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Spectrum of COVID-19 infection in children in Southern Nigeria

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Abstract: *Background:* Corona virus disease 2019 (COVID-19) is a global pandemic that affects all age groups. Infected asymptomatic children can transmit the disease to vulnerable adults with co-morbidities resulting in severe disease in the latter. There are few reports of COVID-19 in children in Sub-Saharan Africa in general and in Nigeria in particular.

Aim: To determine the prevalence, symptoms and risk factors for COVID-19 in Southern Nigerian children.

Methods: This was a one-year retrospective cross-sectional study between April 2020 and March 2021. Data of all children tested for COVID-19 was extracted from the Epidemiology unit of Akwa Ibom state ministry of health. All patient identifiers were omitted and data was analyzed using STATA version 13.

Results: Two hundred and fifty-five children (2.25%) out of a total of 11,289 people were tested for COVID-19. Fifty -four children (0.47%) of the total number of persons tested for COVID-19

were positive. Twenty one percent of the 255 children tested were positive for COVID-19. Two hundred and fifty- four (99.6%) of children that were tested had a positive history of contact with a confirmed COVID-19 case. Five (9.3%) of COVID-19 positive children were symptomatic. The commonest symptoms seen were Fever (90.9%), Anosmia (63.6%) and Aguesia (36.4%). Increasing age (15 years and above) was significantly associated with COVID-19 positivity ($p=0.000$). In addition, the presence of symptoms was significantly associated with COVID-19 positivity ($p=0.04$).

Conclusion/Recommendation: The prevalence of COVID-19 in Southern Nigerian children is low. Majority of the children have asymptomatic disease. Increasing age is significantly associated with COVID-19 positivity. We recommend increased COVID-19 testing in the general children population.

Keywords: COVID-19, Children, Nigeria, Prevalence, Symptoms

Introduction

Corona Virus Disease 2019 (COVID-19) is a viral disease caused by severe acute respiratory syndrome coronavirus-2 (SARS CoV-2).¹ SARS CoV-2 is a member of a large family of viruses called coronavirus.^{1,2} In December 2019, the first case was reported in Wuhan China. Since then, it has become a global pandemic, not sparing any age group or gender.³⁻⁵ The World Health Organization (WHO) declared COVID-19 a public health emergency of international concern (PHEIC) in March 2020.⁶ Common symptoms of COVID-19 include cough, fever and breathlessness.² Transmission of COVID-19 is mainly through close contact with an infected person via respiratory droplets and after touching contaminated objects.⁷

Since the first reported case in Wuhan China, data on the prevalence and clinical characteristics of the affected patients have been mainly in the adult population with only a few studies on the pediatric population.⁷ Newland JG *et al* reports that globally, children comprise about 1% to 6% of all positive COVID-19 patients.⁸ A study done in China, showed the prevalence of COVID-19 in children less than 18 years to be 2% with no fatality in children less than 9 years of age.⁹ Severe disease was only observed in 4.3% of these children. Of the 44672 patients infected with COVID-19, 416 patients (0.9%) were below 10 years of age and 549 patients (1.2%) were between 10 and 18 years of age.⁹ This low incidence of COVID-19 in children does not necessarily indicate that the children are resistant to the disease.¹⁰ Similarly, an Italian study in 2020 gave a prevalence of 1.2% of COVID-19 in children with no reported death.¹¹

As at March 2020, in a study of 4226 COVID-19 cases in the United States of America, 5% were children.¹²In a multicentre retrospective study of 135794 patients less than 25 years of age tested for SARS CoV2 in the United States of America, the prevalence of COVID-19 in children was 4% with a case fatality of 0.2%.¹³ Though children are equally susceptible to COVID-19 symptoms, these symptoms tend to be less severe than the adult population.¹⁴In a systematic review by Riccardo *et al*, children at any age were mostly reported to be asymptomatic or have mild respiratory symptoms.⁷A group study at John Hopkins Bloomberg School of Public Health highlighted that although children have a similar risk of COVID-19 infection as the general population, there is a lesser chance of having severe infection.¹⁵Other reports have maintained this finding.¹⁶⁻¹⁸There is insufficient data on the possible cause of this situation however, some studies have considered factors such as less international travelling compared to their parents,¹⁹ lower exposure to public risk factors such as smoking,²⁰ and immaturity of angiotensin converting enzyme 2 (ACE2) receptors, the binding sites for COVID-19.^{2,20}

Although data is available for the adult patients with COVID-19, limited reports analyse paediatric patients with limited information on the paediatric population as a source of transmission of the infection.¹⁷Most of these reports are mainly from studies done in China, some parts of Europe, USA, and the United kingdom.⁷ There remains a paucity of data in the African setting including Nigeria especially in children.⁵

In this study, we reviewed data from testing centres in Akwa Ibom State, Nigeria to determine the prevalence, clinical manifestation, and risk factors for COVID-19 in children in the hope to add to the body of literature available of COVID-19 in African children.

Methods

In a retrospective study over one year period (April 2020 to March 2021), data for all children tested for COVID-19 from testing centres in Akwa Ibom State were reviewed. Children were defined as less than or equal to 18 years of age. Children were screened if they were considered a suspected case or as part of contact tracing where transmission was being considered.

A suspected case was defined as:

- Any person presenting with fever, cough or difficulty in breathing and who within 14 days before onset of illness had any of the following exposure
- History of travel to any country with confirmed and ongoing community transmission of SARS-CoV2.
- Close contact with a confirmed case of COVID-19.
- Exposure to a health facility where COVID-19 cases have been reported.

Patients were said to be positive if their nasopharyngeal and oropharyngeal swab specimen tested positive for 2019-n CoV nucleic acid by real time reverse transcriptase polymerase chain reaction assay. Results of tests were available between 24 to 48 hours. All children that tested positive were then classified into those that were asymptomatic, mildly symptomatic or severely symptomatic.

Data set was extracted from the Epidemiology Unit of the Ministry of Health Akwa Ibom State, Nigeria. Data was entered into an Excel spread sheet. Codes were given to each case. Data were cross-checked and data cleaning were performed before data analysis.

The data was analyzed using STATA version 13. Categorical variables were summarized as frequencies and percentages while quantitative continuous data were summarized as mean and standard deviation. Association between categorical data was assessed with chi square test at a level of significance of $P < 0.05$. Data was presented in tables, charts and graphs.

Ethical approval for this study was obtained from University of Uyo Teaching Hospital Institution Research and Ethical Committee. Permission was received from the Epidemiology unit of the Ministry of Health Akwa Ibom State to access the data. All patient identifiers like names, addresses, hospital number and other identifiers were omitted.

Results

Out of 11289 persons tested for COVID-19 within the one-year period of the study, 255 (2.26%) were children with 138 (1.2%) males and 117 (1.0%) females.

Fifty-four children (0.47%) of the 11289 persons were positive for COVID-19. Looking at the paediatric population only, 54 children (21.2%) were positive for COVID-19 while 201 children (78.8%) were negative as shown in Table 1.

Table 1: Clinical characteristics of respondents

Variable	Frequency	Percent
<i>Status</i>		
Positive	54	21.2
Negative	201	78.8
<i>Any symptoms</i>		
Yes	11	4.3
No	244	95.7
<i>Symptoms amongst Positives(n=54)</i>		
Positive with symptoms	5	9.3
Positive without symptoms	49	90.7
<i>On medication</i>		
Yes	17	6.7
No	238	93.3
<i>History of contact</i>		
Yes	254	99.6
No	1	0.4

Almost all the children tested for COVID-19 (99.6%) had a history of contact with a confirmed case of COVID-19. Only 11 (4.3%) of all tested children had symptoms while 244 (95.7%) had no symptoms. Five (0.09%) of the 54 children that were COVID positive were symptomatic. The three commonest symptoms in the COVID-19 positive children were Anosmia (100%), Fever and Aguesia (80% respectively).

Symptoms were seen mostly in children 15 years and above (72.7%) though this was not statistically significant. There was no difference when considering the gender of children that had symptoms, males (54.6%) and female (45.4%). Fever emerged as the most common symptom with headache the least. This is depicted in figure 1 below.

There was no statistically significant relationship between gender and age with the presence of symptoms. ($P=0.99$ and $P=0.41$ respectively) as shown in Table 2.

The association between gender and confirmatory positive status of respondent was not statistically significant ($p=0.32$). However, age and the presence of symptoms were significantly associated ($p=0.000$ and $p=0.04$ respectively) with a positive confirmatory status as shown in Table 3.

Table 2: Association between symptoms and selected characteristics of respondents

Variable	Presence of symptoms		Total n (%)	Statistical tests and P value
	Yes n(%)	No n (%)		
<i>Gender</i>				
Male	6 (54.6)	132 (54.1)	138 (54.1)	$\chi^2=0.001$
Female	5 (45.4)	112 (45.9)	117 (45.9)	$P=0.98$
<i>Age category</i>				
0-4	1 (9.1)	18 (7.4)	19 (7.5)	FE=0.41
5-9	1 (9.1)	14 (5.7)	15 (5.9)	
10-14	1 (9.1)	64 (26.2)	65 (25.5)	
15 and above	8 (72.7)	148 (60.7)	156 (61.2)	

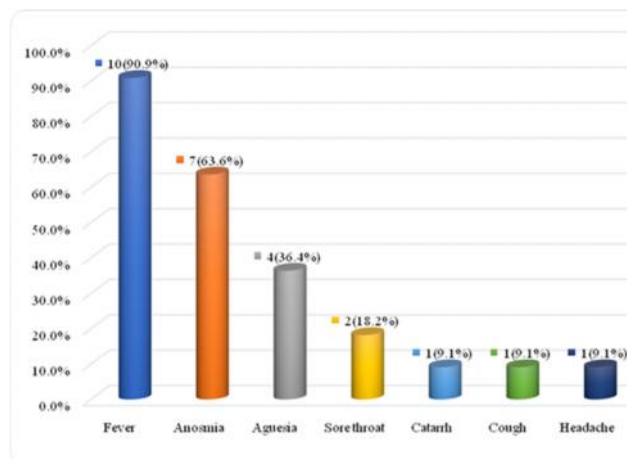
*FE – Fishers Exact

Table 3: Association between selected characteristics and confirmatory status of respondents

Variable	Confirmatory status		Total n (%)	Statistical tests and P value
	Positive n (%)	Negative n (%)		
<i>Gender</i>				
Male	26 (48.2)	112 (55.7)	138 (54.1)	$\chi^2=0.98$ $P=0.32$
Female	28 (51.8)	89 (44.3)	117 (45.9)	
<i>Age category</i>				
0-4	9 (16.7)	10 (5.0)	19 (7.5)	$\chi^2=31.14$ $P=0.000^*$
5-9	10 (18.5)	5 (2.5)	15 (5.9)	
10-14	13 (24.1)	52 (25.9)	65 (25.5)	
15 and above	22 (40.7)	134 (66.7)	156 (61.2)	
<i>Symptom status</i>				
Symptomatic	5 (9.3)	6 (3.0)	11 (4.3)	$\chi^2=4.1$ $P=0.04^*$
Asymptomatic	49 (90.7)	195 (97.0)	244 (95.7)	

*=significance of p-value

Fig 1: Symptom profile of respondents with COVID-19



Discussion

In our study the prevalence of COVID-19 in children was 0.47%. This low prevalence is in keeping with low prevalence in studies done in other countries.^{9,11-13} Though lower than most reports in developed countries, Bailey LC *et al* gave a prevalence of 4% in children.¹³ However, it should be noted that their study population included young adults up to 25 years of age. Young adults at that age have more freedom to interact with the public more than children less than 16 years of age, which could account for the higher prevalence. However, the exact reason for the low prevalence of COVID-19 in children globally remains unclear. Some authors have attributed it to less international travel resulting in lower exposure to the COVID-19 infection.¹⁹ This we may speculate as a strong point in our environment where there is a high level of poverty and international travel is mainly among children of the few privileged elites. Children also possess a healthier respiratory tract and a more active innate immune response.^{10,21}

Other studies have attributed this lower incidence in children to lower exposure to public risk factors such as crowded places,^{10,20,22} On the other hand, some reports have attributed this low prevalence to the immaturity of the Angiotensin-converting enzyme 2 (ACE2) receptors which are sites for COVID-19 binding.^{20,23} We can however not say with certainty that this was the case in our environment. In addition, the low incidence in children could be because of fewer number of children tested globally,²⁴ as was the case in our study with only 2.25% of the study population as children. Although during a pandemic the focus is usually on ways it affects economically productive age groups or persons who utilize the highest resources, gauging the impact of COVID-19 on children will help to appropriately allocate resources to children requiring care.²⁵ This will start with increasing the testing rate in children.

Almost all the children tested had a history of contact with a confirmed COVID-19 case. This has been widely

reported in studies done in developed countries.^{7,8,17,18} This finding is also in keeping with a case series report on five Nigerian children.⁵ Children therefore maybe more likely to acquire this disease from adult family members than other children, highlighting person to person transmission of the disease.²⁴ There is still little evidence on the role of children in the transmission of the disease.⁸ A study of households in Netherlands reported that there was no indication that children younger than 12 years of age were the first to be infected in the family.¹⁷ Other reports have however argued that the prolonged shedding in nasal secretions coupled with fecal shedding in children with COVID-19 may imply a role of children in community transmission of the disease especially in schools and in the homes.²⁵

Most of the children in this study were asymptomatic. This is in keeping with several studies.^{5,13,24} The finding of less severe or asymptomatic disease in children though still puzzling maybe be due to higher levels of antibodies against viral infection from repeated childhood infections with RSV.²⁴ Asymptomatic patients may not be routinely tested and this has unfortunately played down on the full extent of COVID-19 infection in the paediatric population.¹³ Globally children tend to have a mild disease course with better outcome than adult.³ Frequent clinical manifestation of COVID-19 in children include fever, dry cough, fatigue, upper respiratory symptoms such as nasal congestion and runny nose. Some gastrointestinal symptoms such as nausea, vomiting and diarrhoea have been reported in a few cases.²⁶ Interesting, anosmia was a symptom seen in all the

COVID-19 positive children in this study. Fever was also a common symptom in COVID-19 positive children in this study as has been reported in other studies.^{7,27,28} Of note however, is the fact that none of the patients in our study had these gastrointestinal symptoms. we however had some with ageusia as part of their symptoms. Increasing age emerging as a significant association with COVID-19 infection in children has been reported in several studies.^{13,24} Other factors reported in other studies include male gender, Asian, black race and the presence of comorbidities such as asthma, cardiac diseases and obesity.^{13,16} None of our patients however had any comorbidities.

Conclusion

The prevalence of COVID-19 in children remains low even in developing countries with no gender preference. African children have asymptomatic to mild disease. Although all age groups can be infected, increasing age remains a significant association with COVID-19 infection. We therefore recommend increased testing among the general children population and not only in those with a positive history of contact.

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