

Original Research Article

Changes in pattern of childhood admissions and outcome before and during the COVID pandemic in an emergency unit in Sokoto, Nigeria: A three-year review (2019-2021)

Abstract : The COVID pandemic had widespread impact on the world ranging from direct effects of the infection to changing pattern of morbidity and mortality.

To compare the pattern and outcome of admissions during the COVID pandemic (2020 – 2021) to the preceeding year (2019) in the emergency Paediatric unit (EPU) of a tertiary hospital.

Relevant information extracted from admission register into a study proforma, analysed with SPSS version 23.

Total admissions were 3741. The 1st pandemic year (2020) had the lowest (1116, 29.3%) while 1421 and 1206 patients were admitted in 2019 and 2021.

Lowest admission was in March to June 2020, with spike in August 2020. The topmost admissions yearly were malaria, acute respiratory infections (ARIs) and acute gastroenteritis. All cases reduced in the pandemic years but ARIs increased. Mortality was highest in 2020 ($p=0.001$). Highest case fatality in pre-pandemic year was vaccine preventable diseases while in the pandemic years it was cardiac disease. Deaths from ARIs increased in the pandemic years. Confirmed cases of COVID were three with 1 mortality.

Admission rates reduced during the pandemic year 2020 with increased rate of mortality, increase ARIs in 2021 and cardiac disease was a top cause of mortality during the pandemic years.

Introduction

The COVID pandemic had widespread impact on the world population and especially on health-care. This ranged from direct effects of the infection on populace, health workers inclusive.¹ Also impacted were ability to attend health facilities due to lock down as well as changing disease pattern due to reduced access to care and increased morbidities from respiratory illnesses.²

The COVID pandemic was declared by World Health Organisation (WHO) as a Public Health Emergency of International Concern (PHEIC) on 30 January 2020 and a pandemic on 11 March 2020.³ Lock down was prescribed to limit the spread also in March 2020. Lockdown implies large scale physical distancing measures and movement restrictions which slows infection transmission by limiting contact between people.⁴ The 1st case in Nigeria was in 27th February 2020 while lock down was enforced in May 2020.⁵ This led to shut down of businesses, livelihoods, schools and all income generating activities.⁴ It also impacted immensely the health care system as sick individuals could not access life-saving interventions and medications.⁶ Those with chronic disease could not also assess follow up and drug supply. Supply chain of essential commodities and drugs broke down.⁴ This caused widespread suffering and led to spread of disease and depression due to the confinement which caused potential or actual increase in the burden of disease especially on vulnerable children.⁷

Children being at the receiving end of health care at parents' expense especially in low resource countries may have been negatively impacted during that period, despite not being at increased risk of the COVID infection.⁸ This is a retrospective review over 3 years including 1-year pre and 1st and 2nd pandemic years to assess the pattern of admissions and outcome in an emergency unit of a tertiary health facility.

Materials and Methods

Study area:

Sokoto State is located in the dry Sahel region and is surrounded by sandy Savannah. Sokoto town lies between latitude 10° and 14°N, and longitude 3°31' and 7°71' east of the Equator⁹ with an annual average temperature of 28.3°C, which rises as high as 45° C during the hottest months.

The study was carried out at the Emergency Paediatric Unit (EPU) of Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto which is a tertiary health facility as part of a study on the pattern and outcome of admissions in the EPU.

Study design: This was a retrospective study conducted over a 3-year period (1st January 2019 to 31st December 2021)

Study subjects: Comprised all children aged 1 month to 15 years admitted into the EPU during the study period.

Procedure of recruitment

The details of children admitted during the 3-year period were accessed from the admission register in the unit which is usually updated by the health information officers every morning. The information extracted included socio-demographic characteristics, diagnosis and outcome. Age was categorized using standard paediatric age group classification into infants aged > 1 month to 12 months, age 1 years to 5 years, 6 years to 10 years and 10 years to 15 years. The different diagnoses were categorized into Malaria (Uncomplicated and Complicated), Acute respiratory infections (Pneumonia, Pharyngotonsillitis, Bronchiolitis), Gastroenteritis, Sepsis including Meningitis, Vaccine preventable infections (Tuberculosis, Measles, Tetanus, Pertussis, Diphtheria), Sickle cell disease amongst others. These were captured according to the pre-pandemic, 1st and 2nd pandemic years. Outcome of mortality was also captured according to month and year of admission.

Data entry and analysis

Data were entered into an ODK software and subsequently moved into IBM SPSS statistical software version 22 for analysis. Univariate analysis (mean, standard deviation) was done for the continuous variables such as age while frequency tables, charts and proportions were used for the categorical variables such as gender, type of diagnosis, year and month of admission. Bivariate analysis (chi square or Fisher's Exact test) was used to compare outcomes of different diagnosis in the pandemic vs the pre and post pandemic period while Anova was used to compare the mean age between those periods. A p-value of <0.05 was considered statistically significant.

Results

Demographic profile

The highest number of admissions per year was in 2019 (1406; 37.6%) while lowest was in the 1st pandemic year of 2020 (1116, 29.8%). Males accounted for 57% and the proportion of males admitted increased in the 1st and 2nd year of the pandemic which was significant ($\chi^2 = 14.9$, $p=0.001$). Most of the patients were aged 1 to 5 year throughout the 3 years followed by infantile age group. The rate of infant admissions increased from pre pandemic to pandemic years while the proportion aged 1 to 5 years had a decreasing rate of admission. Those aged 5 to 10 years were also increased in the 1st pandemic year. This relationship to age was statistically significant ($\chi^2 = 17.5$, $p=0.008$). These findings are detailed in Table 1. Their mean age was similar across the three years; however, the median age was higher in the 1st pandemic year.

Monthly trend of admissions over the 3-year period

The chart in figure 1 shows the monthly trend of admission from the pre-pandemic to the pandemic period. The lowest number of admissions was during the lockdown period from March to May 2020 and there was a surge in admissions by August 2020 and another surge in February 2021. In the pre-pandemic year, a surge was seen in July and September 2019.

Case distribution by diagnoses

The most frequent diagnosis was malaria (787, 21%) followed by acute respiratory infections (661, 17.7%), acute gastroenteritis (398; 10.8%), sepsis (370; 9.9%) sickle cell disease (368; 9.8%), febrile convulsions (254; 6.8%), severe acute malnutrition (SAM) (250;6.7%), genitourinary tract disorders (175; 4.7%), vaccine preventable infections (119; 3.2%), cardiac diseases(114; 3.0%) and neurological diseases (44; 1.2%). Other diagnoses constituted 201; 5.4% as in Table 2.

Trend of different diagnoses through the pre-pandemic to pandemic period

The columns in Figure 2 shows the admission rate of all morbidities reduced in year 2020 likewise in the year 2021 for most morbidities. However, a high rate of increase was seen for a acute respiratory infections in 2021. An increase was also seen for gastroenteritis, sepsis and SCD.

Trend of mortality from January 2019 to December 2021

Figure 3 shows mortality was highest in the pandemic year of 2020 from April to June and fell gradually in the 2nd pandemic year.

Proportionate mortality by year

The highest mortality rate was in the pandemic year at 14.4% vs 12.6% in 2019 and 9.4% in 2021 which was statistically significant ($\chi^2 = 14.7$, $p = 0.001$) as seen in Table 3.

Topmost causes of mortality by year

The highest cause of mortality in the pre-pandemic year was vaccine preventable diseases followed by severe malnutrition then cardiac disease and sepsis. While in both pandemic years, cardiac diseases predominated as causes of mortality followed by vaccine preventable infections and sepsis in 2020 and severe malnutrition in 2021. This is shown in Table 3.

COVID cases seen during the pandemic years 2020 - 2021

Three cases of COVID were confirmed during the period. There were 2 males and 1 female. One male was aged four years and the other two cases were aged 12 years. Two cases were seen in June and September 2020 while one was seen in February 2021. The 2 adolescents survived while the younger child died after a day on admission.

Discussion

The study looked at the pattern and outcome of emergency unit admissions a year before the pandemic and compared these to the year when the pandemic was active from 2020 to 2021.

The number of cases admitted in the pandemic year of 2020 was lower than the pre-pandemic year. Similar findings were reported from other studies within and outside the country. These included Ndu¹⁰ from Enugu, South-eastern Nigeria while Bharat¹¹ in India and Kostoupoulou¹² from Greece had similar findings. Also, Anand¹³ observed reduction in all cases in the pandemic year. Reasons for this drop were obvious ranging from the imposed lockdown which was necessary to reduce the transmission of the infection.^{4, 14} There was also a lot of fear of visiting health care facilities due to the rapid transmission and mortality associated with the disease.¹¹ The number of admissions were at their lowest in April to July which also corresponded to about week 10 to 30 of the pandemic. Miron had similar pattern with week 10 having the lowest number and week 32 having the highest number of admissions in the year 2020.¹⁵ The spike in admissions corresponded to the month of August which was when restrictions to movement was much less.

More males were admitted during the pandemic years as shown in this study. Increased proportion of males admitted during that pandemic year was also observed by Bharat.¹¹ Possible reasons could be due to higher vulnerability of male children to infection due to genetically imposed single X chromosome which serves as protection for females who have double X that encodes for immunological activity.¹⁶ However, Gills¹⁴ data showed proportionately more females were admitted during the 1st pandemic year compared to the pre-pandemic period, but only some months within 2020 were studied by them and not the whole year.

It was also observed in this study that higher proportion of infants were admitted during both pandemic years. Etoori¹⁷ observed in their study that infants with chronic health problems were more likely to be admitted during the pandemic period however the specific diagnosis for infants were not assessed in this study. The proportion of those aged 1 to 5 years who were admitted also reduced in the 1st and 2nd year of the pandemic as opposed to infants whose proportion increased progressively while those above 6-10 years had increased number admitted during the 1st year of the pandemic. Sodani¹⁸ had similar findings in New Delhi. The increase in young infants' admission was attributed to lack of access to postnatal visits and immunizations leading to increased incidence of infections while those above 5 years had injuries and accidental poisoning as the cause of the increased rate of their admissions. This may also be due to increased transmission of infections due to unusual overcrowding at home due to the lockdown whereas their

age range actually should be in school at that particular time. Ndu's¹⁰ data from Enugu, Nigeria also showed an increased proportion of age 6 to 10 years in the pandemic vs pre-pandemic year.

The most frequent diagnosis cumulatively for the 3 years was malaria followed by acute respiratory infections then gastroenteritis and sepsis. This mirrors the pattern of admissions seen in the emergency unit in a previous study in the centre.¹⁹ de Jorna²⁰ in France however found acute infectious disease to be more frequent.

The trend through the years showed that the frequency of all the diagnosis reduced from year 2019 till 2021 including malaria. The drop was more in the year 2020 followed by further fall or similar levels in 2021. Only acute respiratory infections, gastroenteritis and sepsis were all increased in the 2nd year of the pandemic 2021 compared to 2020, however, the highest increase was for respiratory infections which also exceeded the pre-pandemic levels in 2019. Anand¹³ got similar findings which showed acute respiratory infections decreased during the 1st pandemic year and increased during the 2nd year, but was still lower than the pre-COVID-19 period unlike in this study where it was higher. The reduced rate of infectious diseases in the 2020 has been attributed to increase rate of hygienic measures imposed.^{1, 13} However, the spike the following year for respiratory infections, sepsis and gastroenteritis could also reflect the decreased utilization of preventive measures.

There was found to be an increase in the mortality during the pandemic year 2020 despite the lower number of admissions compared to 2019 and 2021. This is similar to what was found by Goel with reported increase in mortality then. However, Odd²¹ in England reported reduction in mortality of children likewise Anand²¹ in India did not report increase in mortality during the pandemic compared to pre-pandemic period.

The top cause of mortality pre COVID was vaccine preventable disease, while cardiac causes were the commonest for the 2 years of the pandemic. Recent reviews by Hans in the United States have posited a puzzling finding of excessive cardiovascular mortality from COVID which made it the topmost associated cause of death in adults studied.^{22, 23} A review on cardiac changes in COVID reported that about 17% to 75% of children are found to be affected leading to associated with diagnostic challenges in high-risk groups especially with pre-existing heart disease.²⁴ Most of the cardiac patients in this report who died had pre-existing cardiac diagnoses possibly supporting new onset complications in them. An acute cardiac decompensation caused by severe inflammatory

state after the infection (multisystem inflammatory syndrome in children -MISC) could be responsible.^{25, 26} However, not all admitted children were tested for COVID as done in other countries with resources.²⁷ A retrospective cohort study also revealed previous or preexisting cardiovascular conditions are associated with increased severity of COVID-19 among paediatric patients.

Conclusion

This study revealed a decline in admissions through the COVID pandemic with increased rates of infections especially respiratory in the 2nd year of the pandemic. Cardiac diseases were the top diagnosis associated with mortality in line with recent reports from the West.

Recommendation

More focused studies on pattern of diseases presenting to the emergency paediatric unit and documentation of trends to ascertain true causes of morbidity and mortality per time period to help prepare for management during outbreaks and pandemics likewise any form of disaster.

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Table 1: Demographic profile of admitted children in the pre-pandemic & pandemic years

Parameter	2019 Pre-pandemic year	2020 Pandemic year 1	2021 Pandemic year 2	Total (n=3741)	Test statistic & p-value
Gender					
Male	751 (53.4)	639 (57.3)	742 (60.9)	2132 (57.0)	$\chi^2 = 14.9$ p = 0.001
Female	655 (46.6)	477 (42.7)	477 (39.1)	1609 (43.0)	
Age range					
1- 12months	323 (23.0)	259 (23.2)	341 (28.0)	923 (24.7)	$\chi^2 = 17.5$ p = 0.008
1.1 – 5 years	643 (45.7)	497 (44.5)	488 (40.0)	1628 (43.5)	
5.1 - 10 years	251 (17.9)	229 (20.5)	226 (18.5)	706 (18.9)	
10.1 – 15 years	189 (13.4)	131 (11.7)	164 (13.5)	484 (12.9)	
Total	1406 (37.6)	1116 (29.8)	1209 (32.6)	3741 (100.0)	
Mean age (months)	47.3	47.3	47.2	47.3	F = 0.01 p = 1.00
Median age (IQR) months	24 (60)	26 (60)	24 (62)		

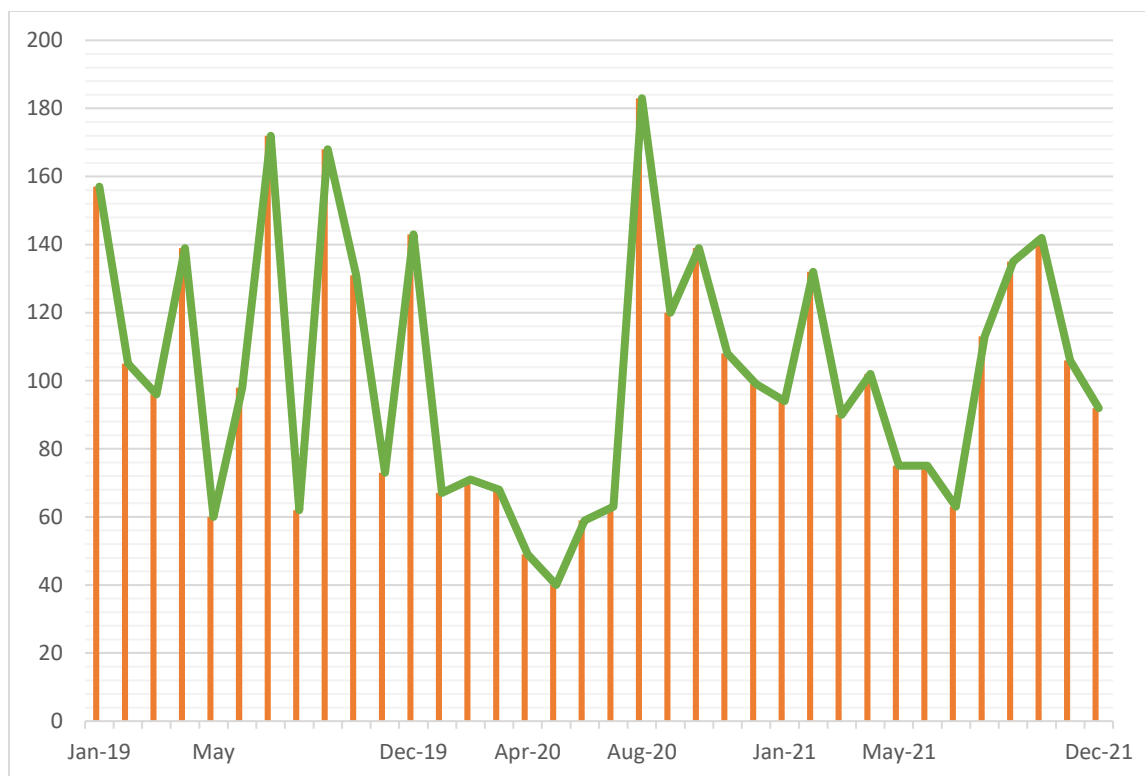


Fig 1: Monthly distribution (January 2019 to December 2021)

Table 2: Distribution of cases by diagnosis in three years (2019 – 2021)

Diagnoses	Frequency (%)
Malaria (complicated & uncomplicated)	787 (21.0)
Acute respiratory infections (Pneumonia, pharyngotonsillitis, bronchiolitis etc)	661 (17.7)
Acute gastroenteritis	398 (10.8)
Sepsis	370 (9.9)
Sickle cell disease	368 (9.8)
Febrile convulsions*	254 (6.8)
Severe acute malnutrition	250 (6.7)
Genitourinary tract disorders including urinary tract infection	175 (4.7)
Vaccine preventable diseases (Tuberculosis, measles, tetanus, Diphtheria, pertussis)	119 (3.2)
Cardiac diseases (congenital and acquired)	114 (3.0)
Neurological disease	44 (1.2)
Others#	201 (5.4)
Total	3741 (100.0)

*Febrile convulsions causes: Malaria, Acute pharyngitis, UTI, Diarrhoea disease

Others include: Malignancies, accidental ingestions, bone and joint infections, COVID, etc

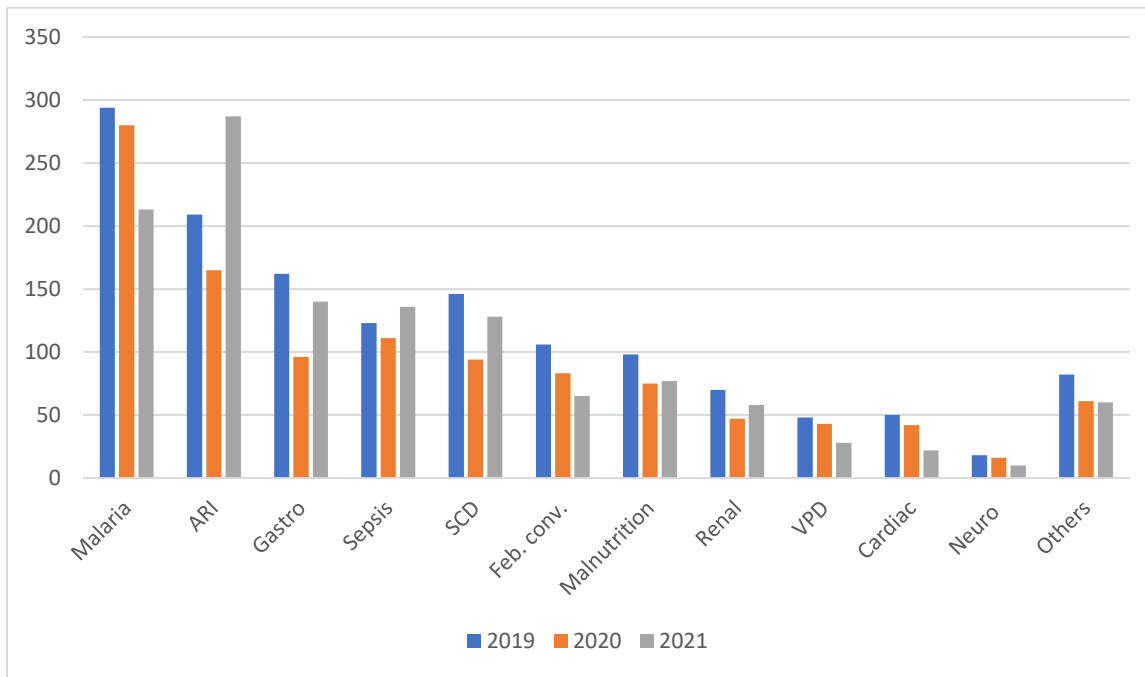


Figure 2: Trend in pattern of admissions by diagnoses

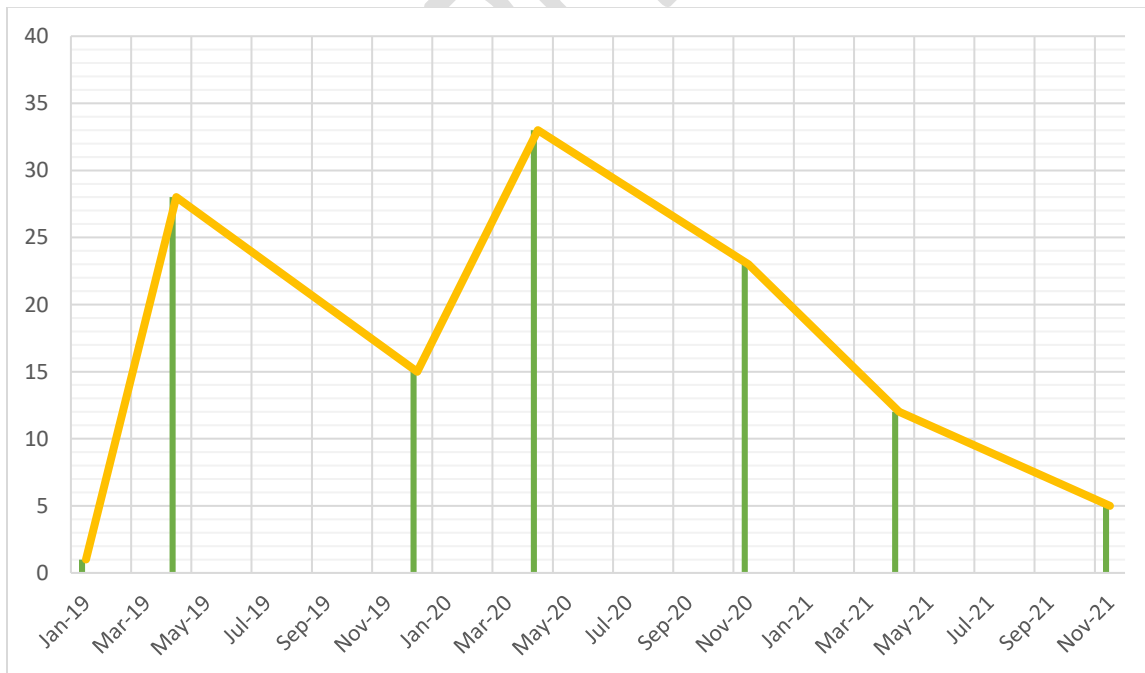


Figure 3: Outcome of mortality from January 2019 to January 2021.

Table 3: Top causes of mortality per year (2019-2021)

Diagnoses	Case fatality rate (%)		
	2019	2020	2021
Malaria (complicated & uncomplicated)	13.9	15.7	13.9
Acute respiratory infections (Pneumonia, pharyngotonsillitis, bronchiolitis etc)	7.7	9.7	7.0
Acute gastroenteritis	5.6	5.2	2.9
Sepsis	20.3	22.5	16.2
Sickle cell disease	1.4	3.2	2.3
Febrile convulsions*	6.6	9.6	3.1
Severe acute malnutrition	28.6	18.7	16.9
Genitourinary tract disorders including urinary tract infection	14.3	4.3	13.8
Vaccine preventable diseases (Tuberculosis, measles, tetanus, Diphtheria, pertussis)	31.3	39.5	31.9
Cardiac diseases (congenital and acquired)	24.0	47.6	40.9
Neurological disease	5.6	6.3	10.0
Others#	13.4	9.5	14.5
Total	12.6	14.4	9.4

#: Malignancies, accidental ingestions, bone and joint infections, COVID, etc