Epidemiological, virological and clinical features of SARS-CoV-2 among individuals during the first wave in Cameroon: Baseline analysis for the EDCTP PERFECT-Study RIA2020EF-3000

Joseph Fokam,[1-3] Désiré Takou,[1] Alex Durand Nka,[1,4,5] Aude Christelle Ka'e,[1,4,5] Bouba Yagai,[1,4] Collins Ambe Chenwi,[1,3] Ezechiel Ngoufack Jagni Semengue,[1,4,5] Grâce Angong Beloumou,[1] Sandrine Claire Djupsa Ndjeyep,[1] Aissatou Abba,[1] Willy Pabo,[1] Davy Gouissi,[1] Michel Carlos Tommo Tchouaket,[1] Laeticia Yatchou,[1] Krystel Zam,[1] Lucien Mama,[6] Regine Claudette Ekitti,[7] Nadine Fainguem,[1,4,5] Rachel Kamgaing,[1] Samuel Martin Sosso,[1] Nicaise Ndembi,[8] Vittorio Colizzi,[1,4,5] Carlo-Federico Perno,[1,9] Alexis Ndjolo[1,3]

[1]Chantal BIYA International Reference Centre for Research on HIV/AIDS Prevention and Management (CIRCB), Yaoundé, Cameroon; [2]Faculty of Health Sciences, University of Buea, Buea, Cameroon; [3]Faculty of Medicine and Biomedical Sciences, University of Yaounde I, Yaounde, Cameroon; [4]University of Rome Tor Vergata, Rome, Italy; [5]Evangelical University of Cameroon, Bandjoun, Cameroon; 6Cite Verte Health District, Delegation of Public Health, Yaoundé, Cameroon; [7]Police Medical Centre, Yaoundé, Cameroon; [8]Africa Centres for Disease Control and Prevention, Addis Ababa, Ethiopia; [9]IRCCS Bambino Gesù Children's Hospital, Rome, Italy

Abstract

In Cameroon, COVID-19 infection spread rapidly and nationwide, with up to 721 deaths reported. To the best of our knowledge, no study reported the on-the-ground data using a large patients' dataset to give a comprehensive knowledge on COVID-19 pandemic in Cameroon. The objective of this study was to shade lights on the epidemiological, virological and clinical features of COVID-19 in the Cameroonian context. An observational study was conducted among symptomatic and asymptomatic individuals tested for SARS-CoV-2 by PCR on nasopharyngeal samples from April 22nd, 2020 to January 5th, 2021. Out of 14119 individuals (59.8% male), overall SARS-CoV-2 positivity was 12.7% (from 7.9% in <10 years to 17.3% in >60 years, p<0.001). The positivity rate of symptomatic individuals was 36.1% *versus* 9.8% among asymptomatic ones, p<0.001. Age group ≤10 [aOR (95%CI): 0.515 (0.338-0.784), p=0.002] and being symptomatic [aOR (95% CI): 5.108 (4.521-5.771), p<0.001] were predictors of SARS-CoV-2 positivity. Regarding PCR Cycle Threshold (CT), 53.8% of positive individuals had a CT <30. According to age, compared to older individuals, those aged 21-40 years showed a higher proportion with high viraemia (CT<20; 21.3% *versus* 12.5% respectively, p=0.003). Similarly, symptomatic individuals showed a higher proportion with high viraemia (22.4%), when compared to asymptomatic (13.9%); p<0.001. During this first wave of the pandemic, overall SARS-CoV-2 positivity remained high (>10%) and was associated with the presence of symptoms and older age. Most of the infection is among young and asymptomatic individuals, suggesting the "*track-and-test*" strategy should target these potential transmitters.

Introduction

The 2019 coronavirus disease (COVID-19), caused by SARS- CoV-2[1] was declared a "global pandemic" by the Director General of the WHO on march 2020. Transmitted from person to person, it generally causes an asymptomatic or mild respiratory infection, but can be severe, life-threatening and fatal,[2] with its severity being frequently associated to hypertension, diabetes, cardiovascular diseases and pathologies of the respiratory system.[3,4] In addition to these clinical parameters, the spectrum of COVID-19 infection, severity and death are believed to be also affected by demographic, institutional, ecological, health system, politico- economic and climatic factors.[5]

Regarding the African continent, the first case of COVID-19 was notified by Egypt on 14 February 2020.[6] Concerning Cameroon, one of the hardest hit countries in Africa, the first case of SARS-CoV-2 infection was notified on March 6th, 2020 (https://www.afro.who.int/health-topics/coronavirus-covid-19). The infection then spread rapidly and nationwide, with up to 47669 confirmed cases and 721 deaths reported to WHO as of March 31st, 2021. So far, in Cameroon, very few studies reported on COVID-19. They mainly focused on its impact on health system[7] and factors associated with its response and severity.[7–10] To

Correspondence: Joseph Fokam, Virology Laboratory, Chantal BIYA International Reference Centre for research on HIV/AIDS prevention and management (CIRCB), Yaoundé, Cameroon.
Tel.: +237.222315450.
E-mail: josephfokam@gmail.com

Key word: COVID-19, epidemiology, positivity, viraemia, symptoms, Cameroon.

Conflict of interest: The authors declare no conflict of interest.

Contributions: JF, DT, ADN, ACK, BY, VC, CFP and AN conceived the study, designed the experiment, and initiated the paper; JF, DT, ADN, ACK, BY, CAC, ENJS, GAB, SCDN, MCTT, LY, KZ, LM, RCE, NF, RK, SMS performed the experiments and analysed the data; JF, DT, ADN, ACK, BY, VC, CFP, AN Interpreted the data; CAC, ENJS, GAB, SCDN, MCTT, AA, LY, KZ, WP, DG, LM, RCE, NF, RK, SMS revised the manuscript; All the co-authors approved the final version for submission.

Funding: This work was partly supported by the Chantal BIYA International Reference centre (CIRCB), the Cameroon government, the Italian cooperation and the European and developing countries clinical trials partners - EDCTP (PERFECT-study RIA 2020EF-3000).

Availability of data and materials: All data generated or analyzed during this study are included in this published article.

Ethics approval and consent to participate: This study obtained ethical approved from the Cameroon national committee for human health research (N°2020/05/1227/CNERSH/SP). The research was conducted on anonymous samples in accordance with the principles of the Declaration of Helsinki and the national regulations. All information, including, demographic and clinical data was recorded in an anonymized database, with limited access to unauthorized persons.

Informed consent: Not applicable.

Received for publication: 3 February 2022.
Accepted for publication: 21 April 2022.

Journal of Public Health in Africa 2022; 13:2142
doi:10.4081/jphia.2022.2142

the best of our knowledge, no study reported the on-the-ground data using a large patients' dataset to give a comprehensive knowledge on COVID-19 pandemic in Cameroon. To bridge this gap, we conducted a study in a large number of individuals tested for the presence of SARS-CoV-2 by PCR during the first epidemiological wave, to throw more lights on the epidemiological, virological and clinical characteristics of COVID-19 in Cameroon.

Materials and Methods

Study design and population

A cross-sectional study was conducted at the Chantal Biya International Centre for research on HIV/AIDS prevention and management (CIRCB).

The study population was made up of all the individuals (symptomatic and asymptomatic) tested for SARS-CoV-2 infection by PCR from April 22, 2020 to January 5, 2021.

Definitions

An individual was considered symptomatic when s/he had at least one of the COVID-19 related symptoms such as fever, dry cough, aches and pains, sore throat, diarrhoea, conjunctivitis, headache, loss of taste or smell, difficulty breathing/shortness of breath, chest pain/pressure (https://www.who.int/health-topics/coronavirus#tab=tab_3). A SARS-CoV-2 positive case was defined as any individual with SARS-CoV-2 positive test by PCR. The Realtime cycle threshold values were used to estimate the viraemia; a high viremia was defined as having a CT values less than 20.

Data collection and accuracy

Patients' information was extracted from an anonymous database used by national laboratory network for COVID-19 that make use of standardized data collection form. Data were entered by experienced data clerk.

Sample collection and processing, and interpretation of the results

All the samples were collected in designated and appropriate COVID-19 sample collection sites. Nasopharyngeal swabs were collected from the nasopharynx by trained personnel in a 1 mL tube containing a sample preservative solution (Sansure Biotech Inc, China), following the manufacturer's instructions. This sample type was previously reported to provide a low false-negative results across age groups.[11] After collection, the samples were temporarily stored between 4°C and 8°C for 2-5 hours prior to their shipment to the laboratory.

Molecular diagnosis of SARS-CoV-2 was performed using realtime PCR on Abbott m2000rt and QuantStudio 5 of Applied Biosystem by using commercial kits [Abbott diagnostics (www.fda.gov/media/136258/download), *DaAn Gene Co., LTD* (www.daangene.com)] according to the manufacturers' recommendations.

Briefly, a sample was interpreted as positive when the CT value was lower than 37 for both the N and ORF1ab genes. Based on the study of Yamada and colleagues, who established that upper respiratory specimen with CT <30 cycles show a high risk of harbouring transmissible viruses, we categorised the CT values into two groups: CT <30 cycles (potential transmitters) and CT >30 cycles (less likely infectious). Furthermore, those with CT <30 cycles were further divided into two subgroups: individuals with CT <20 (high viremia) and those with a CT 20-30 (intermediate viremia level).

Ethical considerations

This study obtained ethical approved from the Cameroon national committee for human health research (N°2020/05/1227/CNERSH/SP). The research was conducted on anonymous samples in accordance with the principles of the Declaration of Helsinki and the national regulations. All information, including, demographic and clinical data was recorded in an anonymized database, with limited access to unauthorized persons.

Statistical analysis

The analyses were performed using the software package SPSS version 21.0 for Windows (SPSS Inc., Chicago, Illinois). The continuous variables are presented in terms of median (IQR: interquartile range) and categorical variables in absolute number (proportion in %). The associations between the SARS-CoV-2 positivity or CT values levels and demographic and clinical characteristics were investigated by Chi-Square (Pearson or for trend) test, Mann-Witney or Kruskal-Wallis test as appropriate. The univariate and multivariate regression analysis were conducted to identify factors independently associated with the risk of SARS-CoV-2 infection and the risk of being a potential transmitter. Giving the fact that data on some variables were not properly recorded for all patients, we decided to include in the analysis only the variables with high level of completeness. For all the analyses, the significance level was set at $p<0.05$.

Results

Socio-demographic characteristics

A total number of 14119 individuals was included in this analysis. The majority of individuals (98.2%) resided in the Centre region, mainly in the city of Yaoundé. The study population was predominantly made up of males (59.8%), against 40.2% of females. The overall median (IQR) age was 38 (28-49) years. Looking at age categories, 394 (2.8%) had less or equal to 10 years and 16.9% were more than 50 years old; thus the majority (67.0%) of our study population was aged between 21 and 50 years (Table 1). Regarding the presence of COVID-19 related symptoms, overall, 1556 (11.1%) individuals were symptomatic.

Positivity rate of COVID-19, overall and according to gender, age and the presence symptoms

Our analysis showed that the overall positivity rate of SARS-CoV-2 infection was 12.7% among individuals requesting a COVID-19 molecular testing. According to gender, we found that contrarily to males, the frequency of positive individuals was higher among females (females *versus* males: 13.7% *versus* 12.0%, p=0.002; Table 1). By analysing the positivity rate according to age categories, we observed that children ≤10 years had the lowest positivity rate (7.9%), while those aged >60 years showed the highest positivity rate of 17.3%. Of note, apart from these two extremities (<10 years and >60 years), the infection was similarly distributed in all age categories from 11-60 years, with the positivity rate ranging from 11.2% to 13.4% (Table 1).

According to whether or not individuals presented with at least one COVID-19 related symptoms, our analysis showed that the frequency of SARS-CoV-2 positive individual was significantly higher among symptom presenters (36.1%), when compared to asymptomatic individuals (9.8%; p<0.001; Table 1). The commonly observed symptoms among positive cases included cough, headache, myalgia, dyspnea, diarrhoea, vomiting, rhinorrhoea, sore throat and conjunctivitis (data not shown).

Distribution of the presence of symptoms in SARS-CoV-2 positive individuals according to age groups

This analysis revealed that among

individuals ≤10 years tested positive, about 12.9% were symptomatic, compared to 87.1% showing no COVID-19 related symptoms (p=0.025); this frequency slightly increased to up to 18.2% in the age group 11-20 years. A stable frequency around 30% was observed for those aged between 31-50 years (Figure 1). Among individuals aged ≥60 years, up to 47.1% were symptomatic. Generally, the frequency of having COVID-19 related symptoms among SARS-CoV-2 positive individuals consistently increased with age (Figure 1).

Factors associated with SARS-CoV-2 positivity

At univariate analysis, we have observed that being female (compared to male) and showing a COVID-19 related symptoms (compared to asymptomatic) were positively associated with the odds of being positive for SARS-CoV-2; while being in the age group less than 60 years (compared to >60 years) was negatively associated with SARS-CoV-2 positivity (Table 2). At the multivariate analysis, after adjusting for sex, age and the presence of COVID-19 related symptoms, being in the age group ≤10 [adjusted OR (95% CI): 0.515 (0.338-0.784)] was the only parameter confirmed to be negatively associated with SARS-CoV-2 positivity; while showing COVID-19 related symptoms [adjusted OR (95% CI): 5.108 (4.521-5.771)] was confirmed to be positively associated with SARS-CoV-2 positivity. Moreover, even though not reaching statistical significance, females showed a trend of higher odds of SARS-CoV-2 positivity [adjusted OR (95% CI): 1.108 (0.996-1.232), p=0.059], when compared to males. Similarly, a trend towards significance was observed for younger age between 11-30 years when compared to >60 years (Table 2).

Comorbidities among SARS-CoV-2 positive patients

The majority of individuals tested positive for SARS-CoV-2 reported no comorbidities (91.34%). The most frequently reported comorbidity was cardiovascular diseases (n=54, 4.03%), followed by diabetes (n=30, 2.24), respiratory tract disease (n=17, 1.27%) and renal diseases (n=6, 0.45%). Other comorbidities were equally reported and it included among the others cancer, malaria and hepatitis.

Trend of the SARS-CoV-2 positivity rate per month

Globally, a decreasing trend of the pos-

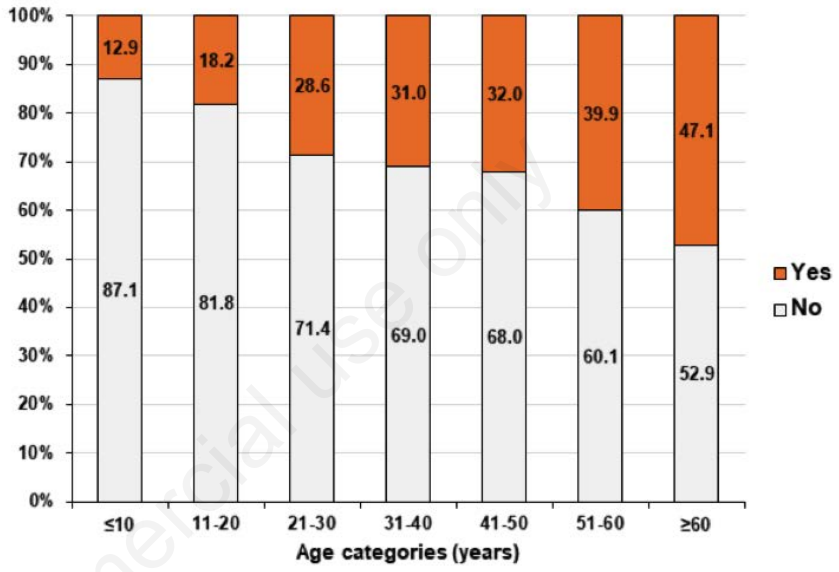

Figure 1. Distribution of individuals tested positive according to age and presence/absence of COVID-19 related symptoms. The most recurrent symptoms that was observed among positive cases included cough, headache, myalgia, dyspnea, diarrhea, vomiting, rhinorrhea, sore throat and conjunctivitis.

Table 1. Characteristics of 14 119 individuals tested for COVID-19, overall and according to positivity status.

Variables	Overall N= 14119	SARS-CoV-2 positivity status		
		Negative N= 12330, 87.3%	Positive[a] N= 1789, 12.7%	p-value[b]
Gender, N (%)				
Male	8444 (59.8)	7434 (88.0)	1010 (12.0)	0.002
Female	5675 (40.2)	4896 (86.3)	779 (13.7)	
Age, years, median (IQR)	38 (28-49)	37 (28-49)	38 (29-50)	<0.001
Age categories, N (%)				
≤10	394 (2.8)	363 (92.1)	31 (7.9)	<0.001
11-20	1079 (7.6)	958 (88.8)	121 (11.2)	
21-30	2945 (20.9)	2585 (87.8)	360 (12.2)	
31-40	3656 (25.9)	3160 (86.4)	496 (13.6)	
41-50	2851 (20.2)	2495 (87.5)	356 (12.5)	
51-60	1588 (11.2)	1375 (86.6)	213 (13.4)	
>60	799 (5.7)	661 (82.7)	138 (17.3)	
Unknown	807 (5.7)	733 (90.8)	74 (9.2)	
Presence of at least one Covid-19 related symptoms, N (%)				
No	12563 (88.9)	11336 (90.2)	1227 (9.8)	<0.001
Yes	1556 (11.1)	994 (63.9)	562 (36.1)	

[a]Presence of SARS-CoV-2 was assessed by realtime PCR. [b]Computed using Chi-square test or Mann-Whitney test as appropriate. Bold face indicates variables with significant P-value. IQR: interquartile range; SARS-CoV-2: severe acute respiratory syndrome coronavirus-2. For the column "overall", the column percentage was used; while the row percentages were used in all the other columns.

itivity rate was observed over the study period (Figure 3). The range varied between 4.3% in August 2020 and 31.2% in May 2020. The positivity rate curve showed three distinct phases (April to July, August to September and October to December, Figure 3), with the trend reflecting the testing strategy implemented at different period. For example, the second phase (August to October), which has a quite low rate, was characterized by a mobile testing strategy that considered voluntary people in the community, independently of their clinical history. Moreover, after the plateau phase observed from October to December (positivity rate of about 9%), even though all data for the month of January 2021 was not yet available at the time of analysis (n=214), we observed an increase to up to 16.8%. Of note, the positivity rate did not seem to significantly correlate with the total number of tests performed (r=-0.299, p=0.400).

Realtime CT values among SARS-CoV-2 positive individuals

The overall median (IQR) CT values among SARS-CoV-2 positive individuals (n=1340) was 29 (23-33) cycles. About 54% of specimen had a CT less than 30 cycles, with up to 17.1% of them showing a high viremia (CT<20 cycles). Table 3 shows the distribution of CT values of the 1340 individuals tested by Da An Gene protocol.

No significant difference of CT values was found regarding gender. Concerning age, individuals with CT<20 showed a significantly lower median (IQR) age [34 (27-44)], when compared to those with a CT 20-30 and CT>30 [38 (29-51) and 39 (30-50), respectively], p<0.001 (Table 3). Stratifying by age categories, among individuals with a CT<20, individuals aged 21-40 years showed a significantly higher frequency (21.3%), followed by those aged <20 years (18.4%), p=0.003. Furthermore, the median (IQR) CT values in age groups

Table 2. Factors associated with SARS-CoV-2 positivity.

Variables	Odds ratio of being positive for SARS-CoV-2			
	OR (95% CI)	p-value	aOR (95% CI)	p-value
Gender				
Male	1		1	
Female	1.155 (1.043-1.280)	*0.006*	1.108 (0.996-1.232)	0.059
Age categories, N (%)				
≤10	0.409 (0.271-0.616)	*<0.001*	0.515 (0.338-0.784)	*0.002*
11-20	0.605 (0.465-0.787)	*<0.001*	0.767 (0.583-1.009)	0.058
21-30	0.667 (0.539-0.826)	*<0.001*	0.813 (0.650-1.017)	0.070
31-40	0.752 (0.612-0.924)	*0.007*	0.892 (0.719-1.108)	0.301
41-50	0.683 (0.552-0.847)	*0.001*	0.837 (0.669-1.047)	0.120
51-60	0.742 (0.588-0.937)	*0.012*	0.841 (0.659-1.073)	0.164
>60	1		1	
Presence of at least one Covid-19 related symptoms				
No	1		1	
Yes	5.213 (4.618-5.884)	<0.001	5.108 (4.521-5.771)	<0.001

Italics indicates variables with significant P-value. CI: confidence interval; OR: odds ratio; aOR: adjusted OR; SARS-CoV-2: severe acute respiratory syndrome coronavirus-2.

Table 3. Distribution of real-time PCR CT values according to gender, age, presence of symptoms and presence of comorbidities.

Variables	Overall	Realtime CT values			
	N= 1340	<20 N= 229, 17.1%	20-30 N= 492, 36.7%	>30 N= 619, 46.2%	P-value[a]
Gender, N (%)					
Male	755 (56.3)	132 (17.5)	273 (36.2)	350 (46.4)	0.855
Female	585 (43.7)	97 (16.6)	219 (37.4)	269 (46.0)	
Age, years, median (IQR)	38 (2.8)	34 (27-45)	39 (30-52)	40 (31-52)	*<0.001*
Age categories, N (%)					
≤20	103 (7.7)	19 (18.4)	36 (35.0)	48 (46.6)	*0.003*
21-40	629 (46.9)	134 (21.3)	228 (36.2)	267 (42.4)	
>40	553 (41.3)	69 (12.5)	211 (38.2)	273 (49.4)	
Unknown	55 (4.1)	7 (12.7)	17 (30.9)	31 (56.4)	
Presence of Covid-19 related symptoms, N (%)					
No	840 (62.7)	117 (13.9)	296 (35.2)	427 (50.8)	*<0.001*
Yes	500 (37.3)	112 (22.4)	196 (39.2)	192 (38.4)	
Days from symptoms onset, median (IQR)	6 (0.4)	3 (2-6)	6 (4-7)	8 (5-11)	*<0.001*
Days from symptoms onset categories, N (%)[b]					
≤5	83 (6.2)	29 (34.9)	34 (41.0)	20 (24.1)	*<0.001*
6-10	72 (5.4)	9 (12.5)	35 (48.6)	28 (38.9)	
>10	34 (2.5)	1 (2.9)	8 (23.5)	25 (73.5)	
Presence of Comorbidities, N (%)					
No	1244 (92.9)	216 (17.4)	454 (36.5)	574 (46.1)	0.605
Yes	96 (7.1)	13 (13.5)	38 (39.6)	45 (46.9)	

[a]Computed using Chi-square for trend or Kruskal-Wallis test as appropriate. [b]N=189. Italics indicates variables with significant P-value. CT: cycle threshold; IQR: interquartile range; SARS-CoV-2: severe acute respiratory syndrome coronavirus-2. For the column "overall", the column percentage was used; while the row percentages were used in all the other columns.

≤40 years and >40 years were 29 (22-33) and 30 (25-33), respectively, p=0.004.

Regarding symptoms, we observed a significantly higher frequency of symptom presenters among those with CT<20 (22.4%), when compared to those who are asymptomatic (13.9%), p<0.001 (Table 3). Among these symptom presenters, we observed that individuals with symptom onset ≤5 days showed the highest frequency among those with CT<20 (34.9%), when compared to those with symptom onset from 5-10 days and >10 days (12.5% and 2.9%, respectively), p<0.001. Concerning comorbidities, no significant difference between the various CT value levels and the presence of a comorbidity was found (p=0.605).

Factors associated with CT values among SARS-CoV-2 positive individuals

At univariate analysis, being in the age group 21-40 years (compared to >40 years), being symptomatic (compared to asymptomatic) and having shown symptoms in ≤10 days before testing (compared to >10 days) were found to be associated with high risk of harbouring transmissible viruses (CT<30 cycles, potential transmitters). At multivariable analysis, after adjusting for sex, age, presence of symptoms and number of days from symptom onset, the only predictor of being a potential transmitter was the time between testing and symptom onset (adjusted OR [95% CI] for the time periods 0-5 days and 6-10 days were 9.244 [3.533-24.190] and 4.473 [1.720-11.632, respectively, P<0.05]).

Discussion

Our study aimed to provide evidence on the epidemiological, virological and clinical characteristics of the first epidemiological wave of COVID-19 pandemic in Cameroon. We analysed a large dataset of more than 14000 individuals tested for SARS-CoV-2 by PCR. The study population was young, with a median age of 36 years, reflecting the population youthfulness. Regarding the testing coverage according to sex, females seemed to request less testing (40% of the requests) than males, suggesting potential difficulties of women to access COVID-19 testing[12] and the need to emphasize on COVID-19 sensitization among women in the African context. In this regard, a previous study in Cameroon reported that, women showed a lower COVID-19 practice score.[9] On the hand, the inclusion of young people might reflect their high awareness regarding COVID-19.[9] The overall positivity rate of SARS-CoV-2 was about 13% in the analysed population. The rate observed in our analysis is high, but comparable to the rate observed in other countries such as South Africa and Nigeria, and more than that of some Western countries such as Italy. In the first phase (May to July 2020) in which testing was performed mainly in symptomatic cases, a high positivity rate (about 20%) was observed. By contrast, in August to September where an opened policy to testing was implemented, the positivity rate was lower than 5%, suggesting that this

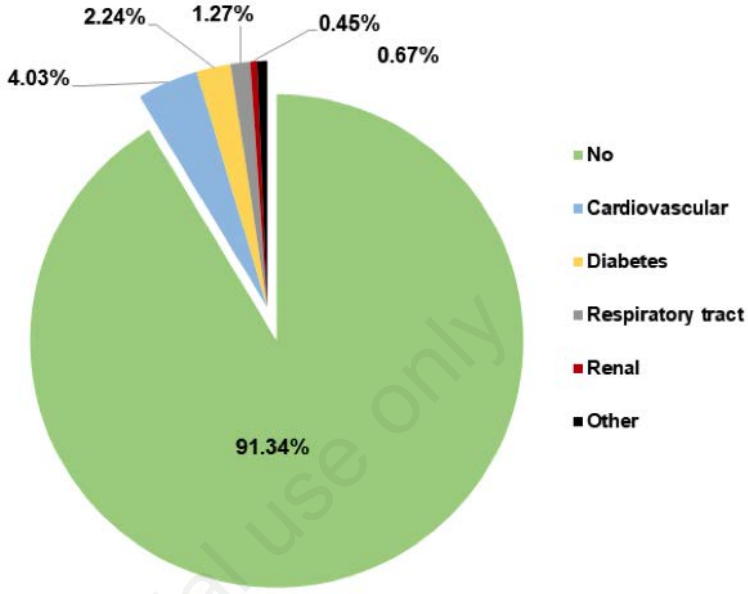

Figure 2. Distribution of comorbidities among SARS-CoV-2 positive individuals. Other comorbidities include: cancer, hepatitis, malaria and gastritis.

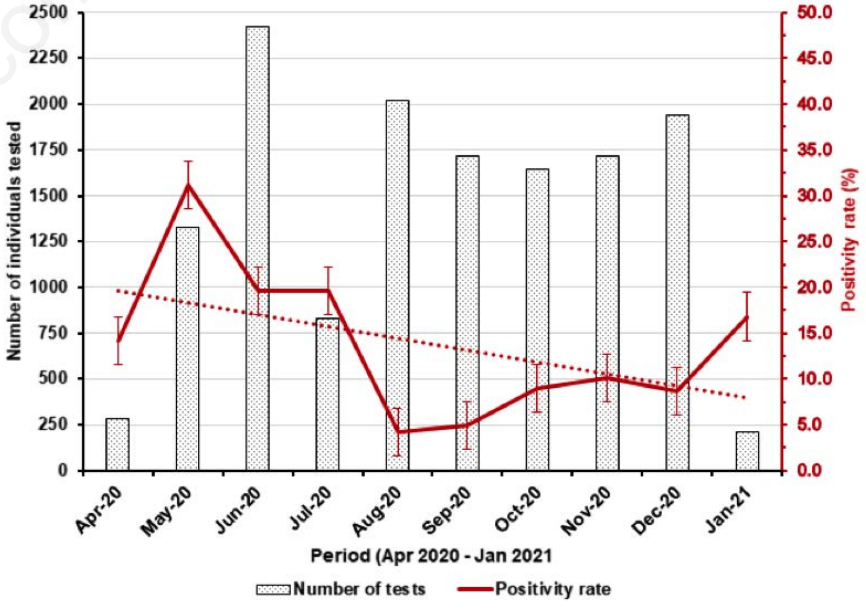

Figure 3. Trends of the number of SARS-CoV-2 molecular testing and positivity rates per month. The error bars represent the 95% confidence interval. Molecular testing began during the month of April 2020. For the month of January 2021, the analysis included individuals tested up to the 5th of January 2021. The red dot line represents the linear trend of the positivity rate.

might be more indicative of the real transmission level in urban settings in Cameroon. In this regard, even though not significant, a negative correlation was found between the number of tests performed and the positivity rate. It is also important to note that the relatively strict barrier measures and massive sensitization implemented in the month of May 2020 could have also contributed to lower the risk of contamination observed in the following months. An increase of the positivity rate in January 2021 was observed (Figure 3), suggesting that more emphasis should be put on the respect of barrier measures that work and the reinforcement of the testing capacity in order to expand the access to SARS-CoV-2 testing.[13] This is especially prominent in the present context, which is marked by the advent of new and more contagious SARS-CoV-2 variants that fuels Africa's second wave.[14]

Regarding the positivity rate according to gender, even though several reports identified males as being at higher risk of SARS-CoV-2 infection,[15,16] due to their biological characteristics, risk behaviour and societal roles towards infection, we found that the proportion of SARS-CoV-2 positive females was slightly higher, when compared to males (Table 1), but this difference was not confirmed at the multivariate analysis. Even though analysis conducted by WHO in 28 African countries showed that about 41% of COVID-19 cases were women, regarding Cameroon, the percentages of cases between the two sexes were similar. This observation might however underscore the potentially limited access of women to COVID-19 testing in Cameroon.

A low prevalence of comorbidities was observed in our analysis, when compared to previous reports.[17,18] The impact of some comorbidities on the acquisition and progression of SARS-CoV-2 infection bas been well established.[18,19] This low prevalence might be due to the differences in population characteristics as well as their potential under reporting in our study.

Regarding age, our analysis confirmed the higher propensity of older individuals to contract SARS-CoV-2 infection, when compared to younger ones.[20–22] Even though high, the positivity rate observed in individuals ≤10 years (about 7.9%) is comparable with previous reports.[22–25] We confirm here that in the Cameroonian context, age >60 years is a predictor of SARS-CoV-2 positivity. Noteworthy, among individuals in age categories 11-60 years, our analysis showed that the distribution of SARS-CoV-2 infection was similar; highlighting the fact that the infection is present in all age groups and should be taken into consideration when implementing control measures.

Our findings also showed that the odds of individuals with a COVID-19 related symptoms were 5 times higher than those without symptom. Policy makers should thus improve on the knowledge of COVID-19 symptoms among different communities, prompting the concerned people to seek testing and health care early enough. Moreover, our analysis showed that about 70% of SARS-CoV-2 positive individuals are asymptomatic (Table 1), this could be partly explained by the youthfulness of our study population. This group should not be therefore under looked in the prevention strategies because it also contributes to the spread of SARS-CoV-2 infection.[26,27] Our analysis reveals the highly silent circulation of the virus as observed in other reports.[28] In fact, we demonstrated that there was a consistently decreasing frequency of symptoms presenters with decreasing age (Figure 1). In particular, the data shows that children ≤10 years experienced a substantial proportion of symptoms (about 13%, Figure 1); but this observation might be probably explained by the fact that they are more likely to experience symptoms such as fever and diarrhoea, which might be explained by other endemic tropical infections. Overall, these observations however call for the reinforcement of contact tracing and the implementation of massive screening in high-risk areas for early detection of cases, also among those below 40 years, which accounted for more than 50% of the infection in this analysis.

This last aspect is further supported by the fact that, though only at the univariate analysis, the risk of transmissible viruses was 1.3 times higher in those with <40 years category, when compared to older individuals. However, age was not confirmed to be a predictor of viremia level at the multivariate level in this analysis. Compared to asymptomatic individuals, symptom presenters had a significantly higher proportion among those with high viremia (CT<20), even though this was not confirmed in the multivariate analysis. On the other hand, the short time between symptom onset and testing was found to be a strong predictor of high viral concentration.[29,30] Even though the significance was only observed at the univariate analysis, we found when compared to older and more younger individuals that those between 21-40 years (more than 70% of them were asymptomatic, Figure 1) showed a significantly higher proportion of those with a high viremia. This observation suggests that in Cameroon and in similar settings, individuals aged <40 years in general (particularly those aged 21-40 years) might potentially be an important driver of the on-going but silent epidemics. This observation also implies that public health measures such as the wearing of facemask should be emphasised in this age group.

Our study had some limitations. First, the reasons for testing were not fully available. Secondly, the proportion of symptomatic individuals (especially among young people) might have been overestimated due to other endemic infections. Data were not initially collected for research purposes, thus they might have introduced some biases.

Conclusions

During the first wave of COVID-19 pandemic in Cameroon, there was a decreasing trend of SARS-CoV-2 infection over time in Cameroon. However, the overall high positivity rate indicates the need to extend more access to COVID-19 testing and tracking. Most of the infected individuals were young and asymptomatic. Factors independently associated with SARS-CoV-2 positivity were older age and having a COVID-19 related symptoms, while only the number of days from symptom onset predicted high SARS-CoV-2 viral concentration. Thus, to curve down the pandemic in countries like Cameroon, public health interventions should implement target-testing, focusing on detecting SARS-CoV-2 infection in asymptomatic and young individuals. The dynamics of infection supports the need to continue surveillance for updated strategies.

References

1. Zhu N, Zhang D, Wang W, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. N Engl J Med 2020;382:727-33.
2. Oran DP, Topol E J. Prevalence of Asymptomatic SARS-CoV-2 Infection : A Narrative Review. Ann Int Med 2020;173:362–7.
3. Guan W, Ni Z, Hu Y, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med 2020;382: 1708–20.
4. Jiang F, Deng L, Zhang L, et al. Review of the Clinical Characteristics of Coronavirus Disease 2019 (COVID-19). J Gen Intern Med 2020;35:1545-9.
5. Meo SA. Impact of weather conditions on incidence and mortality of COVID-19 pandemic in Africa. Eur Rev Med Pharmacol Sci 2020;24:9753-9.

6. Massinga Loembé M, Tshangela A, Salyer SJ, et al. COVID-19 in Africa: the spread and response. Nat Med 2020;26:999-1003.
7. Mboua CP, Keubo FRN, Fouaka SGN. Anxiété et dépression associées à la prise en charge de la COVID-19 chez les personnels de santé au Cameroun [Anxiety and Depression Associated with the Management of COVID-19 Among Healthcare workers in Cameroon]. Evol Psychiatr (Paris) 2021;86:131-9.
8. Mbopi-Keou FX, Pondi JE, Sosso MA. COVID-19 in Cameroon: a crucial equation to resolve. Lancet Infect Dis 2020;20:1367–8.
9. Ngwewondo A, Nkengazong L, Ambe LA, et al. Knowledge, attitudes, practices of/towards COVID 19 preventive measures and symptoms: A cross-sectional study during the exponential rise of the outbreak in Cameroon. PLoS Negl Trop Dis 2020;14:e0008700.
10. Fouda Mbarga N, Epee E, Mbarga M, et al. Clinical profile and factors associated with COVID-19 in Yaounde, Cameroon: A prospective cohort study. PLoS One 2021;16:e0251504.
11. Buchan BW, Hoff JS, Gmehlin CG, et al. Distribution of SARS-CoV-2 PCR Cycle Threshold Values Provide Practical Insight Into Overall and Target-Specific Sensitivity Among Symptomatic Patients. Am J Clin Pathol 2020;154:479-485.
12. Ahmed SB, Dumanski SM. Sex, gender and COVID-19: a call to action. Can J Public Heal 2020;111:980–3.
13. Kobia F, Gitaka J. COVID-19: Are Africa's diagnostic challenges blunting response effectiveness? AAS Open Res 2020;3:4.
14. WHO. New COVID-19 variants fuelling Africa's second wave. WHO Africa; 2021.
15. Rozenberg S, Vandromme J, Charlotte M. Are we equal in adversity? Does Covid-19 affect women and men differently? Maturitas 2020;138:62–8.
16. Abate BB, Kassie AM, Kassaw MW, et al. Sex difference in coronavirus disease (COVID-19): a systematic review and meta-analysis. BMJ Open 2020;10: e040129.
17. Guan WJ, Liang WH, Zhao Y, et al. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. Eur Respir J 2020;55:2000547.
18. Deravi N, Fathi M, Vakili K, et al. SARS-CoV-2 infection in patients with diabetes mellitus and hypertension: a systematic review. Rev Cardiovasc Med 2020;21:385-97.
19. Nishiga M, Wang DW, Han Y, et al. COVID-19 and cardiovascular disease: from basic mechanisms to clinical perspectives. Nature Reviews Cardiology 2020;17;543–58.
20. Gesesew HA, Koye DN, Fetene DM, et al. Risk factors for COVID-19 infection, disease severity and related deaths in Africa: a systematic review. BMJ Open 2021;11:e044618.
21. Shahbazi F, Solgi M, Khazaei S. Predisposing risk factors for COVID-19 infection: A case-control study. Casp J Intern Med 2020;11:495–500.
22. Clark A, Jit M, Warren-Gash C, et al. Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study. Lancet Glob Health 2020;8:e1003-e1017.
23. Wells CR, Stearns JK, Lutumba P, Galvani AP. COVID-19 on the African continent. Lancet Infect Dis 2020;20: 1368–70.
24. Rathore V, Galhotra A, Pal R, Sahu KK. COVID-19 pandemic and children: A review. J Pediatr Pharmacol Therapeut 2020;25:574–85.
25. Rabinowicz S, Leshem E, Pessach IM. COVID-19 in the Pediatric Population—Review and Current Evidence. Current Infectious Disease Reports Curr Infect Dis Rep 2020; 22:29.
26. Yanes-Lane M, Winters N, Fregonese F, et al. Proportion of asymptomatic infection among COVID-19 positive persons and their transmission potential: A systematic review and meta-analysis. PLoS One 2020;15:e0241536.
27. Gandhi M, Yokoe DS, Havlir DV. Asymptomatic Transmission, the Achilles' Heel of Current Strategies to Control Covid-19. N Engl J Med 2020; 382:2158–60.
28. Almadhi MA, Abdulrahman A, Sharaf SA, et al. The high prevalence of asymptomatic SARS-CoV-2 infection reveals the silent spread of COVID-19. Int J Infect Dis 2021;105:656-61.
29. Salvatore PP, Dawson P, Wadhwa A, et al. Epidemiological Correlates of Polymerase Chain Reaction Cycle Threshold Values in the Detection of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Clin Infect Dis 2021;72:e761-7.
30. He X, Lau EHY, Wu P, et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. Nat Med 2020;26:672-5.