Covid-19, Institutional Responses and the Role of Climate

A Comparative Study Between Côte d'Ivoire and Other West African Countries

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How to cite this paper:
Eboko, F., Kanté, I.K., Diedhiou, A. (2022). Covid-19, Institutional Responses and the Role of Climate
A Comparative Study Between Côte d'Ivoire and Other West African Countries. *Global Africa*, (2), pp. 55-69.
https://doi.org/10.57832/trm0-3614

Received: September 8, 2022
Accepted: October 15, 2022
Published: December 16, 2022

Abstract

This paper analyzes Côte d'Ivoire's institutional response to the spread of Covid-19 and explores the measures beyond political control, especially the impact of environmental variations, by comparing the Ivorian case to other West African countries, to deconstruct misconceptions about the propagation of Covid-19 in Africa and suggests a rereading of Africa's place in the collective imaginaries, including at the scientific level.The approach uses political science, which pays particular attention to national political trajectories in relation to institutional responses to the Covid-19. In the subtitle of his book, American political historian Peter Baldwin (2021) asks the question that runs through our contribution: "Why has the fight against the coronavirus been so different around the world?" Our approach to the problem, based on a broadly defined multifactorial one, attempts to refine the overly encompassing factors, putting each of the empirical factors into a national, or in Côte d'Ivoire's case, even a local context. The lockdown imposed by the authorities on Abidjan (Côte d'Ivoire's capital) from March 26 to July 15, 2020, for example, was a major event in the country's response to the Covid-19 pandemic. The paper is borne out of our transdisciplinary research (in political science, sociology, climatology, meteorology, atmospheric physics, and oceanography) presented at the West African Consortium for Clinical Research on Epidemics Pathogens (WAC-CREP, 2022) international symposium in March 2022 in Yamoussoukro.

Keywords

Covid-19, Climate, Côte d'Ivoire, Prevalence, West Africa, Policy Response

Introduction

The emergence of Covid-19 raised considerable concern in Africa (Jessani et al., 2020; Vidal et al., 2020). Yet, official infection and death figures from the disease have remained relatively lower than in other regions of the world (Table 1), except in Northeast Asia, where morbidity and case fatality are relatively low. These data also show that the number of deaths from the virus in Côte d'Ivoire is three times lower than in other African countries, with between 80,000 and 170,000 infections.

Country /region	Population	Number of cases	Casualties
United States	328 million	94.8 million	1.04 million
Europe (54 countries)	747.18 million	250,191,179	2,084,987
Sub-Saharan Africa	1.66 billion	8,794,087	173,301
Côte d'Ivoire	25.07 million	88,870	820
Senegal	17.24 million	88,153	1,968
Cameroon	26.57 million	122,000	1,935
South Africa	57 million	4,010,000	102,000

Table 1: Distribution of Covid-19 cases in selected regions and countries, including Côte d'Ivoire on 07/09/2022 (source: afro.who.int; who.int/europe; coronavirus-statistics.com).

It is particularly important to distinguish between public action and the climate issue, which is beyond immediate political control. As one of the most vulnerable regions to epidemiological and climatic shocks, Africa is receiving international attention (Lone & Ahmad, 2020). Climatic factors therefore deserve special attention in a pandemic that spreads through multiple factors and ways. Meteorological variables such as air temperature, humidity, or solar radiation act differently on coronavirus survival in Africa, compared to other continents (Yuan et al., 2020). For example, research in 2020 documented the relationship between meteorological factors (temperature, atmospheric pressure…) and Covid-19 in China. On the contrary, Ma et al. (2020) and Kanté et al. (2021) found negative correlations between temperature and Covid-19 in China, as well as in Guinea. However, the number of studies on the spread of the virus and the influence of climate-related factors is still limited. The Covid-19 pandemic has highlighted a kind of paradigm reversal from the case of sub-Saharan Africa, which has a lower fatality rate than most other regions of the world, in contrast to other pandemics (HIV/AIDS, Ebola) in the previous decades.

This article aims to analyze the climatic, social, demographic, structural and political determinants of this situation. It presents the Ivorian case within the cluster of African cases, which are relatively different from one another, but with a degree of convergence – with the exception of South Africa and North African countries – if compared with the countries in Europe, the Americas and part of Asia.

Beyond the "deceptively good ideas"

Over time, the epidemics suffered by Africa have raised legitimate concerns, which have led to a variety of scientific discourse, representations and research (Eboko, 2021). For example, climate, allegedly one of the explanations for the slower circulation of Sars-Cov-2 (Sars: Severe Acute Respiratory Syndrome), is part of a series of hypotheses about factors that are beyond the control of political decisions and social behavior. Before examining the climate issue, we will explain why some of the other hypotheses are disproved or contextualized by facts and/or data, namely population density in African cities, cross-immunity, and the fragility of health systems. The supposed population density of African cities is a red herring, as there is confusion between the number of people in a city and its density, which may indeed be a factor in the spread of the virus.

According to available estimates, with 20,641 inhabitants/km^2, Paris is denser than three of the four most populous cities in Africa: Lagos (6,871 inhabitants/km^2); Johannesburg (3,603 inhabitants/km^2); and Kinshasa (1,462 inhabitants/km^2). The only exception is Cairo with 52,237 inhabitants per square kilometer. Dakar (5,795 inhabitants/km^2) is four times less dense than Paris; Paris is six times denser than Abidjan (2,983 inhabitants/km^2). The matter of "cross-immunity" is also a legitimate scientific hypothesis. Indeed:

> "It is [...] possible that part of the population is protected against Sars-CoV-2, due to cross immunity with other coronaviruses. Antibodies that detect Sars-CoV-2 are indeed present in patients who have been infected with Sars-Cov, but they probably do not neutralize the other. Cellular antiviral immunity may also confer some degree of cross-protection". (Mahieu & Dubée 2020) [1].

This hypothesis has led to the initiation of legitimate exploratory studies, whose results have not yet been published[2] . However, the quantitative weakness of the data neither supports the testing, nor distracts from its scientific contribution. Similar studies have also been conducted in Europe, where the data are considered more reliable. Covid-19 seroprevalence surveys have been conducted in Africa: Mali, Niger, Kenya, Sudan, Democratic Republic of Congo (DRC) and Cameroon. The evidence suggests that by the second wave, the virus had affected the majority of African populations in proportions that remain well below the most affected regions of the world. National surveys conducted in Senegal in 2020 and 2021 show varying degrees of prevalence that double between 2020 and 2021 (Table 2).

Régions	SEROPREVALENCE 2020 (%)	SEROPREVALENCE 2021 (%)*
Dakar	44.0	94,38
Diourbel	19.0	86,46
Fatick	17,5	87,06
Kaffrine	26,9	86,19
Kaolack	33,1	88,41
Kédougou	19,2	93,13
Kolda	23,4	90,67
Louga	11,1	89,27
Matam	11,2	88,10
Sédhiou	48	94,18
Saint-Louis	16,2	76,53
Tambacounda	23,9	91,89
Thiés	24,3	89,78
Ziguinchor	56,7	93,53
SENEGAL (14 régions)	28,4	89,57

11 | COVID-19 | March 16, 2022 World Health Organization

Table 2: Provisional results of the seroprevalence survey in Senegal (source: WHO, 2021).

Accurely focused on the African continent than on regions of the world which have experienced much higher percentages of deaths. One explanation is based on the widely known fragility of African health systems, whose resistance to Covid-19 is said to be due to the youthfulness of African populations. Cursory reading of scientific articles on the excess mortality rate of Covid-19 worldwide (Collaborators, 2022) has brought out the constant refrain of "hidden data3" . Yet the paper clearly states that excess mortality due to Covid-19 is highest in South Asia, North Africa, the Middle East and Eastern Europe, but makes clear it is difficult to know whether such excess mortality is due to Covid-19 or to other factors (societal, economic, behavioral changes) because of lack of detailed data

1 See also Huibin et al., 2020; Grifoni et al., 2020.

2 In 2020, the IRD and the Institut Pasteur in Ivory Coast launched a study on the impact of "cross-immunity" regarding the Covid-19.

3 Berthaud-Clair, S., "En Afrique, le fardeau 'caché' de la surmortalité due au Covid-10" (In Africa, the hidden burden of excess Covid 10 mortality), Le Monde Afrique, 11 May 2022: https://www.lemonde.fr/afrique/article/2022/05/11/en-afrique-le-fardeau-cache-de-la-surmortalite-due-au-covid-19_6125678_3212.html

on specific causes of death in many countries (Covid-19 Excess Mortality Collaborators, 2022, pp. 1513, 1515). In contrast, in Africa, people with preexisting medical conditions affected by Covid-19 were generally at great risk, given the crisis in the health systems, including the mismanagement or lack of intensive care units to resuscitate people in respiratory distress. This situation also partly explains the exceptional nature of the Ivorian response through the continuous supply of gas to Abidjan's hospitals, particularly oxygen, due to the presence of the French company Air Liquide.

The issue of climate is also a credible lead that could explain the plight of African cities, particularly in the face of the Covid-19 pandemic. As of February 10 2021, SARS-Cov-2 had already caused 2,360,000 deaths out of more than 107 million reported cases worldwide (Milleliri et al., 2021). Africa remains the continent that suffered the least in terms of morbidity and mortality (Lone & Ahmad, 2020 ; Milleliri et al., 2021). Climate is among the hypotheses put forward to try to explain the low numbers observed in sub-Saharan Africa (Nguimkeu & Tadajeu, 2020). We will now explain the comparative data collected in several countries, with the understanding that the impact of seasonal variation analysis is only meaningful when comparing several sites.

Data and methodology

Clinical Data on Covid-19

The institutionalization of health threat and crisis management is exemplified by the creation of the European Centre for Disease Prevention and Control (ECDC), a European agency responsible for monitoring health threats launched in 2004 in the aftermath of the 2002 Sars epidemic (Deruelle, 2016; Greer, 2012). From the onset of the Covid-19 pandemic, this agency took a direct interest in collecting the world's clinical data. Here we use its clinical data, which are the number of confirmed Covid-19 cases (cured and deceased patients) in 17 West African countries (ECDC 2020). Specifically, we use daily data from January 1, 2020 to April 30, 2021 for Mali (Bamako), Niger (Niamey), Guinea (Conakry), Senegal (Dakar), and Côte d'Ivoire (Abidjan).

Climatic data

In this work, we consider the following three climatic parameters: temperature at 2 m (t 2 m), relative humidity (RHmean) and meridian wind at 850 hPa (v850 hPa). The meridional component of the wind is taken into account in this study because it reflects, when positive, relatively moisture-laden southerly winds from the Gulf of Guinea; and, when negative, generally dry, desert-dust-laden northerly winds blow from the Sahara. Due to lack of recent continuously observed meteorological data from stations in the selected countries, we used ERA5 reanalysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF) (Hersbach et al., 2019; Johannsen et al., 2019).

Methodology

Our study focused on the evolutionary trend of Covid-19 in correlation with weather conditions between January 1, 2020 and April 30, 2021 (Sharma et al., 2021). This approach highlights Abidjan's place among five other West African cities: Conakry, Dakar , Bamako, Niamey; or, in Central Africa, Yaoundé. These cities are addressed in dyads (two by two) in the same geographical area and according to their climatic similarity (Figure 1).

After the overall analysis of Covid-19 cases, of confirmed cured patients and death cases in West Africa, the study focuses on the co-evolution between climatic data (air temperature, relative humidity, meridian wind) and days with a great number of confirmed Covid cases, i.e., days when the variation in the number of cases in each city over the study period is greater than the standard deviation. For these particular Covid-19 strong case days, Pearson's correlation is calculated to measure the existence and strength of a linea of confirmed cases (Sedgwick, 2012; Akoglu, 2018). To quote Cohen, (1992), when

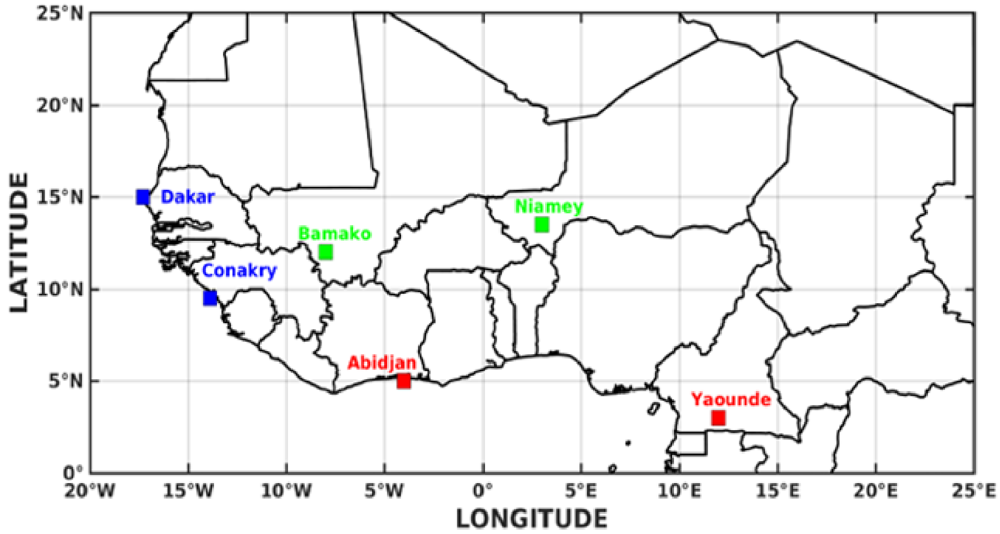


Figure 1: Presentation of the study area: in blue, cities on the west coast (Conakry and Dakar); in green, continental cities (Bamako and Niamey); in red, cities in the Gulf of Guinea countries (Abidjan), as Yaoundé in the east.

two variables are correlated, the change in magnitude of one variable is associated with a change in magnitude of the other variable, either in the same direction (positive correlation) or in the opposite direction (negative correlation) (Schober et al., 2018).

Covid-19 in west african countries: climate context and back story

Abidjan, Côte d'Ivoire

Côte d'Ivoire is located along the Gulf of Guinea, bordering the South Atlantic Ocean, and its capital, Abidjan, has a coastal location. It is the country's main urban center. Influenced by the tropical rains and the Harmattan, its climate varies from a transitional equatorial environment in the south of the country (with two rainy seasons) to a transitional tropical climate in the north (with one rainy season). Rainfall increases from north to south and significantly influences river and water flow regimes.

Like all African countries, Côte d'Ivoire has set up measures to deal with the Covid-19 pandemic since March 2020. They include most of the measures implemented on the African continent (curfews, closure of places of assembly, promotion of social distancing, obligation to wear masks in closed public places, etc.) from the first quarter of 2020. In this sense, Côte d'Ivoire, like all African countries, implemented the emergency and prevention measures prescribed by the WHO following the Ebola epidemic that struck West Africa between 2013 and 2015.

The country stands out for two reasons: it locked down Abidjan, the largest city in Côte d'Ivoire during the first wave; and it was willing to address respiratory distress as a result of the disease, which set it apart from neighboring countries and some of its African counterparts. The lockdown of Abidjan had an unprecedented impact on the pandemic trajectory in the country. Indeed, from the first wave to the current situation, Abidjan has accounted for 95% of the country's Covid cases, according to available official estimates. With a relatively low case-fatality rate, the country had between 30,000 and 60,000 diagnosed cases in 2021 and just over 80,000 cases in September 2022. Since March 2021, it has committed to a vaccination campaign supported by the international Covax initiative.Beyond the case of Côte d'Ivoire, it is appropriate to take a synoptic look at the situation in other countries and link them with their climate context.

Conakry, Guinea

Conakry's geographical position between the ocean and Mount Kakoulima sets up a barrier and makes the Foehn wind stronger. This warm and dry wind blows up a mountain and cools down as it covers it, which can be favorable to initiating convection. According to Guinea's National Health Security Agency (ANSS), the first death cases were recorded in Conakry on March 12 and March 16, 2020, respectively. As of May 13, 2020, the total number of confirmed Covid-19 cases in Guinea was 8,739 – of which 4,115 were reported cured, while the total number of deaths was 29. The total number of active cases as of the same date was 1,076. Indeed, the work of Kanté et al. (2021) on Conakry shows a correlation between meteorological factors (temperature and relative humidity) and Covid-19 in this city.

Dakar, Senegal

As a result of Senegal's geographical position at the western end of Africa, its climate is influenced by both oceanic and continental processes (Fall et al., 2006). Dakar's climate is arid tropical, with a long dry season from November to May, and a warmer, wetter, rainy season that stretches from approximately July to early October. The dry season generally lasts 6 months in the south (November to April) and 8 to 10 months in the north; cool, moist ocean winds blow from the north, and fog can sometimes rise over the coastal area. Because of its location, the climate is milder than in the rest of Senegal due to its proximity to the ocean.

Like other sub-Saharan African countries, Senegal was already facing a number of challenges at the onset of the pandemic (Middendorf et al., 2021). Since the first confirmed case of Covid-19 in Senegal on March 2, 2020 (Ministry of Health and Social Action, 2020), the government has taken steps to contain the spread and impact of the virus (Faye et al., 2020). Therefore, in addition to curfews, schools, universities and places of worship were closed, transportation was curtailed, and strict hygiene rules were imposed (Unesco, 2020). Despite these swift actions, Covid-19 still poses a severe threat to the country (National Agency of Statistics and Demography, 2020).

Work by Diouf et al. (2021) shows that, in the Sahel, Senegal is experiencing the most rapid expansion of Covid-19 cases. These are consistent with the results of Faye et al. (2020), which show a relationship between three elements: the Covid-19 pandemic (confirmed cases, active cases, recovered cases, and reported deaths); population; and density. In terms of number of infected cases, the Dakar region represents the epicenter of the pandemic with 80.5% of the country's infected cases, followed by Diourbel with 8.3%, Thiès with 3.9%, Sédhiou with 2%, and for the rest of the regions the percentage remains below 1.5% (Faye et al. 2020). The same is true for the total number of active, recovered and deceased cases, for which Dakar records 69.1%, 85.8% and 73.8% respectively (Faye et al., 2020).

Bamako, Mali

Bamako, the capital of Mali, a landlocked country in West Africa, and located in the Sudan zone, has a dry and humid tropical climate, with average maximum temperatures above 30°C. Bamako is very hot on average throughout the year; the hottest months are March, April, and May, and the rainy season is uni-modal, with the onset of rains occurring in the main agricultural areas from May to July and ending in September or October (Toure et al., 2017).

According to Mali's Ministry of Health and Social Affairs (2020), the country recorded the first two Covid-19 cases in Kayes on March 25, 2020 and Bamako on March 26, 2020 (in Commune III). Since then, the epidemic has spread to most health regions (Togola et al., 2021). As of August 2, 2020, the district of Bamako was the most affected, with 1,207 Covid-19 cases, 105 of which were in Bamako's Commune III (Ministère de la Santé et des Affaires Sociales du Mali, August 2, 2020). Multiple efforts have been made by the State and its partners in the framework of epidemiological surveillance of diseases with epidemic potential through equipment, recruitment and training of personnel (Togola et al., 2021). The disease surveillance system has existed in Mali for several decades, with systematic collection of health data (Mali Ministry of Health and Social Affairs, 2020).

Niamey, Niger

The Republic of Niger has a Saharan, desert, and hot climate type in the north according to Köppen's classification (Kottek et al., 2006) as the desert covers about two-thirds of the country's area, while in the south, the hot semi-arid climate creates a predominance of Sahelian savanna (Bigi et al., 2018). The capital, Niamey, covers a 255-km^2 area, with a population of 1,802,910 in 2018, making it the most populous city in Niger. The country is the largest in West Africa, but one of the least developed, with a vulnerable economy, low literacy levels, lack of infrastructure, and limited access to healthcare (African Wildlife Foundation, 2020). In addition, Niger is currently facing armed attacks and kidnappings (Garda World, 2020), which have undoubtedly exacerbated the health crisis (Tchole et al., 2020). On March 19, 2020, a 36-year-old Nigerien warehouse worker who had recently traveled abroad was the first case of Covid-19 in Niger (Agency Niger Press, 2020). Within 15 days, 120 patients tested positive for Sars-Cov-2 (WHO, 2020). Thereafter, Covid-19 spread rapidly and Covid-19 case admissions jumped between April 8 and 12, 2020, with a peak on April 10, 2020 (Aminou et al., 2021). As of June 25, 2020, according to the Ministry of Public Health's situation report, 1,059 cumulative cases have been recorded throughout the territory, including 75.60% of cases (i.e., 801 cases) in Niamey's urban areas (Ministry of Public Health, 2020). During this pandemic, health workers paid a heavy price, with 184 confirmed cases out of 1,059 – or 17.40% (MSP, 2020). This finding could be explained, on the one hand, by lack of infection prevention and control (IPC) precautions and, on the other hand, by the novelty of the disease in the health system (Baissa et al., 2020).

Climate and Covid: towards multifactorial leads

The study of the relationships between Covid-19 and climate factors in Bamako, Niamey, Conakry, Dakar, Abidjan and Yaoundé provides a number of results.

The results of the correlations between high Covid-19 and climatic factors in Bamako and Niamey are presented in Figure 2. In Bamako, negative correlations between days of high Covid-19 cases and climatic factors, notably temperature (Figure 2b) and meridian winds (Figure 2c), are obtained without being significant: a decrease in temperature and an increase in northerly winds (generally dry and dusty) are conditions favorable to an increase in high numbers of confirmed Covid-19 cases; on the other hand, it cannot be concluded that periods of high humidity are conditions favorable to an increase in contaminations (Figure 2a)

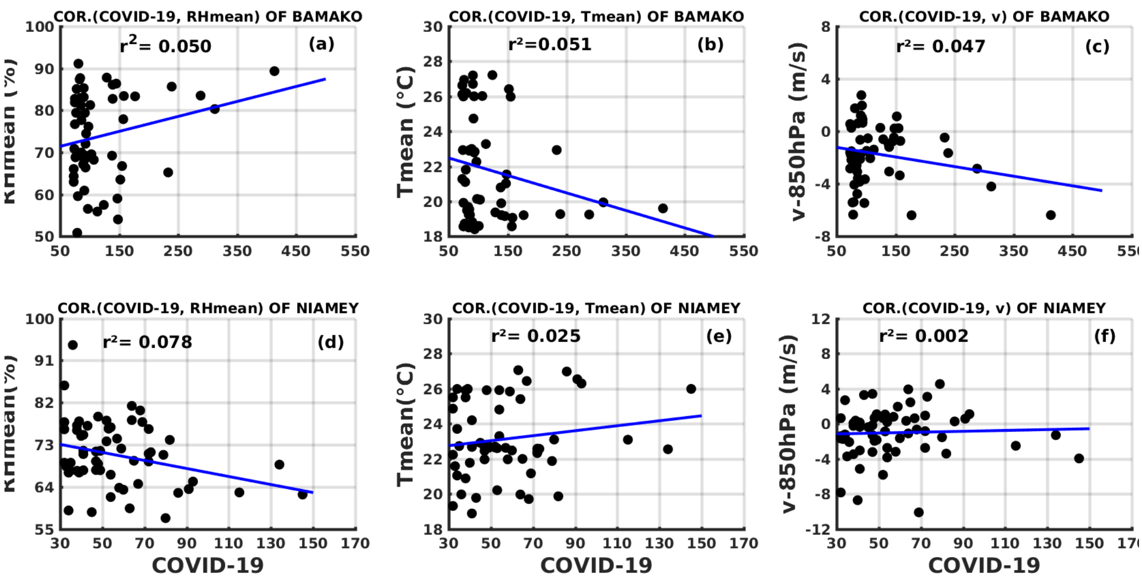


Figure 2: Correlation between strong Covid-19 cases and climate factors (RHmean, t 2 m v850 hPa) in Bamako (a, b and c) and Niamey (d, e and f). Correlation coefficients are indicated by the r2 value

The situation in Niamey is the opposite of the Bamako case, even though both countries have the same Sahelian climatic conditions. Indeed, in Niamey, the correlation between days of high Covid-19 cases and relative humidity (Figure 2d) is negative. The correlation with meridional wind is very weak because on average, regardless of the number of cases, the wind varies little (low slope of regression). Similarly, the small average variations in temperature are insignificant compared to the number of cases, as compared to the situation in Bamako.

Figure 3 shows that in both Dakar and Conakry, although the correlation coefficient values are very low, a decrease in relative humidity or a decrease in temperature or an increase in winds from the north prove to be favorable meteorological conditions for an increase in numerous confirmed Covid-19 infection cases. Trends in Abidjan and Yaoundé turn out to be qualitatively similar to patterns in Dakar and Conakry. However, in the Abidjan and Yaoundé cases, the correlation coefficients values are generally very low, suggesting a lesser role of the studied climatic variables in the evolution of high contamination days.

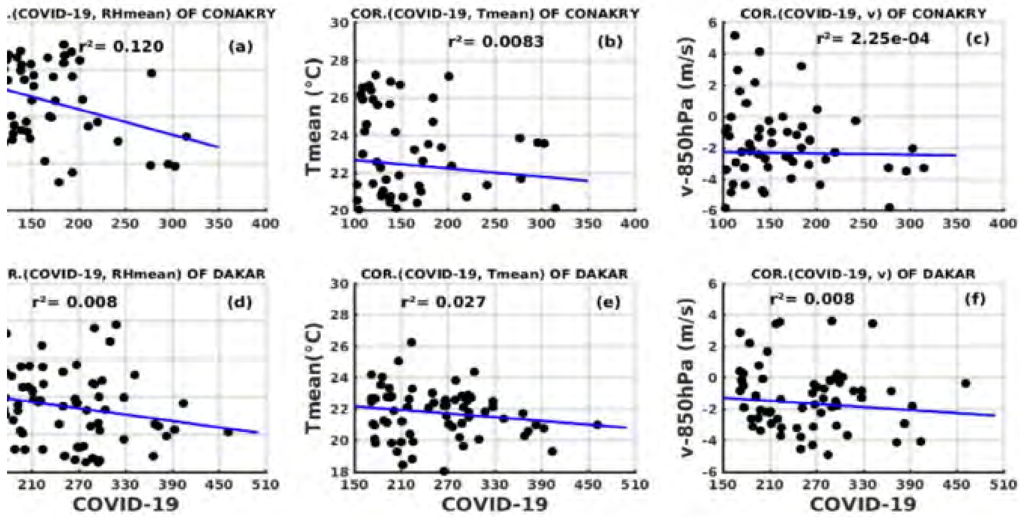


Figure 3: Correlation between Covid-19 cases above threshold and climatic factors (RHmean, t 2 m, v850 hPa) in Conakry (a, b and c) and Dakar (b, e and f). Correlation coefficients are indicated by the r2 value.

Trends from this comparative study between cities with similar climatic contexts demonstrate that air temperature, relative humidity, and wind speed may play a role in the increase in contamination, despite very flimsy or insignificant correlations, as in previous studies on other continents. Further analyses are needed to describe the relative influence of each variable according to the city's geographical position. Furthermore, these results highlight the need for additional research and multivariate analyses to evaluate the potential impact of weather types with contrasting indicators combining temperature, humidity and wind at the same time. From this perspective, it would be instructive to understand how the number of infection cases evolves on days associated with decreases in temperature, humidity (dry) and strong northerly winds, and compared to warm, humid days with southerly winds. Finally, considering the virus incubation time, the analysis should include the average weather conditions 5 to 10 days before peak contamination days.

The Institutional Response to Covid-19 in Côte d'Ivoire

Current knowledge: a paradigm shift in Africa and Côte d'Ivoire

The first case of Covid-19 in Côte d'Ivoire was diagnosed on March 11, 2020, in a 45-year-old Ivorian national returning from Italy and hospitalized at the Treichville University Hospital in Abidjan. Since then, the country has experienced four successive epidemic waves as of January 15, 2022 (Table 3).

Epidemic waves	Periods
1st wave	June to July 2020
2nd wave	December 2020 to March 2021
3rd wave	July to September 2021
4th wave	Since December 2021

Table 3: Covid-19 epidemic waves in Côte d'Ivoire between June 2020 and after December 2021 (Source: Institut Pasteur in Côte d'Ivoire).

On September 3, 2022, Côte d'Ivoire had 86,779 cumulative confirmed cases and 819 deaths. The case-fatality rate was 0.9%, one of the lowest in West Africa. These results are partly related to the Ivorian institutional response, consistent with African authorities' early response since the beginning of the pandemic (Eboko & Schlimmer, 2020). Citation=Following the WHO global alert calling on all countries to activate Public Health Emergency Operations Centers (PHECs), the Ministry of Health and Public Hygiene activated its PHEC on December 31, 2019, with the launch of a crisis committee to better manage the disease contraction and spread risk. As part of this, COUSP has developed an emergency plan that is currently being implemented. (Prime Minister's Office, March 2020, p. 3) Two measures differentiate the Ivorian response from other countries' in West and Central Africa: the lockdown of Abidjan and the quality of care for respiratory illnesses.

An early response

On June 20, 2020, Africa had one death for every 10,798 inhabitants; Europe one death for every 3,886 inhabitants; the United States one death for every 2,754 inhabitants. Although some African countries (South Africa, Morocco, Mali, Senegal, etc.) were experiencing a "second wave" and Côte d'Ivoire was facing an acceleration of the pandemic from early 2021, the Ivorian situation benefited from the measures taken in March–April 2020. Indeed, the lockdown of Abidjan from March 26 to July 15, 2020 helped to contain the pandemic in the economic capital, which is also the most important health network in the country. A total of 577 bars were closed in the Abidjan district and the state of emergency was extended until July 30. The Ivorian Prime Minister, the late Mamadou Gon Coulibaly, announced on March 31, 2020, an "economic, social and humanitarian support plan" amounting to "1.7 trillion CFA francs" (€2.6b), or "approximately 5% of the Ivorian GDP". At the time of this announcement, Côte d'Ivoire had only one death (Eboko & Schlimmer, 2020). Figures 4 and 5 show the epidemiological impact of this policy measure over a two-year period.

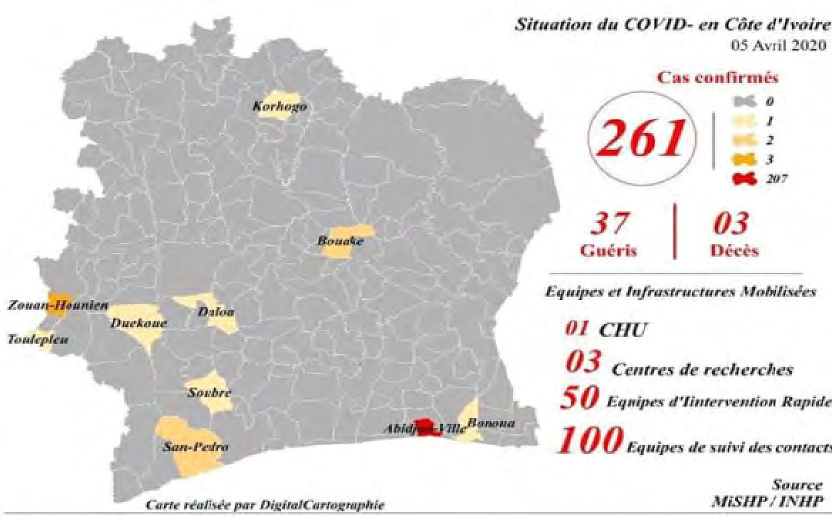
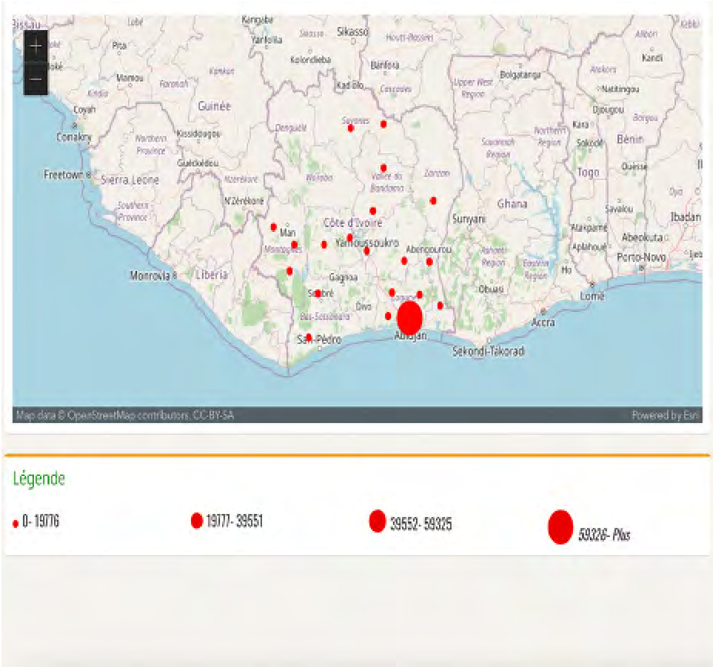


Figure 4: Initial impacts of the Abidjan lockdown on the spread of the disease in Côte d'Ivoire on April 5, 2020 (Source: National Institute of Public Health of Côte d'Ivoire).



Regions	Confirmés
DISTRICT AUTONOME ABIDJAN	79100
AGNEBY-TIASSA	166
DISTRICT AUTONOME YAMOUSSOUKRO	160
SUD-COMOE	118
SAN-PEDRO	24
GBEKE	22
GRANDS-PONTS	9
NAWA	8
GUEMON	4
PORO	4
CAVALLY	3
HAUT-SASSANDRA	3
MARAHOUE	3
TONKPI	2
INDENIE-DJUABLIN	2
LA ME	2
MORONOU	1
[illegible]	1

Figure 5: The two-year impact of the closure of Abidjan on the spread of the disease in Côte d'Ivoire (September 2022).

From one wave to the next

As the impact of the pandemic was lower in Africa than elsewhere, the easing of barrier measures was observed throughout the continent, from Dakar to Abidjan and from Yaoundé to Accra. Compared to African countries with an equivalent number of Covid-19-infected people, Côte d'Ivoire (88,870 cases) recorded 3 to 4 times fewer deaths in late April 2021. This situation is linked to the specificity of the Ivorian case, which has taken measures similar to procedures in other countries, particularly in cities[4] , in addition to the Abidjan lockdown. Without passing judgment on the effectiveness of treatments, it should also be noted that Côte d'Ivoire soon ditched hydroxychloroquine[5] , whereas most countries, such as Senegal and Cameroon, used it until very recently. The virus has been relatively confined to Abidjan, which has the only international airport through which the virus entered the country. The concentration of treatment centers in the same city has made it possible to provide an appropriate response to this viral containment within the autonomous district of Abidjan.

Skills and circumstances for patient management

The majority of patients who died in the sub-Saharan African cities covered in this article required respiratory support. In Abidjan, oxygen was supplied by Air Liquide without interruption, unlike in other countries. Cultural events, rather than religious gatherings, were opportunities to reduce barrier measures, including the relative discontinuance of wearing masks in enclosed areas. Whether it is singer Singuila's concert on December 10, 2020 in Abidjan, the end-of-year festivities, or the gatherings following Prime Minister Hamed Bakayoko's death on March 10, 2021 (national mourning), these events undoubtedly contributed to an increase in Covid cases. This is illustrated in Figure 6.

4 "Covid-19 in African Cities: Impacts, Responses and Policy Recommendations", UN-Habitat, 2020, p. 4, available at: https://unhabitat.org

5 The Ivorian protocol for clinical cases without comorbidity and without exceptional clinical episodes is as follows: Prednisolone (15 mg × 3/day); Azithromycin (500 mg/day); Acetylcysteine (200 mg × 3/day); Amoxicillin (1 g × 2/day + clavulanic acid (125 mg × 2/day) for 8 days

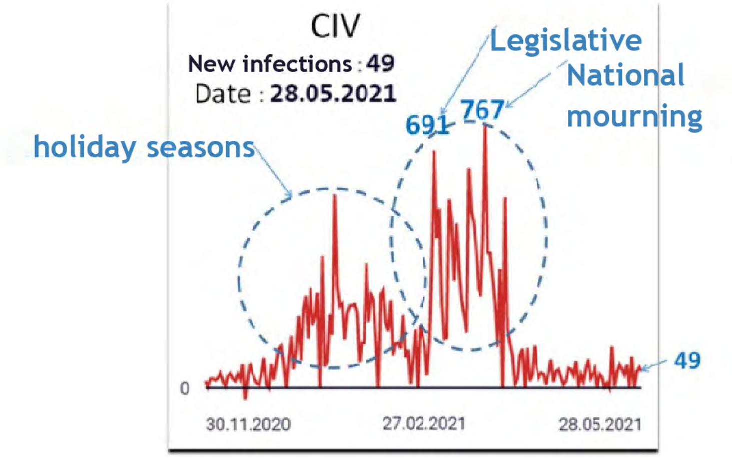


Figure 6: gatherings and rise in cases in Côte d'Ivoire in 2020 and 2021 (source: National Institute of Public Health 2021).

The third wave in 2020 also featured a "middle class epidemic", linked to Christmas holidaymakers from Europe, according to a team member's testimony at the Institut Pasteur in Abidjan dedicated to the collection and analysis of Covid-19 PCR (polymerase chain reaction) tests.

Conclusion: the social conditions of the evolution of covid cases, beyond the climate

The work presented here highlights that a link between climatic variations and contamination is not clearly established, and that the impact of these climatic variations is not the most determining factor in the African cities considered. Variations in the incidence of Covid-19 cases are multifactorial, with a predominance of the impact of human behavior over the role of climate, which is real but not yet identified. In the case of Abidjan, the second wave, in early 2021, is closely linked to the decline in compliance with barrier measures brought on by the Christmas vacations festive period and other events previously reported. Weather in this context is a minor variable.

What has penalized the "age of affluent societies" (Sahlins, 1976) are the lifestyles and infrastructures linked to their ability to cram into planes, subways, streetcars, trains, etc. So, the neoliberal economy has shown itself to be the producer of not only "the politics of accumulation" but also what can now be called "the politics of crowding". It would be a perverse logic though to propose that the various shortages of all kinds that punctuate daily life in Africa actually generate life-lessons. Most Africans between the ages of 50 and 60 who died of Covid-19 on the continent would have survived in countries with decent health systems. A cross-sectional study was conducted by teams at the Treichville University Hospital on 1,230 people (average age: 37 years), who tested positive and were symptomatic with Covid-19 and were treated at various quarantine sites (hotels). The results show that it takes an average 15-day period before patients become negative (plus or minus 4 days); 98.7% of cases returned home; and 1.3% of cases were transferred to hospitals (Kouakou, Éholié et al., 2022, p. 180). African populations' youthfulness, a characteristic pointed out at the beginning of the pandemic, confirms to be the main criterion for the low Covid-19 mortality (except for Southern Africa and North Africa) compared to the rest of the world. This age variable highlights that Covid-19 primarily affects the elderly.

Nevertheless, if Ivorians recorded a lower case-fatality rate than their neighbors, this is due to the concentration of patients in the city, which has the best health-care facilities in the country and is able to provide care without oxygen shortages for respiratory problems, regardless of the season. This raises the issue of the management of non-communicable diseases in Africa (Baxerres & Eboko, 2020), whose "comorbidity" with Sras-Cov-2 is the main cause of Covid-19-related deaths. From this perspective, African health systems, weakened but "protected" from the slaughter house by the population's youthfulness, have gone through the health crisis as an allegory of those whom anthropologist Pierre

Sansot (1928–2005) called “les gens de peu” (“People of modest condition”): “starting from nothing, arriving at little, but who do not have anyone to be grateful to” (Sansot, 1991). Conversely, we in the West can consider that it is not inevitable that we all live crammed together on a daily basis. What Africa has revealed is also the impasse in the reasoning that Henri Bergson called associationism:

> Associationism is therefore wrong in constantly replacing the concrete phenomenon that takes place in the mind with the artificial reconstruction that philosophy gives of it, thereby confusing the explanation of the fact with the fact itself (Bergson, 2013, p. 123).

Nowadays, the most pressing need proves to be the improvement of care for vulnerable patients in order to avoid deaths. Very few questions remain to be answered about the survival rate of hospitalized Covid-19-infected patients in acute respiratory problems in sub-Saharan Africa. It seems that Africa and Africans increasingly understand that their place in the world is the one they shape themselves. In this logic, the organization of the first major Covid-19 scientific conference in West Africa in Côte d'Ivoire, organized by the West African Consortium for Clinical Research on Epidemic Pathogens, is a significant event for Africa. This event brought to light concrete results from more than 180 papers. Africa and Covid urge us to think about the moral economy of life, according to Didier Fassin, whose eponymous book La Vie [Life], published in 2020, is almost a premonitory reasoning of the Covid-19 pandemic. Revealing the contradictions that run through the moral economy of life does not make contemporary societies fairer, but it does provide weapons for those who want to fight to make them more equitable (Fassin, 2018, p. 157).

In this light, work presented at the symposium tend to show a linkage of social adaptation to scientific knowledge. An important example is vaccination. According to a questionnaire answered by 1,061 respondents in the 6 Abidjan districts, 82.28% were aware of the existence of the Covid-19 vaccine but 34.04% believed in its effectiveness, while 37.07% did not. Between the two [latter] groups, 30.89% of people admit to having no opinion (Kangah et al., 2022). More specifically, the work of Kouassi and Irika (2022) on vaccination coverage among people over 50 years of age shows that 60% of these people consider themselves to be “people at risk of Covid-19”. Although only 46% of them are actually vaccinated, 88.4% think that wearing a mask is effective in protecting themselves. Up to 41% do not trust vaccines; 4.6% are hostile to them in general and 10% point to practical problems in getting to vaccination centers. While the dissemination of “fake news” (Djaha, 2021) has had an impact in Côte d'Ivoire, in all African countries and beyond, these results undermine the notion of an allegedly specific hostility to Covid-19 vaccines.

Another study conducted in the homes of 207 families in 8 Abidjan communes (Anoumatacky et al., 2022) shows that 90% of them think it is a deadly disease. However, 37% think they are “moderately exposed” in 2020, compared to 25% in 2021. This social contradiction runs counter to the evolution of the pandemic, which was more widespread in 2021 than in 2020. Fear is a bad adviser, and this phenomenon was already known and documented in previous pandemics and epidemics. People confronted with the risk of contracting the disease and/or experiencing its deleterious effects modify their perceptions of the disease, including in counter-intuitive ways, whether in Africa or elsewhere. For example, as age increases, people are more willing (or less willing) to be vaccinated. Another study conducted in Bouake shows that, in a small 51-people group, 68% of those vaccinated and found to be positive said the Covid-19 vaccine “protected them from severe forms of the disease” (Soumahoro, Irika et al., 2022, p. 208).

Côte d'Ivoire provides a case study in the hypothesis of the role of climate, among other factors. This example is not far from being an unintended but stimulating echo of Achille Mbembe's analysis:

> “Anticipating a potential, but as yet to be proven, presence that has not yet assumed a stable form should perhaps be the starting point for any future critique whose horizon is to forge a common ground” (Mbembe, 2020, p. 29).

Acknowledgements

We acknowledge the following institutions and individuals:

Institut de recherche pour le développement (IRD)
Ministère de l'Enseignement supérieur et de la Recherche scientifique (MESRS) de Côte d'Ivoire
Service des Maladies infectieuses et tropicales (SMIT). Centre hospitalier universitaire de Treichville, Abidjan, Côte d'Ivoire
Institut Pasteur de Côte d'Ivoire (IPCI)
Institut national de la santé publique (INSP) de Côte d'Ivoire
Ministère de la Santé et de l'Hygiène publique et de la Couverture Maladie Universelle de Côte d'Ivoire
Université Félix Houphouët Boigny (UFHB) d'Abidjan
Université Alassane Ouattara de Bouaké (UAOB)
Valéry Riddle, IRD
Ousmane Zina, Université Alassane Ouattara de Bouaké

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