for Burkina Faso and DRC online and one would need to review daily epidemiologic bulleting and manually enter data for each day to obtain graphs.

This research would have benefitted from the involvement of researchers present in each of the six countries to ensure that up-to-date and complete information was included. Finally, data was collected at the start of the third wave of COVID-19 which saw a sharp increase in cases. Changes brought about by the third wave may not have been reflected in this research.

Recommendations

Based on the findings above, the following set of recommendations to improve the comparability are made to countries and researchers/policy makers:

To countries

- While it is understandable that standardization across countries is not always possible, consistent definitions and clear information on how indicators are defined and measured are needed to appropriately interpret data and make valid comparisons across countries. Countries should publish the definitions of the measures they use online and in their bulletins. Changes in definitions and measurement should also be documented and communicated.
- Countries should publish processes for data collection and reporting, including the size of the reporting sample and processing times. This information should be updated regularly.
- Countries should aim to publish COVID-19 data updates online using the same time interval and location (e.g., government website). Ideally, updates should be posted daily and any delay in reporting should be documented and explained.
- Countries should make COVID-19 datasets readily available online. The dataset should be updated using a set time interval (example twice a week).
- Countries should aim to document and communicate contextual factors that may affect the interpretation of the reported data (example medical staff or laboratory personnel strike)
- To ensure comparable data, countries should, whenever possible, publish multiple measures. For instance, both the number of tests conducted, and the number of people tested should be reported. If that is not possible, at a minimum, it should be specified whether the unit of analysis for testing is the total number of tests, or the total number of unique people tested. Countries with stronger registration systems should aim to publish excess mortality in addition to other mortality measures such as case fatality ratios.
- The number of tests and number of positive cases should be reported separately for travelers versus suspected cases.

Researchers/policy makers

- When comparing data across countries, the same data sources should be used to minimize differences in reporting (e.g., either government sources or the same international website). Any differences that could affect comparisons should be documented.

- International websites should specify the reason they omit data for certain countries or time periods (e.g., data not readily available, important data delays, data quality issues etc.) as well as their data collection practices (data source, frequency of update, processes to deal with discrepancies and data updates, timing for reporting data etc.)
- Local, regional, and international health organizations should stress the importance of data quality, comprehensiveness, reliability, and timeliness and provide support and guidance to strengthen data quality. This is particularly important as these data may be used in the future to inform resource allocation such as vaccine distribution.

Appendix A: Interview guide for semi-structured interviews with key informants

Testing and COVID cases identification

1. In practice, who is currently able to get tested for COVID-19 in [name of country]?
2. Are there geographical differences in terms of access to testing?
3. How long after testing, are results usually available?
4. How is a positive COVID-19 case defined for reporting purposes?
5. What do you think are the limitations of the data on the number of tests and the number of cases reported in [name of country]?

Contact tracing

6. How would you describe current efforts in terms of tracing contacts of COVID-19 cases in [name of country]?

Mortality

7. How is death from COVID-19 determined in [name of country]?
8. In your opinion, what are the limitations of the COVID mortality data that is reported for [name of country]

Humanitarian settings

9. What do you think there are tissues specific to humanitarian settings in [name of country] when collecting and reporting data?

References

Abaenogbe, T. Nigeria submitting to COVID-19, not winning the war – Experts.Daily Post. Published on February 25, 2021. https://dailypost.ng/2021/02/25/nigeria-submitting-to-covid-19-not-winning-the-war-experts/

Abir, Mahshid, Megan K. Beckett, Wenjing Huang, Hamad Al-Ibrahim, Joan Chang, Florian F. Schmitzberger, Kirstin W. Scott, and Peter S. Hussey, A Comparison of National and International Approaches to COVID-19-Related Measures. Santa Monica, CA: RAND Corporation, 2021. https://www.rand.org/pubs/research_reports/RRA438-1.html.

Bollyky TJ, Murray CJL, Reiner RC. Epidemiology, not geopolitics, should guide COVID-19 vaccine donations. The Lancet. 8 June 2021. doi:10.1016/ S0140-6736(21)013234.

http://www.healthdata.org/research-article/epidemiology-not-geopolitics-should-guide-covid-19-vaccine-donations

Center for Operational Analysis and Report (COAR). Syrian Public Health after COVID-19: Entry points and lessons learned from the pandemic response. March 2021. https://coar-global.org/2021/03/10/syrian-public-health-after-covid-19-entry-points-and-lessons-learned-from-the-pandemic-response/

Colombia Ministry of Health and Social Protection, Instructions for recording, coding and reporting of acute respiratory illness caused by a new coronavirus COVID-19, in the medical records of morbidity and mortality in the health system. 2020. https://www.minsalud.gov.co/Ministerio/Institucional/Procesos%20y%20procedimientos/PSPS01.pdf

Cousins S. Bangladesh's COVID-19 testing criticised. Lancet. 2020 Aug 29;396(10251):591. doi: 10.1016/S0140-6736(20)31819-5. PMID: 32861296; PMCID: PMC7836877. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7836877/

Davis, E. L., Lucas, T. C. D., Borlase, A., Pollington, T. M., Abbott, S., Ayabina, D., Crellen, T., et al. (2021). Contact tracing is an imperfect tool for controlling COVID-19 transmission and relies on population adherence. *Nature Communications, 12* (1)https://doi.org/10.1038/s41467-021-25531-5

Democratic Republic of Congo (DRC). SITUATION ÉPIDÉMIOLOGIQUE COVID-19 EN REPUBLIQUE DEMOCRATIQUE DU CONGO AU 01 AOÛT 2021. https://us3.campaign-archive.com/?u=b34a30571d429859fb249533d&id=7303e458f5

Democratic Republic of Congo (DRC). SITUATION ÉPIDÉMIOLOGIQUE COVID-19 EN REPUBLIQUE DEMOCRATIQUE DU CONGO AU 15 AOÛT 2021. https://us3.campaign-archive.com/?u=b34a30571d429859fb249533d&id=2792fabd95

Dong, E., Du, H., & Gardner, L. (2020). An interactive web-based dashboard to track COVID-19 in real time. The Lancet infectious diseases, 20(5), 533-534.

Dowdy D and D'Souza G. COVID-29 testing: understand the "percent positive". Johns Hopkins Bloomberg School of Public Health. August 10, 2020. https://publichealth.jhu.edu/2020/covid-19-testing-understanding-the-percent-positive

Ducharme Jamie. COVAX was a great idea, but is now 500 million doses short of its vaccine distribution. September 9, 2021. https://time.com/6096172/covax-vaccines-what-went-wrong/

Economic Commission for Africa. Report on the status of civil registration and vital statistics in Africa. ECA, Addis

Government of the People's Republic of Bangladesh. National Guidelines on Clinical Management of COVID-19. Version 8.0. 5 November 2020

Gudbjartsson DF, Helgason A, Jonsson H, Magnusson OT, Melsted P, Norddahl GL, Saemundsdottir J, Sigurdsson A, Sulem P, Agustsdottir AB (2020) Spread of SARS-CoV-2 in the Icelandic population. New England Journal of Medicine 382(24):2302-2315

Hannah Ritchie, Esteban Ortiz-Ospina, Diana Beltekian, Edouard Mathieu, Joe Hasell, Bobbie Macdonald, Charlie Giattino, Cameron Appel, Lucas Rodés-Guirao and Max Roser (2020) - "Coronavirus Pandemic (COVID-19)". *Published online at OurWorldInData.org.* https://ourworldindata.org/coronavirus'Accessed August 4, 22021

Hasell, J., Mathieu, E., Beltekian, D. et al. A cross-country database of COVID-19 testing. Sci Data 7, 345 (2020). https://doi.org/10.1038/s41597-020-00688-8

Heneghan C, Brassey J, Jefferson T. COVID-19: What Proportion are Asymptomatic? 2020 . The Centre for Evidence-bsed medicine. https://www.cebm.net/covid-19/covid-19-what-proportion-are-asymptomatic/.

Herzog L M, Norheim O F, Emanuel E J, McCoy M S. Covax must go beyond proportional allocation of covid vaccines to ensure fair and equitable access *BMJ* 2021; 372:m4853 doi:10.1136/bmj.m4853. https://www.bmj.com/content/372/bmj.m4853

iMMAP/DFS. COVID-19 Analyse de Situation Burkina Faso. May 2021. https://immap.org/product/may-2021-covid-19-situation-analysis-report-burkina-faso/

Kung S, Doppen M, Black M, Braithwaite I, Kearns C, Weatherall M, Beasley R, Kearns N. Underestimation of COVID-19 mortality during the pandemic. ERJ Open Res. 2021 Feb 15;7(1):00766-2020. doi: 10.1183/23120541.00766-2020. PMID: 33614772; PMCID: PMC7734715

Lavezzo E, Franchin E, Ciavarella C, Cuomo-Dannenburg G, Barzon L, Del Vecchio C, Rossi L, Manganelli R, Loregian A, Navarin N (2020) Suppression of a SARS-CoV-2 outbreak in the Italian municipality of Vo'. Nature 584(7821):425-429

Lloyd-Sherlock P, Sempe L, McKee M, Guntupalli A. Problems of Data Availability and Quality for COVID-19 and Older People in Low- and Middle-Income Countries. Gerontologist. 2021 Feb 23;61(2):141-144. doi: 10.1093/geront/gnaa153. PMID: 33017839; PMCID: PMC7665497. https://www.ncbi.nlm.nih.gov/pmc/articles/pmid/33017839/

Mizumoto K, Kagaya K, Zarebski A, Chowell G (2020) Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020. Euro Surveill 25(10)

Mwai P. Coronavirus: Africa infections rising sharply in worst-affected countries (Available from: https://www.bbc.com/news/world-africa-53181555). Last accessed: November 11. 2021.

Nigeria Centre for Disease Control (NCDC). An update of COVID-19 outbreak in Nigeria. 29 October 2021. https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria

Nigeria Centre for Disease Control (NCDC). Case Definitions for Coronavirus Disease. January 2021.https://covid19.ncdc.gov.ng/media/files/COVID-19_Case_Definition_Janary_2021_hN90uuA.pdf.

Nigeria Centre for Disease Control (NCDC). One Year After: Nigeria's COVID-19 Public Health Response (February 2020 – January 2021). February 2021. https://covid19.ncdc.gov.ng/media/files/COVIDResponseMarch1.pdf

Nigeria Presidential Task Force on COVID-19. COVID-19 Response: Provisional Quarantine Protocol for travelers arriving in Nigeria from any Country. September 4th, 2020. https://fmic.gov.ng/covid19-response-provisional-quarantine-protocol-for-travelers-arriving-in-nigeria-from-any-country/

Our World in Data. Coronavirus (COVID-19) Testing. https://ourworldindata.org/coronavirus-testing#our-checklist-of-questions-to-understand-testing-data

Pan A., Liu L., Wang C., Guo H., Hao X., Wang Q. Association of public health interventions with the epidemiology of the COVID-19 outbreak in Wuhan, China. JAMA. 2020 doi: 10.1001/jama.2020.6130. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7149375/

Rahmandad, H., Lim, TY., Sterman, J., Behavioral Dynamics of COVID-19: Estimating Under-Reporting, Multiple Waves, and Adherence Fatigue Across 92 Nations, System Dynamics Review, https://ssrn.com/abstract=3635047 or http://dx.doi.org/10.2139/ssrn.3635047

Sinnathamby, M. A. et al. All-cause excess mortality observed by age group and regions in the first wave of the COVID-19 pandemic in England. *Euro Surveill.* **25**, 2001239 (2020). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7376843/

Tang, D., Comish, P., & Kang, R. (2020). The hallmarks of COVID-19 disease. Plos Pathogens, 16(5), e1008536. https://doi.org/10.1371/journal.ppat.1008536

US Embassy in Burkina Faso. Alert: Laboratory staff on srtikre-COVID testing impacted. 18 May 2021. https://bf.usembassy.gov/alert-laboratory-staff-on-strike-covid-testing-impacted/

Thomas Hale, Noam Angrist, Rafael Goldszmidt, Beatriz Kira, Anna Petherick, Toby Phillips, Samuel Webster, Emily Cameron-Blake, Laura Hallas, Saptarshi Majumdar, and Helen Tatlow. (2021). "A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker)." Nature Human Behaviour. https://doi.org/10.1038/s41562-021-01079-8

Vanguard News Nigeria. Nigeria needs policy review on COVID-19 testing. Editorial. Published January 6th 2021. https://www.vanguardngr.com/2021/01/nigeria-needs-policy-review-on-covid-19-testing/

Watson, O.J., Alhaffar, M., Mehchy, Z. et al. Leveraging community mortality indicators to infer COVID-19 mortality and transmission dynamics in Damascus, Syria. Nat Commun 12, 2394 (2021).. https://www.nature.com/articles/s41467-021-22474-9#citeas

WHO. Antigen-detection in the diagnosis of SARS-CoV-2 infection (2021). https://www.who.int/publications/i/item/antigen-detection-in-the-diagnosis-of-sars-cov-2infection-using-rapid-immunoassays

WHO. COVID-19 Case definition (2020). https://www.who.int/publications/i/item/WHO-2019-nCoV-Surveillance_Case_Definition-2020.2

WHO. COVID-19 Dashboard Syrian Arab Republic. 18 November 2021. https://app.powerbi.com/view?r=eyJrIjoiNmY5OGYzNDYtNjZhMy00MWIyLWIyMzctYzc4MmI3ZDNlODk5IiwidCI6ImY2MTBjMGI3LWJkMjQtNGIzOS04MTBiLTNkYzI4MGFmYjU5MCIsImMiOjh9

WHO. Guidance Document for a Differentiated Response to COVID-19 Outbreak in Urban and Rural settings (2020). https://www.afro.who.int/sites/default/files/Covid-19/Techinical%20documents/Guidance%20Document%20for%20a%20Differentiated%20Response%20to%20COVID-19%20Outbreak%20in%20Urban%20and%20Rural%20settings.pdf

WHO. Guidance for Implementation of Antigen Rapid Diagnostic Tests for COVID-19 (2021)

https://www.afro.who.int/sites/default/files/Covid-19/Techinical%20documents/Guidance%20for%20Implementation%20of%20Antigen%20Rapid%20Diagnostic%20Tests%20for%20COVID-19.pdf

WHO. International guidelines for certification and classification (coding) of COVID-19 as cause of death (2020). https://www.who.int/classifications/icd/Guidelines_Cause_of_Death_COVID-19.pdf

WHO. COVID-19 Portal Countries and Territories. Accessible at: https://portal.who.int/report/eios-covid19-counts/#display=Countries_and_Territories&nrow=2&ncol=3&arr=row&pg=1&labels=&sort=cur_case_who;desc&filter=&sidebar=4&fv=. Last Accessed: November 11, 2021

WHO. Recommendations for national SARS-CoV-2 testing strategies and diagnostic capacities (2021). https://www.who.int/publications/i/item/WHO-2019-nCoV-lab-testing-2021.1-eng

World Health Organization and the Bangladesh Ministry of Health and Family Welfare. Epidemiological Highlights Week 26 (28Jun-4Jul 2021). https://reliefweb.int/report/bangladesh/bangladesh-epidemiological-highlights-week-26-28-jun-4-jul-2021Accessed August 5th, 2021. https://reliefweb.int/sites/reliefweb.int/files/resources/ewars-w26-2021.pdf

World Health Organization and the Bangladesh Ministry of Health and Family Welfare. Epidemiological Highlights Week 26 (28Jun-4Jul 2021). https://reliefweb.int/sites/reliefweb.int/files/resources/ewars-w26-2021.pdf

The outbreak of disease caused by the virus known as Severe Acute Respiratory Syndrome (SARS-CoV-2) or COVID-19 started in China in December 2019. The virus quickly spread across the world, with the WHO Director-General declaring it as a pandemic on March 11th, 2020.

The virus' impact has been felt most acutely by countries facing humanitarian crises due to conflict and natural disasters. As humanitarian access to vulnerable communities has been restricted to basic movements only, monitoring and assessments have been interrupted.

To overcome these constraints and provide the wider humanitarian community with timely and comprehensive information on the spread of the COVID-19 pandemic, iMMAP initiated the COVID-19 Situational Analysis project with the support of the USAID Bureau of Humanitarian Assistance (USAID BHA), aiming to provide timely solutions to the growing global needs for assessment and analysis among humanitarian stakeholders.

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