Trends in Pediatric Hospitalizations and Mortality during the Covid-19 Pandemic in an Urban Setting in Cameroon

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ABSTRACT

BACKGROUND: The first case of COVID-19 in Cameroon was recorded in March 2020. In response to the pandemic, Cameroon like most countries instituted a number of control measures to curb the spread of the pandemic across the country. These COVID-19 control measures added to the fear of this disease within the population may have led to other detrimental health effects like; the pattern of hospitalizations and hospital outcome.

METHODS: We did a cross-sectional study with data from in-patient admission records of children admitted at the pediatric ward of the Regional Hospital Bamenda over a 24 months period, (1st of March 2019 to the 28th of February 2021). The pre-pandemic period in Cameroon (that is the first 12 months, from March 2019-February 2020) and the pandemic period (that is the last 12 months, from March 2020-February 2021) were compared.

RESULTS: A total of 2,282 hospitalization records were included in the study. Most of the hospitalized children were males (57.23%). There was a 19.03% decline in pediatric hospitalizations during the first twelve months of the pandemic, which was statistically significant (P = 0.00024). The causes of hospitalizations and mortality remained similar over both periods, with severe malaria the leading cause of admissions. Hospital deaths before and during the pandemic were 1.6% and 1.9% respectively.

CONCLUSION: There was a statistically significant decline in pediatric hospitalizations during the first twelve months of the pandemic, as compared to the same period before the pandemic. Hospital mortality, and causes of hospitalizations remained similar over both periods.

KEY WORDS: Trends, hospitalizations, mortality, COVID-19, Cameroon.

LAY SUMMARY

The COVID-19 pandemic is a public health emergency and challenge to the health systems of most countries worldwide. The initial response of the Cameroon government to the COVID-19 pandemic was to put a number of measures in place to stop the spread of the virus across the country. These measures, though beneficial in the fight against COVID-19 could have led to other detrimental health effects on the population, through a change in the pattern of hospitalizations and hospital outcome, and all these made worse by the fear of COVID within the population.

We carried out a descriptive and retrospective cross sectional study using hospitalization and mortality data from the pediatric ward of the Regional Hospital Bamenda, in Cameroon. We compared the data for the last twelve months before the pandemic (March 2019 – February 2020) to that of the first twelve months during the pandemic in Cameroon (March 2020 – February 2021).

The comparison of the two periods showed that there was a statistically significant decline in pediatric hospitalizations during the first twelve months of the pandemic, by 19.03% (P = 0.00024). The hospital mortality rates before and during the pandemic were 1.6% and 1.9% respectively and the causes of these hospitalizations and mortality remained similar over both periods.

INTRODUCTION

Coronavirus disease (COVID-19) is an infectious, acute respiratory illness in humans, caused by the SARS-CoV-2. It originated from China in late 2019, going on to spread all across the world in the next few months, creating a pandemic**[1]**. In Cameroon, the first case was recorded in Yaounde, on the 6th of March 2020**[2]**. The COVID-19 pandemic is a public health emergency, and a challenge to the health systems of most countries globally.

Cameroon, like many nations worldwide, instituted some control measures to try and stop the spread of COVID within the national territory. Some of these measures were; Limitations on urban and inter urban movement, closure of schools and training institutions, closure of entertainment spots as from 6 PM and limitations on public gatherings**[3]**. These measures, though beneficial in the fight against COVID-19, may have led to other detrimental health effects, especially when compounded by the fear of COVID within the population.

Childhood morbidity and mortality remains a global point of interest, and more so in developing countries like Cameroon that have overburdened health care systems and so were expected to suffer greatly from the pandemic. Some studies have shown COVID-19 - associated disruptions in routine child care since the start of the pandemic**[4]**. Others noted more deaths due to disruptions caused by the pandemic**[5]**.

Pandemic associated disruptions in the form of various control measures, and the fear of the disease within the population may have affected the pattern of hospitalization and hospital outcome in children. A similar study carried out in a pediatric hospital in Yaounde, showed a marked decline in hospitalizations, and an increase in mortality, both occurring within the first few weeks of the pandemic**[6]**.

Our research goal was to study the effect of the COVID-19 pandemic on the number of hospitalizations, the causes of these hospitalizations and the mortality of hospitalized children in the pediatric ward of the Regional Hospital Bamenda (RHB).

METHODOLOGY

Study setting

This study was done at the pediatric unit of Regional Hospital Bamenda. It is a third level referral hospital located in the Bamenda II subdivision of Mezam division in the North West region of Cameroon.

Study design, period and duration

It was a retrospective cross-sectional study, at the general pediatric ward of the Regional Hospital Bamenda. We compared hospitalization and mortality figures for the pre-pandemic period (that is 12 months, from March 2019-February 2020) to the pandemic period (that is 12 months, from March 2020-February 2021). This study was carried out over a period of 6 months, from January 2021 to June 2021. The study population comprised all children hospitalized at the RHB pediatric ward during the study period. As for the sample size, we used the hospitalization records at the pediatric ward that were within the study period, and met the inclusion criteria. Admission records and files of participants were consecutively explored and enrolled in the study.

Included into our study were;

- Files of admissions recorded in the registers of the pediatric ward, which contained all the clinical details required for the study purpose.

We excluded the admission records of;

- Children < 3 months of age (because in this hospital, infants less than 03 months are hospitalized in the neonatology unit).
- Children > 15 years of age (because only children up to 15 years are hospitalized in this ward).

Data collection

Data was collected using an adequately designed data collection form. Information was extracted from the hospitalization records and files. A total of 2,344 hospitalization records were explored. After elimination using both the inclusion and exclusion criteria, 2282 hospitalization records were included into the study.

Data analysis

Data was entered into SPSS for windows version 21.0 and analysis was done. Chi square test was used to compare categorical variables. A P-value<0.05 was considered as statistically significant.

Ethical considerations

Ethical clearance was obtained from the Institutional Review Board of the Faculty of Health Sciences of The University of Bamenda while administrative authorization was obtained from the Regional Delegation of Public Health, Northwest Region, and from the Directorate of the RHB.

RESULTS

Hospitalizations

Majority of the children hospitalized during the study period were: males (57.23%), less than five years old (60.60%) and resided in Bamenda town (82.12%) (Table 1). The mean ages of the children hospitalized before and during the pandemic were 4.28(±4.19) and 3.60(±3.60) years respectively. The total percentage drop in hospitalizations over the two periods was 19.03%, which was statistically significant (P = 0.00024). The start of the pandemic in Cameroon (in March 2020) saw a 19.13% drop in hospitalizations compared to the corresponding period before the pandemic (March 2019). The two comparative months with the highest percentage variation (-45.38%) were July 2020 and July 2019 (Table 2).

There was an overall decline in hospitalizations for the period during the pandemic as compared to the period before. This drop was statistically significant (P = 0.00024). However, despite this overall decline, there were peaks of hospitalization noted during this period, in May and November 2020 (Table 2).

The top nine causes of hospitalizations over the two periods remained essentially the same. The number one cause of hospitalizations over both periods was severe malaria. There was a large decline in hospitalizations due to urinary tract infections (55.8%), sickle cell disease crises (48.65%), and meningitis (67.24%) for the period during the pandemic as compared to the period before the pandemic (Table 3)

The number of patients referred for better management and discharged against medical advice were subtracted from total admissions (the denominator) when calculating the mortality rate, because their outcome could not be determined. Of the 39 deaths over both periods, 20 (51.3%) occurred before the COVID 19 period, and 19 (48.7%) during the COVID 19 period. There was only a small difference in

the in-hospital mortality rate across both periods (1.6% versus 1.9%). There was found to be no association between death in the periods before and during the pandemic (P-value = 0.513) (Table 4)

The top 5 causes of deaths before the pandemic were severe malaria, sepsis, meningitis, severe anemia due to sickle cell disease, and Severe dehydration in these percentages respectively; 25%, 15%, 15%, 10% and 10%. While the top 5 causes of deaths during the pandemic were sepsis, severe malaria, pneumonia, chronic kidney disease and acute kidney injury in these percentages respectively; 15.79%, 10.53%, 10.53%, 10.53% and 10.53%.

The top two causes of death were the same over both periods (severe malaria and sepsis, responsible for a combined 40% and 26.32% of the deaths before the pandemic and during the pandemic respectively) (Table 5). However, it was also noted that there was a 14.47% decrease in deaths due to severe malaria and a 0.79% decrease in deaths due to sepsis both occurring during the pandemic (Table 6).

DISCUSSION

There was an overall drop in hospitalizations by 19.03% during the first twelve months of the pandemic, as compared to the last twelve months before the pandemic, which was statistically significant (P = 0.00024). Chelo *et al* 2020 showed a drastic drop in hospitalizations during the first few months of the pandemic in Cameroon**[6]** while Pelletier *et al* 2020 showed that pediatric admissions in the USA decreased between January and June 2020**[7]**. There were similar findings in many other studies**[8–15]**.

Majority of the children hospitalized during the study period were: males (57.23%), less than five years old (60.60%) and resided in Bamenda town (82.12%). The mean ages of the children hospitalized before and during the pandemic were 4.28(±4.19) and 3.60(±3.60) years respectively.

Many reasons could be put forward to explain this decline in hospitalizations, but the most plausible explanation was the public exhibiting risk aversion behavior, by avoiding health institutions especially

those known to harbor a COVID-19 treatment center for fear of contracting the disease there, as they may have seen and heard over the media how rapidly the disease can spread and how fatal it can be. Another reason for the decline in hospitalizations could be the control measures put in place by the government early on to try and curb the spread of COVID-19. These measures while being beneficial health wise, affected many Cameroonians financially, especially those operating in the informal sector and hence limited the financial ability of many parents to seek medical care for their children**[6].**

The largest decline in hospitalizations was observed in July 2020 (a 45.38% drop comparative to July 2019) which was just a month after the peak of the first wave of COVID-19 infections in Cameroon (June 2020)**[2]**. It is possible that the public avoided seeking medical care at hospitals even harder during this period in response to the fear of contagion arising from the media outlets, as well as from their own perception of the severity of the situation.

Also, despite there being a general decline in hospitalizations during the pandemic, there were peaks of hospitalizations recorded during this period, in May and November 2020.The peak in May 2020 could be due to the fact that, the government had eased some of the COVID control measures a month earlier**[6]**, and by so doing, relieving some of the financial weight of these measures on the population, making them more able to financially pursue hospital based care as before. The rise in hospitalizations observed in November 2020 may have been due to a decrease in risk aversion behavior by the public, given that the first wave of COVID-19 infections in Cameroon was now close to its lowest point**[2]** and so the public, having perceived this, may have felt it safer to pursue hospital based health care as before, with decreased risk of acquiring COVID-19 at health facilities.

The top ten causes of hospitalizations remained essentially the same across both periods, with severe malaria remaining the leading cause of hospitalizations before and during the pandemic. Tette *et al* 2016 in Ghana showed that malaria was the leading cause of hospitalizations in children over a ten year

period**[15]**. Ezeonwu *et al* 2014 in Nigeria showed that malaria was a leading cause of childhood morbidity and mortality and was the most common reason for hospitalization (30.3% of admissions) over a 5 year period**[16]** while Ilo *et al* 2011 in Nigeria showed that malaria was by a distance, the most common cause of hospitalization over a 12 month period**[17]**. The similarity in the results in the above studies was surely due to the fact that they all had similar settings.

There was only a slight change in the in-hospital mortality before compared to during the pandemic (1.6% versus 1.9%), which was not statistically significant. This was in contrast to the findings of Chelo *et al*, as they showed that the in-hospital mortality doubled during the first few months of the pandemic in Cameroon**[6]**. Birkmeyer *et al* 2020 in the USA showed that the in-hospital mortality rate for non-COVID-19 hospitalizations increased only modestly, and this modest increase occurred during the nadir of medical admissions in April 2020 before returning to pre-COVID levels in June 2020**[8]**.

Raman *et al* 2020 in India showed a reduction in admissions but at the same time, an increase in delayed presentations at the pediatric emergency department and hence increased intensive care unit requirement**[12]**. These findings demonstrate the relationship between deferred health care and increased morbidity leading to poorer health outcome. With the observed decline in hospitalizations we had, and this known relationship between deferred health care and increased morbidity, we expected to have patients present at the hospital late, in more severe disease condition, leading to poorer hospital outcome and an increase in in-hospital deaths, but this was not the case. Reasons for this discrepancy in mortality observed between our study and that done by Chelo 2020 *et al* in Cameroon might not only be due to their study setting. The missing admissions we had could have resulted in increased out-of-hospital deaths in our setting, or in increase rates of death on arrival at the emergency department which we did not study as it was out of the scope of our study.

The main causes of in-hospital deaths were the same over both periods (severe malaria and sepsis). Chelo *et al* showed that the probable causes of mortality during the first three months of the pandemic in Cameroon remained the same, with malaria topping the list**[6]**. Ezeonwu *et al* 2014 in Nigeria showed that severe malaria (responsible for 24.4% of deaths) and sepsis (responsible for 19.9% of deaths) were the major causes of mortality over a 5year period. Blackman *et al* 2010**[18]** and Lui *et al* 2012**[19]** also have both malaria and sepsis as two of the major causes of child mortality in developing countries.

In conclusion, this study has shown that, there was an overall decline in hospitalizations during the first twelve months of the pandemic as compared to the same time frame before the pandemic. However, mortality was similar over the two periods. Mitigating measures to prevent COVID-19 spread were responsible for the decreasing trends.

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Table 1: Sociodemographic characteristics by period of admission

Variable	Period before pandemic	Period during pandemic	Total	P value
Sex (%)				0.257
Males	735 (58.29%)	571 (55.93%)	1306 (57.23%)	
Females	526 (41.71%)	450 (44.07%)	976 (42.77%)	
Sex ratio	1.40	1.27	1.34	0.132
Age range in years (%)				
[3 months-5 years[	789 (62.57%)	594 (58.18%)	1383 (60.60%)	
[5 years-10 years[	280 (22.20%)	244 (23.90%)	524 (22.96%)	
[10 years-15 years]	192 (15.23%)	183 (17.92%)	375 (16.43%)	
Mean age(± SD)	4.28(±4.19)	3.60(±3.60)	3.86(±3.89)	
Residence (%)				0.738
In town	1029 (81.60%)	845 (82.76%)	1874 (82.12%)	
Out of town	202 (16.02%)	155 (15.18%)	357 (15.64%)	
Out of the Region	30 (2.38%)	21 (2.06%)	51 (2.23%)	

Table 2: Total monthly admissions and percentage variations over the two periods *

Month	Period before pandemic	Period during pandemic	Variation (%) *
	Number of admissions	Number of admissions	
March	115	93	-22(19.13)
April	133	109	-24(18.08)
May	112	115	+3(2.68)
June	114	65	-49(42.98)
July	119	65	-54(45.38)
August	122	71	-51(41.80)
September	53	45	-8(15.09)
October	51	63	+12(23.58)
November	106	107	+1(0.94)
December	109	98	-11(10.09)
January	118	104	-14(11.86)
February	109	86	-23(21.10)
Total	**1261**	**1021**	**-240(19.03)**

*The drop in total hospitalizations during the pandemic, as compared to before the pandemic, was found to be statistically significant (P = 0.00024).

*The negative sign (-) shows that there was a drop after the pandemic, compared to before, while a positive sign (+) indicates that there was increase.

Table 3: Comparison of the top ten causes of admissions over the two periods *

Period before pandemic			Period during pandemic		
Cause of admission	**Number of admissions**	**(%)**	**Cause of admission**	**Number of admissions**	**(%)**
Severe malaria	425	33.70	Severe malaria	364	35.65
Urinary tract infections	181	14.35	Gastroenteritis	84	8.23
Meningitis	174	13.80	Urinary tract infections	80	7.84
Gastroenteritis	75	5.95	Sepsis	66	6.46
Sickle cell disease crises	74	5.87	Pneumonia	60	5.88
Pneumonia	58	4.6	Meningitis	57	5.58
Sepsis	40	3.17	Bronchitis	48	4.7
Acute otitis media	40	3.17	Sickle cell disease crises	38	3.72
Bronchitis	23	1.82	Acute otitis media	24	2.35
Malnutrition	13	1.03	Tonsillitis	22	2.15

*****The causes of hospitalizations are arranged by period of admission in decreasing order of frequency, from the most frequent to least the frequent.

Table 4: Deaths by period of admission *

Period of admission	Number of admissions	Number of deaths	Percentage deaths(%)
Period before COVID-19	1261	20	1.6
Period during COVID-19	1021	19	1.9
Total	**2282**	**39**	**1.7**

*The rise in the in-hospital mortality rate during the pandemic, as compared to before the pandemic, was found to be not statistically significant (P = 0.531).

Table 5: Comparison of the top five causes of deaths over the two periods

Period before pandemic			Period during pandemic		
Cause of death	**Number of deaths**	**(%)**	**Cause of death**	**Number of deaths**	**(%)**
Severe malaria	5	25	Sepsis	3	15.79
Sepsis	3	15	Severe malaria	2	10.53
Meningitis	3	15	Pneumonia	2	10.53
Severe anemia due to sickle cell disease	2	10	Chronic kidney disease	2	10.53
Severe dehydration	2	10	Acute kidney injury	2	10.53

Table 6: Percentage variations in the main causes of deaths over the two periods *

Period before pandemic		Period during pandemic		
Cause of death	**Number of deaths (%)**	**Cause of death**	**Number of deaths (%)**	**Percentage variation**
Severe malaria	5(25)	Severe malaria	2(10.53)	-14.47%
Sepsis	3(15)	Sepsis	3(15.79)	-0.79%

*The negative sign (-) indicates that there was a drop during the pandemic compared to before.