West African Health Organisation (WAHO)

HEALTH INFORMATION BULLETIN N°001

One year with COVID-19 pandemic in the ECOWAS Region

WAHO Health Information System Unit

August 2021

TABLE OF CONTENTS

List of tables 3
List of figures 3
1 Introduction 4
2 Methods 4
2.1 Study setting 4
2.2 Source of data 5
2.3 Study period 6
2.4 Statistical analysis 6
3 Results 6
3.1 Total number of cases and cumulative incidence 6
3.2 COVID-19 incidence cases during the first year 8
3.3 Deaths from COVID-19 during the first year 13
3.4 Effective reproductive number 17
3.5 Case detection and testing 20
3.6 Public health and non-pharmaceutic response to the pandemic 20
4 Discussion and conclusion 23
5 References 25

LIST OF TABLES

Table 1: Summary of the COVID-19 pandemic situation in the ECOWAS region after one year (March 2020 – March 2021) 7
Table 2: Distribution of main comorbidities associated with COVID-19 deaths (%). 17
Table 3: Different testing indicators per country 20
Table 4: Countries non pharmaceutical health measures undertaken by countries to control COVID-19 expansion in the ECOWAS region 22

LIST OF FIGURES

Figure 1: Presentation of the ECOWAS region 5
Figure 2: Snapshot of WAHO COVID-19 dashboard 5
Figure 3: COVID-19 cumulative incidence rate per million population by country as at 31st March 2021 8
Figure 4: Number of daily new cases 9
Figure 5: Evolution of the number of COVID-19 confirmed cases during the first year of the pandemic by country 10
Figure 6: Evolution of the incidence rate of all ECOWAS countries during the first year of the pandemic 11
Figure 7: Evolution of the number of COVID-19 incident cases during the first year of the pandemic by country 12
Figure 8:COVID-19 case fatality rate (%) by country as at 30th March 2021 13
Figure 9: Evolution of the Case Fatality Rate (%) in the ECOWAS region during the first year with COVID-19 14
Figure 10: Evolution of COVID-19 case fatality rates during the first year with the pandemic in ECOWAS states 15
Figure 11: Gender distribution of COVID-19 deaths for some countries (%) 16
Figure 12: Age distribution of COVID-19 cases in some countries 17
Figure 13: Estimation of the effective reproductive number at regional level during the first year with COVID-19 outbreak 18
Figure 14: Evolution of the COVID-19 effective reproductive number in the ECOWAS countries 19
Figure 15: Mode of quarantine for contacts and travellers and mode of isolation of asymptomatic cases by country in the region 21

1 INTRODUCTION

The West African region, through its Health Economic Community, has organised itself to deal with the COVID-19 pandemic, since its outbreak in 2019. Preparations to address OVID-19 began with a regional meeting of Health Ministers held on 14th February 2020 in Bamako, before the first cases were detected in the region. The meeting resulted in producing/outlining the ECOWAS regional approach to address COVID-19. This joint regional approach included among others, the development of a regional plan and the establishment of a coordination, communication and collaboration mechanism between the different countries. It also included the improvement of cross-border surveillance, the strengthening of risk communication, the acquisition of critical equipment for countries to ensure better case management and finally to accelerate the training of personnel.

Since this date, the West African Health Organization (WAHO), in collaboration with many partners, has rapidly put in place several strategies to collect data, mobilize funds, strengthen surveillance and training of health actors, and to facilitate exchange and sharing of COVID-19 data between countries. The first COVID-19 case in the ECOWAS region, was identified in Lagos on 27 February 2020 (Nigerian Center for Disease Control (NCDC) 2020) and throughout March 2020 all 15 countries in the region reported their first case. The last country to report its first case was Sierra Leone on 31 March 2020 (WHO, Regional Office for Africa 2020). One year after the pandemic occurred in the region, what have been the dynamics of the epidemic and the response of the countries? Publications have attempted to provide answers at country (Abubakar et al. 2021; Quakyi et al. 2021), sub-regional (Mongbo et al. 2021; Sombié et al. 2020; Lokossou et al. 2020; Bonnet et al. 2020) and continental (Salyer et al. 2021; Cabore et al. 2020; Medinilla, Byiers, and Apiko 2020) levels. These studies have shown several differences in countries in terms of morbidity, mortality, and response to the pandemic. Information was lacking on the demographic profile of cases and especially a comparative analysis of the evolution of the pandemic and mortality. Also, most of the publications did not cover the entire first year and did not focus solely on all the 15 ECOWAS countries, which share a regional economic space with dynamic and functional institutions that allow for frequent exchanges between countries and collegial and harmonised decision-making to deal with public health situations. This economic area also presents an economic, cultural, linguistic, demographic and health context that differs between countries.

This work has been undertaken by the West African Health Organisation (WAHO) to analyse the status of the pandemic after one year in terms of the evolution of morbidity and mortality in the countries and also the factors that may have contributed to this evolution.

2 METHODS

2.1 Study setting

The Economic Community of West African States, also known as ECOWAS (CEDEAO in French), is a regional political and economic union of fifteen countries located in West Africa. Collectively, these countries comprise an area of 5,114,162 km2 (1,974,589 sq mi) and had an estimated population of around 387 million as of 2020. ECOWAS has 15 member states namely Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Eight of these are French-speaking, five are English-speaking, and two Portuguese-speaking.



Figure 1: Presentation of the ECOWAS region

Several ECOWAS countries including Niger, Mali and Burkina Faso are among the poorest countries on the continent according to the 2020 UNDP Human Development Index ranking. Similarly, health indicators in terms of infant and maternal mortality are among the most worrying in the world and the health systems of these countries are poorly organized to deal with pandemics such as COVID-19.

2.2 Source of data

The epidemic data was collected on the WAHO epidemic platform. Up to date information and analytic visualizations can be obtained on: https://data.wahooas.org/outbreaks/ (Figure 2)

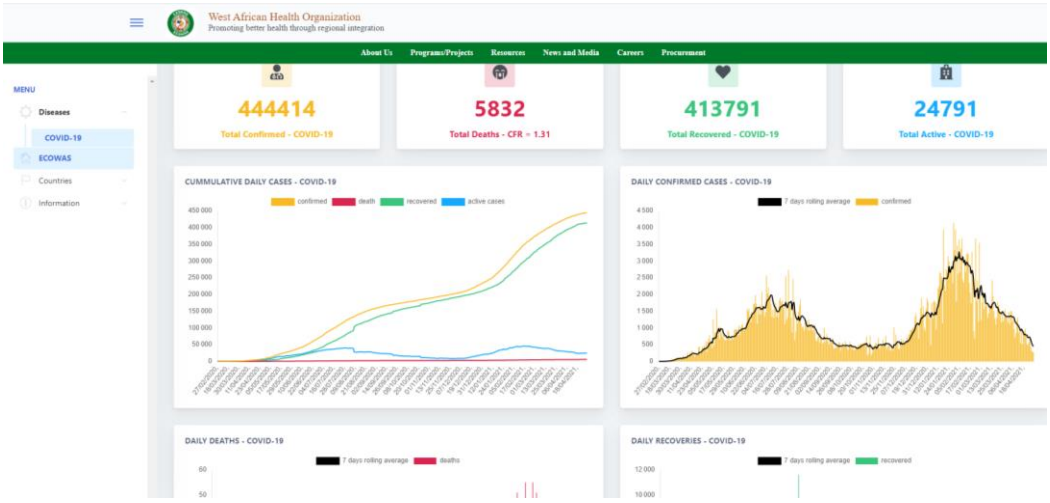


Figure 2: Snapshot of WAHO COVID-19 dashboard

The platform is fed on daily basis by data based on the countries' situation reports. The data used in these documents are those validated and shared by the respective ministers of health and contain information on the number of new cases, new deaths, and new discharged cases. They are available either as single documents shared by email or by social media or in national official platforms. According to the

information the country publishes, other variables such as number of tests performed are collected. However, as sometimes this information is not published, crosschecks with other data sources were made in order to validate the data and provide consistent reliable information.

Information on public health and social measures (PHSMs) are provided by WAHO staff. In fact, WAHO has assigned each of the 15 countries in the community to a staff. This person serves as liaison person, collecting the information and the requests from the countries and bringing them to discussion at a higher level in the institution. These resource persons agreed to provide summaries all national responses to covid19 in their respective countries. This information was triangulated with data gathered and made publicly available by the OECD (CSAO 2021) and Oxford University (Oxford University 2021).

For testing strategies, we calculated the testing ratio, representing the number of tests performed per one million population. This considers the total number of tests declared by the country, including multiple tests for one person. The number of tests by confirmed case is also calculated. These are the main indicators monitored by the Africa CDC (Salyer et al. 2021). They consider that the optimal number of tests by case, as recommended by the WHO is between 10 and 30.

2.3 Study period

The period used for data analysis was one year, beginning from the date of the first confirmed case in the ECOWAS region which was 27th Feb. 2020 to 31st Mar. 2021).

2.4 Statistical analysis

Descriptive analyses were done on key indicators. The daily incidence rate (DIR) was calculated as the number of new cases per one million population. Cumulative incidence rates (CIR) were calculated as the number of total cases by one million population for comparison reasons. Case fatality rates (CFR) were calculated as the number of deaths reported per 100 confirmed cases. Trend analysis were performed for case incidence and fatality. The daily information were smoothed using a general additive model (GAM) smoother(Lin and Zhang 1999).

The effective reproductive number is defined as a function of time and is the actual average number of secondary cases per primary case (Wallinga and Teunis 2004). The *EpiEstim* package (A. Cori, Ferguson, and Fraser 2019; Anne Cori et al. 2013) was used for the parameters estimations. This uses a two-step procedure to estimate the effective reproduction number from data informing the serial interval and from data on the incidence of cases over time (Thompson et al. 2019). The dates of confirmation were used for the estimation as the date of infection could not be obtained. The serial interval was simulated as an undefined distribution with expectation of the mean 3.6 days and expectation of the standard deviation of 3 days. The serial interval and the reproductive number are simulated using a Monte Carlo approach.

3 RESULTS

3.1 Total number of cases and cumulative incidence

The first case of COVID-19 in the region was confirmed on 27th February 2020 in Lagos State, Nigeria (Nigerian Center for Disease Control (NCDC) 2020). Then, all the fourteen other countries got their new confirmed cases in the following month. The latest country which confirmed a COVID-19 case was Sierra Leone (31st March 2020) (WHO, Regional Office for Africa 2020). The Table 1 presents a summary of the key indicators for all the countries exactly one year after the first case was confirmed in Sierra Leone.

Table 1: Summary of the COVID-19 pandemic situation in the ECOWAS region after one year (March 2020 – March 2021)

COUNTRY	DATE 1ST CASE	POPULATION[1]	CONFIRMED CASES	CUMULATIVE INCIDENCE RATE	DEATHS	CFR
ECOWAS	**02/27/2020**	**386,908,402**	**429,760**	**1,110.75**	**5,620**	**1.31**
NIGERIA	02/27/2020	200,963,599	160,493	798.62	2,012	1.25
SENEGAL	03/02/2020	16,296,364	38,399	2,356.29	1,032	2.69
TOGO	03/06/2020	8,082,366	10,249	1,268.07	109	1.06
BURKINA FASO	03/09/2020	20,321,378	12,748	627.32	149	1.17
COTE D'IVOIRE	03/11/2020	25,716,544	43,542	1,693.15	242	0.56
GHANA	03/12/2020	30,417,856	89,893	2,955.27	734	0.82
GUINEE	03/12/2020	12,771,246	20,083	1,572.52	127	0.63
BENIN	03/16/2020	11,801,151	7,100	601.64	90	1.27
THE GAMBIA	03/17/2020	2,347,706	5,485	2,336.32	165	3.01
CABO VERDE	03/20/2020	549,935	17,121	31,132.77	165	0.96
NIGER	03/20/2020	23,310,715	5,003	214.62	186	3.72
GUINE BISSAU	03/24/2020	1,920,922	3,634	1,891.80	61	1.68
LIBERIA	03/24/2020	4,937,374	2,042	413.58	85	4.16
MALI	03/24/2020	19,658,031	9,998	508.60	384	3.84
SIERRA LEONE	03/31/2020	7,813,215	3,970	508.11	79	1.99

After one year of the pandemic, 429,760 persons were confirmed having COVID-19 infection in ECOWAS member States with 5,620 deaths. According to the number of reported cases, Nigeria followed by Ghana, Côte d'Ivoire, Senegal, and Guinea are the countries where most of the cases were reported.

The cumulative COVID-19 case incidence showed that after 1 year of the epidemic, the region counted 1,111 cases per million inhabitants. There is a difference between countries. Cabo Verde presented highest incidence, while Niger had the lowest. More than eight countries (Cabo Verde, Ghana, Gambia, Senegal, Guinea Bissau, Côte d'Ivoire, Guinea, and Togo) had an incidence over 1,000 cases per million. Figure 3 shows the countries per group of cumulative incidences.

[1] 2019 population from World Bank estimation: https://data.worldbank.org/indicator/SP.POP.TOTL

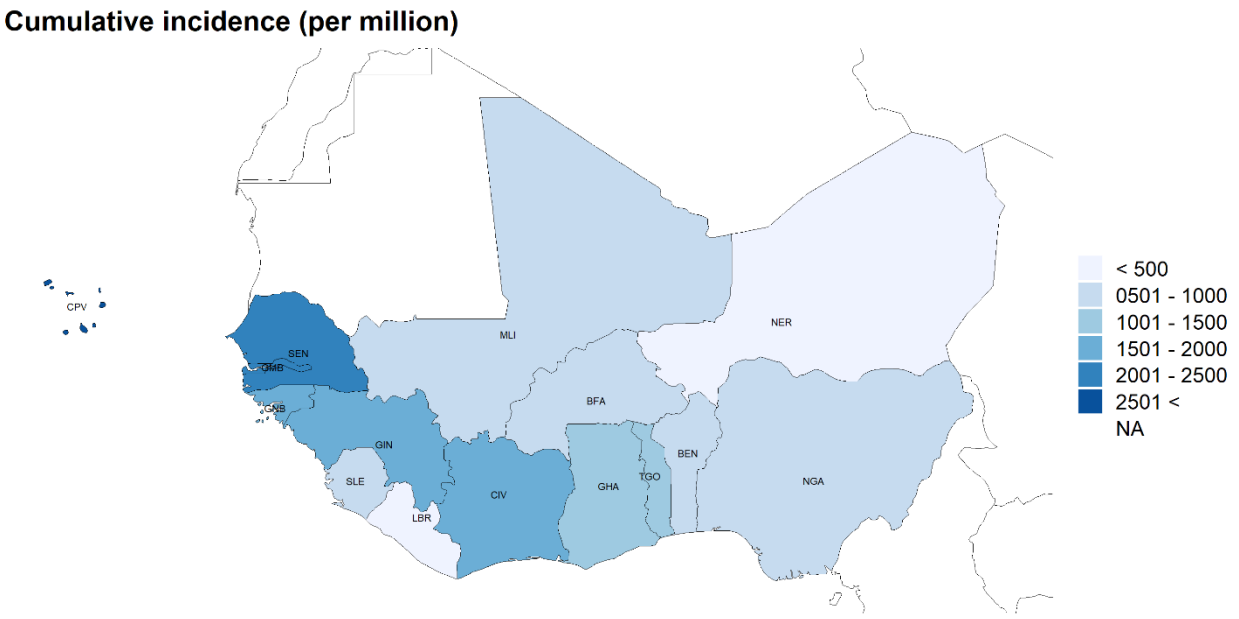


Figure 3: COVID-19 cumulative incidence rate per million population by country as at 31st March 2021

3.2 COVID-19 incidence cases during the first year

Figure 4 shows the trend of the new daily cases within the entire ECOWAS region from February 2020 to March 2021. Two epidemic waves can be noticed. The first one occurred between April and October 2020 with the peak observed early in July 2020. The second wave, that was most important compared to the first, started at the end of November 2020 with the peak around February 2021.

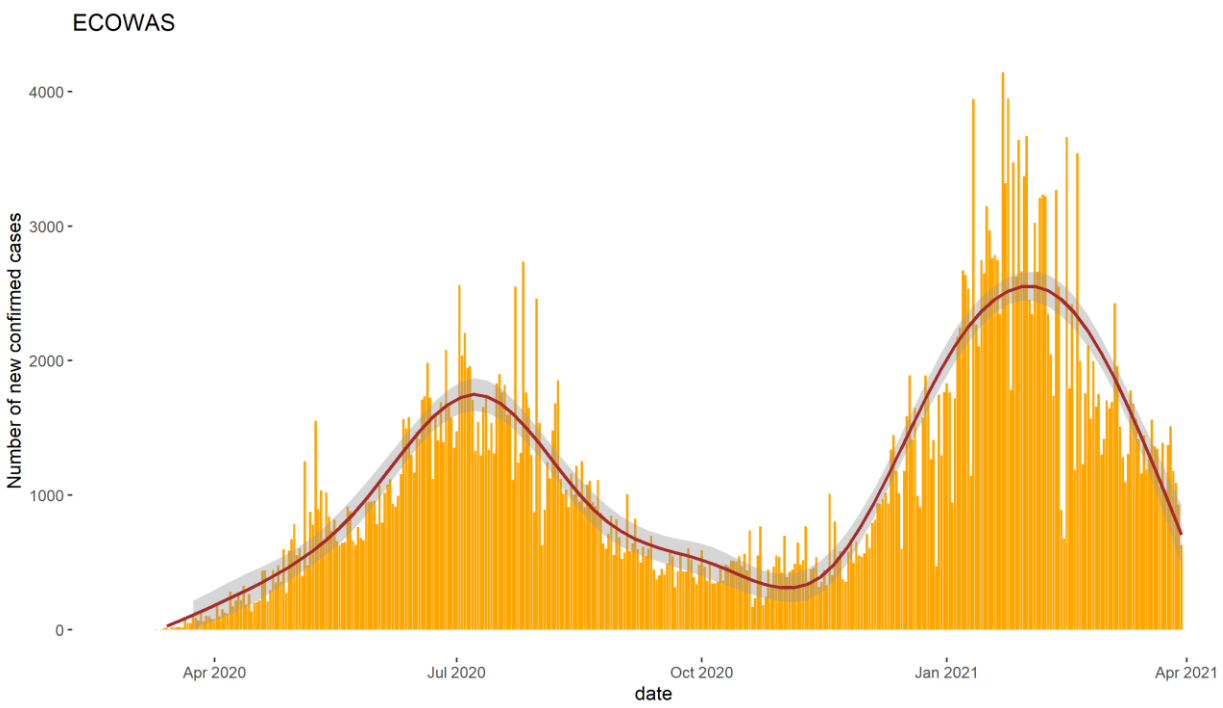


Figure 4: Number of daily new cases

Figure 5 presents the evolution of new daily COVID-19 cases for each of the 15 ECOWAS countries. Four groups can be observed. The first group of countries have the regional pattern. These countries generally present the larger number of cases and influence the pooled data. The pattern is the two major waves, the first presenting a peak around July 2020 and the second one in February 2021. Nigeria, Ghana, and Senegal are the main representative of such groups. The second group presents more than two peaks. As for Burkina Faso, two small waves were observed in May and October 2020 before the larger one in February 2021. Mali, Niger, and Sierra Leone present this specific pattern with a starting third wave. The third group includes countries like Cabo Verde and Guinea, where the first wave didn't really end before the occurrence of the next. This means that as the transmission start decreasing, another wave occurs and the curve restart increasing. Finally, for the last group of countries like Guine-Bissau, Togo and Benin there have not been epidemic waves.



Figure 5: Evolution of the number of COVID-19 confirmed cases during the first year of the pandemic by country

Daily incidence rates are presented in Figure 6. One country is presenting a very high incidence rate, Cabo Verde. The others are at a comparable level. The country wise details can be observed in Figure 7.

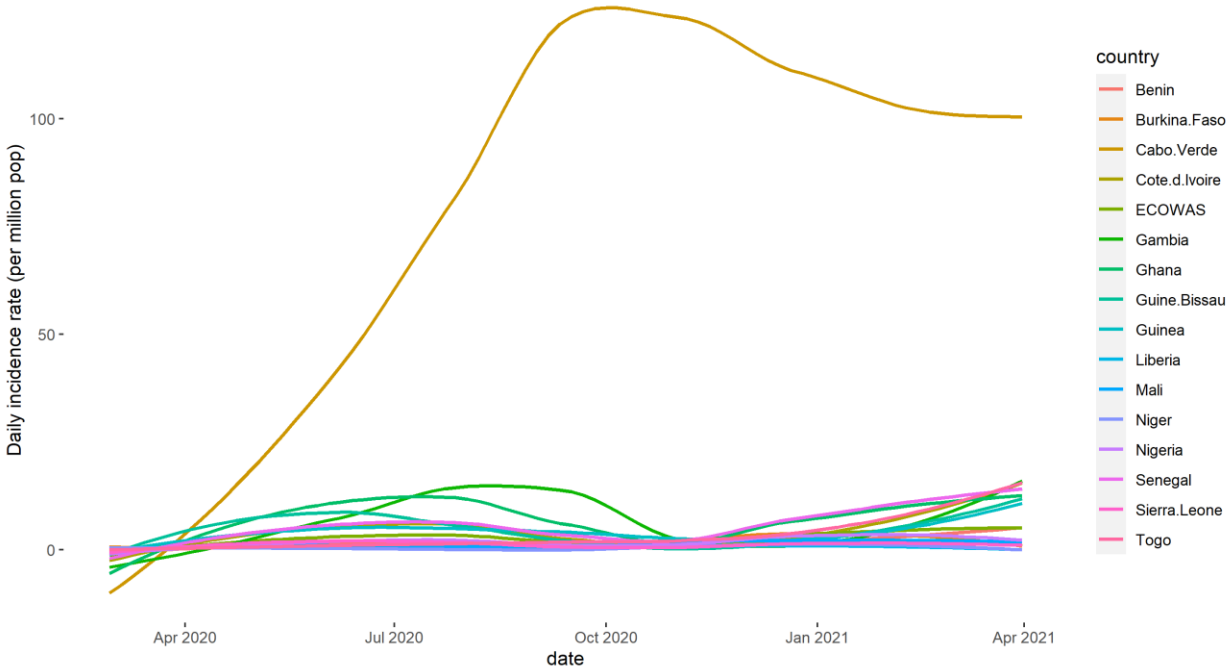


Figure 6: Evolution of the incidence rate of all ECOWAS countries during the first year of the pandemic

.

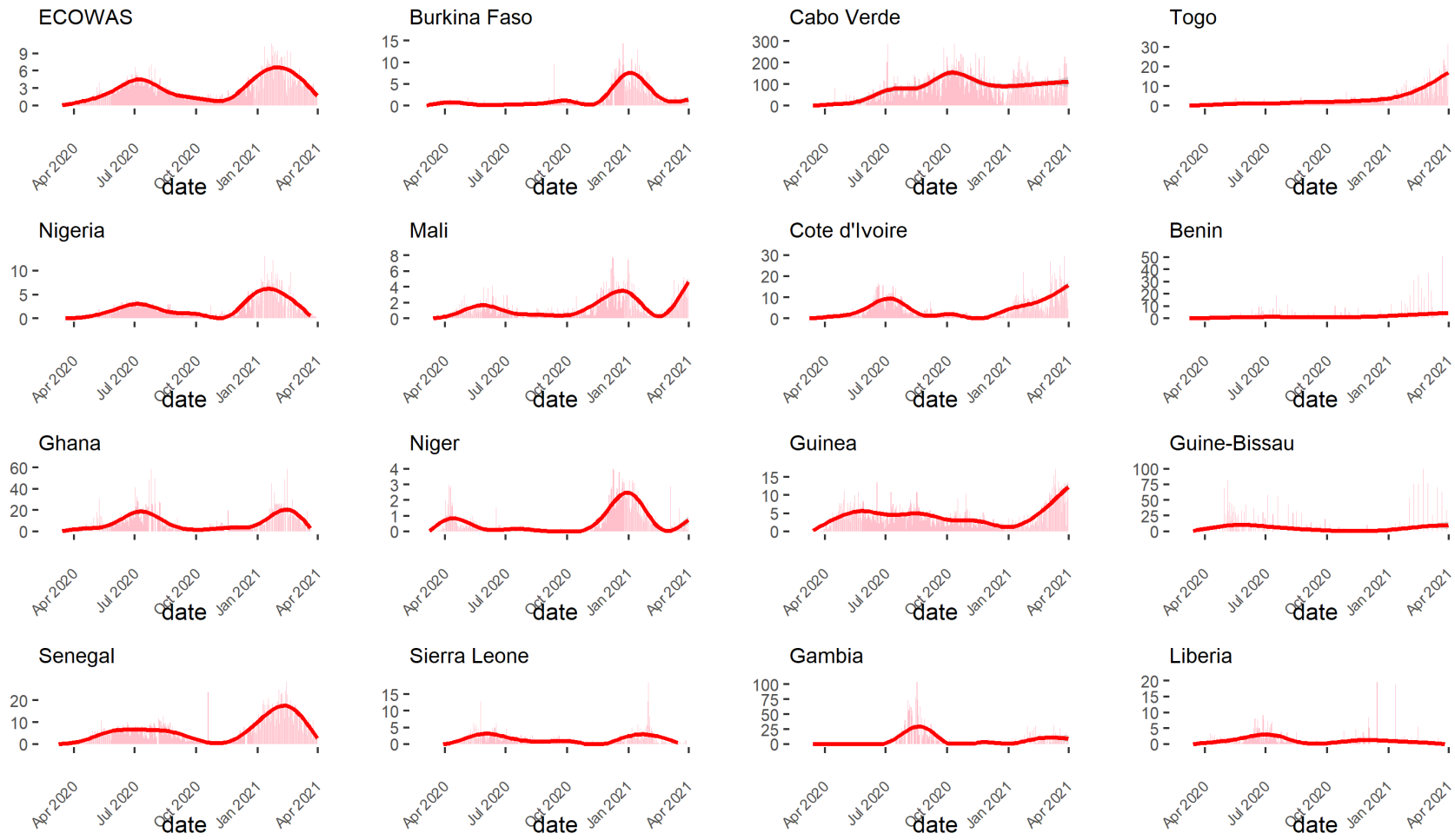


Figure 7: Evolution of the number of COVID-19 incident cases during the first year of the pandemic by country

3.3 Deaths from COVID-19 during the first year

One year after the epidemic in the ECOWAS region, 1.31% of all the confirmed cases were deceased. The case fatality rate is quite different from one country to another (Figure 8). The lowest fatalities are observed in Côte d'Ivoire, Guinea, Ghana and Cabo Verde. The highest case fatality rate was in Liberia (4.16%). We did not find any relationship between the fatality rate and the number of cases or the cumulative incidence.

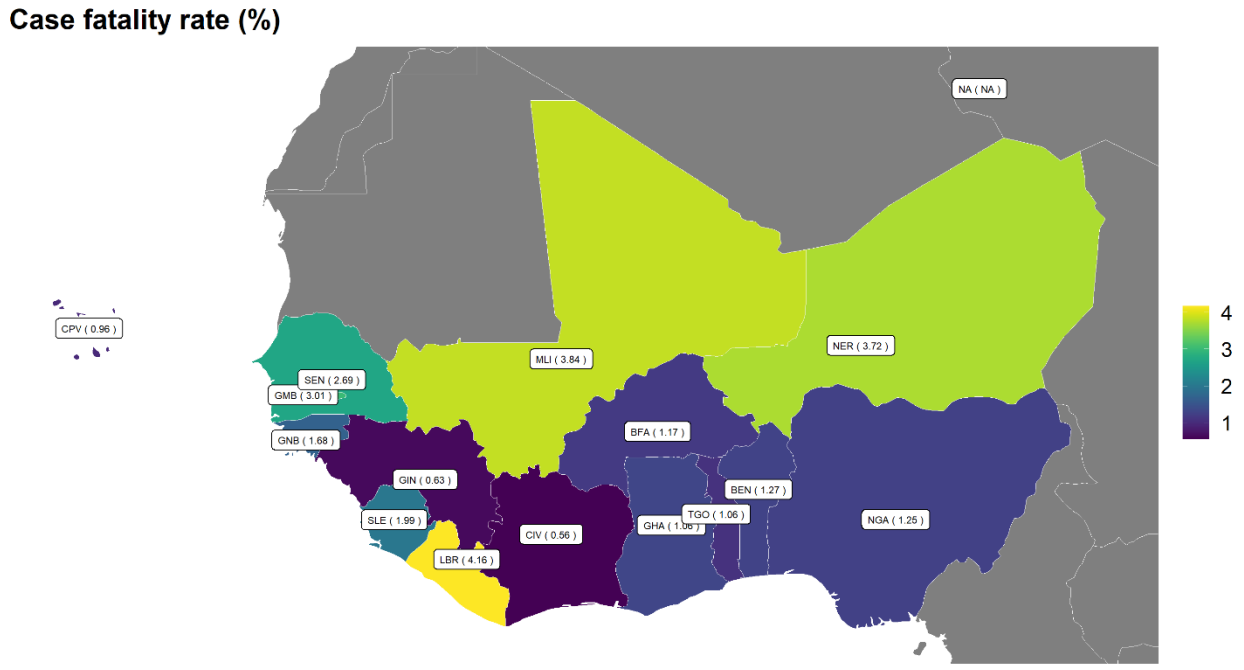


Figure 8:COVID-19 case fatality rate (%) by country as at 30th March 2021

The trend of the fatality rate showed an increasing very rapidly between March and April (Figure 9). In May and June, it was nearly 3% of the confirmed cases (more than 6% in Togo, Mali, Liberia, Burkina Faso). It then decreases to a plateau value since August and September which usually corresponds to the value represented Figure 8.

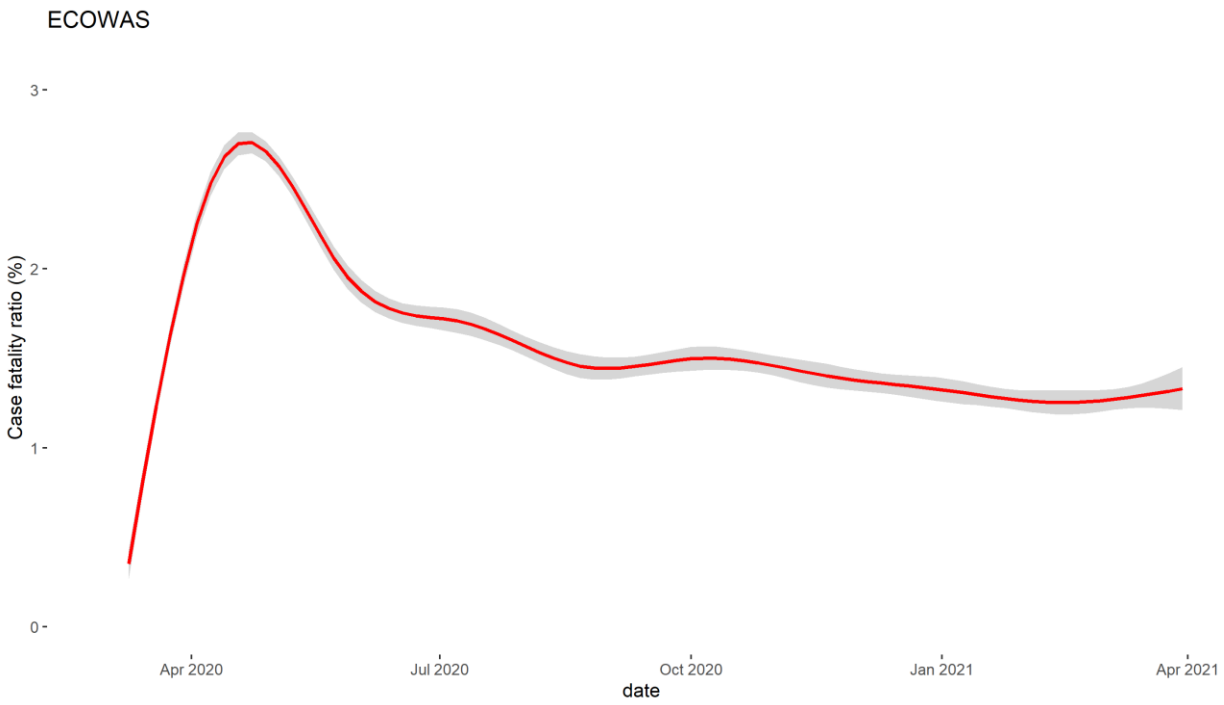


Figure 9: Evolution of the Case Fatality Rate (%) in the ECOWAS region during the first year with COVID-19

Figure 9 presents the evolution of the case fatality rate for each country and in the region. Some countries show steady trends, which are questionable. We have the example of Guine-Bissau and Senegal. If the curve in Guine-Bissau seems to have reached the peak in January, this is not the case in Senegal where the fatality is steadily increasing with the time.

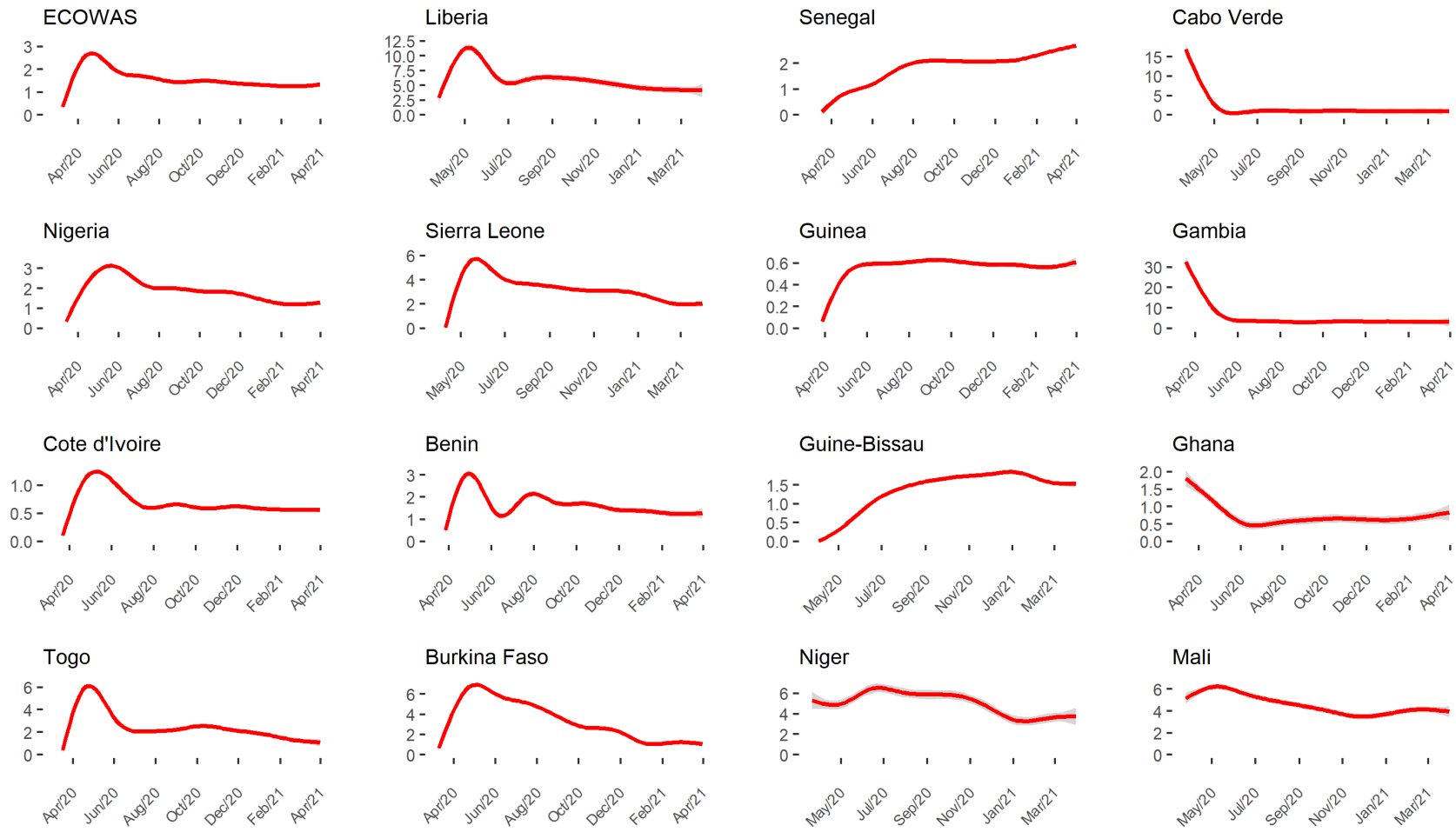


Figure 10: Evolution of COVID-19 case fatality rates during the first year with the pandemic in ECOWAS states

Data about the characteristics of the deaths are scarce. It was however possible to gather the main comorbidities in February 2021. Some countries could provide the distribution of deaths by gender. For all of them, the most of deaths were male. When the data are pooled, we observe that 2/3 of the deaths are males (Figure 11).

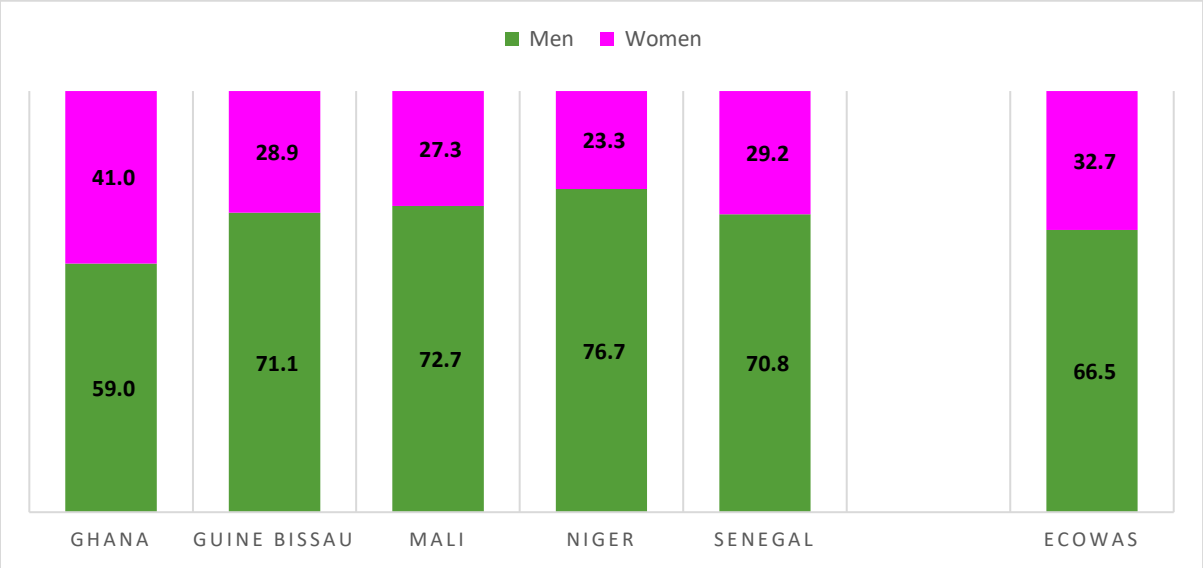


Figure 11: Gender distribution of COVID-19 deaths for some countries (%)

In terms of age distribution, more countries are collecting this information. However, the definition of the thresholds for organising the age distribution is different from one country to another, which makes them difficult to compare. Figure 12 shows a simplified breakdown (over or under 60 years) of a threshold that was common to all countries. In terms of results, even though the proportion of persons over 60 years in the population is very few, they represent almost the half of the deaths. However, in Liberia, the reported deaths were generally young as only 13% were over 60 years.

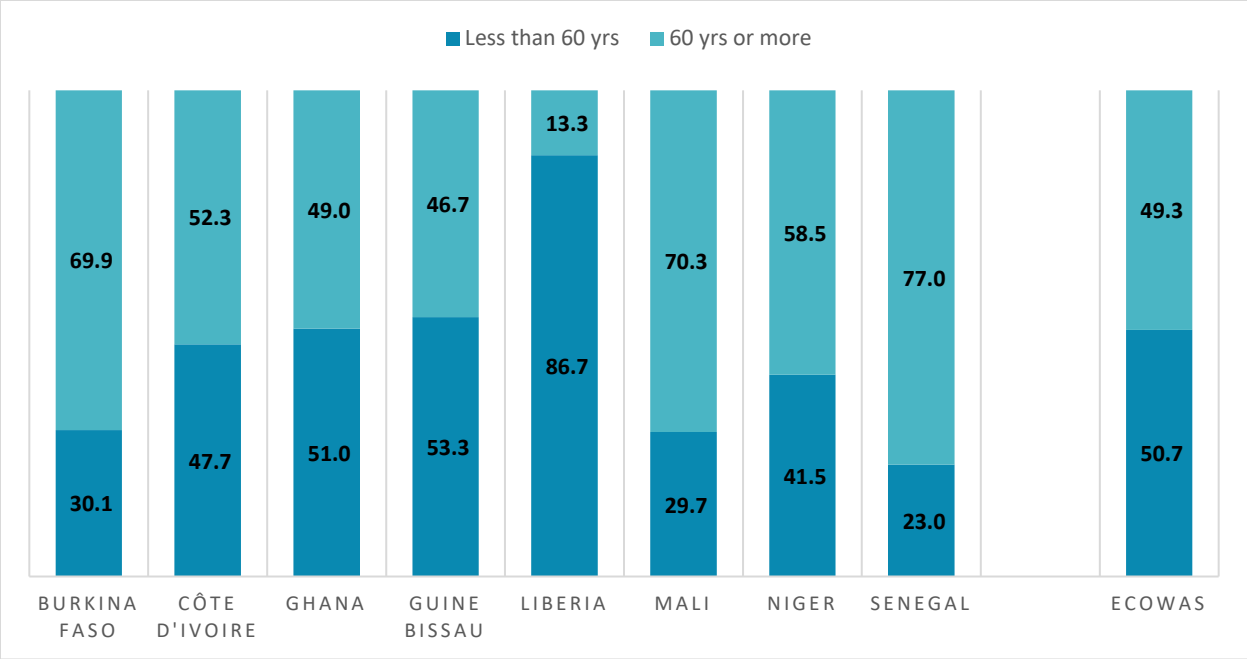


Figure 12: Age distribution of COVID-19 cases in some countries

Table 2 presents the distribution of main comorbidities in some countries. The most reported comorbidity was heart diseases which represents almost the half of the available information. Then diabetes was also frequent and represents around 25% of the cases. Several cases of renal diseases and cancers were also observed. It is important to add that most of the cases with morbidities were multiple comorbidities.

Table 2: Distribution of main comorbidities associated with COVID-19 deaths (%).

	NB DEATHS	HEART DISEASE	RENAL DISEASE	DIABETES	CANCER	OTHER
BURKINA FASO	125	65.6	7.2	24.0	-	3.2
CABO VERDE	135	30.9	10.1	17.4	2.7	38.9
THE GAMBIA	11	9.1	-	81.8	9.1	-
GHANA	358	51.7	3.7	40.6	4.0	-
GUINE BISSAU	45	44.4	-	17.8	-	37.8
MALI	204	43.9	1.5	37.3	-	17.3
NIGER	160	50.0	1.3	23.8	1.9	23.1
SENEGAL	689	41.7	4.5	19.6	4.1	30.2
SIERRA LEONE	79	25.3	3.6	18.7	1.8	50.6
OVERALL	1806	43.6	4.1	26.4	2.7	23.1

3.4 Effective reproductive number

The effective reproductive number is a predictive tool to monitor the evolution of the epidemic. Figure 13 shows that the maximum level of this indicator was 4, at the early periods of the outbreak. Then the

number stabilized between 0.5 and 1.5, showing slow increases or slow decreases during the different waves.

Looking at the trends, the reproductive number was kept at more than one levels until July 2020 predicting the first epidemic peak. Then number stayed below the reference value of one for three months. In November, it passed the threshold, showing that the epidemic restarted a new wave. Then, we have an approximately constant trend.

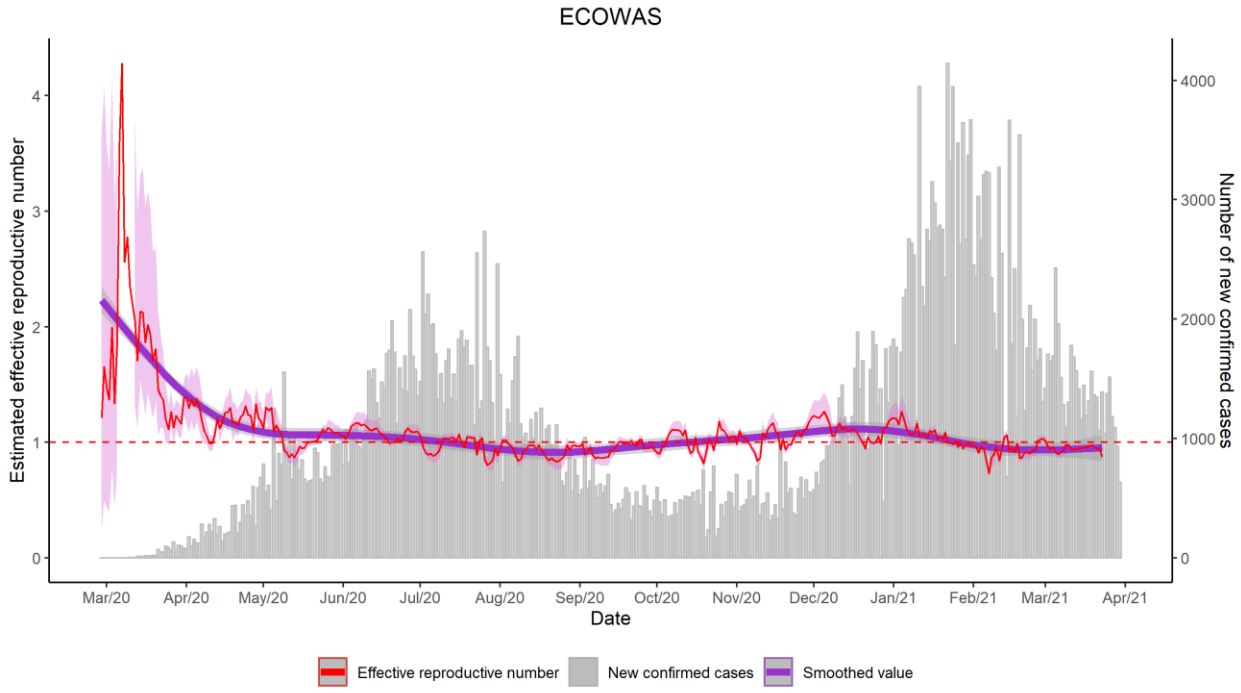


Figure 13: Estimation of the effective reproductive number at regional level during the first year with COVID-19 outbreak

The effective reproductive numbers could be calculated by country. These are represented in Figure 13.

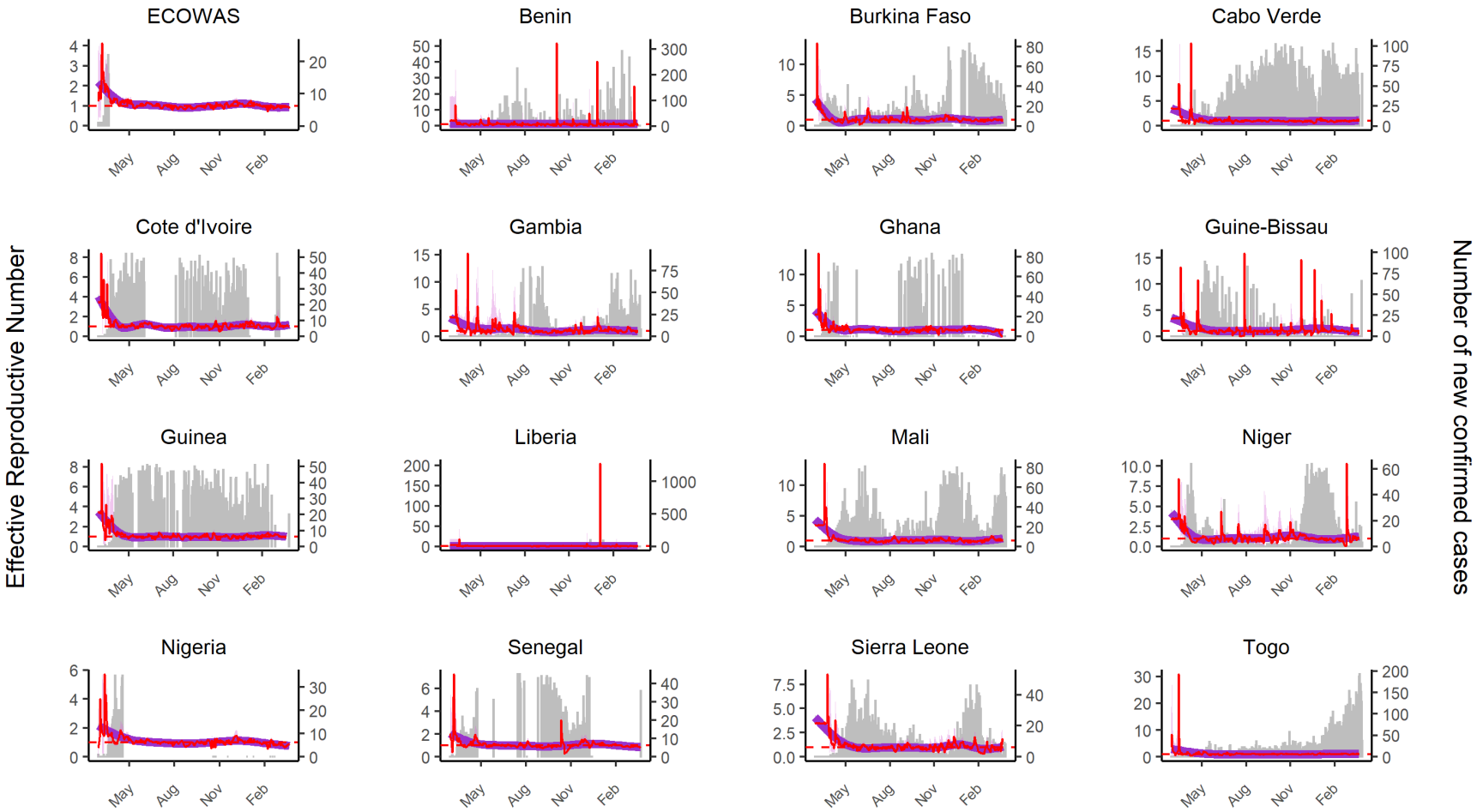


Figure 14: Evolution of the COVID-19 effective reproductive number in the ECOWAS countries

3.5 Case detection and testing

Table 3 presents the number of tests by population and the number of cases by tests as of 6th April 2021. In the ECOWAS region, 5.9 million tests were performed during the first year of the pandemic. The number of tests per million population was 15,390. We observe differences between countries. Cabo Verde is the country who performs more tests, followed by Benin, Togo Ghana and Guine-Bissau. According to the number of cases by test, Cabo Verde was also presenting the lowest number of cases by test. To get one positive cases. The ECOWAS region lays to the WHO's recommendation of ten to 30 tests per reported COVID-19 case as a measure for optimal testing coverage in the population. However, Cabo Verde is below the recommendation threshold while Liberia and Benin have exceeded the value. There is no relationship between both indicators.

Table 3: Different testing indicators per country

	POP	TESTS	CASES	TESTING RATIO	TESTS PER CASES
ECOWAS	**386,908,402**	**5,954,507**	**439,664**	**15,390**	**14**
CPV	549,935	130,599	18,023	237,481	7
BEN	11,801,151	548,484	7,515	46,477	73
TGO	8,082,366	283,560	11,310	35,084	25
GHA	30,417,856	1,016,808	91,009	33,428	11
GNB	1,920,922	59,431	3,662	30,939	16
SEN	16,296,364	447,147	39,127	27,438	11
GIN	12,771,246	335,390	20,510	26,261	16
GMB	2,347,706	58,454	5,564	24,898	11
CIV	25,716,544	539,507	44,854	20,979	12
SLE	7,813,215	140,170	3,990	17,940	35
LIB	4,937,374	85,675	2,061	17,352	42
MAL	19,658,031	238,212	10,758	12,118	22
NGA	200,963,599	1,803,177	163,388	8,973	11
BFA	20,321,378	175,907	12,845	8,656	14
NER	23,310,715	91,986	5,048	3,946	18

3.6 Public health and non-pharmaceutic response to the pandemic

The first public health and non-pharmaceutic measure to mitigate the spread of the disease was the management of the cases. All symptomatic cases were managed in dedicated health facilities presenting the required isolation characteristics. Three approaches were observed regarding asymptomatic cases isolation. Most of the countries (Cabo Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea, Senegal, and Togo) preferred isolating them in non-medical facilities like hotels. Four countries (Liberia, Mali, Niger, and Sierra Leone) were isolating all their cases in medical facilities whereas four others (Benin, Burkina Faso, Guine-Bissau and Nigeria) were asking the asymptomatic cases to self-isolate at home.

Regarding the need for quarantine, concerning contacts and travellers, they were either in non-medical facilities like hotels or at home. Nine countries were keeping all the cases in non-medical facilities. Ghana was doing both strategies, depending on the case. Figure 15 presents where the people were isolated or quarantined when they were positive or suspected.

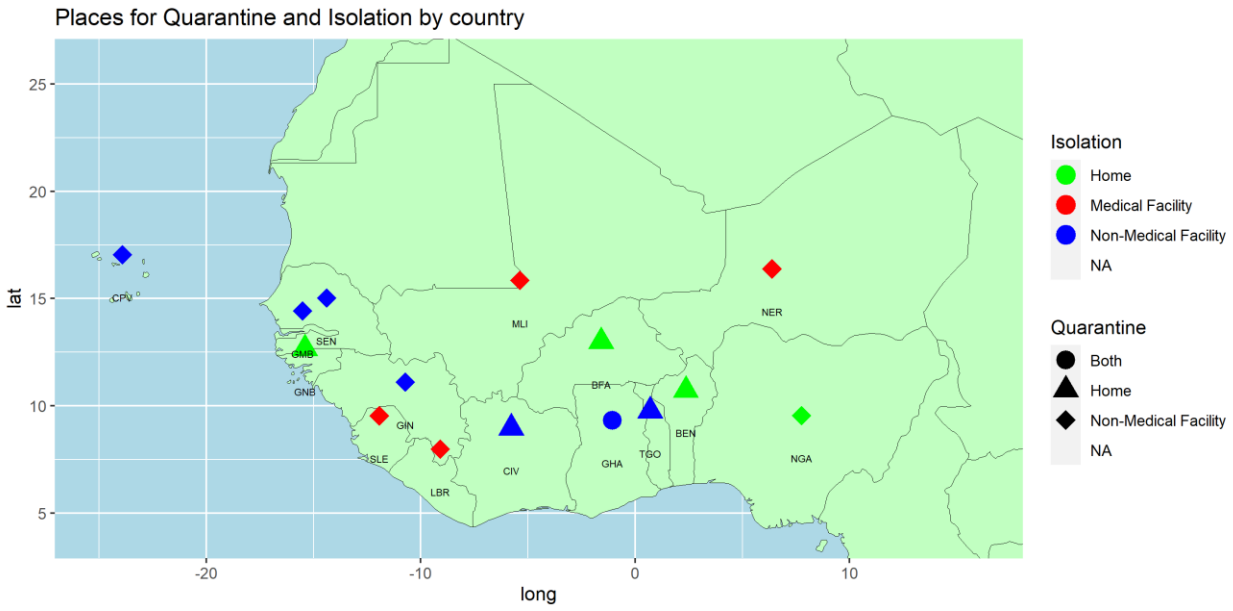


Figure 15: Mode of quarantine for contacts and travellers and mode of isolation of asymptomatic cases by country in the region

As political measures to respond to the epidemic, almost all the countries promote community social distancing. These were organized in terms of large communication actions, annulation, postponement or modification of certain gathering activities, etc. seven countries had a period with night curfews (Burkina Faso, Guine-Bissau, Guinea, Nigeria, Senegal, Sierra Leone and Togo). Eight countries had partial lockdown, but no complete lockdown was observed in any of the ECOWAS countries. Table 4 provides a summary of the different actions by the governments.

One can consider that the measures were not usually taken the same day. However, these were taken at the same period (two to three weeks interval). Table 4 describes the measures and the dates these were undertaken in 2020. One can notice that three countries decided to close their international borders before their first case was detected. These countries are Guine-Bissau, Niger and Sierra Leone. In March 2020, less than a month after the first confirmed case, all the countries had taken at least one PHSM.

Table 4: Countries non pharmaceutical health measures undertaken by countries to control COVID-19 expansion in the ECOWAS region

PHSM	PARTIAL LOCKDOWN	CURFEW	CLOSURE/RESTRICTION INTERNATIONAL BORDERS	GATHERING FORBIDEN	SCHOOLS AND UNIVERSITY CLOSURE	CLOSURE OF RESTAURANTS, CAFÉ, NIGHT CLUBS, …
BÉNIN	30-Mar		18-mars		30-march -	
BURKINA FASO	26-march - 4-may (if < un positive case)	21-Mar	21-mars	20-Mar	14-march -	20-Mar
CABO VERDE	20-Mar			16-Mar		18-Mar
COTE D'IVOIRE	23-Mar	23-march - 7-may & 14-may	20-mars	16-march - 7-may	16-march -	16-march - 7-may & 14-may
THE GAMBIA			23-mars	17-Mar		27-Mar
GHANA	30-march - 20-april		22-mars	15-Mar	17-march -	
GUINEA		31-march - 15-may (except Conakry region)	26-mars	19-Mar	25-march -	26-Mar
GUINE-BISSAU		27-Apr	18-mars	16-Mar		16-Mar
LIBERIA	10-Apr		31-mars	16-Mar		21-Mar
MALI		26-march - 8-may	25-mars	17-Mar	19-march -	17-Mar
NIGER	29-Mar	27-Mar	17-mars	17-Mar	17-march -	18-Mar
NIGERIA	30-march - 21-may					
SENEGAL		23-mars	19-mars	15-Mar	14-march -	
SIERRA LEONE		9-Apr	27-mars	18-Mar		
TOGO	21-Mar	2-Apr	20-mars	16-Mar		20-Mar

Several other measures were taken by the governments which are not listed here. The main one is the border closure. All the ECOWAS countries (except Benin) closed their borders during a long period. After setting up measures in the airports, the air borders could be opened in August 2020. The land borders are still closed as setting up all the safety and control equipment are yet to finish.

4 DISCUSSION AND CONCLUSION

After one year of the pandemic, 429,760 persons were confirmed having COVID-19 infection in ECOWAS member States with 5,620 deaths. At the same period, the ECOWAS region represents around 30% of the African population. However, the confirmed cases and the deaths from the region represents all 10% of the African cases and deaths. The rapid closure of borders and the taking of non-pharmaceutical measures may explain the apparent containment of the pandemic.

Combining population and number of cases shows that countries did not contribute homogeneously to the pandemic. For example, Nigeria, which has the largest number of cases, representing 52% of the regional population, contributed only 37% of the cases. However, Cape Verde and Ghana, representing less than 1% and 8% of the regional population respectively, contributed 4% and 21% of confirmed cases in the ECOWAS region.

Countries with a trend similar to the regional trend were the largest contributors to the pandemic at the regional level. Nigeria, Ghana, Côte d'Ivoire and Senegal alone accounted for 77% of the region's cases. Trends in Benin and Guinea-Bissau are very difficult to analyse. Indeed, the information is transmitted irregularly and with data grouped over several days. The very slow evolution of the epidemic in Togo gives arguments to advocates of barrier measures. Empirically, it has been observed that Togo is the country where the public health measures put in place were strictly observed. However, a more detailed analysis is needed to better understand the evolution of the epidemic in this country.

Important comments are made regarding the published statistics on the pandemic, especially in developing countries. In fact, the number of confirmed cases will depend on the testing strategy. Many of the cases are asymptomatic. As an example, Fergusson et al. (Neil M., Fergusson et al. 2020) reported that the data from China and repatriating flights suggests that 40% - 50% of infections were not detected as “cases”. Then when the strategy consists in testing the people showing symptoms or people indicated as known contacts (under certain conditions), many cases will be lost. Not yet published seroprevalence survey that are run in the region will confirm the large number of missed COVID-19 cases. In another hand, some experience severe COVID-19 episodes without being diagnosed. Then the number of deaths from the disease is also certainly underestimated.

The incidence curves are identical to those for cases per day. However, when comparing the levels, Cape Verde has a very high incidence compared to the other countries. This country, with the smallest population, has a number of cases comparable to the other countries. Looking at the number of tests per population (testing ratio), Cape Verde tested the equivalent of more than a quarter of its population during the year. On the other hand, if we look at the number of tests required for a confirmed case, the country has the lowest value. It is below the thresholds recommended by the WHO and Africa CDC. In this sense, one could question the quality of the strategy in place in Cape Verde. In another sense, Benin and Liberia have very high test per case ratios. The situation in Benin requires further study. This could be due to the strict regulations for international travellers in this country since the outbreak of the disease. Liberia

was systematically testing dead bodies in the morgue at the beginning of the epidemic. This explains both the case fatality and this indicator.

The fact that most countries are within the test per cases recommended range could be explained by the improvement in the countries' testing capacities. For example, from February to September 2020 the region went from 2 to more than 200 laboratories offering COVID-19 testing capacity. However, after the first wave of the pandemic, countries experienced a relaxation of measures and surveillance. This was due to fatigue, devolution processes of care functions, etc.

As already stated, Liberia had the highest case-fatality rate because at the beginning of the epidemic all dead bodies were systematically tested. It is followed by Mali, Niger and The Gambia. In these countries, the quality of care could explain the values obtained. The rapid rise in the first two months of the pandemic and the regression of the regional fatality curve could be explained by the quality of care at the very beginning of the epidemic, when the countries had neither the structures nor the equipment nor the adapted protocols. It then fell and generally stabilised around an equilibrium point. On the other hand, three countries, Guinea-Bissau, Guinea and Senegal, showed increasing lethality curves. The situation in Senegal could be explained by the delay in diagnosis and the refusal of patients to adhere to the protocol, due to the stigmatisation of cases and finally the overflow of care structures. The second wave in Senegal concerned more elderly people, which has an impact on lethality. For Guinea-Bissau and Guinea, this could be the effect of the weakness of the health system which needs more support to respond to this disease while many other health problems are emerging. Finally, it is important to study the effect of co-morbidities on deaths.

The main limitation of the study is the quality of the data. They were collected from official country reports. These do not present information on cases such as age, sex, co-morbidities, etc. Moreover, these inputs are not regular and often include carryovers to previous periods. For tests, data are often not available. It is also difficult to discuss strategies on the basis of the figures obtained. Finally, the information needed to explain the situation was generally lacking as systematic event recording were not done in the countries. In depth analysis are planned, for countries where more granular data are available with national teams. These will help to propose more accurate information.

At the end of the study, we learn that the context of COVID-19 is specific to each country. The evolution of the epidemic is strongly influenced by the country context. This analysis shows the importance of a better understanding of the response in each country. The second part of the study will focus on the actions of each country and the implications of these on the control of the pandemic.

5 REFERENCES

Abubakar, Ibrahim, Sarah L. Dalglish, Chikwe A. Ihekweazu, Omotayo Bolu, and Sani H. Aliyu. 2021. "Lessons from Co-Production of Evidence and Policy in Nigeria's COVID-19 Response." *BMJ Global Health* 6 (3): e004793. https://doi.org/10.1136/bmjgh-2020-004793.

Bonnet, Emmanuel, Fréderic Le Marcis, Adama Faye, Emmanuel Sambieni, Florence Fournet, Florence Boyer, Abdourahmane Coulibaly, Kadidiatou Kadio, Fatoumata Binetou Diongue, and Valery Ridde. 2020. "The COVID-19 Pandemic in Francophone West Africa: From the First Cases to Responses in Seven Countries."

Cabore, Joseph Waogodo, Humphrey Cyprian Karamagi, Hillary Kipruto, James Avoka Asamani, Benson Droti, Aminata Binetou Wahebine Seydi, Regina Titi-Ofei, et al. 2020. "The Potential Effects of Widespread Community Transmission of SARS-CoV-2 Infection in the World Health Organization African Region: A Predictive Model." *BMJ Global Health* 5 (5): e002647. https://doi.org/10.1136/bmjgh-2020-002647.

Cori, A., N. M. Ferguson, and C. Fraser. 2019. *EpiEstim: Estimate Time Varying Reproduction Numbers from Epidemic Curves. R Package, Version 2.2-1, 2019*.

Cori, Anne, Neil M. Ferguson, Christophe Fraser, and Simon Cauchemez. 2013. "A New Framework and Software to Estimate Time-Varying Reproduction Numbers During Epidemics." *American Journal of Epidemiology* 178 (9): 1505–12. https://doi.org/10.1093/aje/kwt133.

CSAO. 2021. "Coronavirus-Ouest-Afrique - Club Du Sahel et de l'Afrique de l'Ouest (CSAO)." 2021. https://www.oecd.org/fr/csao/coronavirus-ouest-afrique/.

Lin, X., and D. Zhang. 1999. "Inference in Generalized Additive Mixed Modelsby Using Smoothing Splines." *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* 61 (2): 381–400. https://doi.org/10.1111/1467-9868.00183.

Lokossou, Virgil Kaussi, Basil Benduri Kaburi, Delia Akosua Bandoh, Edgard-Marius Ouendo, Aboubacar Ouédraogo, Franklin Aseidu-Bekoe, Samuel Kaba Akoriyea, Issiaka Sombié, Ermel Johnson, and Donmozoun Télesphore Somé. 2020. "COVID-19 Pandemic Readiness Status of West Africa."

Medinilla, Alfonso, Bruce Byiers, and Philomena Apiko. 2020. "African Regional Responses to COVID-19." Discussion Paper.

Mongbo, Yves, Issiaka Sombié, Blami Dao, Ermel AK Johnson, Léopold Ouédraogo, Fatim Tall, Chilanga Asmani, et al. 2021. "Maintaining Continuity of Essential Reproductive, Maternal, Neonatal, Child and Adolescent Health Services during the COVID-19 Pandemic in Francophone West Africa." *African Journal of Reproductive Health* 25 (2). https://mail.ajrh.info/index.php/ajrh/article/view/2684.

Neil M., Fergusson, Daniel, Laydon, Gemma, Nedjati-Gilani, Natsuko, Imai, Kylie, Ainslie, Marc, Baguelin, Sangeeta, Bhatia, et al. 2020. "Report 9: Impact of Non-Pharmaceutical Interventions (NPIs) to Reduce COVID-19 Mortality and Healthcare Demand." 9. Imperial College London COVID-19 Response Team. London: Imperial College. https://doi.org/10.25561/77482.

Nigerian Center for Disease Control (NCDC). 2020. "COVID-19 Outbreak in Nigeria: Situation Report." Situation Report S/N: 001. Nigerian Center for Disease Control (NCDC). https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria.

Oxford University. 2021. "Our World in Data." Our World in Data. 2021. https://ourworldindata.org.

Quakyi, Nana Kofi, Nana Ama Agyemang Asante, Yvonne Ayerki Nartey, Yaw Bediako, and Nadia Adjoa Sam-Agudu. 2021. "Ghana's COVID-19 Response: The Black Star Can Do Even Better." *BMJ Global Health* 6 (3): e005569. https://doi.org/10.1136/bmjgh-2021-005569.

Salyer, Stephanie J, Justin Maeda, Senga Sembuche, Yenew Kebede, Akhona Tshangela, Mohamed Moussif, Chikwe Ihekweazu, et al. 2021. "The First and Second Waves of the COVID-19 Pandemic

in Africa: A Cross-Sectional Study." *The Lancet* 397 (10281): 1265–75. https://doi.org/10.1016/S0140-6736(21)00632-2.

Sombié, Issiaka, Ermel Johnson, Virgil Lokossou, Tete Amouh, Abdourahmane Sow, Nanlop Ogbureke, and Stanley Okolo. 2020. "How Does the West African Health Organisation (WAHO) Contribute to the Evidence Based Decision-Making and Practice during COVID-19 Pandemic in ECOWAS Region?" *The Pan African Medical Journal* 37 (Suppl 1). https://doi.org/10.11604/pamj.supp.2020.37.20.25625.

Thompson, R. N., J. E. Stockwin, R. D. van Gaalen, J. A. Polonsky, Z. N. Kamvar, P. A. Demarsh, E. Dahlqwist, et al. 2019. "Improved Inference of Time-Varying Reproduction Numbers during Infectious Disease Outbreaks." *Epidemics* 29 (December): 100356. https://doi.org/10.1016/j.epidem.2019.100356.

Wallinga, Jacco, and Peter Teunis. 2004. "Different Epidemic Curves for Severe Acute Respiratory Syndrome Reveal Similar Impacts of Control Measures." *American Journal of Epidemiology* 160 (6): 509–16. https://doi.org/10.1093/aje/kwh255.

WHO, Regional Office for Africa. 2020. "Sierra Leone Confirms First Case of COVID-19." WHO | Regional Office for Africa. March 31, 2020. https://www.afro.who.int/news/sierra-leone-confirms-first-case-covid-19.