

Epidemiological and Clinical Profile of Children Exposed to SARS-CoV-2 at the COVID-19 Treatment Center at the ISIRO Hospital and WATSA in the Democratic Republic of the Congo

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Abstract

Introduction: COVID-19, an emerging infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), typically presents with mild clinical manifestations in pediatric populations. As in many other regions of the Democratic Republic of the Congo (DRC), the COVID-19 pandemic affected children in Haut-Uélé, a province bordering South Sudan and Uganda. This study aimed to describe the epidemiological profile of COVID-19 in pediatric population in this area. **Materials and Methods:** This descriptive cross-sectional study was conducted over a 6-month period from August 1, 2021 to February 7, 2022. It included all patients aged 0 to 19 years with confirmed COVID-19 using RT-PCR and managed at the COVID-19 Treatment Centers (CTCO) in ISIRO and WATSA. Data were collected from patient records supplemented by the dataset from the service of Health Information System (SNIS) and the Epidemiological Surveillance Commission of the Provincial Health Division (DPS). Epidemiological and clinical profiles were analyzed. All statistical analyses were performed using SPSS software, Version



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18. Results: During the 4th wave of the pandemic, 5 out of 13 health zones in Haut-Uélé province were affected, with a total of 569 recorded cases; 45 of them were children aged 0 to 19 years (7.9%). Asymptomatic cases accounted for 33.3% (15 cases). The mean age was 9.88 ± 5.49 years, with the most affected age group being 10 - 14 years (44.45%). There was a predominance of males (73.3%), with a male-to-female sex ratio of 2.75. Half of the patients (53.3%) were from Watsa Health Zone. A seasonal peak was observed between December and January. Comorbidities were present in 10% of infected patients, and nearly half of participants were contacts of infected individuals. The primary reasons for admission were fever (66.66%), followed by rhinorrhea (57.77%) and cough (31.11%). All patients responded favorably to treatment. **Conclusion:** The proportion of pediatric COVID-19 cases at the CTCO centers in Haut-Uélé was low, with adolescent males being the most affected group. More than half of the cases were asymptomatic. The most common reasons for consultation were fever, rhinorrhea, and cough.

Keywords

COVID-19, Morbidity and Mortality, Children, Haut-Uélé

1. Introduction

COVID-19, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1], has emerged as a global public health emergency since December 2019, owing to its rapid spread and escalating severity [2] [3]. As of July 5, 2020, a total of 11,125,245 cases and 528,204 deaths had been reported worldwide [4]. While COVID-19 presents a significant risk of mortality in adults, it results in a milder clinical course in children and adolescents with a lower mortality rate compared to adults [5]. The Omicron variant has been the predominant strain in Quebec since December 20, 2021, and due to its high transmissibility, there has been a substantial increase in pediatric COVID-19 cases. In Guinea, among 7308 patients hospitalized at the CTPI of HND, 189 (2.59%) were children aged 0 to 16 years [6]. Similarly, in the Democratic Republic of the Congo (DRC), the COVID-19 pandemic impacted children in the Haut-Uélé province, which borders South Sudan and Uganda, as of December 15, 2019. This study aimed to assess the epidemiological and clinical profiles of COVID-19 in children in this region of the DRC.

2. Materials and Methods

We conducted a descriptive cross-sectional study from August 1, 2021, to February 7, 2022, at the COVID-19 Treatment Centers (CTCO) in ISIRO and AUNGBA. These centers served patients from the health zones of WATSA, ISIRO, PAWA, FARADJET, RUNGU, and NIANGARA, all located within the Haut-Uélé Provincial Health Division. The study included all patients aged 0 to 19 years who tested

positive for COVID-19 via RT-PCR and received treatment at the designated CTCOs. Nasopharyngeal swabs were collected for RT-PCR testing. The variables of interest included age (in years), sex, geographic origin, medical history, clinical signs, RT-PCR results, COVID-19 variant, radiographic findings, treatment regimen, complications, and patient outcomes. Data were collected from patient's records supplemented with the dataset from the service of Health Information System (SNIS) and the Epidemiological Surveillance Commission of the Provincial Health Division (DPS). Categorical variables were presented as absolute frequencies while mean \pm standard deviation (median where applicable) was used for quantitative variables. All analyses were performed using SPSS (Statistical Package for the Social Sciences), Version 18.

3. Results

A total of 569 patients were followed up for COVID-19 during the study period, including 45 children, representing 7.9% of cases. There was a predominance of males, accounting for 73.3% of the cases, with a male-to-female sex ratio of 2.75.

3.1. Sociodemographic Characteristics of Confirmed Cases

The most affected age group was 10 - 14 years, representing 44.5% of cases. The mean age was 9.88 ± 5.49 years (**Table 1**).

Table 1. Group age.

Age group	n	%
0 - 4 years	12	26.7
5 - 9 years	4	8.89
10 - 14 years	20	44.5
15 - 19 years	9	20.0
Total	45	100.0

The study population consisted of 33 males (73.3%) and 12 females (26.7%), resulting in a male-to-female sex ratio of 2.75 (**Table 2**).

Table 2. According to gender.

Sex	n	%
Male	33	73.3
Female	12	26.7
Total	45	100.0

The majority of patients were from Watsa, comprising 53.3% of the cases, followed by Isiro, which accounted for 31.1% of the cases (**Table 3**).

Table 3. The health zone of origin.

Health zone of origin	n	%
Watsa	24	53.3
Isiro	14	31.1
Pawa	4	9.0
Rungu	2	4.4
Faradje	1	2.2
Total	45	100

3.2. Clinic

The comorbidities noted in descending order were allergic rhinitis, asthma, sickle cell anemia, HIV, epilepsy and finally malnutrition (**Table 4**).

Table 4. The comorbidity.

Comorbidity	n	%
Allergic rhinitis	6	13.33
Asthma	5	11.11
Sickle cell disease	3	6.66
HIV	2	4.44
Epilepsy	2	4.44
Malnutrition	1	2.22

3.2.1. Distribution of Patients by Mode of Transmission or Contact Cases

More than half of the mothers were engaged in trading or farming, and 40% (18 cases) had been in contact with known COVID-19 cases. Additionally, 37.78% (17 cases) of the fathers were employed as civil servants at KIBALI GOLD Mining Company.

3.2.2. Asymptomatic Patients

Asymptomatic cases accounted for 33.3% (15 cases).

3.2.3. The Reasons for Consultation

Fever 66.6%, rhinorrhea 57.77%, followed by cough, were the most noted reasons for consultation (**Table 5**).

Table 5. The reasons for consultation.

Reasons for consultation	n	%
Fever	30	66.66
Rhinorrhea	26	57.77
Cough	14	31.11
Headaches	8	17.77
Diarrhea	4	13.33
Dysphagia	3	6.66
Vomiting	2	4.44

The Polymerase Chain Reaction (PCR) test was positive in 51.11% of participants, corresponding to 23 cases. All cases were due to the Omicron variant. There were no specific lesions in 12 patients (26%) who had the standard X-ray.

All patients received treatment according to the WHO COVID-19 guidelines adopted in the DRC, which included:

- Hydroxychloroquine: 10 mg/kg, administered in two daily doses for 10 days.
- Azithromycin: 20 mg/kg, given as a single daily dose for 5 days.
- Zinc: 20 mg per day in two doses for children over 6 months and 10 mg per day for children under 6 months for 10 days.
- Antipyretics: Paracetamol, 15 mg/kg per dose (maximum of 4 doses/day) for fever.
- Cough: Symptomatic treatment, including nasal saline and Vitamin C (100 mg twice daily) or cough suppressants as appropriate (e.g. Bisolvon).

No complications or deaths were reported

4. Discussion

4.1. Prevalence

A total of 569 cases were documented, including 45 children aged 0 to 19 years, representing 7.9% of the cohort. This prevalence is higher compared to Camara *et al.* in Guinea (2.59%) and other studies, such as those conducted by Qiu *et al.* in China and Nicole le Seaux in Canada, which reported prevalence between 1.5% and 5% [3] [6] [7].

4.2. Age Group

The Age

The participants' ages ranged from 0 to 19 years, with a mean age of 9.88 ± 5.49 years. The most prevalent age group was adolescents of 10 to 14 years old ($n = 20$, 44.5%). This finding contrasts with Claude-Audrey *et al.* in Yaoundé, who reported 50% of children aged 13 to 19 years with a mean age of 10.89 ± 7.13 years. In contrast, Camara *et al.* in Guinea observed a higher prevalence in the 0 - 4-year age group (38.62%). Viner *et al.* and Zhu *et al.* identified higher frequencies in the age group over 10 years. This trend is consistent with global observations by the American Academy of Pediatrics, the European Centre for Disease Prevention and Control, and INSP Québec (2021). Adolescents' cellular physiology, which mimics adult cellular regeneration mechanisms with slower epithelial turnover, may explain these observations [6]. Additionally, children might exhibit different physiological responses compared to adults at various stages of infection. Recent studies suggest that children may have fewer ACE2 receptors, potentially limiting SARS-CoV-2 infection [8]. Furthermore, innate immunity, potentially "trained" by previous viral and bacterial infections or live vaccines such as BCG, may provide enhanced protection [9]. Cross-immunity with other coronaviruses and pre-existing respiratory infections could also be factors [10]. In contrast to other respiratory infections, such as legionella, RSV, influenza, measles, and varicella, which

are generally more severe in adults, SARS-CoV-2-induced pathology might involve exaggerated immune responses, potentially differing in children.

4.3. Sex

A significant male predominance was observed among pediatric COVID-19 cases, with 73.3% of cases being male, resulting in a sex ratio of 2.75. This is comparable to the findings by Claude-Audrey *et al.* in Yaoundé, which reported a male predominance of 52% and a sex ratio of 1.08. In contrast, Camara *et al.* in Conakry found a higher proportion of females with a sex ratio of 1.52. The increased male susceptibility may be attributed to higher expression of immune system proteins and a longer half-life of antibodies in females, as suggested by other studies [3] [6].

4.4. Residence

Half of the patients resided in the Watsa health zone, a strategic geographic area at the entry point to Haut-Uélé province. The region's high mobility is influenced by the presence of Kibali Gold Mining, subcontracting activities, artisanal mining, and the international Duembe market, which attracts people from Uganda, South Sudan, and Congo. These factors contribute to significant movement of people and goods, increasing the risk of transmission due to close proximity and the breakdown of hygiene measures [3]-[5].

4.5. Contact Case

More than half of the mothers were traders and farmers, with 40% (18 cases) being identified as contacts. Additionally, 37.78% (17 cases) of fathers were employed as civil servants at Kibali Gold Mining. Transmission was predominantly intra-familial, as schools were closed, and children remained at home while parents were at work. Close contacts, primarily mothers and/or fathers, were the most common sources of infection. Most studies have identified household exposure as a major risk factor for COVID-19 transmission in children [3].

4.6. Clinical Manifestations of COVID-19 in Children

The most frequent admission reasons were fever (66.66%, 30 cases), followed by rhinorrhea (57.77%, 26 cases) and cough (31.11%, 14 cases). These findings align with observations by Mercier *et al.* at the University of Paris. While children typically experience milder forms of COVID-19, severe cases do occur. Clinical presentations in children can vary and may include rhinorrhea, cough, fever, dysphagia, and occasionally gastrointestinal symptoms (diarrhea and/or vomiting), non-specific rashes, and irritability. Severe adult markers, such as pneumonia with typical radiographic findings, anosmia, or acrocyanosis, are less common in children, particularly before age 10. Few young patients require oxygen therapy or intensive care, and when they do present with pneumonia, it is generally less severe [11]-[14].

4.7. Treatment

All patients showed improvement under treatment and did not exhibit severe symptoms as outlined by the WHO COVID-19 management protocol. The relatively mild severity of COVID-19 in children is supported by epidemiological data from the United States, where, among 149,000 confirmed cases from February 12 to April 2, 2020, only 2572 (1.7%) were children under 18 years. According to a British study, higher adult mortality is linked to acute respiratory distress syndrome and multi-organ failure, with pro-inflammatory cytokine levels potentially causing more severe responses in adults compared to children [14]-[17].

4.8. Limitations and Strengths

Limitations include low alert reporting from the community and healthcare facilities, risky behaviors, non-compliance with preventive measures, and limited resources for comprehensive testing such as complete blood counts, D-dimers, prothrombin time, and activated partial thromboplastin time. The absence of these tests in peripheral facilities poses a risk of patient loss during disruptions.

5. Conclusion

This study provides important insights into the impact of COVID-19 on children in resource-limited settings using data from the COVID-19 treatment centers in Isiro and Watsa. The fourth wave of the pandemic affected 5 out of 13 health zones in Haut-Uélé province, with a notable proportion of children aged 0 to 19 years (7.9%) affected from August 1, 2021 to February 7, 2022. Among the 569 confirmed cases, including both adults and children, there were 3 adult deaths. Male children were more affected than female children. Children generally exhibited fewer symptoms, lower infection rates, and reduced contagion compared to adults. Direct transmission between children or from children to adults is considered low, with most infections originating from adults. Indirect transmission via hands and objects may be more significant. No deaths were reported among children.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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