



(RESEARCH ARTICLE)



## COVID-19 in Douala-Cameroon: Epidemiologic features, challenges to fight the pandemic, and psychosocio-economic impacts

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World Journal of Biology Pharmacy and Health Sciences, 2021, 07(01), 045–058

Publication history: Received on 09 June 2021; revised on 13 July 2021; accepted on 15 July 2021

Article DOI: <https://doi.org/10.30574/wjbphs.2021.7.1.0075>

### Abstract

Coronaviruses are a family of viruses that can cause illnesses such as the common cold, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). In 2019, a new coronavirus was identified as the cause of a disease outbreak that originated in China. Cases of COVID-19 have been reported in a growing number of cities worldwide. Cameroon recorded the first case of the Coronavirus on March 6, 2020 and thereafter, there was a geometric increase in the number of cases. In response to this, the government announced firm measures in an effort to curb the exponential increase of the Coronavirus cases in the country. Despite the measures, the number of cases has continued to increase, coupled with another unwanted socio-economic phenomenon. This study aims to present the challenges to fight COVID-19 in Cameroon urban settlements as with the case of Douala metropolitan city, to examine its geographical distribution pattern, and to apprehend its socio-economic impacts on Douala city dwellers. Data used here derived from local and national health statistics, and from a cross-sectional study conducted in Douala city from May to December 2020. Results reveal that coherent measures were taken by health officials to fight the pandemics. However, spread of the virus has continued in the city, under a differentiated dissemination pattern. Findings also revealed that during lockdown, the city witnessed downturn in the economy, increase in domestic violence and mental health problems. The study recommends the effective follow-up of the measures put in place by the government as well as all the stakeholders, the financial support of enterprises and an aggressive sensitization of the population.

**Keywords:** COVID-19; Health measures; Socio-economic impacts; Geographic pattern of distribution; Douala; Cameroon

### 1. Introduction

An outbreak of a new coronavirus disease that causes respiratory tract infections and can be lethal in humans began in China in December 2019. On 11 March 2020, the World Health Organization (WHO) announced that the current outbreak of the coronavirus disease 2019 (COVID-19), a respiratory illness caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), is a pandemic [1]. This COVID-19 started spreading rapidly to other countries by the end of December 2019. With the spread of the virus worldwide, global concerns about the human pandemics are growing. Presently, the global death toll had passed 4,028,891, with infections rising to more than 186,459,129 [2]. The first case in Africa was identified in Egypt in February 2020. According to WHO, there were 5,876,212 confirmed cases and 150,031 deaths registered in Africa by 10 July 2021. South Africa and Morocco have crossed the 5 000-cases bar. They are followed by Tunisia (473,229 cases), Algeria (3 848 cases) and Egypt (282,737cases) [3]. The magnitude of the disease has prompted much scientific works. While some studies investigated biological and clinical aspects of the disease, [4,5], others explored its risks factors and the role of "space" such as cities in the spread of the pandemics. More

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precisely, the Italian study [6] revealed that population density along with lifestyle in developed countries may partially explain the regional differences regarding the COVID-19 infection between the north and south. Such a link was already reported during the 2003 SARS outbreak in China, where Cui et al. [7] revealed that infected people who lived in densely regions were twice as likely to die as those living in regions with low densely localities.

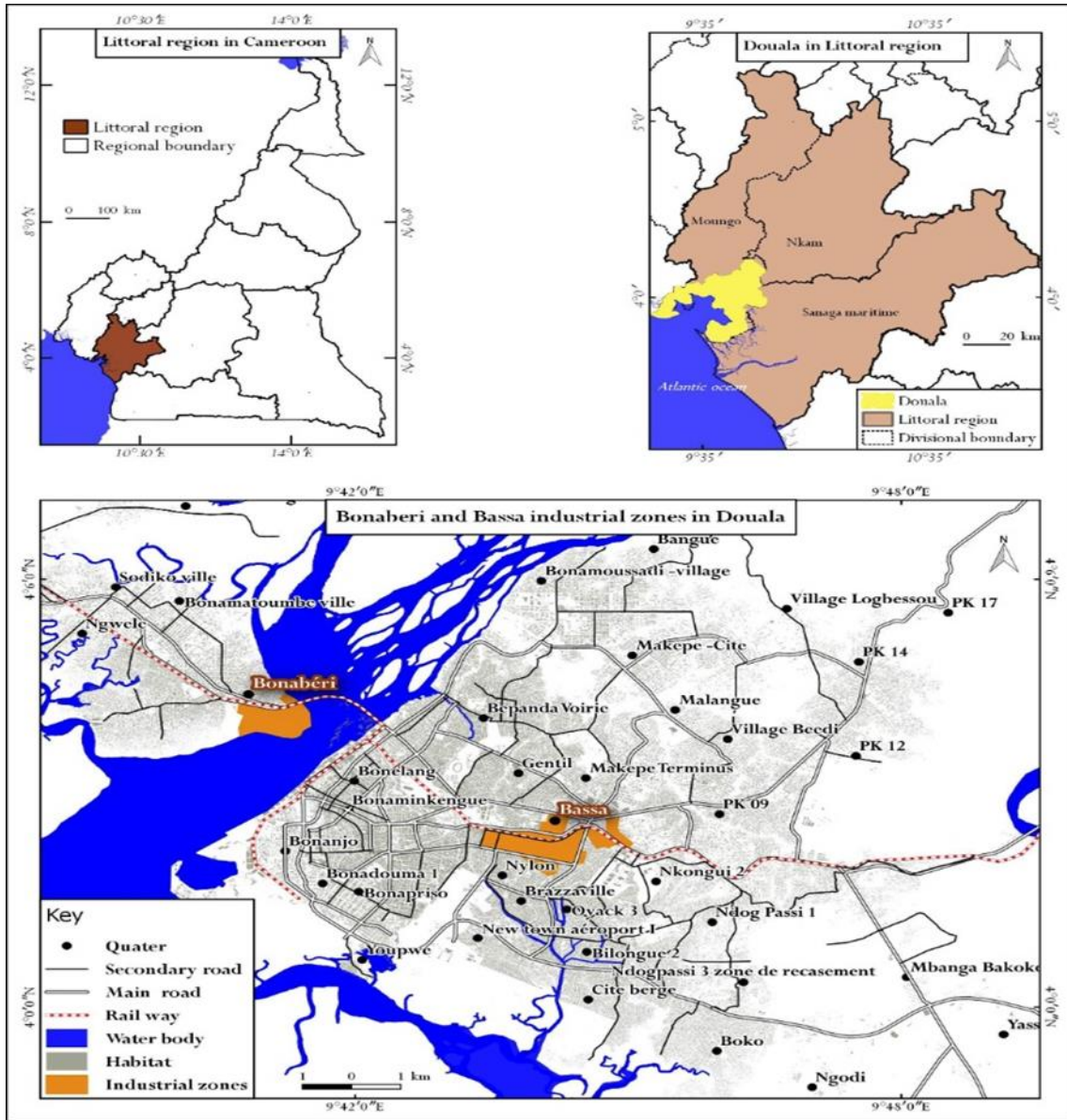
With reference to Cameroon, the first case declared was on March 6, 2020. By 30 April 2020, there were 2069 confirmed cases and 61 deaths registered (MINSANTE, 2020). With the passage of time, new cases have been on the rise, currently making Cameroon one of the African countries most affected by the pandemic [8]. The COVID-19 outbreak is spreading very fast every day and more than 11,857,507 people around the world have been actively infected by this virus so COVID-19 restrictions are applied in almost all areas of life [9]. The most basic measure to reduce the spread of coronavirus or to prevent infection is to follow hygiene rules. The measures taken to mitigate the impact of the COVID-19 pandemic have suddenly changed daily human functioning. Social distancing, self-isolation, loss of freedom, uncertainty, school and business closings, economic vulnerability and job loss have been some results of the lockdown [10]. People worldwide have been told by authorities to stay home to reduce the transmission of coronavirus, and social isolation and domestic quarantine can deepen relationships between family members, intensifying intimacy, affective exchanges, personal ties and previous behaviors, thus becoming a period of emotional growth for all involved [11]. Despite the measures taken by the government in Cameroon, there is an increase in cases and deaths by COVID-19, especially in metropolises like Douala. Therefore, the main question addressed here is: as the pandemic transitions to more widespread community transmission, how can the lessons learned thus far be consolidated to effectively curb the spread of COVID-19 while minimizing social disruption and negative humanitarian and economic consequences in Douala? The goal of this study is to highlight epidemiologic features and challenges to fight COVID-19 in Douala-Cameroon.

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## 2. Material and methods

### 2.1. Study area

The spatial framework of this study is Douala, which is located between latitude 4°3'53.77" North of the Equator and longitude 9°41'15.41" East of the Greenwich meridian. It is a coastal city established on the banks of the river Wouri. Located approximately 30 km from the Atlantic Ocean, Douala covers an area of approximately 210 km<sup>2</sup> with an approximate population of 3.6 million inhabitants, giving a population density of 177.79 inhabitants/km<sup>2</sup>. Before coming under German rule in 1884, the town was known as Cameroon Towns; thereafter it became Kamerunstadt the capital of German Kamerun. It was renamed Douala in 1907 when Cameroon became part of French Cameroon in 1919. Douala features a tropical monsoon climate with relatively consistent temperatures throughout the course of the year, though the city experiences somewhat cooler temperatures in July and August. Douala typically features warm and humid conditions with an abundant rainfall of the order of 4000 to 6000 mm of rainfall per year, allocating the driest month in December with about 28 mm of rainfall while the wettest month is August with about 700 mm of rainfall. The average annual temperature is of the order of 27°C and the thermal amplitude is 2.4°C. Moisture is very high year-round and low-intensity winds are generally southwesterly. The hydrographic network is constituted by its principal river Wouri which divides the city in two parts. In addition to the Wouri River, the hydrography is distributed over nine major hydrographic basins that flow into the Wouri River: Bonassama, Besséke, Bobongo, Mgoua, Kambo, Nsapé, Mbopi, Mbanya and TongoBassa. It can be seen that the beds of these rivers were very small because of the anarchical occupation of the urban space by the populations and the system of waste disposal. Douala is the largest city in Cameroon. It is today a mosaic of ethnic groups that make up Cameroon and owes its recent growth to the rural exodus that has pushed thousands of Cameroonians to leave their countryside to settle in the city, coupled with present civil crisis in the North and South West region of Cameroon. The Population of Douala shifted from 458 426 in 1976 to 1,907479 inhabitants in 2005 and an estimated population of 3,663,000 inhabitants in 2020 with a population growth rate of 3.59%. This increase in population can be justified by the presence of numerous industries that serve as a source of job opportunity to the inhabitants. The city of Douala has established itself as the economic capital of the country through its giant seaport, which has allowed the development of nearly 80% of Cameroon's industrial activity. On its own, the port drains more than 95% of the country's port traffic. The largest companies in the country have set up their headquarters in Douala rather than in Yaoundé. This is due to the openness of the coast to other countries for fast distribution of goods and services.



**Figure 1** Location of Douala metropolitan town in Cameroon

## 2.2. Study Design and sampling

This is a cross-sectional study conducted from March 2020 to March 2021, adopting a mixed research method, that is, a quantitative and a qualitative approach method. The target populations included inhabitants living within the urbanized area made up of the five boroughs (Douala I, Douala II, Douala III, Douala IV and Douala V). Douala VI which is a rural and island area is excluded. A sample size of 600 households was determined and distributed proportionally to the population size of each borough. In each borough, respondents were selected following a simple random sampling.

## 2.3. Data collection and management

Data used here stem both from secondary and primary sources. Secondary sources are related to data obtained from document reviews (web pages /blog reviews dedicated to COVID-19, newspapers), and mostly from official health statistics derived from weekly COVID-19 reports produced by the Ministry of public health through the National Public Health Emergency Operations Centre (NPHEOC). Primary data was collected through field observations and surveys. Selected participants responded to a structured questionnaire containing the following items: COVID-19 and respect of government measures, preventive behaviors, effect of the application of measures on respondents' income, gender-based violence or tensions experienced

in the household, household adaptive strategies against the effects of government measures. Qualitative method included in-depth interviews and was aiming to capture people’s perception and attitudes towards COVID-19. Due to the restriction of movement and physical distancing policies to reduce spread of COVID-19, all data collection was conducted by mobile phone. Data collection was carried out by enumerators trained on conducting mobile phone surveys. Basic respondent characteristics, such as demographics, perceived risk of COVID-19, and social and economic effects of COVID-19, were tabulated using the SPSS® statistical software 20.0 for Microsoft windows. Instead, the open source software QGIS was used for the mapping of COVID-19 cases.

### 2.4. Ethical Approval

The Regional Delegate of Ministry of Health provided written approval to conduct the surveys with resource persons. All personally identifiable information was removed to ensure confidentiality. Each household received a coded ID number. Informed consent was obtained from all participants included in the study and they were told they could terminate the survey at any time or refuse to answer specific questions.

## 3. Results and Comments

### 3.1. General epidemiology of the pandemic in the country

It’s more than a year already that the world is experiencing the severe novel coronavirus named SARS-CoV-2 for its similarity with the epidemic Severe Acute Respiratory Syndrome (SARS) occurred between 2002 and 2003. The outbreak of the novel coronavirus (defined with the acronym COVID-19) is an ongoing global epidemic declared as pandemic in March 2020 by the World Health Organization [12]. In Cameroon, the first case was declared on March 6, 2020. Since then, the spread of the disease has continued to increase. The time series shows the increasing spread of active COVID-19 cases in Cameroon, to the point that, presently, an estimate of 44,622 confirmed cases (of which 4,760 active cases) and 601 deaths are registered (Figure 2).

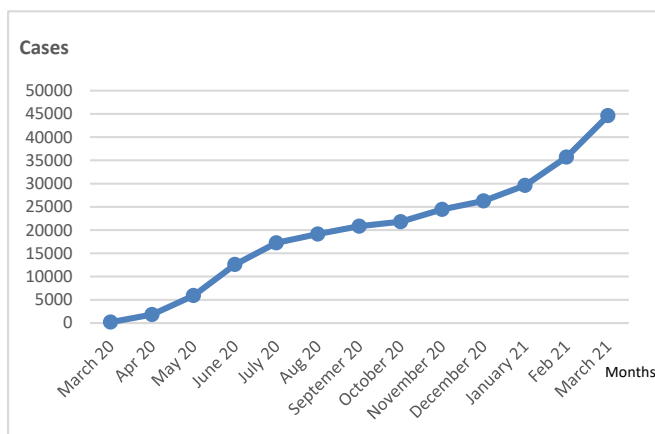


Figure 2a Confirmed cases

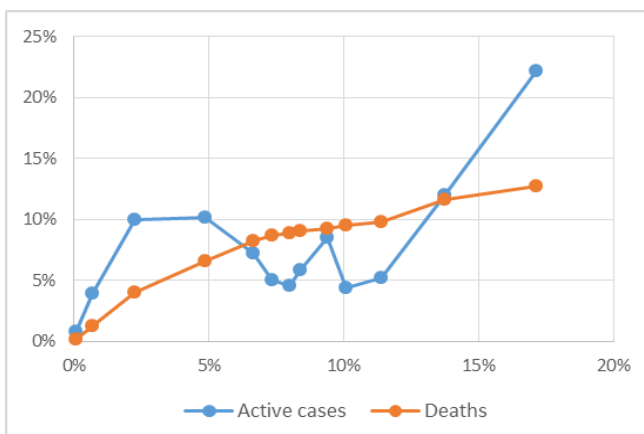
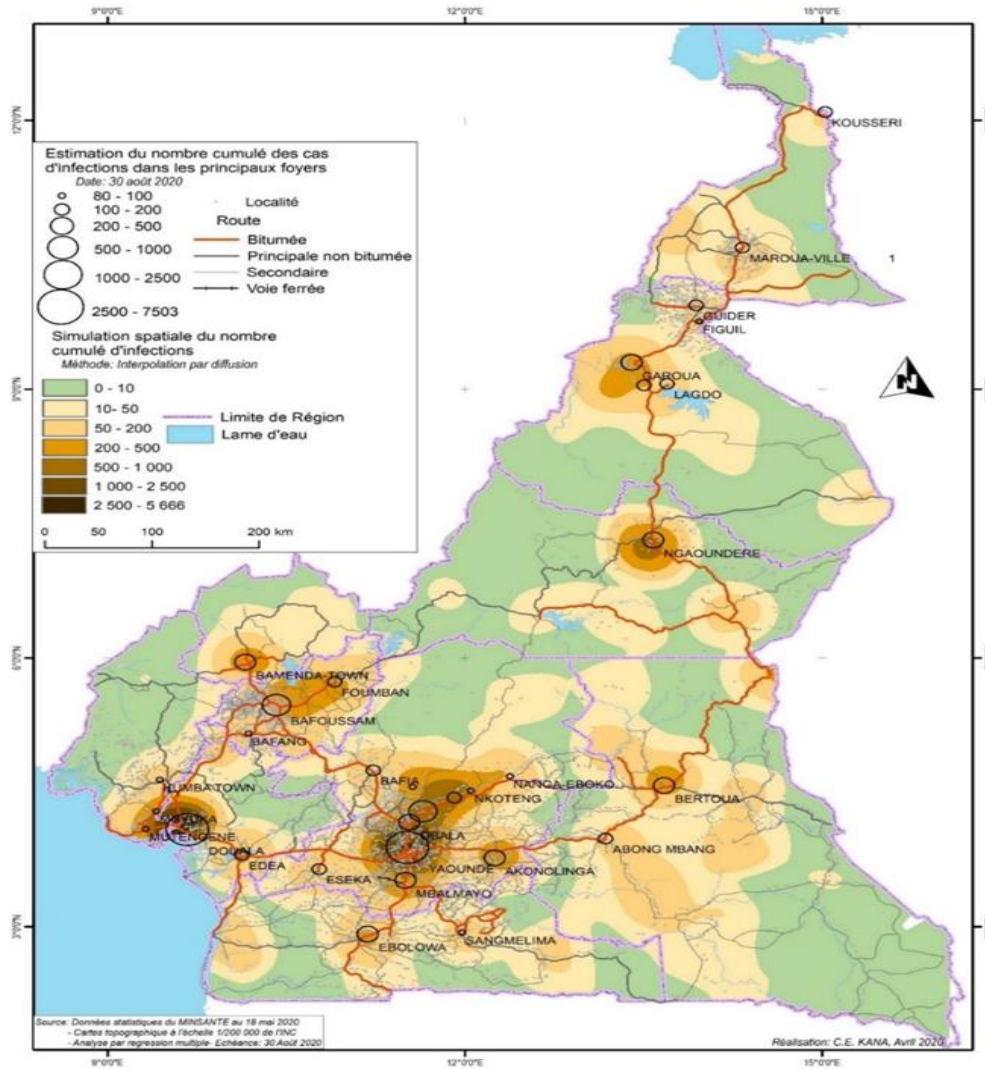


Figure 2b Active cases and deaths

Figure 2 Trend of COVID-19 cases and deaths in Cameroon

A modelling of the spread of the pandemic highlights the main hotspots of COVID-19 in Cameroon, and to appreciate the spread pattern of the disease from metropolises to small and medium urban centers (Figure 3). Through that figure, we clearly see that Douala is one of the country’s metropolises with high levels of confirmed and active cases of COVID-19.



**Figure 3** Spatial diffusion of COVID-19 in Cameroon; **Source:** Kana et al, 2020

### 3.2. COVID-19 in Douala: a worrying, but not alarming epidemiological and clinical situation

The epidemiological summary of COVID-19 cases in Douala shows that the situation, while worrying given the daily increase in the number of cases, is not alarming, compared to the world and national situations (Table 1).

**Table 1** Epidemiological summary of COVID-19 in Douala (as at march 31, 2021)

	Global world	Africa	Cameroon	Douala
Confirmed cases	116 834 629	3 693 662	42 286	10082
Recoveries	93 515 568	3 255 896	36 362	8142
Deaths	2 913 871	105 906	633	138
Lethality	2.5%	2.8%	1.5%	1.3%

Source: Ministère de la santé du Cameroun, 2020, <https://www.worldometers.info/coronavirus/>

Globally and reflecting the whole country, situation of the pandemic in Douala is constantly evolving. The first confirmed COVID-19 case in Cameroon was in Douala, on March 5, 2020. It was a French citizen arrived in Cameroon on February 24, 2020. Since then, the disease has continued to spread. Figure 4 shows the trend of confirmed and active cases due to COVID-19 in the period March 2020-March 2021. The distribution is biphasic with two peaks: the first one in the early stages of epidemic, ie May-July 2020; and the second since February 2021. Noteworthy, data for the month of March still be incomplete due to an update delay. Those two peaks correspond to the two waves of the epidemic that

the whole world is experiencing, and which are related to the new South-Africa and British variants of the virus [13]. According to Kana et al (2020) [14], population density (9,251 hab./km<sup>2</sup>) and urban mobility of citydwellers are the most explanatory factors of the disease’s spread. Taking into account the total number of deaths, the provisional toll for the period amounted to 128 deaths. Noteworthy, the excess mortality in the period July-August (25.7%) did not take into account the actual impact of COVID-19 and March’s 2021 data are not consolidated.

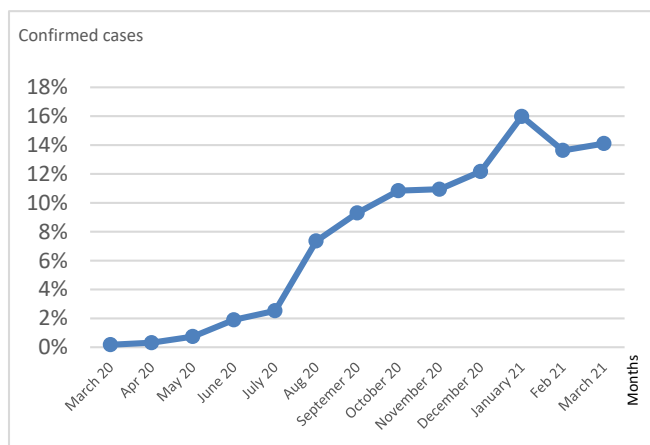


Figure 4a Confirmed cases

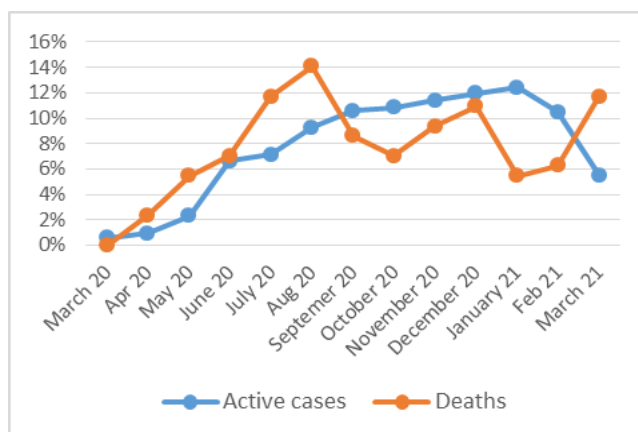


Figure 4b Active cases and deaths

**Figure 4** Trend of COVID-19 cases and deaths in Douala

From demographic and clinical perspectives, of the 492 patients with COVID-19 (over the 1940 active cases) who had been hospitalized at the 3 Designated COVID-19 Care Centres, we obtained data regarding clinical symptoms and outcomes for 386 patients (78.4%). Their demographic and clinical characteristics are shown in Table 2. Most of the patients were adults and males (66.5%). A total of 38.4% and 29.3% were respectively retailers and employees workers, and both groups had a history of contact with contaminated relatives, friends, or colleagues/customers. The first most common symptoms were fever (96.1%) and cough (75.9%); and the second most common symptoms were fatigue (72.8%), shortness of breath (78.7%), nausea (59.1%), and nasal congestion (43.5%). Diarrhea and Myalgia or arthralgia were uncommon. Among the overall patients, 23.7% had at least one coexisting illness (e.g., hypertension, diabetes, chronic obstructive pulmonary disease, and Hiv/Sida).

**Table 2** Demographic and clinical characteristics of the study patients in Douala

Characteristics	Frequency	Percentage
<b>1. Age</b>		
0-14	2	00.5
15-49	183	47.4
50-64	122	31.6
> 65	79	20.5
<b>2. Gender</b>		
Male	257	66.5
Female	129	33.5
<b>3. Socio-professional status</b>		
Student	17	04.4
Retired	81	20.9
Employees	113	29.3
Self-employment (small business)	27	07.0
Informal economy <sup>+</sup>	148	38.4
<b>4. Use of psychoactive products (smoking, alcohol)</b>		
Never	61	15.9
Former	141	36.5
Current	184	47.6
<b>5. Symptoms<sup>**</sup></b>		
Fever	371	96.1
Conjunctival congestion	138	35.7
Nasal congestion	168	43.5

Cough	293	75.9
Sore throat	92	23.8
Fatigue	281	72.8
Shortness of breath	304	78.7
Nausea or vomiting	228	59.1
Diarrhea	107	27.7
Myalgia or arthralgia	73	18.9
<b>6. Co-existing disorders ++</b>		
Hypertension	239	61.9
Chronic obstructive pulmonary disease	86	22.3
Diabetes	113	29.3
Chronic renal disease	64	16.6
Coronary heart disease	52	13.5
Tuberculosis	28	07.3
Vih/Sida	16	04.1

+ By informal economy, we mean street vendors and informal hawkers, local convenience stores, taxi drivers, home-base workers, informal sector farmers. ++ A patient could have several symptoms or co-existing health conditions.

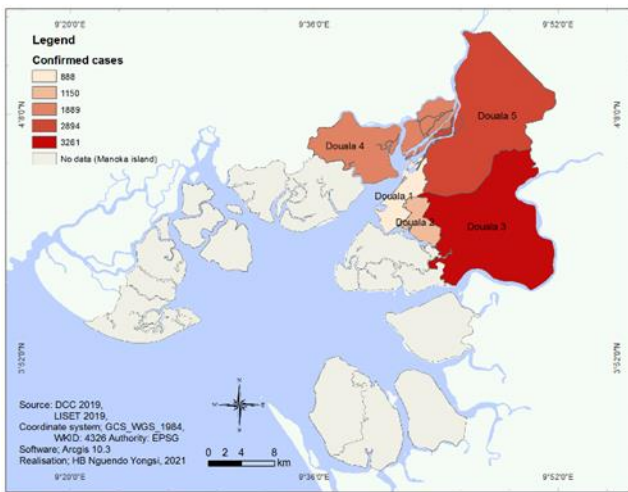


Figure 5a Confirmed cases of COVID-19

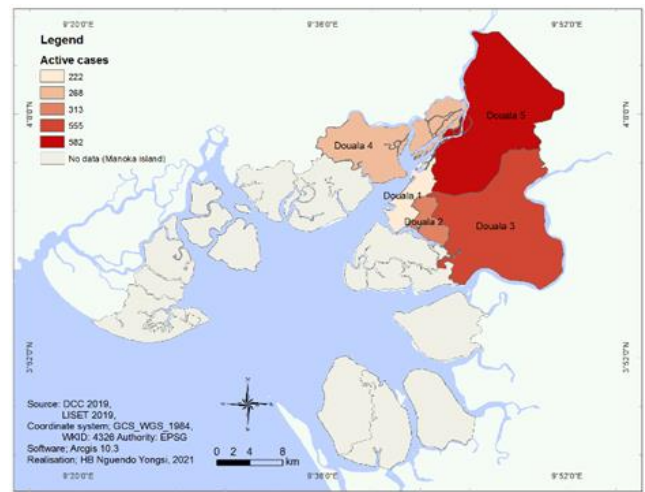


Figure 5b Active cases of COVID-19

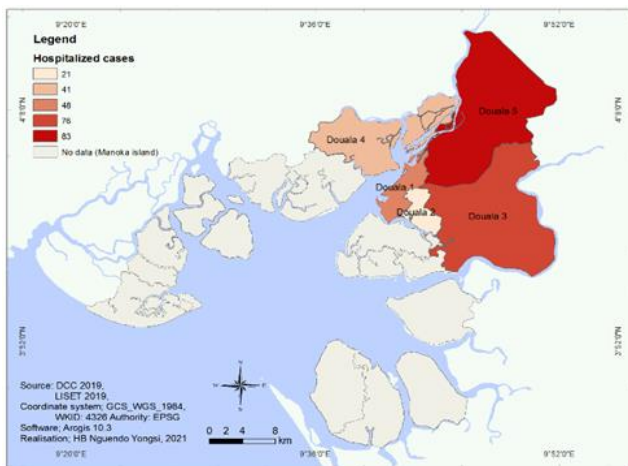


Figure 5c Hospitalized cases of COVID-19

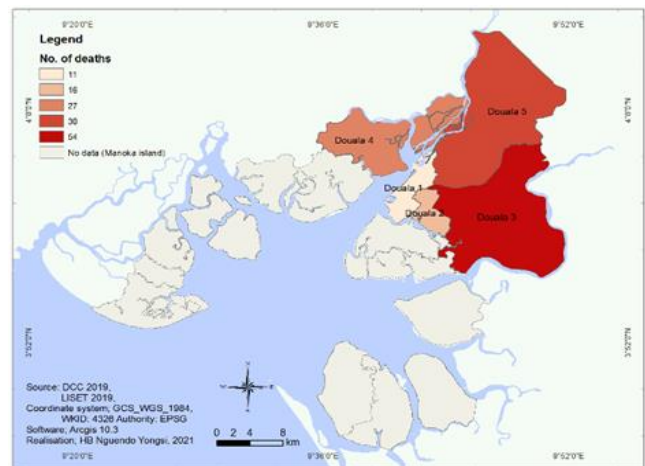


Figure 5d COVID-19 deaths

Figure 5 Spatial distribution of COVID-19 events-related in Douala

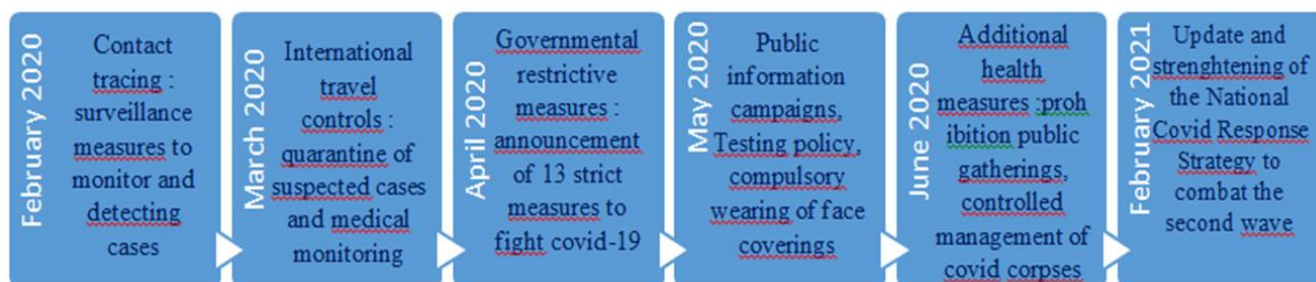
As reported in Italy and France, the ongoing epidemic revealed strong geographical differences in the spread of infection [15]. Figure 5 details the boroughs containing the most likely clusters of high risk of COVID-19 related -health incidence.

Whatever, the COVID-19 related event, the most likely clusters had a statistically significant high risk of COVID-19 related-event incidence. More precisely, the result revealed that the risk of COVID-19 confirmed cases was 2.13 greater in Douala III than the rest of the city (p-value = 0.001). The spatial analysis of COVID-19 related death revealed the same most likely clusters located in the eastern part of Douala and composed of densely populated quarters such as Ngogpassi, Dakar, Nylon, Soboum, etc.). In those quarters, inhabitants mostly work in the informal sector or are self-employed (small retail business), all economic activities where human interaction is essential. However, we found that COVID-19 active cases and intensive care hospitalized cases are located in the north-north-eastern part of the city, that is Douala V (p-value = 0.039). This borough is composed of densely informal settlements (Bepanda, Logbessou, Bangué) and planned quarters (Bonamoussadi, Makepe, Logpom). These results indicate that percentage of households living in an overcrowding housing explained a great part of the excess risk of COVID-19 active case and hospitalization. Our results are consistent with studies carried out in other countries which suggest that people living in densely populated area are more predisposed to develop severe events COVID-19 related [16]. This unequal spatial distribution of the infection spread combined with the healthcare capacity of each borough, lead the local authority to classify the city in different categories (borough at greater or lesser risk) guiding the uncontainment plan started the 11th may 2020.

### 3.3. Learning from experience: health-specific measures taken to address COVID-19 in Douala

As the virus was reported in Douala-Cameroon relatively late compared to Europe and the Americas, the country was afforded extra time to prepare. Based on previous experiences in health crisis management, cameroon government seized this window of opportunity to rapidly mobilize a nation-wide response. An emergency inter-ministerial meeting held on february 2020 led to adoption of the Cameroon strategy for COVID-19. The strategy was approved by the Head of state

who underpinned Minister of public health leadership and ownership of the response to the outbreak. Partnerships with health agencies in sub-regional economic blocs ensured further alignment and synergies. Figure 6 below summarises the national COVID-19 Response Strategy. The strategy, aiming to curb the exponential increase of the coronavirus cases in the country was to be implemented throughout the country, with the utmost rigor in the main metropolises of Yaounde and Douala.



**Figure 6** Timeline of National COVID-19 Response Strategy

Implementation of the national strategy was led by the Ministry of public health. A collaboration of partners, including the World Health Organization has harnessed and leveraged existing regional expertise through technical working groups aligned to priority areas. With reference to Douala, the Regional Delegate of Public health review the latest evidence and best practices, adapting them into policies and technical recommendations to inform public-health action against COVID-19 and to foster coordinated preparedness and response across the city. Hence, early efforts have concentrated on capacitating hospitals and specialized COVID-19 health centers for case detection and containment. Synergies among stakeholders and civil society led to the increase in COVID-19 testing laboratories in the city between mid-March and August 2020. Meanwhile, local workshops were conducted to strengthen the capacity of health staff for enhanced surveillance at points of entry, infection prevention and control, risk communication and clinical case management, with face-to-face workshops transitioning to webinars in April as borders were closed and lockdowns were implemented. Globally, Cameroon and Douala authorities have invested in preparedness and response efforts geared toward various outbreaks on the continent (such as Cholera, HiV/Aids, Poliomyelitis, measles, tuberculosis). This technical know-how has been swiftly adapted to COVID-19. National and urban-level exchange platforms with an established wide audience have been repurposed for training and information on COVID-19 diagnostics. Networks of community health agents that support the response to cholera and other diseases have been leveraged for sensitization and to raise the alarm about suspected COVID-19 at the subnational level. We believe that such an experience in health crises management has helped to limit the spread of the disease in the city and cases severity, and consequently to avoid the announced health disaster.



### 3.4. Douala city dwellers' attitudes towards COVID-19 health measures

On April 2020, the government issued 13 strict measures in order to curb the increase of the coronavirus cases in the country. However, compliance with these health measures has been variously observed by Douala inhabitants (Table 3). For example, and according to the systematic washing of hands with water and soap measure, only 30.3 % of the respondents did practically respect the measure. The same trend is observed regarding face covering with only 27.1%, respondents were complying with the measure in public places, versus 72.9% who were reluctant to do so. This seems embarrassing given the two potential functions of face coverings: they protect the wearer from exposure (personal protective equipment) and protect individuals from exposure to respiratory aerosols/droplets from the mask wearer. That's why the use of masks for the general public has been recommended as one of several COVID-19 pandemic mitigation strategies [17]. Then, facemask or nose masks have been used widely all around the world. However, in Douala, the effectiveness of wearing of mask remains problematic. Even social and physical distancing was not considered, as merely 19.9% comply with the measure. This is not surprising given the urbanizing process and character of the city (about 80% of the city is made up of densely populated informal settlements) and that the majority of inhabitants are involved in the informal sector and survive thanks to products retail and self-help. In addition, other measures have not been complied (prohibition of public gatherings, prohibition of overcrowding in public transport, closing of bars, restaurants and entertainment spots). This should be set in the socioeconomic context of the country with low-recorded unemployment but very high levels of informal employment. In many cities, self-employment and informal employment absorb the overwhelming majority of labor-force. The poor quality of employment reflects in the low income and those are classified as "working poor" [18].

**Table 3** Follow-up of COVID-19 health measures targeting population in Douala

<b>Government health measures</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Handwashing</b>		
Yes	182	30.3
No	418	69.7
<b>Wearing face coverings</b>		
Yes	163	27.1
No	437	72.9
<b>Hand shaking</b>		
Yes	503	83.8
No	97	16.2
<b>Social and physical distancing</b>		
Yes	119	19.9
No	481	80.1
<b>Prohibition of public gatherings</b>		
Yes	161	26.8
No	439	73.2
<b>Closing of bars, restaurants and entertainment spots after 6 pm</b>		
Yes	371	61.8
No	138	35.7
<b>Prohibition of overcrowding in public transport</b>		
Yes	239	61.9
No	86	22.3

They then rely on their daily jobs or activities to survive. In this context, compliance with lockdown is for them a suicidal measure. That is why, places like markets were still crowded, bars and restaurants were door closed but in-functional, taxis overloaded, inter-urban transports still operating on their frequent schedule, as they depend on these activities as their source of income. In contrast, a large majority of the respondents respected the measure of non-hand shaking with respectively 83.8% compliance versus 16.2% of non-compliance. The reason behind this massive follow-up was not really the fear of COVID-19, but the fact that population saw in the new way of greetings a fun time, particularly the clapping of the feet, the elbow to elbow and the blow and wrist to wrist.

### **3.5. Economic implications and psychosocial impact associated with the COVID-19 Pandemic in Douala**

#### *3.5.1. Economic implications*

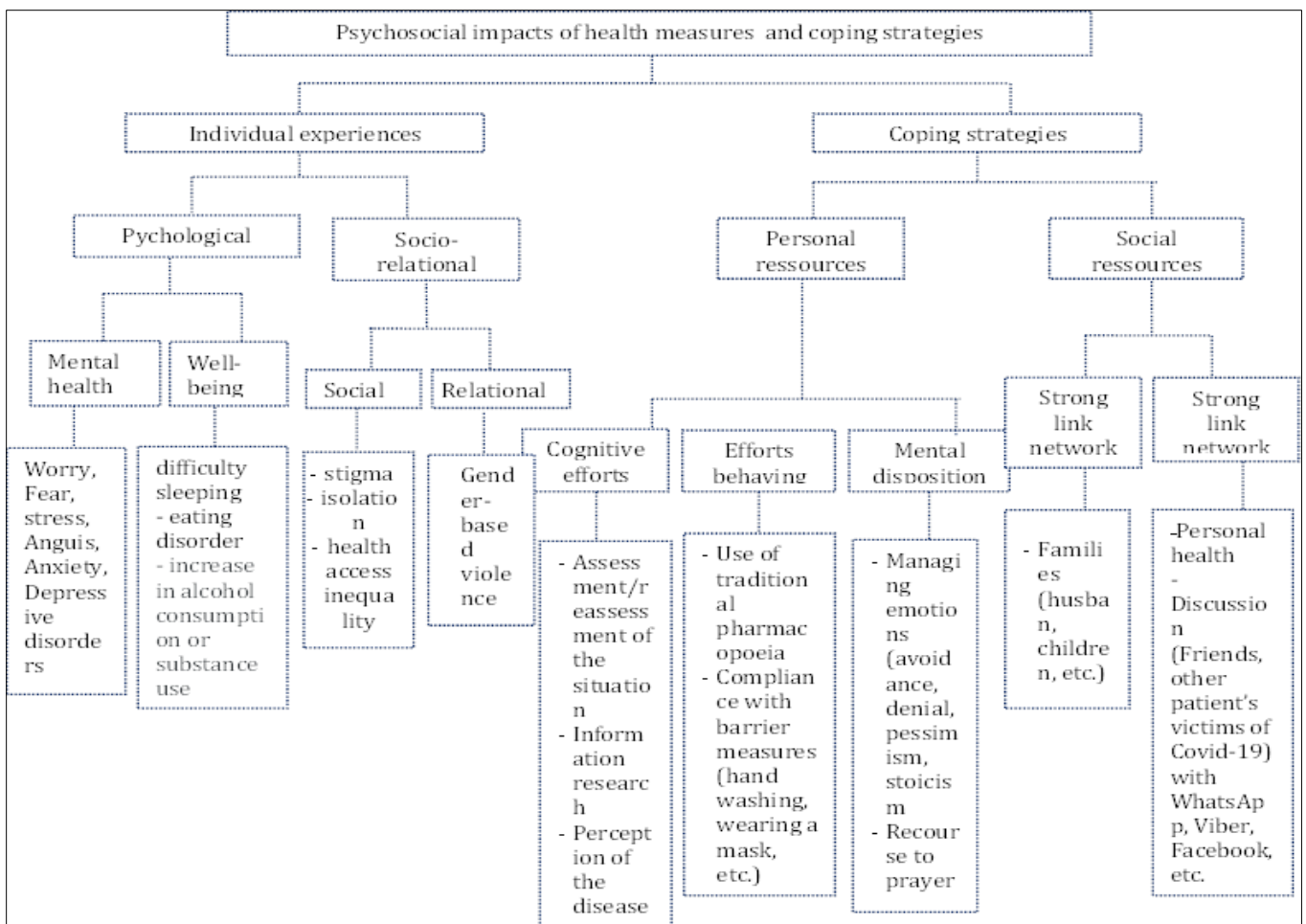
The coronavirus disease has spread quickly across the city with devastating effects on the national economy as well as the local and societies' socio-economic fabrics and the way of life for several city dwellers. These implications can be analyzed at the micro and macro-economic levels.

- The microeconomic costs relate to those borne by individuals/households, firms and other establishments like schools, health facilities, health and workers. With the COVID-19 pandemic, 91% of investigated families have borne costs for diagnosis and treatment because they are not covered by the government or health insurance schemes. Even where these costs are covered, households have still incurred copayments, transport costs and other related expenses, including the indirect costs of care. The COVID-19 pandemic has exacerbated the burden of out-of-pocket health spending on 83% households in Douala, and dampen financial protection for health. Restriction on or removal of the ability to work and earn a living, especially for informal workers who are predominantly women and account for about 89% of all employment in Douala, has put a strain on families. Given the precarious nature of informal work, as evidenced by the absence of a contract or income protection, 63% of respondents stated that their sources of livelihood has been impacted significantly during lockdown. Some firms and establishments have incurred productivity losses from closure of their businesses and from giving employees leave to stay at home to avoid any possible spread of the virus. They also incurred costs related to keeping their work environments disinfected. With Shops, including informal grocery stores, bars and restaurants that had to close face a significant decline in demand. Unfortunately, the associated 'microeconomic' costs are difficult to estimate accurately at this moment as the COVID-19 outbreak continues to unfold and costs will depend on the extent of the uncertainty/panic and actual/suspected cases. However, some owners claimed a 40% to 50% decrease in their turnover. In June-July, an analysis of the socio-economic impacts of the epidemic has been carried out under the City Council leadership. According to the results of the analysis, overall, 82.6% of business leaders reported experiencing a drop-in production. The situation was more pronounced in formal sector enterprises than in the formal sector. In terms of impact, almost half of the negatively affected companies say they have recorded a drop of more than 50% in their production. At the household level, considerable food and economic vulnerability was reported due to COVID-19 control measures. Over 80% of respondents reported a partial or complete loss of income, and 75% reported eating less or skipping meals due to COVID-19. Households reported they were receiving some assistance, but that their biggest remaining unmet need was food. Although the prevalence of COVID-19 was low, and these factors can largely be attributed to control measures rather than illness from COVID-19 itself, it is important to recognize the counterfactual of no control measures is an unmitigated epidemic, and not an absence of these harms.
- The macroeconomic impacts result from a combination of 'demand' and 'supply' shocks in the economy. These impacts can be summed up by looking at, for instance, the effects of the pandemic on macroeconomic aggregates such as the city's GDP, unemployment rate and inflation rate. The macroeconomic impact of the COVID-19 pandemic was the less talked-about economic effect in popular media. However, interviews with economic operators and stakeholders in charge of the city's economic development show that commodity scarcity created by a decline in productivity and by reduction in imports from countries affected by the COVID-19 pandemic has fueled a rise in general price levels (i.e. inflation). According to the mayor of Douala, decline in economic activity has affected the city's revenue generation for about 35%, especially tax revenue (both direct and indirect taxes). As for the Regional Delegate in charge of Public health, public health spending also increased because they had to manage and treat health service users and contain the spread of the virus. Generally, both local and national governments did incur costs related to building, equipping and maintaining

infrastructure to manage, treat and contain the COVID-19 pandemic. The magnitude of public funds incurred went up to 500 millions CFA for the period from April to July 2020.

### 3.5.2. Psychosocial impacts

Measures taken which have created confinement for part of the population are not without foreseeable consequences on individual and collective behavior in Douala. In confinement, whether or not one is contaminated, the new constraining experience of concrete prevention realities due to COVID-19 creates behaviors accepted or forced by constraint, which leads the individual to dyssynchrony, ie to break with the habits and behaviors generally postulated. Figure 7 summarises social and psychological impacts of lockdown along with individuals coping strategies in Douala. Social implications are related with health system and domestic violence. In fact, health system of the country being in a fragile state and having very limited facilities and equipment needed to combat the virus, during the period, particular attention of healthcare staff was more oriented towards COVID-19. Then, city dwellers were afraid of going to health facilities for fear of being infected by COVID-19 or of seeing their associated disease to COVID-19 as a rumor had dominated the whole city. This has created an adverse impact on prenatal care, which ensures that pregnant women and developing babies get proper care during the pregnancy period. Also, this has contributed to the delay in treatment of other infectious diseases like tuberculosis, malaria and non-infectious diseases like diabetes and hypertension. Regarding gender relations and gender-based violence, female respondents reported increase in sexual and gender-based violence including physical, sexual, emotional and economic violence and its health and psychosocial effects, similarly to what has been reported by Nakalembe (2020) [19] and foretold by the United Nations: “ As in past pandemics, there are clear signs women continue to bear the brunt of emergent risks to public health, safety, and human rights” [20].



**Figure 7** Social and psychological impacts of lockdown along with individuals coping strategies in Douala

This is because the lockdown has challenged the traditional gender roles in terms of men being the main breadwinners for families. For instance, the closure of markets interrupted the work of males who previously operated as

vendors/small scale retailers. Consequently, such a sudden loss of work has resulted in a lack of income to support their children and women under their care. This causes anger and frustration within families, which aggravate emotional and physical violence. Lockdowns amidst economic hardships for families are associated with an increase of violence and abuse especially for dependents such as children [21]. Although females would supplement the family income, these regularly work in the traditionally female-dominated informal economy such as braiding hair, washing clothes and tailoring [22, 23, 24]. These have however, also been closed during the lockdown but without providing any social protection to mitigate the effects of loss of livelihoods. Social distancing directives also indicate that such workers are no longer welcome in the places (including households) where they previously worked as casual domestic workers. This situation has particularly been observed among displaced women who fled the war zones (North-West and South-West regions) to seek refuge in Douala. With no livelihood options and lack of social support, sexual violence and commercial sexual exploitation of those displaced women and adolescents were almost inevitable. In Douala IV borough for example which is separated from the city center and other boroughs by the Wouri bridge, closure of informal trade contributed enough to females taking up survival sex to support their families. This exposed them to HIV/AIDS and other sexually transmitted infections and increases the rates of unwanted pregnancies among them, especially in the context that access to reproductive health services is constrained due to the reduction in services provided by health care centers and humanitarian actors due to the lockdown measures and banning of public transport that would have allowed them to access such services. We also find that the mental health of the population was affected due to confinement with 67.33% and the proportion of men among them was 38.11% while that of women was 61.89%. The inhabitants of Douala who were not used to staying in confinement developed a lot of stress. Self-isolation and lockdown then affected mental and physical health significantly because social isolation is adversely related to health (mental and physical), as we know that. households locked down in unfavorable housing conditions (e.g. over crowded with poor ventilation), which characterize many informal urban settings and slums, face adverse health outcomes [25, 26, 27]. The recommended social distancing was a source of stress and anxiety and the fear of contamination too. According to Peijin et al. [28], disconnection from the outside world, being away from familiar people, items and routines, anxiety related to uncertainties, fear of stigmatization as well as challenges in communication are stressors for those isolated due to coronavirus disease. Though not possible to eliminate these stressors, there are ways to mediate. The use of technology has shown to be particularly useful to enhance communication between individuals, provide entertainment and information as well as to facilitate communication between people and their loved ones.

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#### 4. Conclusion

Cameroon recorded the first case of the Coronavirus on the 6th of March 2020 and thereafter, there was a geometric increase in the number of cases. Our study revealed that all the outcomes related to COVID-19 infection investigated (including active cases, hospitalization, deaths, intensive health care) were not randomly distributed. The increased COVID-19 related outcome incidence on Eastern of Douala was statistically significant; the spatial distribution of both active cases/deaths and overcrowding housing may be taken into account to fully interpret the spatial distribution of incidence of COVID-19 related outcomes. Thus, the current sanitary crisis reminds us of how unequal we all are in facing this disease. In response to the spread of the virus, the government announced 13 firm measures in an effort to curb the exponential increase of the Coronavirus cases in the country. However, it appears that a majority of citizens was not really following them. Social distance was more a slogan than a practice as markets places remain overcrowded, bikes, buses and taxis still carry more than the government prescribed numbers. Despite the measures, the number of cases has continued to increase, couple with other unwanted socio-economic phenomenon. The impact of COVID-19 on Douala citizens was severe due to the confinement. Some employers have put staff on technical leave and others workers lost their job. The informal economy, which has a large number of workers, has been hit hard, leaving a large part of the population in poverty. It was revealed that during lockdown, the city witnessed increase in domestic violence, increase of mental health problems, and increase in other infectious diseases and delays in other treatments. In the absence of adequate social protection and welfare programs targeting the poor during the pandemic, the local and even national authorities need to put in place flexible but effective policies and legislation approaches that harness and formalize the informal economy. There is an urgent need to strengthen social protection systems to make them responsive to crises, and embed them within human rights-based approaches to better support vulnerable populations and enact health and social security benefits. The COVID-19 response needs to adhere to the well-established 'do no harm' principle to prevent further damage or suffering as a result of the pandemic and examined through local lenses to inform peace-building initiatives that may yield long-term gains in the post-COVID-19 recovery efforts.

## Compliance with ethical standards

### Acknowledgments

The author would like to thank the healthcare workers, patients, public health experts, and participants for their cooperation to this study. The author is particularly grateful to institutions, especially the Ministry of Public Health, involved in the COVID-19 response in Cameroon and who set free open access its data including the monthly measures of monitoring stations.

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