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Clinical characteristics and burden of COVID-19 in children and adolescents in Colombia: a retrospective database analysis

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ABSTRACT

Background The burden of COVID-19 infections has been extensively studied in some parts of the world. However, in emerging economies and particularly in Latin America and Colombia, research is still incomplete, especially in the paediatric population. This study aims to investigate the burden of COVID-19 infections in children and adolescents in Colombia to understand the burden and outcomes of COVID-19.

Methods This is a retrospective database analysis of 0–17-year-old persons diagnosed with COVID-19 and given inpatient or outpatient care at a large health maintenance organisation covering 10% of the entire population from March 2020 to January 2023. Cases were confirmed by International Classification of Diseases 10th Revision codes for COVID-19 and a lab test. The incidence rates of COVID-19 cases per 100 000 persons were calculated. With a multivariate logistic regression model adjusted for demographical and clinical characteristics, the factors related to developing severe or critical COVID-19 during the study period were identified.

Results Of the 76 376 COVID-19 cases included in the analysis, the mean age was 9.8 years, about 51.5% were male, 99.6% lived in urban areas and 98.9% were unvaccinated (76.9% of the cases occurred before the vaccination of this group began on 31 October 2021). Most cases (69 528, 91%) were classified as mild, 0.9% as moderate, 8% as severe and 0.1% as critical. The most prominent comorbidities were mental health-related conditions (18.9%), chronic lung disease (13.6%) and immunocompromised condition (10.6%). 28 deaths were observed, of which 22 had at least 1 comorbidity, the most frequent being chronic lung disease and mental health conditions.

Conclusion Nearly 1 in 5 cases of COVID-19 was documented in children with underlying medical conditions. Our findings underscore the need to target children with comorbidities.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Children and adolescents present mild to moderate COVID-19 symptoms and usually constitute a low proportion of COVID-19 cases.

WHAT THIS STUDY ADDS

⇒ Provides evidence about the frequency of COVID-19 and severity in this population, studying its behaviour in different subgroups. In addition, it analysed some risk factors where the frequency was higher and requires differentiated attention, such as the youngest and those with comorbidities for instance those associated with mental health conditions.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This research provides evidence to support public policy that aims to protect children against COVID-19 and to generate hypothesis for future studies specially to deepen the connection between mental illness and COVID-19, among others.

INTRODUCTION

In most countries, COVID-19 infection in children and adolescents under 19 years old constituted 1%–5% of all patients.[1] The explanations for this relatively low frequency of cases in children include their reduced capacity of response to the virus and limited expression of angiotensin-converting enzyme 2, as well as the presence of other viruses in the respiratory epithelium that inhibit, by virus-virus interaction, the proliferation of SARS-CoV-2.[2]

According to various studies, children and adolescents with COVID-19 had milder symptoms of the disease (on average) than adults. In contrast, adults seem less affected than children by other respiratory viruses.[1 3 4] Compared with seasonal respiratory viruses, children and adolescents infected with COVID-19 reportedly had a lower share of hospitalisations and similar intensive care

unit and death rates among hospitalised patients.[5] However, COVID-19 does not only cause the immediate symptomology associated with a mild to severe infection. It also gives rise to long-lasting symptoms in children and adolescents,[6] such as neurological, gastrointestinal, cardiovascular and behavioural problems months after infection.[7]

Although the demographics and characteristics of COVID-19 infections have been analysed in depth in some parts of the world, information from Latin American countries is spotty. It is derived from heterogeneous sample sizes,[8 9] mostly focused on a few centres in specific subregions,[10 11] or in other areas only at the beginning of the pandemic.[12] In Colombia, the research carried out on children and adolescents has been based on limited samples, taking into account their size, location or short time of collection.[12–14] It is necessary to provide the latest information on the burden of COVID-19 from diverse sectors of the population in Colombia, not only to understand the burden of disease but also to support decision-making on immunisation strategies. Therefore, the current contribution aimed to investigate the burden of COVID-19 infections in children and adolescents in Colombia from March 2020 to January 2023 from a large real-world data (RWD) sample in order to understand its demographic and clinical characteristics.

METHODS

Study design and population

A retrospective observational study was conducted in one of the largest health maintenance organisations (HMOs) in Colombia based on a census on the clinical records of children/adolescents under 18 years of age that received inpatient or outpatient medical care from March 2020 to January 2023. Colombian healthcare system has a universal health coverage operated through a publicly financed insurance plan at HMOs, this HMO covers around 10% of the Colombian population (the third largest in the country) and its members have freely subscribed and can make use of its services in exchange for co-payments established by law according to household payment capacity.

The paediatric cases were identified by using the International Classification of Diseases 10th Revision diagnostic codes associated with COVID-19 (U07.1 or U07.2). The laboratory confirmation of a SARS-CoV-2 infection had to be reported for a child/adolescent to be included in the sample. The only exclusion criteria are those implicit in the inclusion criteria. The protocol was reviewed and approved by the institutional ethics committee of the HMO involved. Informed consent was not obtained due to the retrospective study design.

The period of a COVID-19 case is presently defined as the period starting from a positive diagnosis (the index date) to the day of follow-up or until the care ended. This period lasted for 45 days after the index date for outpatients and from hospital admission to discharge plus the follow-up outpatient care (defined as aforementioned) for inpatients (online supplemental figure 1).

Each COVID-19 case was categorised as mild, moderate, severe or critical based on the WHO definition and the healthcare resource utilisation associated to it.[15] Mild cases were those managed by outpatient care or telemedicine, while moderate cases required oxygen therapy within the context of outpatient care or telemedicine. Cases were considered as severe in the event of hospitalisation and as critical when the patient needed attention in an intensive care unit. Variant predominance in the country was extracted from the National Health Institute[16] and Holdcroft *et al*.[17]

Comorbidities were identified in accordance with the guidelines of the Centers for Disease Control and Prevention for general population in early 2023.[18] These included a history of cancer, chronic kidney disease, chronic lung disease, dementia or other neurological conditions, type 1 or type 2 diabetes, Down syndrome, cardiovascular disease, HIV infection, hypertension, an immune deficiency or immunocompromised condition, liver disease, obesity, sickle-cell disease, thalassaemia, and a solid organ or blood transplant.

Vaccination status is categorised in the following manner: (a) unvaccinated: no COVID-19 vaccine record; (b) partially vaccinated: one dose of an mRNA or adenoviral vector vaccine; (c) fully vaccinated: two doses of an mRNA or adenoviral vector vaccine or one dose of the Johnson & Johnson vaccine; and (d) fully vaccinated+booster: full vaccination plus any extra COVID-19 vaccine dose. Death was considered to be COVID-19-related when occurring within the disease period, as defined above.

Data sources

Data was obtained from the RWD of one of the largest HMOs in Colombia, integrating epidemiological and clinical data, and vaccination records. This HMO covers approximately 7% children under 18 years old (~1 million people), according to the Ministry of Health.[19]

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Statistical analysis

The statistical analysis consists of descriptive statistics, expressing qualitative variables in percentages and frequencies, and quantitative variables as the mean, median, SD and IQR. The relative frequency of events, such as the monthly and annual cumulative frequency, was calculated as (new cases/population) × 100 000, for frequencies accumulating more than 1-year period, the denominator refers to the population at the beginning of the period. A multivariate logistic regression model was employed to identify the factors linked to the development of a severe or critical COVID-19 case. Multicollinearity was assessed with the variance inflation factor.

Statistical analysis was performed using R statistical language (v.4.3.1), with significance set at 5%.[20]

RESULTS

Demographic and clinical characteristics

Included in the study were a total of 76 376 COVID-19 cases of children/adolescents from 0 to 17 years of age. The mean age of patients was 9.8 (SD 4.8) years. Most cases (32 095, 42%) were 12–17-year-old children/adolescents, followed by 5–11-year-old children (29 582, 38.7%), and then children under 5 years of age (14 699, 19.2%). About 51.5% of the patients (39 360) were male, 57.1% lived in Antioquia, and virtually all (99.6%) lived in urban areas (table 1). Regarding socioeconomic status, 59.1% of the cases (45.121) came from low-income families, in which the caregivers earned less than 2 times the minimum wage, while only 10.8% of the cases had caregivers earning more than 5 times the minimum wage (table 1).

Most cases (69 528, 91%) were classified as mild, 0.9% as moderate, 8% as severe and 0.1% as critical. Those classified as mild and severe cases displayed a pattern similar to the whole population with a mean age of 9.9 years (SD 4.8) and 9.5 years (SD 4.8), respectively. In contrast, those classified as moderate and critical had a mean age of 5.6 years (SD 4.7) and 5.9 years (SD 5.2), respectively. The mean weight was 31.5 kg (SD 22.2) and the mean height was 111.2 cm (SD 54.7), and these values were of course higher in mild and severe cases (consistent with the mean age) (table 1).

Male patients represented the majority of severe cases, a pattern particularly pronounced for critical cases (66/108, 61.1%). The proportion of critical cases decreased as the income of the caregiver increased, finding 63% (68/108) of critical cases associated with an income of less than 2 times the minimum wage, and only 3.7% (4/108) related to an income of over 5 times the minimum wage (table 1).

The mean number of comorbidities was 0.6 (SD 0.8) with differences found between the distinct severity groups. Whereas, mild cases had the lowest mean (0.5, SD 0.8), and the critical ones had the highest mean (1.4, SD 1.3). The most prevalent comorbidities in the sample were some forms of mental health condition (14 432, 18.9%), followed by chronic lung diseases (10 391, 13.6%), an immunocompromised condition (8077, 10.6%), obesity (5.8%) and cancer (2246, 2.9%). The other conditions (eg, hypertension, chronic kidney disease and diabetes) were each present in under 1% of the population. There were more patients with chronic lung disease in the severe vs mild infection group. This comorbidity existed in 51.9% of critical cases compared with only 12.2% of mild cases.

Severity, vaccination status and hospital length of stay

In most cases, patients in the sample population were unvaccinated (75 506, 98.9%) with only 1.1% having received some vaccine dose, a pattern that held true in every category of severity (table 1). However, 76.9% (58 767/76 376) of the cases under study occurred prior to the opening of the vaccination programme for children/adolescents (16 years of age or less) in Colombia on 31 October 2021.[21] Severe COVID-19 was found in only 1 of 486 fully vaccinated patients (0.2%), and in 6079 of the 75 506 unvaccinated patients (8.1%), indicating a reduced risk of a severe case if the vaccination status was complete.

The median hospital length of stay (mLoS) for severe and critical cases was 10 days (IQR 5) for the former and 9 days for the latter (IQR 9). However, this behaviour was reversed by variant dominance in the country; the mLoS for critical cases tended to be higher than severe ones (Mu variant 11 vs 10 days, Delta variant 17 vs 10 days; Omicron 8 vs 4 days); it only sustained at the Gamma predominance period (7 vs 10 days) (figure 1). The LoS pattern is similar for 5–17-year-old patients (mLoS=10 days) but it is lower for children under 5 years of age (mLoS=5 days); by variant predominance, it was observed that when comparing Gamma vs Omicron period, the mLoS fell more steeply in the 5–11-year-olds (60%, 10 vs 4 days), while in 0–4-year-olds and 12–17-year-olds, this mLos was reduced by 43% (7 vs 4 days) and 35% (10 vs 6.5), respectively.

Multivariate logistic regression was used to identify variables that have a statistically significant association with the risk of developing severe or critical COVID-19. The characteristics related to a greater risk were height, weight, reinfection and a higher number of comorbidities, while those linked to a lower risk were age, a high-income parent/caregiver, and a partial or full vaccination status (table 2).

Main risk factors

Of the patients with the five most prevalent comorbidities, an elevated proportion were unvaccinated. For example, the percentages of unvaccinated cases with a chronic lung disease, cancer or an immunocompromised condition, for example, were 98.7%, 99.2% and 99.1%, respectively. As with the overall sample, cases with comorbidities showed a slightly higher number of cases of male patients, ranging from 50.7% (cases with cancer) to 56.1% (cases with chronic lung disease). The average age was about 8 years for cases with chronic lung disease or an immunocompromised condition and around 10 years for those with a mental health condition, cancer or obesity.

Relative frequency of cases by year and age group

Regarding temporal distribution, 64.6% of cases of infected children and adolescents (49 304) occurred in 2021, when the Gamma and Mu variants were predominant in the country. Among the remainder of the cases, 17.7% were found in 2020, 17.5% in 2022 and 0.2% in 2023 (including only January) (table 1). From 2020 to 2022, a yearly decrease took place in the percentage of

Table 1 Clinical characteristics of children and adolescents with COVID-19

	Total	Mild	Moderate	Severe	Critical
	76376	69528	652	6088	108
Demographic data					
Mean age±SD	9.8±4.8	9.9±4.8	5.6±4.7	9.5±4.8	5.9±5.2
Age groups, n (%)					
0–4 years old	14699 (19.2)	13088 (18.8)	369 (56.6)	1180 (19.4)	62 (57.4)
5–11 years old	29582 (38.7)	26787 (38.5)	181 (27.8)	2588 (42.5)	26 (24.1)
12–17 years old	32095 (42)	29653 (42.6)	102 (15.6)	2320 (38.1)	20 (18.5)
Sex, n (%)					
Female	37016 (48.5)	33763 (48.6)	293 (44.9)	2918 (47.9)	42 (38.9)
Male	39360 (51.5)	35765 (51.4)	359 (55.1)	3170 (52.1)	66 (61.1)
Caregiver's income, n (%)					
Unknown	7055 (9.2)	6428 (9.2)	87 (13.3)	527 (8.7)	13 (12)
<2 times the minimum wage	45121 (59.1)	40792 (58.7)	426 (65.3)	3835 (63)	68 (63)
2–5 times the minimum wage	15919 (20.8)	14477 (20.8)	114 (17.5)	1305 (21.4)	23 (21.3)
>5 times the minimum wage	8281 (10.8)	7831 (11.3)	25 (3.8)	421 (6.9)	4 (3.7)
Region of residence, n (%)					
Antioquia	39521 (51.7)	34067 (49)	365 (56)	5009 (82.3)	80 (74.1)
Atlántico	11249 (14.7)	11030 (15.9)	109 (16.7)	108 (1.8)	2 (1.9)
Bogotá D.C.	9595 (12.6)	8757 (12.6)	25 (3.8)	798 (13.1)	15 (13.9)
Valle del Cauca	6497 (8.5)	6294 (9.1)	148 (22.7)	49 (0.8)	6 (5.6)
Bolívar	2188 (2.9)	2179 (3.1)	1 (0.2)	8 (0.1)	(0)
Other	7326 (9.6)	7201 (10.4)	4 (0.6)	116 (1.9)	5 (4.6)
Zone of residence, n (%)					
Rural	281 (0.4)	271 (0.4)	1 (0.2)	9 (0.1)	(0)
Urban	76064 (99.6)	69230 (99.6)	650 (99.7)	6076 (99.8)	108 (100)
Unknown	31 (0)	27 (0)	1 (0.2)	3 (0)	(0)
Clinical data					
Number of comorbidities±SD	0.6±0.8	0.5±0.8	0.6±0.9	0.9±1	1.4+1.3
Comorbidities n (%)					
Mental health condition	14432 (18.9)	12850 (18.5)	106 (16.3)	1450 (23.8)	26 (24.1)
Chronic lung disease	10391 (13.6)	8508 (12.2)	135 (20.7)	1692 (27.8)	56 (51.9)
Immunocompromised condition	8077 (10.6)	6889 (9.9)	101 (15.5)	1066 (17.5)	21 (19.4)
Obesity	4437 (5.8)	3868 (5.6)	32 (4.9)	524 (8.6)	13 (12)
Cancer	2246 (2.9)	1932 (2.8)	18 (2.8)	289 (4.7)	7 (6.5)
Hypertension	405 (0.5)	324 (0.5)	7 (1.1)	72 (1.2)	2 (1.9)
Chronic kidney disease	354 (0.5)	286 (0.4)	1 (0.2)	64 (1.1)	3 (2.8)
Substance use disorder	285 (0.4)	255 (0.4)	5 (0.8)	25 (0.4)	(0)
Diabetes (type 1 or type 2)	271 (0.4)	223 (0.3)	5 (0.8)	40 (0.7)	3 (2.8)
Peripheral vascular disease	250 (0.3)	216 (0.3)	1 (0.2)	33 (0.5)	(0)
Heart disorder	225 (0.3)	173 (0.2)	1 (0.2)	46 (0.8)	5 (4.6)
Chronic liver disease	182 (0.2)	149 (0.2)	3 (0.5)	28 (0.5)	2 (1.9)
Down syndrome	176 (0.2)	144 (0.2)	2 (0.3)	23 (0.4)	7 (6.5)
Tuberculosis	175 (0.2)	139 (0.2)	5 (0.8)	26 (0.4)	5 (4.6)
Sickle cell disease	103 (0.1)	90 (0.1)	(0)	13 (0.2)	(0)
Solid organ or blood stem cell transplant	82 (0.1)	58 (0.1)	(0)	22 (0.4)	2 (1.9)

Continued

Table 1 Continued

	Total	Mild	Moderate	Severe	Critical
	76376	69528	652	6088	108
Stroke or cerebrovascular disease	67 (0.1)	61 (0.1)	1 (0.2)	4 (0.1)	1 (0.9)
Dementia or other neurological condition	35 (0)	27 (0)	(0)	8 (0.1)	(0)
Transient ischaemic attack	20 (0)	18 (0)	(0)	2 (0)	(0)
HIV infection	13 (0)	9 (0)	(0)	3 (0)	1 (0.9)
Reinfected, n (%)	1702 (2.2)	1503 (2.2)	6 (0.9)	190 (3.1)	3 (2.8)
Vaccination status, n (%)					
Unvaccinated	75506 (98.9)	68676 (98.8)	644 (98.8)	6079 (99.9)	107 (99.1)
Partially vaccinated	365 (0.5)	351 (0.5)	5 (0.8)	8 (0.1)	1 (0.9)
Fully vaccinated	486 (0.6)	482 (0.7)	3 (0.5)	1 (0)	(0)
Fully vaccinated+booster	19 (0)	19 (0)	(0)	(0)	(0)
Year, n (%)					
2020	13519 (17.7)	11471 (16.5)	51 (7.8)	1979 (32.5)	18 (16.7)
2021	49304 (64.6)	45697 (65.7)	137 (21)	3434 (56.4)	36 (33.3)
2022	13400 (17.5)	12228 (17.6)	459 (70.4)	661 (10.9)	52 (48.1)
2023	153 (0.2)	132 (0.2)	5 (0.8)	14 (0.2)	2 (1.9)

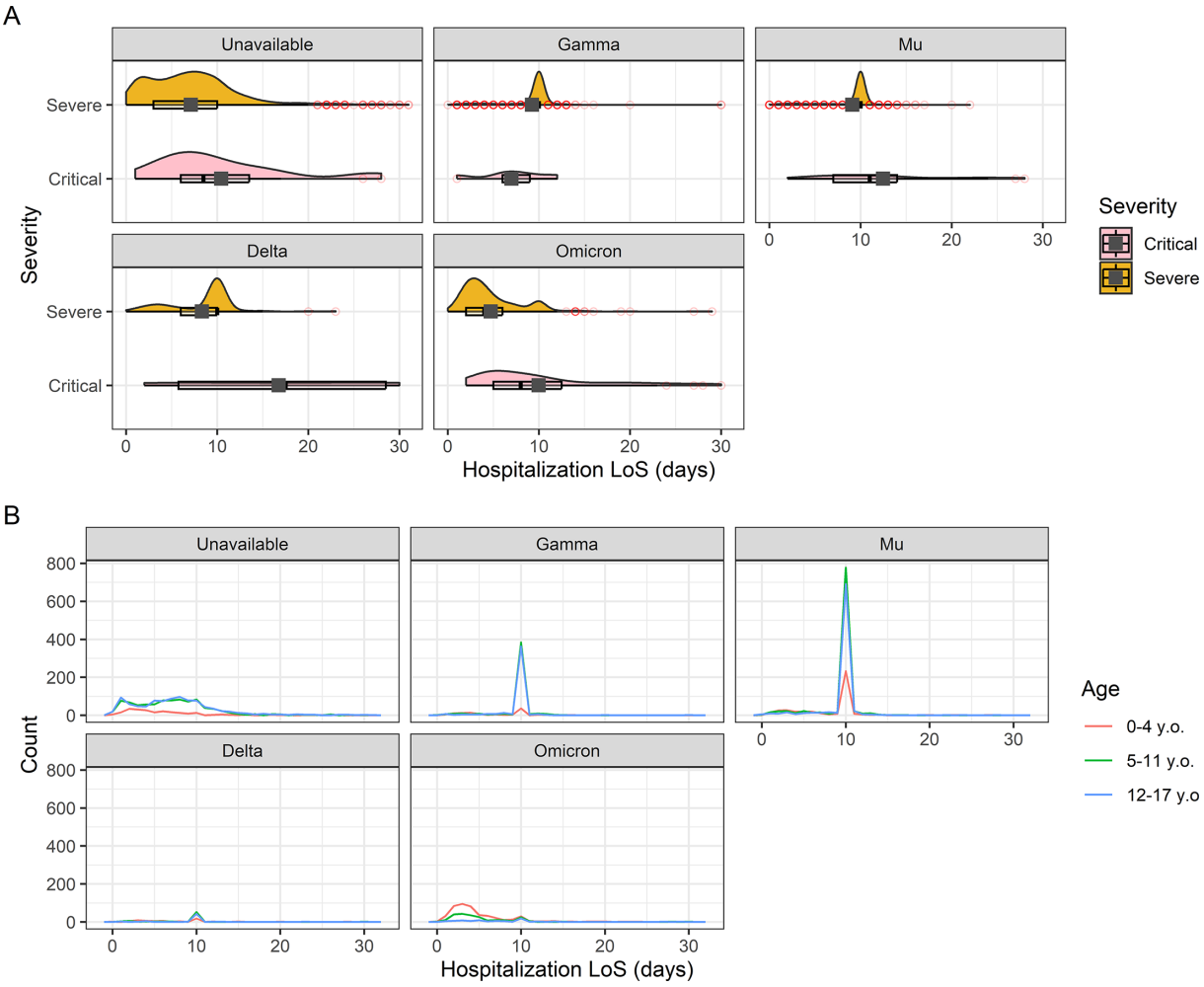

Figure 1 Plots of the hospital length of stay by COVID-19 variant by severity (A) and age (B).

Table 2 Logistic regression

	OR (CI 95%) (p value)
(Intercept)	0.120***
	(0.107, 0.133) (<0.001)
Age	0.937***
	(0.929, 0.945) (<0.001)
Male	0.984
	(0.933, 1.037) (0.547)
Weight	1.005***
	(1.003, 1.007) (<0.001)
Height	1.005***
	(1.004, 1.006) (<0.001)
Income: 2–5 times the minimum wage	1.047
	(0.979, 1.119) (0.175)
Income: unknown	0.916†
	(0.832, 1.007) (0.071)
Income: >5 times the minimum wage	0.880*
	(0.790, 0.979) (0.019)
Fully vaccinated	0.049**
	(0.003, 0.216) (0.003)
Fully vaccinated+booster	0
	(0.015) (0.898)
Partially vaccinated	0.457*
	(0.217, 0.838) (0.022)
Reinfection	1.874***
	(1.595, 2.191) (<0.001)
Number of comorbidities	1.440***
	(1.402, 1.479) (<0.001)
Year: 2021	0.437***
	(0.412, 0.464) (<0.001)
Year: 2022	0.307***
	(0.279, 0.337) (<0.001)
Year: 2023	0.615†
	(0.349, 1.012) (0.071)
Num.Obs.	76 355
AIC	40 630.7
BIC	40 778.6
Log.Lik.	–20 299.374
F	148.854
RMSE	0.27

*p<0.05, **p<0.01, ***p<0.001.
†p<0.1.
AIC, Akaike information criterion; BIC, Bayesian information criterion; F, F-statistic; Log.Lik., log-likelihood; Num.Obs., number of observations; RMSE, root mean square error.

severe cases. However, preliminary information for 2023 points to an increase in severe cases, being 9.2% (14/153) vs 4.9% of total cases (661/13 400) in 2022.

At this HMO, the number of underage members has been increasing since 2020, in March 2020 were 664 167, while in January 2023, they accounted for 1 011 592, representing about the 20% of the total membership. The annual incidence and frequency of cases per 100 000 present an inverse U-shaped pattern (figure 1). The incidence rate was 1798.0 (CI 95%; 1767.5–1828.6) in 2020, rose to 5707.7 (CI 95%; 5656.0–5759.6) in 2021, and dropped to 1334.5 (CI 95%; 1311.8–1357.3) in 2022. As can be appreciated in figure 2, patients 0–4 years of age were most at risk. In 2020, the annual cumulative incidence rate in children under 5 years of age was 2172.5 cases (CI 95%; 2075.4–2270.8) and in 2022, it presented the highest incidence rate among the studied age groups with 2737.9 (CI 2664.3 to 2812.0) (additional information on 2022 can be found on online supplemental table 1). The annualised incidence rate by age and variant predominance presented a similar pattern regardless the age, with values around 2500 cases per 100 000 at the beginning of the pandemic when variant was not available, peaking at incidences over 9500 cases during Mu variant predominance, to finally fall to figures below 1224 cases during the predominance of Omicron, excluding the group of 0–4 years old whom registered 3899.8 cases (CI95% 3796.4–3951.5) (figure 2).

The monthly cumulative incidence rate of COVID-19 cases illustrates that this disease had a multimodal pattern. Two plateaus can be observed, the first from April to July 2021 with over 810 cases per 100 000 persons, and the second during January 2022, with 878.3 cases per 100 000 persons (CI 95%; 858.6–898.1). Subsequently, the cumulative frequency declined to an average below 142 cases per 100 000, reaching 15.1 cases per 100 000 in January 2023 (CI 95%; 12.8–17.6) (figure 3).

Mortality

Of the 28 deaths found presently, the mean age was 6.5 years (SD 5.6). Of the total, 46.4% (13/28) were 0–4 years old, 57.1% were male, and all of them were unvaccinated. The percentage of overall deaths was 14.3% in 2020, 32.1% in 2021 and 53.6% in 2022. In addition, 57.1% of the fatalities were originally classified as mild cases, among which there was a median of 2 comorbidities, 22 deceased patients (78.6%) presented at least one comorbidity and 14 of them had chronic lung disease (table 3). The yearly mortality rate per 100 000 children and adolescents' members has been rising, in 2020, it was 0.5 (CI 95%; 0.1–1.4), 1.0 (CI 95%; 0.5–2.0) in 2021 and 1.5 (CI 95%; 0.8–2.5) in 2022.

DISCUSSION

Cases of COVID-19 infection in children and adolescents occurred more frequently in those from 11 to 17 years of age. Of the total cases, 90% had only a mild infection. Although it was expected that most infections would be classified as mild,[15 22 23] the percentage found in this study is higher to that described in previous reports. For

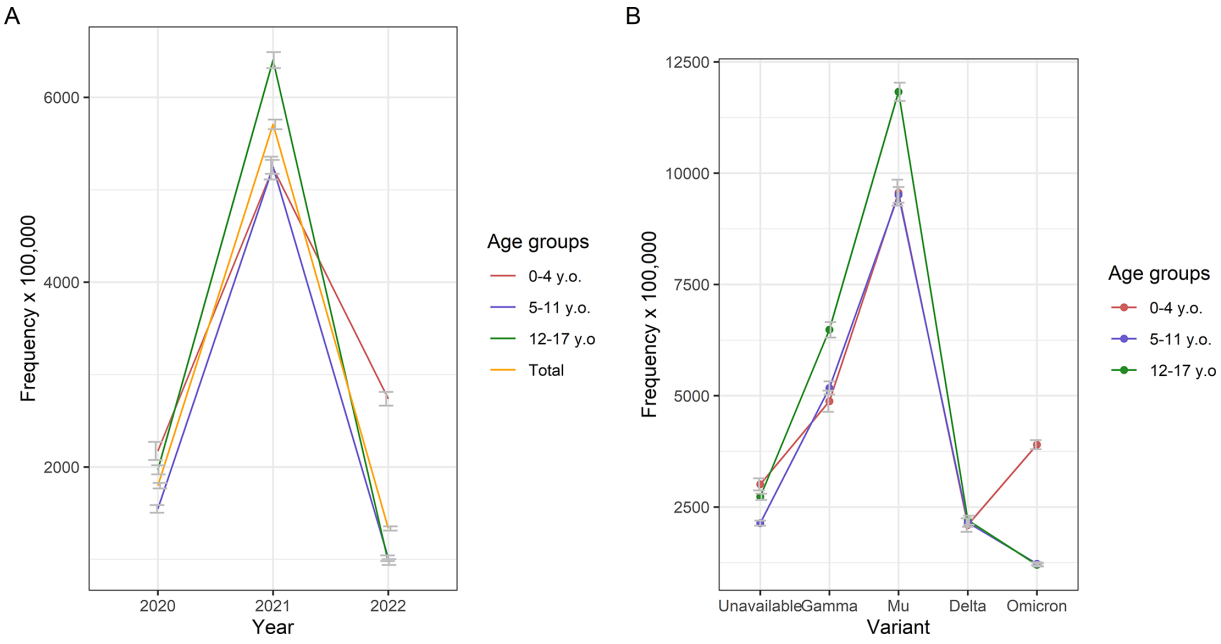

Figure 2 Incidence rate of COVID-19 infection by age groups by year (A) and annualised by variant predominance (B).

example, mild cases in Malaysia accounted for 59.6% of the paediatric COVID-19 cases in age group 0–12, and in Colombia (analysing nationwide cases up to mid-2020), they constituted 79.4% of the paediatric COVID-19 cases in age group 0–17.[12 24] The present result could possibly stem from the collection of data beyond hospitalised cases.

Several studies have consistently reported that COVID-19 vaccination in preventing symptomatic, hospitalisation and death.[25 26] In the current population, a low proportion of vaccinated individuals (with at least one dose) became infected with COVID-19 even among those with key risk factors, such as chronic lung disease, an immunocompromised condition and obesity. The reduced percentage of vaccinated patients infected with COVID-19 may have been influenced by the national vaccination plan in Colombia that was launched on 17 February 2021 in adults aged 18 and above and on 31 October 2021 for children and adolescents from 3 to 16 years of age.[21 27] The uptake of COVID-19 vaccination was 71.09% and 71.72% for the primary dose in the country in 2022 and 2023 respectively.[28] As other authors have

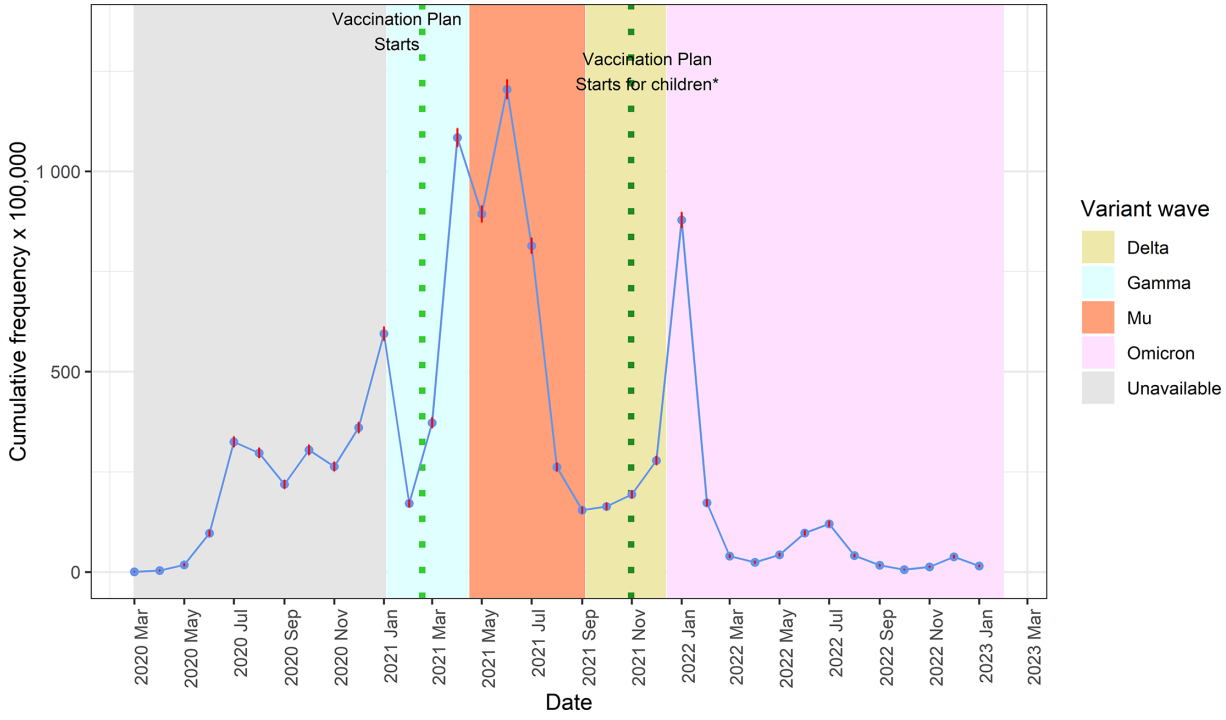

Figure 3 Monthly incidence rate of COVID-19 cases: March 2020 to January 2023.

Table 3 Deceased cases comorbidities

Comorbidities, n (%)	
Chronic lung disease	14 (50)
Mental health condition	8 (28.6)
Immunocompromised condition	8 (28.6)
Cancer	6 (21.4)
Tuberculosis	3 (10.7)
Hypertension	2 (7.1)
Heart disorder	2 (7.1)
Down syndrome	2 (7.1)
Solid organ or blood stem cell transplant	2 (7.1)
Obesity	1 (3.6)
Diabetes (type 1 or type 2)	1 (3.6)
Chronic liver disease	1 (3.6)
Dementia or other neurological condition	1 (3.6)
HIV infection	1 (3.6)

pointed out, increasing the uptake of vaccination in children and adolescents is crucial not only to further reduce the burden of COVID-19 but to prevent the emergence and widening of health outcomes gaps.[29 30]

The interpretation of the data revealed very important findings. Most cases (91%) were mild. The greatest proportion of critically compromised children was from the group under 5 years of age. Similarly, a study including children and young adults aged 0–24 from the USA indicated that 0–4-year-old children were also found to be the largest group of COVID-19 patients needing care in an intensive care unit among COVID-19 cases.[31] These data highlight that COVID-19 causes severe illnesses in very young children and therefore, vaccination is the best way to prevent serious COVID-19 outcomes. Furthermore, the greatest burden of COVID-19 infection, measured by cumulative annual and monthly incidence rates, occurred during 2021 and has been decreasing steadily since then. The available data in 2023 indicate that critical cases continue to decline, while the proportion of such cases has increased compared with previous years. This is probably due to less frequent testing and diagnosis in less severe COVID-19 cases. We observed the difference in COVID-19 disease rates and outcomes in children and adolescents by variants as well as pre-vaccination and post-vaccination era.

For over half of the patients in the current population, the caregiver earned less than two times the minimum wage, a finding that is in line with the inequalities described in another study carried out in Colombia during the pandemic[32] and is in agreement with the results reported from different countries,[33–35] in which low levels of income are associated with a disproportionate number of cases or deaths caused by COVID-19. These data gain highlight the need to target preventive strategies such as vaccination to those with low income or poor socioeconomic groups.

Notable concern is expressed in the literature about pandemic-related weight gain and obesity rates[36] because obese children have inadequate immune responses to other infections, such as bacterial pneumonia.[37] Indeed, the latter infection is one of the most prevalent complications of COVID-19. Cases of COVID-19 infection in obese children accounted for 5.8% of all paediatric COVID-19 cases. As in the total population, most infected obese children were unvaccinated.

Immunocompromised children and adolescents accounted for 1 in 10 cases, a high proportion for this population, considering other studies have found this proportion is around 6%;[38] this finding might reflect a behaviour of the region. Additionally, the definition of immunocompromise can differ among studies affecting the number of cases. This finding can benefit from future research that allows a deeper understanding of the frequency of COVID-19 in this population.

Children with a mental health condition or chronic lung disease tended to have more critical complications. The existence of a mental health condition was the most frequent comorbidity, suggesting the need not only to deepen knowledge of a COVID-19 infection in this understudied subpopulation but also to prioritise it. In fact, the pandemic may have expanded the number of cases at risk for developing a mental health condition.[39]

The paediatric population with comorbidities presented increased odds of severe or critical disease, as evidenced by the OR of 1.44; in addition, they also display a higher risk of dying, considering that around 80% of those who died presented at least one comorbidity. These studies are consistent with what was found by a study in Latin America, which found that different comorbidities are associated with a higher odds of hospitalisation.[9] However, as a systematic review notes, critical disease may be weighed by adolescents, children under 1 year of age and premature infants.[38]

On the other hand, an almost unexplored aspect is the hidden burden on the caregivers and family of hospitalisation, since the majority of infected children and adolescents are from low-income families. The hospital stay was usually around 9–10 days, similar to the data described in various studies.[40]

Finally, among the limitations of the current contribution is the lack of collection of some relevant data. For instance, detailed clinical information was not included (eg, symptoms, laboratory results, variant of COVID-19 in each case and some relevant outcomes such as the development of multisystem inflammatory syndrome). Also omitted was information on different types of outpatient behaviour likely relevant to the present results (eg, non-prescription drug use). Additionally, the authors did not seek to identify asymptomatic cases. Moreover, the present data can only show associations between the variables and not causation, and the findings cannot be generalised to the entire Colombian population.

Despite these limitations, our study provides additional evidence of COVID-19 disease burden in children and

adolescents. The risk of severe COVID-19 is highest in children under 5 years of age and those with underlying medical conditions, who accounted about 1 out of 5 cases. Targeting vaccination to these at-risk groups is needed to reduce the burden of COVID-19 disease in children in Colombia.

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Contributors Study conception and design: JA, JMR, LEP, JB-L, CFM, ACR, JS, JY, OE, JLR and MK. Data collection and data cleaning: JB-L, FJG, CB, ACH and LEP. Data analysis: JA and JB-L. Interpretation of the results: JA, JB-L, JMR, MG, OE, JLR, FM, CFM, JS, JY, ACH, LEP and MK. Draft manuscript preparation: JA and MG. Planning and supervising the work: JMR, LEP and JB-L. JA is responsible for the overall content as the guarantor. All authors provided critical feedback, helped shape the research, analysis and approved the final version of the manuscript. Generative AI and AI-assisted technologies were not used in this study.

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