Annales Africaines de Médecine
Article original

Impact of COVID-19 on admission due to diarrhea to the emergency department of the largest specialized Pediatric Hospital, Kinshasa, the Democratic Republic of the Congo: A retrospective analysis

Impact de la COVID-19 sur les admissions dues à la diarrhée aux urgences du plus grand hôpital pédiatrique spécialisé, Kinshasa, RDC : une analyse rétrospective

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Résumé
Contexte et objectif. L'effet de confinement dû à la COVID-19 sur l'utilisation des soins pédiatriques a été démontré sous d'autres cieux. Cependant, on en sait peu concernant cet impact sur le fardeau des maladies diarrhéiques chez les enfants en Afrique subsaharienne. Cette étude visait à rechercher l'impact de la pandémie à COVID-19 sur les admissions dues à la diarrhée dans un hôpital pédiatrique. *Méthodes*. Etude documentaire des cas de diarrhées recensés, au service des urgences de l'hôpital pédiatrique de Kalembe-Lembe, entre les 1er janvier et 31 juillet 2019 et 2020. Les variables ont été comparées, entre la période du confinement de la pandémie en 2020 et la période équivalente en 2019. *Résultats*. Au total 442 dossiers médicaux ont été colligés. Une baisse de 45 % d'admissions des cas de diarrhée a été observée, aux urgences pédiatriques pendant le confinement. Les admissions quotidiennes étaient significativement plus élevées en 2019 qu'en 2020 (p <0,001). La majorité des patients ont été admis avec une déshydratation modérée en 2019 qu'en 2020 (p <0,001) mais une augmentation de la proportion de patients avec une déshydratation légère et sévère a été observée en 2020 par rapport à 2019 (p <0,001). Le taux d'hospitalisation était significativement plus élevé en 2019 qu'en 2020 (p <0,001). *Conclusion*. Les restrictions dues à la COVID-19 ont conduit à une diminution substantielle des admissions dues à la diarrhée chez les enfants aux urgences pédiatriques. Des interventions de santé publique sont nécessaires pour promouvoir un système de santé ambulatoire lors d'une telle crise dans un proche avenir.

Mots-clés : COVID-19, confinement, diarrhée, enfants, service des urgences pédiatriques
Reçu le 1er mars 2020
Accepté le 28 avril 2021

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Summary
Context and objective. The COVID-19's lockdown effect on pediatric healthcare utilization has been demonstrated. However, little is known about this impact on the burden of diarrheal diseases among children in sub-Saharan Africa. This study aimed at studying the impact of the COVID-19 pandemic on admissions due to diarrhea into the largest specialized Pediatric Hospital in the city of Kinshasa. *Methods*. A retrospective study was conducted on diarrhea cases admitted into the emergency department of the Kalembe-Lembe Pediatric Hospital between January 1st and July 31st of 2019 and 2020. Variables were compared during the pandemic's lockdown period in 2020 to the equivalent period in 2019. *Results*. Overall, 422 medical records were examined. A 45% drop in diarrhea cases was observed in the pediatric emergency department between the study periods in 2019 and 2020. Daily admissions were significantly higher in 2019 than in 2020 (p < 0.001). The majority of patients were admitted with moderate dehydration in 2019 than in 2020 (p < 0.001) but an increase in proportion of patients with mild and severe dehydration was observed in 2020 than in 2019 (p < 0.001). The hospitalization rate was significantly higher in 2019 than in 2020 (p < 0.001). *Conclusions*; The COVID-19's restrictions led to a substantial decrease in admissions due to diarrhea among children to the pediatric emergency department. Public health interventions are needed to promote an ambulatory healthcare system during future crises.

Keywords: COVID-19, lockdown, diarrhea, children, pediatric emergency department

Received: March 1st, 2020
Accepted: April 28th, 2021

Introduction

The coronavirus disease 19 (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) led to more than 100 million cases and 2 million deaths worldwide (1). The explosive magnitude of the current pandemic has prompted governments in several countries to adopt draconian public health measures including lockdown. The latter consisted of social distancing, school and workplace closures and travel ban (2).

Environment, Besançon, France

Collateral effects of the COVID-19 pandemic through coercive measures applied were rapidly felt, in particular on healthcare systems. Among them, a significant decrease in admissions to pediatric emergency departments was reported (3-16). Also, delayed pediatric emergency healthcare utilization was observed (8,17). Moreover, substantial reductions in pediatric admissions were observed for gastrointestinal emergencies (3,7-8). A few studies have focused on the COVID-19's lockdown effect on health systems in Africa (18-19), however there is a paucity of detailed data about the impact of COVID-19's lockdown on the burden of the second leading cause of mortality among children (especially those aged under five) (20-21). The largest proportion of diarrhea-specific child mortality in sub-Saharan Africa is concentrated on a reduced number of countries including the Democratic Republic of the Congo (DRC) (22).

COVID-19 was officially declared on March 10th 2020 in the DRC. Faced with the exponential increase in the number of cases, a lockdown was implemented on March 24th in the capital of Kinshasa, the most affected city in the DRC. In countries heavily hit with a large number of confirmed COVID-19 cases, the total number of visits due to acute infectious symptoms, including diarrhea, to pediatric emergency departments was decreased by more than 50% from 2019 to 2020 (3,7,8,10,11,13). Here, we assessed the impact of pandemic COVID-19 on admissions due to diarrhea into the largest health facility specializing in the treatment of children in 2020, particularly during the lockdown period (March-July), compared to the same period in 2019.

Methods

Study setting

The Kalembe-Lembe Pediatric Hospital is a health institution specializing in the treatment of diseases of children from 0 to 15 years old, according to the standards of the World Health Organization (WHO). It is the largest pediatric hospital in the capital Kinshasa. The hospital takes care of the 94,635 inhabitants of the Lingwala area with its 31 health centers, but also treats children from all over the city of Kinshasa. It is also the referral hospital for children from the provinces surrounding Kinshasa (Kongo central and Equateur) and neighboring countries of the DRC, such as Angola.

The hospital was founded in 1948 by the Red Cross of the former Belgian Congo and became a state hospital in 1973. Its management was entrusted in 1997 to the Belgian Red Cross in partnership with the Congo Red Cross.

The Kalembe-Lembe hospital is entirely dedicated to children. It has 144 beds and has various departments: nutritional services, emergency department, pediatric surgery and neonatal service, as well as auxiliary services such as the laboratory, blood bank, pharmacy and medical imaging. There is also an otolaryngology and pediatric orthopedics department (focusing on clubfoot surgery). The Kalembe Lembe Hospital has a special intensive care unit for children with infectious diseases (HIV and tuberculosis). The hospital also records around 19,800 consultations per year and 3,650 hospitalized patients. Each year, some 172 children undergo major surgery in the Kalembe-Lembe Pediatric Hospital.

Data collection

Medical records of diarrhea cases (n = 442) admitted during visits to the emergency department of the specialized Pediatric Hospital of Kalembe-Lembe between January 1st and July 31st 2019 and January 1st and July 31st 2020 were used. Demographic (sex and age) and medical (daily admissions of diarrhea, level and severity of dehydration, hospitalization rate) data were taken into account in this study.

Diarrhea is defined as a child having loose or watery stools for three or more times in 24 hours (23).

Degrees of dehydration were classified according to an updated guideline of pediatric dehydration (24). These are summarized in Table 1.

Table 1: Clinical assessment of degrees of dehydration

Dehydration (%)	Mild (3-5 %)	Moderate (6-10 %)	Severe (> 10 %)
Mental status	Normal	Listless, irritable	Lethargy, altered mental status
Heart rate	Normal	Increased	Increased
Quality of pulses	Normal	Normal to decreased	Decreased to thready
Capillary refill	Normal	Prolonged	Prolonged
Blood pressure	Normal	Normal	Normal to decreased
Respirations	Normal	Tachypnea	Tachypnea, deep
Eyes	Normal	Slightly sunken, decreased tears	Sunken, cries without tears
Fontanelle	Normal	Sunken	Sunken
Urine output	Normal to decreased	Decreased	Oliguric or anuric

% of weight loss

Statistical analysis

Quantitative variables following a skewed distribution were presented as median with interquartile range (IQR) and categorical variables as frequency and percentage. They were compared using the non-parametric Wilcoxon test and the Chi square test or the Fisher exact test as appropriate, respectively. All statistical analyses were performed with R® version 3.6.1. The threshold of statistical significance was defined as p Value < 0.05.

Results

Overall, 442 diarrhea cases were admitted between January 1st and July 31st 2019 and January 1st and July 31st 2020 into the emergency department of the specialized Pediatric Hospital of Kalembe-Lembe. Children under one year old were predominant (55.7%) and 57.9% were male.

Table 2 presents demographic and clinical characteristics of patients included in the study. Half of the patients (51.4%) were admitted to the emergency department with a moderate dehydration including 56.3% in 2019 and 43.6% in 2020 (p = 0.009). They were more hospitalized in 2019 (73.3%) than in 2020 (39%) (p < 0.001). Demographic characteristics did not differ significantly between 2019 and 2020.

Table 2: Demographic and clinical characteristics of patients included in the study

Characteristics	Total (n = 442)	Year 2019 (n = 270)	Year 2020 (n = 172)	P value
Age of patients, years, median (IQR)	0 (0-1)	0 (0-1)	0 (0-1)	0.328
Age groups, years, n (%)				0.657
< 1	246 (55.7)	154 (57.0)	92 (53.5)	
1-4	179 (40.5)	107 (39.6)	72 (41.9)	
≥ 5	17 (3.8)	9 (3.3)	8 (4.7)	
Sex, n (%)				0.538
Female	186 (42.1)	110 (40.7)	76 (44.2)	
Male	256 (57.9)	160 (59.3)	96 (55.8)	
Level of dehydration, n (%)				0.009
No dehydration	75 (17)	43 (15.9)	32 (18.6)	
Mild	60 (13.6)	26 (9.6)	34 (19.8)	
Moderate	227 (51.4)	152 (56.3)	75 (43.6)	
Severe	80 (18.1)	49 (18.1)	31 (18)	
Hospitalisation, n (%)				< 0.001
No	177 (40)	72 (26.7)	105 (61)	
Yes	265 (60)	198 (73.3)	67 (39)	

The median (IQR) of the number of diarrhea cases admitted per day was higher in 2019 than in 2020 [1 (0-2) vs 1 (0-1), p< 0.001] (Figure 1).

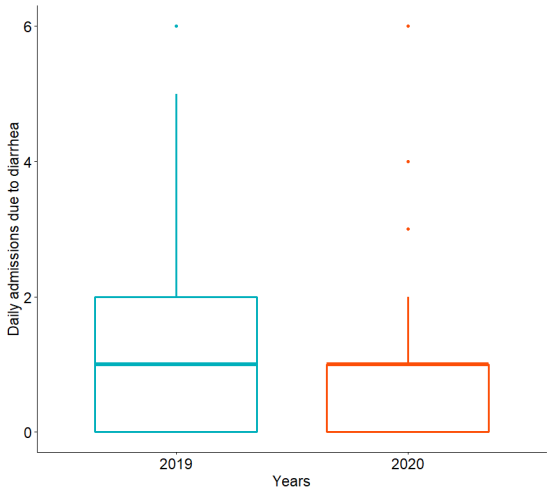

Figure 1. Daily admissions due to diarrhea between January 1st and July 31st of 2019 and 2020

Before the lockdown period (between January 1st and March 24th), the hospitalization rate was significantly higher in 2019 (62.9 %) than in 2020 (45.5 %) (p = 0.032). The remaining demographic and clinical characteristics did not differ significantly between 2019 and 2020 (Table 3).

Table 3: Demographic and clinical characteristics of patients before lockdown

Characteristics	Total (n = 174)	Year 2019 (n = 97)	Year 2020 (n = 77)	P value
Age of patients, years, median (IQR)	0 (0-1)	0 (0-1)	0 (0-1)	0.984
Age groups, years, n (%)				0.879
< 1	94 (54)	52 (53.6)	42 (54.5)	
1-4	70 (40.2)	40 (41.2)	30 (39)	
≥ 5	10 (5.7)	5 (5.2)	5 (6.5)	
Sex, n (%)				0.343
Female	80 (46)	41 (42.3)	39 (50.6)	
Male	94 (54)	56 (57.7)	38 (49.4)	
Level of dehydration, n (%)				0.426
No dehydration	26 (14.9)	17 (17.5)	9 (11.7)	
Mild	28 (16.1)	13 (13.4)	15 (19.5)	
Moderate	100 (57.5)	54 (55.7)	46 (59.7)	
Severe	20 (11.5)	13 (13.4)	7 (9.1)	
Hospitalisation, n (%)				0.032
No	78 (44.8)	36 (37.1)	42 (54.5)	
Yes	96 (55.2)	61 (62.9)	35 (45.5)	

Table 4 showed a 45% drop in admissions due to diarrhea cases into the Pediatric Emergency Department between March 24th and July 31st in 2020 (n = 95) as compared with the similar period in 2019 (n = 173). Patients with moderate dehydration were significantly higher in 2019 (56.6%) than in 2020 (30.5%) (p < 0.001). In addition, the proportion of patients with mild (20% vs 7.5%) and severe (25.3% vs 20.8%) dehydration was significantly increased in 2020 than in 2019 (p < 0.001). The hospitalization rate was significantly higher in 2019 (79.2%) than in 2020 (33.7%) (p < 0.001).

Table 4: Demographic and clinical characteristics of patients during lockdown

Characteristics	Total (n = 268)	Year 2019 (n = 173)	Year 2020 (n = 95)	P value
Age of patients, years, median (IQR)	0 (0-1)	0 (0-1)	0 (0-1)	0.221
Age groups, years, n (%)				0.596
< 1	152 (56.7)	102 (59)	50 (52.6)	
1-4	109 (40.7)	67 (38.7)	42 (44.2)	
≥ 5	7 (2.6)	4 (2.3)	3 (3.2)	
Sex, n (%)				0.984
Female	106 (39.6)	69 (39.9)	37 (38.9)	
Male	162 (60.4)	104 (60.1)	58 (61.1)	
Level of dehydration, n (%)				< 0.001
No dehydration	49 (18.3)	26 (15)	23 (24.2)	
Mild	32 (11.9)	13 (7.5)	19 (20)	
Moderate	127 (47.4)	98 (56.6)	29 (30.5)	
Severe	60 (22.4)	36 (20.8)	24 (25.3)	
Hospitalisation, n (%)				< 0.001
No	99 (36.9)	36 (20.8)	63 (66.3)	
Yes	169 (63.1)	137 (79.2)	32 (33.7)	

The diarrhea cases admitted per day to the pediatric emergency department between January 1st and March 24th did not differ significantly between 2019 and 2020 [1 (0-2) vs 1 (0-1); p = 0. 867] (Figure 2a). In contrast, the daily admissions due to diarrhea between March 24th and July 31st were significantly higher in 2019 than in 2020 [1 (0-2) vs 0 (0-1) ; p < 0.001] (Figure 2b).

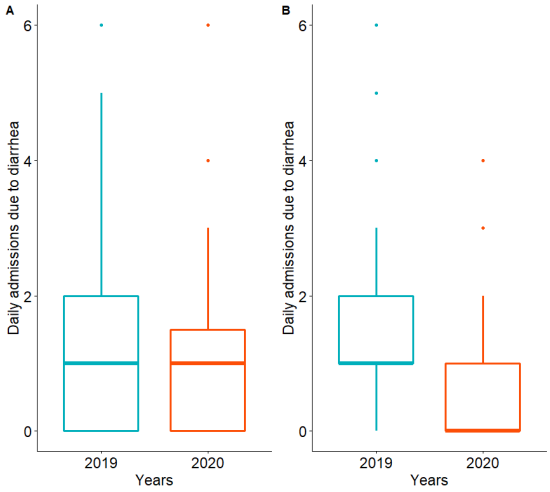

Figure 2. Daily admissions due to diarrhea: (A) Before lockdown; (B) During lockdown

Discussion

The results of our study have shown a significant decrease in admissions due to diarrhea among children to the emergency department of the largest specialized Pediatric Hospital during the COVID-19 pandemic's lockdown. As compared with the same period, daily admissions as well as the proportion of patients with moderate dehydration and the hospitalization rate were significantly higher in 2019 than in 2020. In addition, the proportion of patients with mild and severe dehydration was significantly higher in 2020 than in 2019.

Our finding on the reduction in admissions due to diarrhea in the pediatric emergency department during the COVID-19 crisis is in accordance with other studies conducted elsewhere. A substantial drop by more than 50% in admissions due to acute infectious symptoms, including diarrhea, to pediatric emergency departments has been observed in countries heavily affected by the pandemic (3,7-8,10-11,23). This significant reduction observed during the current crisis may be related to several reasons. But the most relevant could be the reluctance from parents during the early phase of the pandemic to take their children to hospital due to fear of contracting COVID-19 infection during the visit (17,24).

Another likely relevant reason for the decreased rate of admissions due to diarrhea into the pediatric emergency department in the present study is the economic recession resulting from the COVID-19 lockdown. The weak economic and social support measures from the local government would have disrupted small and medium-sized businesses and led to a negative impact on incomes of a population already living on less than US$ 1 per day. Such a crisis inevitably leads to an increased pressure of incompressible expenses, including healthcare costs (25). The reduced household income with COVID-19 lockdown associated with the increased cost of healthcare were also reported as a main barrier in access to healthcare services in other low- and middle-income countries (19). In addition, this negative economic impact could explain the significant reduction of hospitalization rate observed among children during the COVID-19 lockdown.

Regarding the profile of the level of dehydration observed in 2020, the increase of proportion of mild and severe stages compared to 2019 could be related to the context of COVID-19 itself. In countries with higher rates of pediatric infections during the early phase of the pandemic, a fairly large proportion of children infected with SARS-CoV-2, especially those who were asymptomatic or presented mild disease, initially had diarrhea on admission (26-27). As suggested in this case, many children might have been affected without being officially reported (28). On the other hand, the increased proportion of severe dehydration observed may be explained by delayed hospital admissions during the pandemic. An observation on twelve children in Italy reported a delayed access to healthcare due to parental avoidance motivated by the fear of nosocomial transmission of SARS-CoV-2 (17).

Our study presented some limitations. The study population is only representative of diarrhea cases admitted to the emergency department of the Kalembe-Lembe Pediatric Hospital. However, the most common chief complaints in pediatric emergency department are fever, upper respiratory tract infection and diarrhea (29). Nonetheless, we believe that diarrhea was an objective indicator of pediatric emergency healthcare utilization, particularly during the early phase of the pandemic, because clinical management of children with gastrointestinal symptoms did not include COVID-19 evaluation before the knowledge of pandemic (28). Moreover, the single-center retrospective design of this study may limit the generalizability of these findings. Despite this situation, the reduced volume of admissions experienced by the pediatric emergency department in the present study is almost similar to that described in countries severely affected with the SARS-CoV-2 infection. Further multicenter studies are needed to show the profound impact of the COVID-19 pandemic on the use of pediatric emergency healthcare.

Conclusion

The COVID-19's restrictions led to a significant decrease in admissions due to diarrhea among children to the pediatric emergency department. The present study has the merit of filling a gap about the impact of the COVID-19 pandemic on the trend of a leading cause of mortality among children in the Sub-Saharan Africa context where the prevalence is lower than elsewhere. Our findings advocate for public health interventions designed to promote ambulatory healthcare system that could be resilient if such a coercive measure is still considered in the near future.

Competing interest
The authors declare that they have no competing interests.

Author's contributions
DB conceived the study. HCK and LK participated in data collection. HCK analysed the data. HCK wrote the manuscript. MB, PA, EB and GK reviewed the manuscript. All the authors read and approved the manuscript for submission.

Acknowledgements
We thank all staff of the Kalembe-Lembe Pediatric Hospital.

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Cite this article as: Kayembe HCN, Kalubi L, Bosonga M, Ansobi P, Bokabo E, Kapour G. Impact of COVID-19 on admission due to diarrhea to the emergency department of the largest specialized Pediatric Hospital, Kinshasa. *Ann Afr Med* 2021; **14** (3): e4218-e4225.