Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Pediatric COVID-19 and Gastrointestinal Symptoms in Africa

One year into the coronavirus disease 2019 (COVID-19) pandemic, the African continent still seems to be spared from the devastating effects the disease had in other continents. Africa's COVID-19 seems to be of a milder nature both in adults and children. However, lack of data from Africa is significant, and more studies are needed to validate the disease status, clinical manifestations, and future implications for Africa. In this study, we report pediatric COVID-19 features in Africa represented by 8 countries.

We conducted a systematic literature review (March 2020 to November 2021) using the terms COVID-19 Africa, COVID-19 Africa Pediatrics, and COVID-19 Africa Children. Case characteristics (10 studies in 8 countries, 294 patients positive for severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2] by polymerase chain reaction; Table 1, Supplementary Table 1) are described. Symptoms and comorbidities were combined, compared, and analyzed by weighted analysis methods. SPSS version 26 was used for this analysis.

Ethiopian patients were the oldest. The mean age of our cohort was 11.4 years with a minimum of 5.75 years and a maximum of 15 years. Patients from Ethiopia (Table 1, Supplementary Figure 1) were on average 15 years old followed by Morocco, at 13 years old. The youngest patients were from Sierra Leone, at 5.75 years old. Female patients made 55% of our cohort, but gender distribution was not uniform. The Tunisian cohort was 87.5% males, whereas the South African cohort was 73.9% females. No deaths were reported in the overall cohort.

Fever was the most common symptom, found in 24.6% of the cohort. Its distribution was 19.9% in the Moroccan cohort, 5.6% in Ethiopia, and up to 100% in South African and Tunisian cohorts. Cough was present in 20% of our African cohort, ranging from 2.2% in Sierra Leone to 22.5% in the Nigerian cohort. Dyspnea was present in 8.5% (25% in Cameroon cohort) and myalgia in 60.8%. Interestingly, there were 63% asymptomatic cases. The Egyptian cohort had 100% asymptomatic cases, whereas Nigeria and Sierra Leone reported 33% and 22%, respectively.

Diarrhea and abdominal pain were frequent. Our cohort had an 18.4% diarrhea prevalence, with the highest prevalence in Tunisia (87.5%) and the lowest in Morocco (6.7%). Abdominal pain was present in 16.7%, with a prevalence of 100% in Tunisia and 1.3% in Morocco. Nausea was present in 8% and vomiting in 4.9%. Nausea was noted in 50% in the Tunisian cohort, whereas 4.4% and 5.7% had vomiting in Ethiopia and Nigeria, respectively. The least common symptom was anosmia at 4.3%, with the highest prevalence of 5.8% in Morocco (Table 1, Supplementary Figure 2).

Studies from South Africa and Tunisia had more reported symptoms, some of which were highly prevalent. Cumulatively, conjunctivitis was present in 64.5% of these 2 countries' cohorts. More specifically, it was reported in 65.2% in South Africa and 62.5% in Tunisia. Rash followed a similar profile, although at much higher cumulative prevalence of 87.1%, with 87% for South Africa and 87.5% for Tunisia.

Although HIV and Ebola virus had major damaging effects in Africa, SARS-CoV-2 seems to have a different profile. Indeed, more than 60% of African children with COVID-19 were asymptomatic; this is in contrast to what has been reported in an Alberta, Canada study[1] with 33% asymptomatic cases. Compulsory viral vaccinations given routinely in early childhood in Africa[2] might be partially providing some level of resistance against SARS-CoV-2 infections. Angiotensin-converting enzyme 2 gene expression in the nasal epithelium is highest in younger children and decreases with age.[3] This is likely a reason why pediatric cases in general and those in our study did not display significant respiratory symptoms, because the virus might have been mitigated by the pediatric immune system before reaching the lungs.

A comparison of our African cohort with a US cohort of 6581 pediatric cases[4] revealed different profiles with fever at 24.6% vs 48%, cough at 20% vs 37.6%, and vomiting at 4.9% vs 13.2% in African vs US cases, respectively. These profiles seem to reflect a difference in the immediate response to infection between these 2 groups. Nausea was equally represented in the 2 cohorts (8% vs 8.8%). Abdominal pain and diarrhea were more prevalent in the African cohort (16.7% vs 10.1% and 18.4% vs 11%, respectively). Gastrointestinal symptoms have been reported as potential mitigators and attenuators of COVID-19 disease as they generally correlated with better outcomes. Of note, conjunctivitis was highly prevalent at 64.5% in African pediatric cases compared with only 2.7% in US pediatric cases. This finding might have major consequences if not addressed adequately. It will be important to determine whether the conjunctivitis cases are of bacterial or viral origin because bacterial cases are generally treatable, whereas viral cases might linger longer and be more damaging to patients' sight, as was reported for Ebola survivors who suffered from uveitis, even after treatment.[5]

Another prominent symptom in our African cohort was rash, which was reported in 87.1% of patients in the Tunisian and South African cohorts. Studies from Europe have reported skin manifestations in pediatric COVID-19 patients[6] but not at the higher prevalence as in our African cohort. Although skin rash can result from extreme immune reactions, it might also reflect potential viral-induced liver function alterations.[7] However, we do not have any lab test results to assess liver function in our cohort.

Limitations of our study include the small cohort and low number of included countries. We did however include

Abbreviations used in this paper: COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

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Table 1. Features and Characteristics of Pediatric COVID-19 Patients From Different African Countries

	Study[a] (N = 294)								
	Total	Cameroon Mekone et al, 2020	Egypt El Kassas et al, 2020	Ethiopia Leulseged et al, 2020	Morocco Chalabi et al, 2020; Fakiri et al, 2020	Nigeria Ibrahim et al, 2020; Adedeji et al, 2020	Sierra Leone Adetola et al, 2020	South Africa Webb et al, 2020	Tunisia Borgi et al, 2021
Patients	294 (100)	4 (1.36)	13 (4.42)	90 (30.61)	89 (30.27)	58 (19.73)	9 (3.06)	23 (7.82)	8 (2.72)
Collection date: March to November 2020		Jan to Apr 2020	Apr to May 2020	End Jun to mid-Sep 2020	Mar 2 to Apr 26, 2020	Mar 25 to May 15, 2020	Apr 24 to Sep 20, 2020	Jun 4 to Jul 24, 2020	Nov 1–30, 2020
Male gender	132 (44.91)	1 (25)	8 (61.53)	33 (36.7)	41 (46.1)	31 (53.40)	5 (55.6)	6 (26.2)	7 (85.7)
Female gender	162 (55.08)	3 (75)	5 (38.47)	57 (63.3)	48 (53.9)	27 (46.6)	4 (44.4)	17 (73.9)	1 (12.5)
Age range, y	12 wk to 19 y	12 wk to 13 y	0-18	<18	<19	7 days to 13 y	0-18	<15	<15
Median age, y	11.43	—	—	15	8.01	12.63	5.75	—	8
Asymptomatic	109 (63)	2 (50)	13 (100)	—	59 (66.33)	33 (56.9)	2 (22.2)	—	—
Mild case	130 (52)	2 (50)	—	73 (81.1)	28 (31.45)	20 (34.5)	7 (77.8)	—	—
Moderate case	34 (14.2)	—	—	17 (18.9)	12 (13.2)	5 (8.6)	—	—	—
Fever	69 (24.6)	2 (50)	—	5 (5.6)	17 (19.09)	10 (17.3)	4 (44.4)	23 (100)	8 (100)
Shortness of breath or dyspnea	13 (8.5)	1 (25)	—	—	12 (13.3)	—	—	—	—
Nasal discharge	12 (8.1)	—	—	5 (5.6)	—	7 (12.0)	—	—	—
Cough	50 (20)	1 (25)	—	20 (22.2)	14 (15.68)	13 (22.5)	2 (2.2)	—	—
Stuffy nose	2 (1.4)	—	—	—	1 (1.35)	—	1 (11.1)	—	—
Sneezing	10 (14.6)	—	—	—	—	9 (15.1)	1 (11.1)	—	—
Fatigue or subjective weakness	10 (7.1)	—	—	5 (5.6)	—	5 (9.4)	—	—	—
Hypotension	16 (18)	—	—	—	—	—	—	13 (56.5)	3 (37.5)
Myalgia	53 (34.5)	—	—	—	47 (53.3)	—	—	—	6 (75)
Anosmia	6 (4.3)	—	—	—	5 (5.87)	1 (1.9)	—	—	—
Irritability	8 (6.5)	—	—	—	—	3 (5.7)	—	—	1 (12.5)
Myocardial dysfunction	12 (14.8)	—	—	—	—	—	—	12 (52)	—

Table 1. Continued

	Study[a] (N = 294)								
	Total	Cameroon Mekone et al, 2020	Egypt El Kassas et al, 2020	Ethiopia Leulseged et al, 2020	Morocco Chalabi et al, 2020; Fakiri et al, 2020	Nigeria Ibrahim et al, 2020; Adedeji et al, 2020	Sierra Leone Adetola et al, 2020	South Africa Webb et al, 2020	Tunisia Borgi et al, 2021
Abdominal pain	29 (16.7)	—	—	—	1 (1.35)	5 (9.4)	—	15 (65.2)	8 (100)
Nausea	13 (8)	—	—	4 (4.4)	—	3 (5.7)	2 (22.2)	—	4 (50)
Vomiting	7 (4.9)	—	—	4 (4.4)	—	3 (5.7)	—	—	—
Diarrhea	34 (18.4)	—	—	—	6 (6.74)	5 (9.4)	1 (11.1)	15 (65.2)	7 (87.5)
Conjunctivitis	20 (64.5)	—	—	—	—	—	—	15 (65.2)	5 (62.5)
Headache	21 (8.1)	—	—	9 (10)	—	—	2 (22.2)	—	6 (75)
Sore throat	37 (15)	—	—	20 (22.2)	1 (1.35)	12 (20)	—	—	4 (50)
Rash	27 (87.1)	—	—	—	—	—	—	20 (87)	7 (87.5)
Lymphocytopenia	8 (5.2)	—	—	—	7 (8)	—	1 (11.1)	—	—
Lymphocytosis	23 (15.8)	—	—	—	—	23 (40)	—	—	—

Values are n (%) unless otherwise defined.
[a]The studies listed here can be found in Supplementary Table 1.

all published reports. Reports from different countries do not have the same set of data, some being more comprehensive than others.[8] Prospective studies need to include standardized protocols developed by the World Health Organization, especially for pandemic diseases.

In conclusion, this is the first African pediatric COVID-19 meta-analysis to show that African pediatric COVID-19 has a distinguishable profile with more pronounced gastrointestinal symptoms such as diarrhea and abdominal pain that likely attenuate the disease severity. Conjunctivitis and skin rash were prominently present in our cohort and deserve more attention and follow-up. Cough, fever, and shortness of breath were less prevalent in our cohort. As a sign of resilience in pediatric African patients, the level of asymptomatic cases was notable compared with other continents.

Supplementary Material

Note: To access the supplementary material accompanying this article, visit the online version of *Gastroenterology* at www.gastrojournal.org and at https://doi.org/10.1053/j.gastro.2021.08.020.

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Conflicts of interest
The authors disclose no conflicts.

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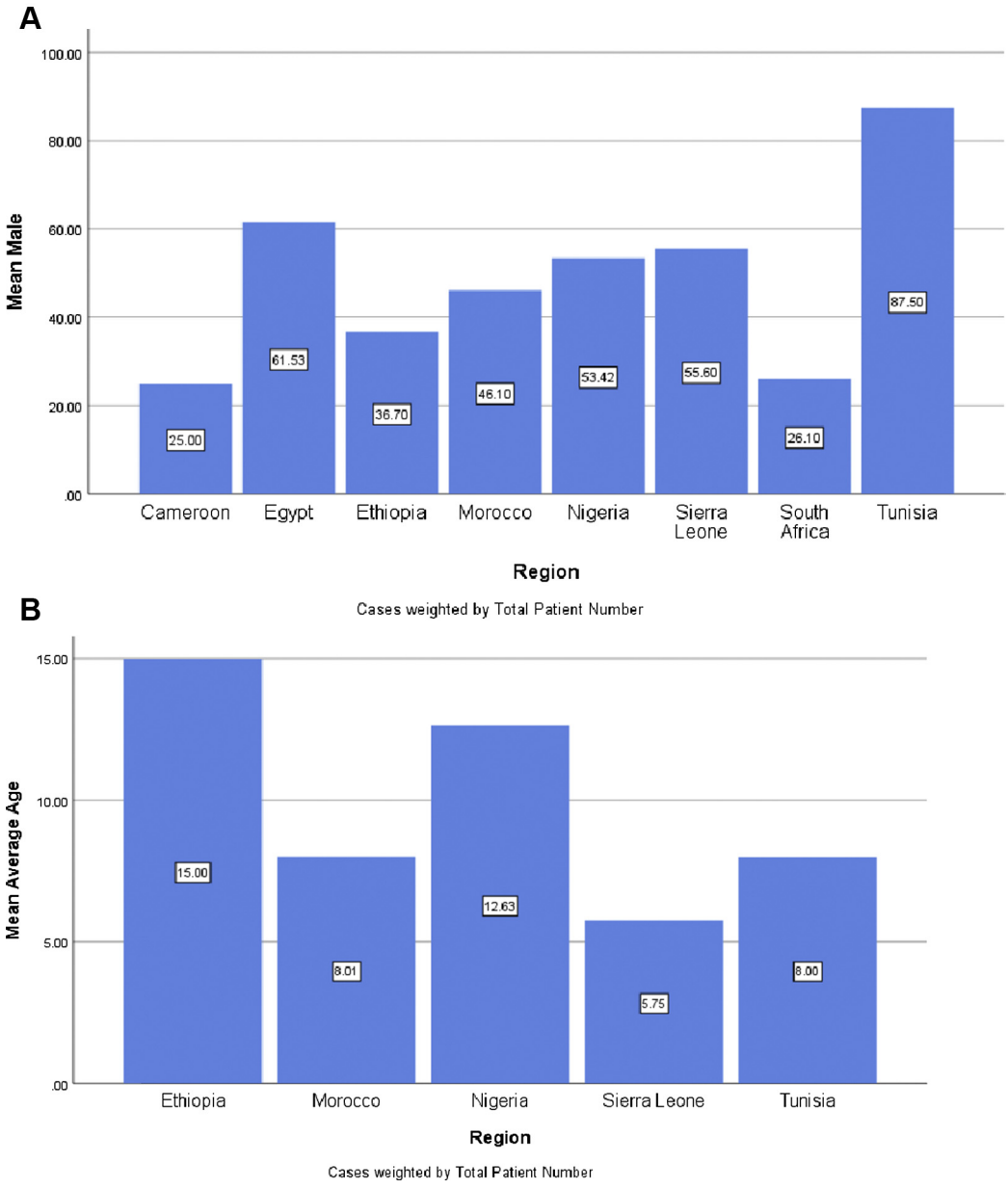
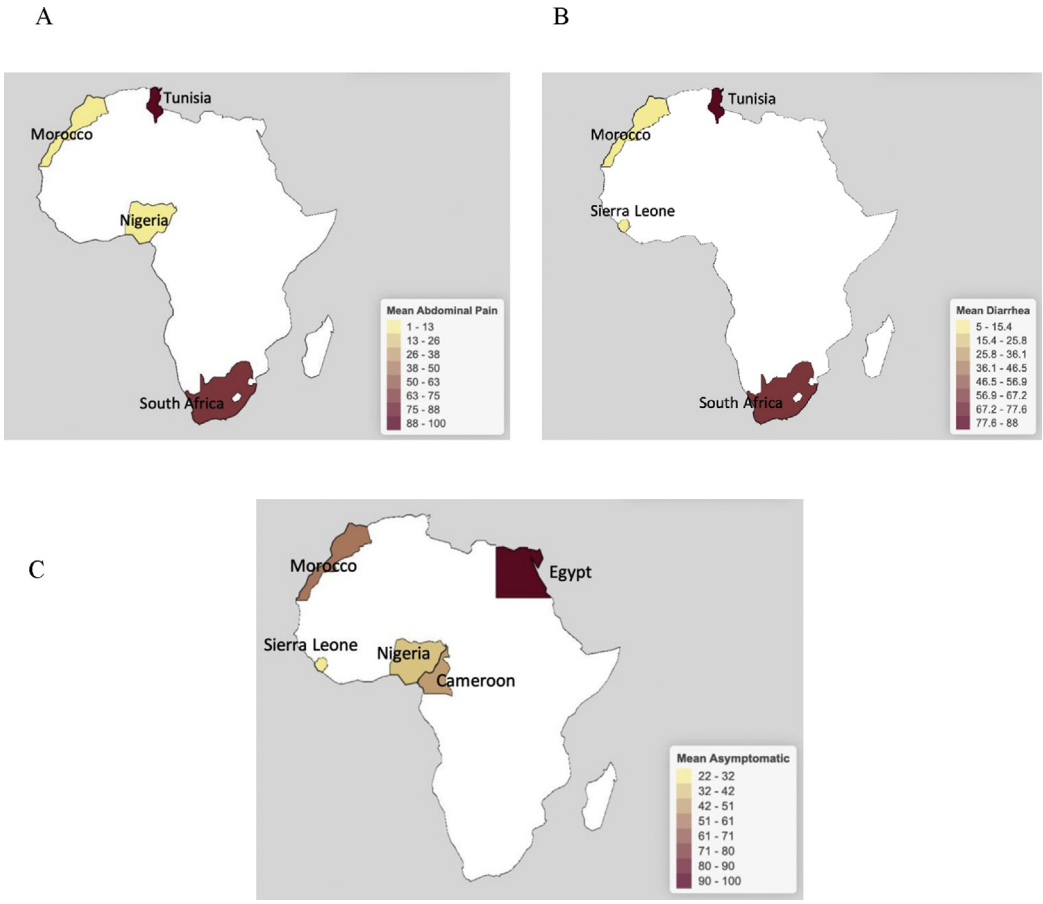


Supplemental Figure 1. Gender (*A*) and age (*B*) distribution of the study patients.



Supplemental Figure 2. Heatmaps showing the prevalence of abdominal pain (*A*), diarrhea (*B*), and asymptomatic patients (*C*) in selected studies from different African countries.

Supplementary Table 1. References and Included Countries for This Study

Study (N = 294)	Cameroon Mekone et al, 2020	Egypt El Kassas et al, 2020	Ethiopia Leulseged et al, 2020	Morocco Chalabi et al, 2020; Fakiri et al, 2020	Nigeria Ibrahim et al, 2020; Adedeji et al, 2020	Sierra Leone Adetola et al, 2020	South Africa Webb et al, 2020	Tunisia Borgi et al, 2021
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