EPIDEMIOLOGY AND CLINICAL CHARACTERISTICS OF LABORATORY-CONFIRMED COVID-19 AMONG INDIVIDUALS AGED ≤19 YEARS, SOUTH AFRICA, 1 MARCH 2020 – 1 MAY 2021

NICD COVID-19 and DATCOV teams

Summary

- As of 1 May 2021, individuals aged ≤19 years made up 9.4% of laboratory-confirmed COVID-19 cases and 3.8% of all COVID-19-associated admissions.
- There were 148,768 new laboratory-confirmed COVID-19 cases aged ≤19 years during the surveillance period.
- The cumulative incidence of laboratory-confirmed COVID-19 cases aged ≤19 years was 681.6 per 100 000 population, 5.5 times lower than that in those aged >19 years (3760.1 per 100 000 population).
- The weekly incidence of laboratory-confirmed COVID-19 cases aged ≤19 years peaked in week 1 of 2021 and has been declining in all provinces except Northern Cape and Free State which saw isolated peaks between weeks 9 and 16. A decrease in weekly incidence was observed in all age groups.
- There were 9 918 reported COVID-19-associated admissions among individuals aged ≤19 years. The incidence of admission among children aged ≤19 years was 13.3 times lower (454.4 per 1 million) than that in those aged >19 years (6027.0 per 1 million).
- The cumulative rate of admission was highest in individuals aged <1 year at 1667.7 per 1 million population, followed by individuals aged 15-19 years at 758.0 per 1 million population.
- The median length of hospital stay among COVID-19-associated admissions aged ≤19 years was 4 days (interquartile range 2- 8 days) with 619 (6.2%) individuals admitted into intensive care units (ICU) at some point during admission and 221 (2.2%) having been ventilated.
- Data on in-hospital outcome were available for 9443 (95.2%) individuals aged ≤19 years. Among these, there were 401 in-hospital deaths giving an in-hospital case fatality risk of 4.2% (401/9443). Among all deaths, 146 (36.4%) were among adolescents aged 15-19 years and 125 (31.2%) were aged under one year. Among 245 (61.1%) in-hospital deaths with available data on underlying conditions, 148 (60.4%) reported ≥1 underlying conditions.

Background

In December 2019, a cluster of pneumonia cases of unknown aetiology was reported in Wuhan, Hubei Province China. (1) The cause of the outbreak has since been confirmed as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and the disease named coronavirus disease 2019 (COVID-19). Infections had been reported in 213 countries and territories with more than 151 million individuals infected and 3.1 million deaths reported to World Health Organization as of 2 May 2021. (1) The first case of COVID-19 in South Africa was reported on 5 March 2020 in KwaZulu- Natal Province. (2) On 1 May 2021, the country reported a cumulative total of 1 582 842 positive cases and 54 406 deaths. (2)

Published studies suggest that the clinical presentation of COVID-19 in individuals aged ≤19 years differs from that of older individuals. Disease in children is more likely to be asymptomatic or mildly symptomatic and less likely to result in hospital admission compared to that in adults. (3) However, there are concerns of possible limited testing in children leading to cases among children being missed. (4) There are concerns regarding possible transmission within and outside schools and other congregate settings. Individuals aged ≤19 years, constitute just over a third of the population of South Africa (21 825 534; 36.6%) and includes the entire compulsory school-going age – considered 7- 15 years (5).

In November 2020, South Africa experienced an increase in cases of COVID-19 in all the provinces in what became the second wave. (2) Associated with this second wave was a new lineage of SARS-CoV-2. This lineage, named 501Y.V2, possesses several mutations that were not previously identified in viruses from South Africa (2, 6). Ongoing surveillance of this variant and the emergence of new variants continues in the country. In recent weeks the number of new COVID-19 cases and hospitalisations has increased in Free State, Gauteng and Northern Cape provinces raising concerns of a third wave of infections. (7) South African public schools have been open for in-person learning since 15 February 2021, raising concerns of increased transmission in schools and cluster outbreaks.

In this report, the epidemiological characteristics of laboratory-confirmed COVID-19 cases aged ≤19 years notified through the laboratory-based national notification system and COVID-19-associated admissions aged ≤19 years at hospitals in South Africa are presented.

Methods

Data collection procedures.

Data extraction for this report was done on 7 May 2021. Data on laboratory results from public and private laboratories submitted to the NICD were extracted from the linelist. Limited demographic and epidemiological data collected at the time of specimen collection were available for analysis. Data on children and adults admitted to hospitals were collected on the DATCOV platform – an online hospital surveillance system. (8) Health care workers at hospitals admitting COVID-19 patients capture demographic and clinical information on admitted cases at admission, during admission and at discharge. As of 1 May 2021, there were 647 hospitals submitting admissions data into DATCOV. This included 252 private hospitals and 395 public hospitals. (9)

Definition of outcomes

A laboratory-confirmed case of COVID-19 was defined as any person who tested positive for SARS-CoV-2 on either i) real-time reverse-transcription polymerase chain reaction (rRT-PCR) or ii) an antigen test conducted on a respiratory sample obtained from a nasopharyngeal and/or oropharyngeal swab.

A COVID-19-associated admission was defined as any person who tested SARS-CoV-2 positive and was admitted to hospitals registered to submit data to DATCOV, regardless of the reason for admission.

Data analysis

Data from the national line list and DATCOV hospital surveillance database were exported into Stata14.2® for analysis. Descriptive statistics were used to describe the characteristics of cases aged ≤19 years. Incidence was determined as the number of cases in different age groups as a proportion of the population as provided by the Statistics South Africa (Stats SA) mid-year population estimates for 2020 and presented as cases per 100 000 persons by age, gender, province and week of diagnosis. Descriptive statistics were used to describe demographic and clinical characteristics among admissions aged ≤19 years at hospitals stratified by age groups: <1 year, 1- 4 years, 5- 9 years, 10- 14 years and 15- 19 years. Descriptive statistics were also used to compare characteristics of COVID-19 cases and associated admissions between the first wave and the second wave, first between patients aged ≤19 years vs >19 years then among patients in different age groups aged ≤19 years. Univariate and multivariate logistic regression were used to determine factors independently associated with the second wave compared to the first wave. For the analysis of new cases and admissions, the first and second waves were described as the periods in which weekly incidence risk was >5 admissions per 100 000 population in the total population among all individuals. For wave 1, these were epidemiologic weeks 24-34 (7 June – 22 August 2020) and for wave 2, these were epidemiologic weeks 47 of 2020-week 5 of 2021 (15 November – 6 February 2021). In order to determine the relative contribution of childhood and adolescent cases to the COVID-19 cases and associated admissions over time, piecewise logistic regression adjusting for sex, province and laboratory sector or health facility sector was used. In this analysis, the monthly cases and admissions among individuals aged ≤19 years compared to individuals aged >19 years were compared to the previous month which acted as the reference month e.g. May 2020 was compared to April 2020.

Results

Incidence of COVID-19 among children and adolescents aged ≤19 years

At data extraction, there were 1 584 799 laboratory-confirmed cases of COVID-19 with a date of specimen collection on or before 1 May 2021 captured on the national linelist. Of these, 14 828 (0.9%) were missing age information. Of the 1 569 971 with known age, 148 768 (9.5%) were aged ≤19 years. The median age of the individuals aged ≤19 years was 14.0 years (interquartile range [IQR] 9.0 – 17.0 years) with 3 722 (2.5%) aged <1 year and 66 019 (44.4%) aged 15-19 years. There were 65 835 (44.3%) males with 3 430 (2.3%) missing information on gender. The majority of cases 123 930/148 768 (83.3%) were in five provinces – KwaZulu Natal (27.0%), Gauteng Province (22.5%), Eastern Cape (14.9%), Western Cape (11.7%), and Free State (7.1%). The cumulative incidence of laboratory-confirmed COVID-19 among individuals aged ≤19 years was 5.5 times lower compared to individuals aged >19 years – 681.6 per 100 000 population vs. 3760.1 per 100 000 population. The cumulative incidence among individuals aged ≤19 years ranged from 198.8 per 100 000 in Limpopo province to 1224.6 per 100 000 population in Northern Cape Province (Table 1). The national weekly incidence among individuals aged ≤19 years increased from <1 per 100 000 in week 10 of 2020, peaking at 32 per 100 000 during week 28 in the first wave, declining to 5.2 per 100 000 in week 44 before peaking again at 55.3 per 100 000 in week 1 of 2021. The weekly incidence has ranged between 3.9 per 100 000 and 55.3 per 100 000 between week 1 and week 17 of 2021. There have been cluster outbreaks among individuals aged ≤19 years in Northern Cape province during week 9-12 and 14-17 in 2021 and the Free State province during weeks 14-17 in 2021 (Figure 1).

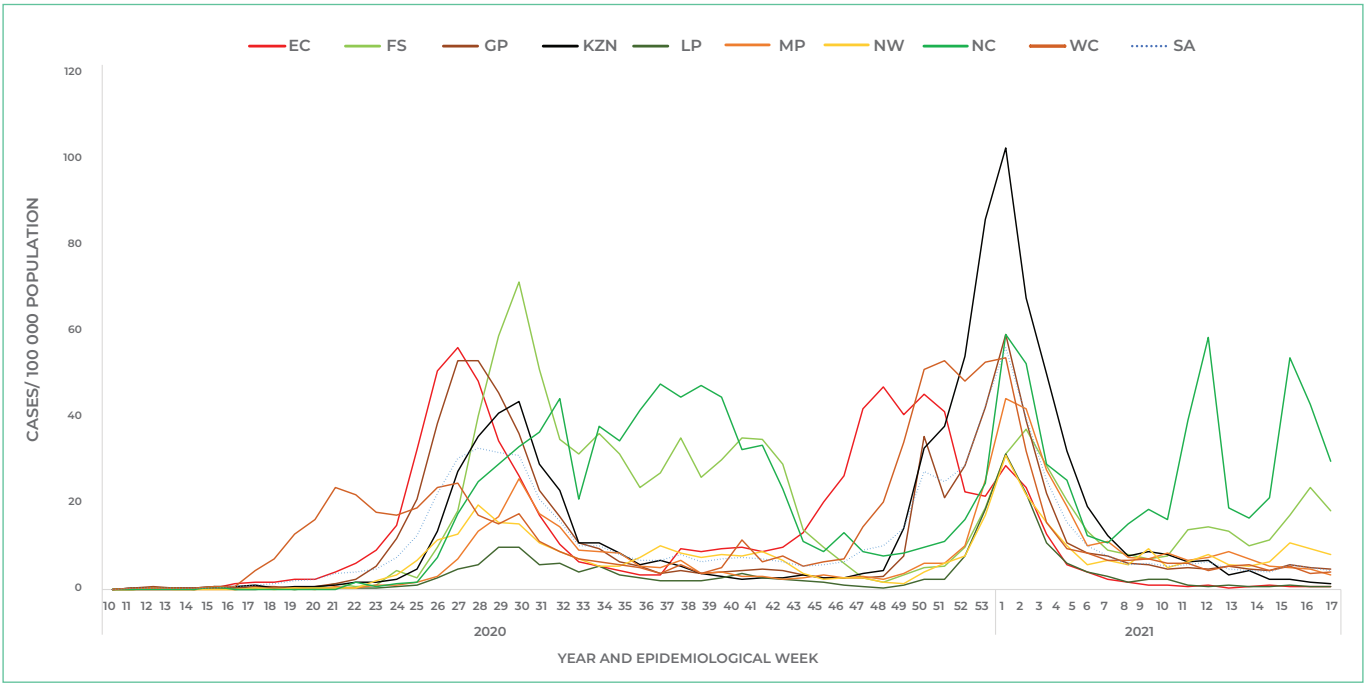

Figure 1. Weekly incidence per 100 000 population of laboratory-confirmed COVID-19 among individuals aged ≤19 years by epidemiologic week and province, South Africa 1 March 2020- 1 May 2021 (N=148 768)*

EC= Eastern Cape, FS= Free State, GP= Gauteng Province, KZN= KwaZulu Natal, LP= Limpopo Province, MP = Mpumalanga province, NW= North West Province, NC= Northern Cape, WC= Western Cape.

*Epidemiologic week was generated using the collection date

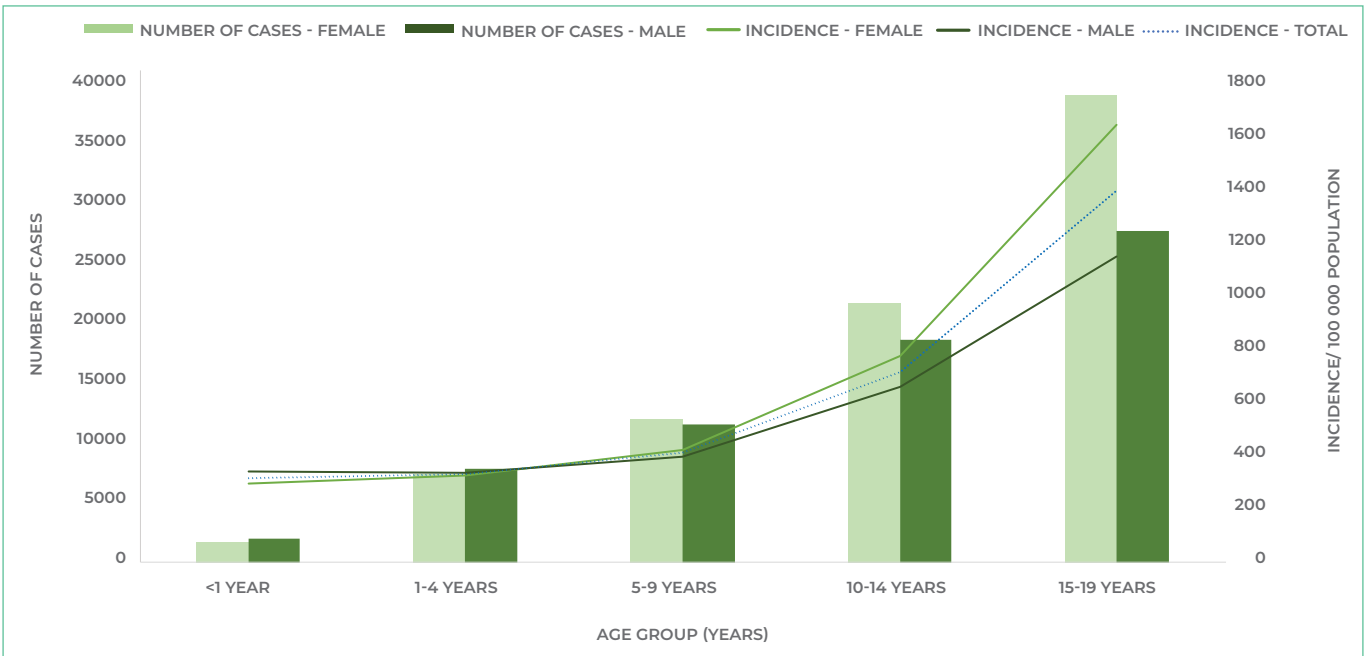

Figure 2. Cumulative incidence per 100 000 population of laboratory-confirmed COVID-19 in individuals aged ≤19 years by age group and sex, South Africa, 1 March 2020 – 1 May 2021 (N=148 768; 3 430 missing sex)

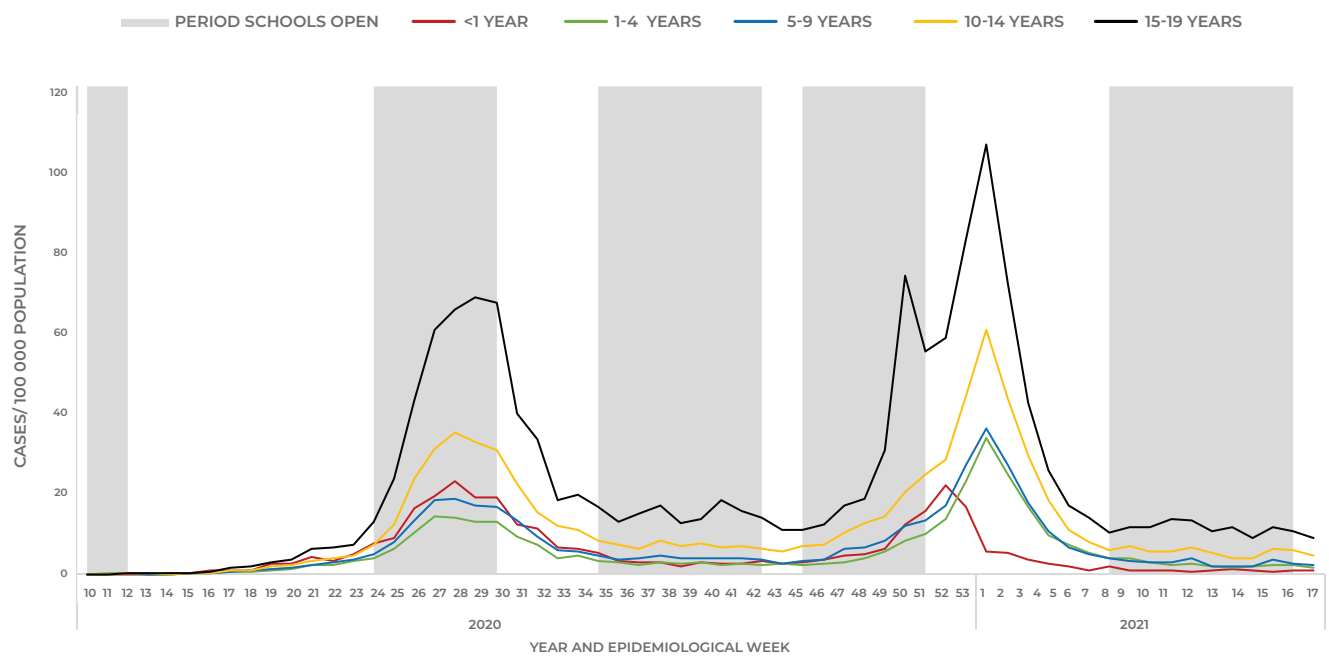

Figure 3a. Weekly incidence per 100 000 population of laboratory-confirmed COVID-19 in individuals aged ≤19 years by age group, South Africa, 1 March 2020 – 1 May 2021 (N=148 768)*

*The period schools were opened was based on the Department of Basic Education amended school calendars for 2020 & 2021

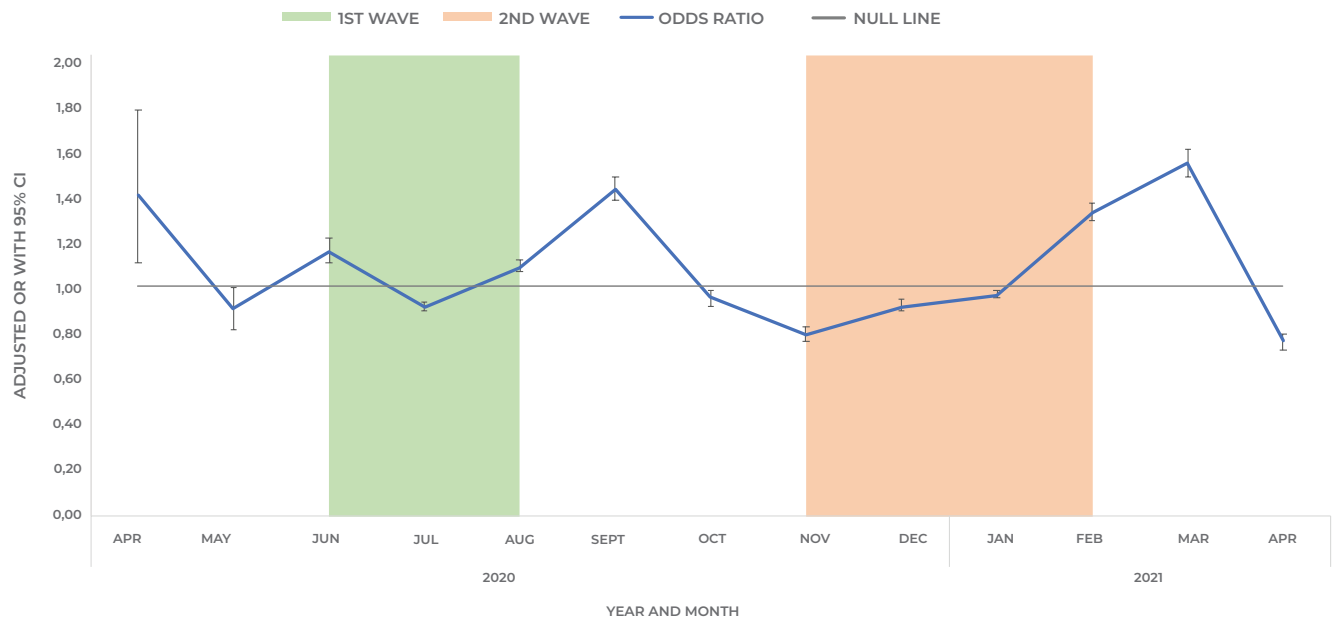

Figure 3b. Weekly odds of being a laboratory-confirmed case aged ≤19 years vs aged >19 years by month compared to the preceding month, South Africa, 1 March 2020 – 1 May 2021 (N=148 768)*

*The model adjusted for sex, province and laboratory facility sector. OR – odds ratio, CI – confidence interval

Table 1. Numbers and cumulative incidence of laboratory-confirmed COVID-19 cases and admissions among individuals of all ages and among individuals aged ≤19 years, 1 March 2020 - 1 May 2021

Province	Population in province n (%)[1]	Population aged ≤19 years n (%)[2]	% of Total population aged ≤19 years[3]	Total COVID-19 cases all ages N (%)[4]	COVID cases aged ≤19 years N (%)[5]	COVID-19 cases aged ≤19 years as % of all COVID-19 cases [6]	Cumulative incidence per 100 000 population among individuals aged>19 years[7]	Cumulative incidence per 100 000 population among individuals aged ≤19 years[8]	Total admissions among individuals of all ages (%)[9]	Admissions among individuals aged ≤19 years (%)[10]	Admissions aged ≤19 years as % of all COVID-19 admissions [11]	Admission rate among individuals ≤19 years per [1]million population[12]
Eastern Cape	6734001 (11.3)	2818181 (12.9)	41.9	194068 (12.4)	22216 (14.9)	11.4	4388.7	788.3	29757 (12.5)	994 (10.0)	3.3	352.7
Free State	2928903 (4.9)	1082712 (5.0)	37.0	89234 (5.7)	10602 (7.1)	11.9	4259.1	979.2	14071 (5.9)	523 (5.3)	3.7	483.0
Gauteng	15488137 (26.0)	4710102 (21.6)	30.4	419712 (26.7)	33460 (22.5)	8.0	3583.7	710.4	64977 (27.7)	2743 (27.7)	4.2	582.4
KwaZulu Natal	11531628 (19.3)	4709686 (21.6)	40.8	333258 (21.2)	40186 (27.0)	12.1	4296.0	853.3	45823 (19.3)	1989 (20.0)	4.3	422.3
Limpopo	5852553 (9.8)	2510790 (11.5)	42.9	63615 (4.1)	4992 (3.4)	7.8	1754.3	198.8	8762 (3.7)	278 (2.8)	3.2	110.7
Mpumalanga	4679786 (7.8)	1773075 (8.1)	37.9	76821 (4.9)	7834 (5.3)	10.2	2373.4	441.8	9347 (3.9)	395 (4.0)	4.2	222.8
North West	4108816 (6.9)	1528001 (7.0)	37.2	67061 (4.3)	6117 (4.1)	9.1	2361.4	400.3	13360 (5.6)	938 (9.5)	7.0	613.9
Northern Cape	1292786 (2.2)	481364 (2.2)	37.2	40124 (2.6)	5895 (4.0)	14.7	4218.4	1224.6	4341 (1.8)	177 (1.8)	4.1	367.7
Western Cape	7005741 (11.8)	2211623 (10.1)	31.6	286078 (18.2)	17466 (11.7)	6.1	5602.9	789.7	47282 (19.9)	1881 (19.0)	4.0	850.5
All provinces	**59622350 (100**	**21825534 (100)**	**36.6**	**1569971 (100)**	**148768 (100)**	**9.5**	**3760.1**	**681.6**	**237720 (100)**	**9 918 (100)**	**4.2**	**454.4**

[1] This is provincial population according to Statistics South Africa 2020 mid-year population estimates. The denominator for percentage is total population of South Africa;
[2] This is population of individuals aged ≤19 years according to Statistics South Africa 2020 mid-year population estimates. The denominator for % is total population aged ≤19 years in South Africa
[3] This is percentage of population aged ≤19 years. Denominator is total provincial population (1) and numerator is provincial population aged ≤19 years (2);
[4] This is the total number of COVID-19 cases reported in the country during the reporting period by province. The denominator is total number of cases in the country;
[5] This is the total number of COVID-19 cases among individuals ≤19 years reported in the country during the reporting period by province. The denominator is total number of cases among individuals aged ≤19 years in the country.
[6] This is percentage of provincial COVID-19 cases aged ≤19 years. The denominator is provincial total number of COVID-19 cases (4).
[7] This is cumulative incidence among individuals aged >19 years and determined as total COVID-19 cases among individuals aged >19 years (4-5) divided by the size of this population (1-2).
[8] This is cumulative incidence among individuals aged ≤19 years and determined as total COVID-19 cases among individuals aged ≤19 years (5) divided by the size of this population (2)
[9] The total number COVID-19 associated admissions reported through DATCOV platform in all age groups by province. The denominator is the total number of admissions at national level
[10] The total number COVID-19 associated admissions among individuals aged ≤19 years reported through DATCOV platform by province. The denominator is the total number of admissions among individuals aged ≤19 years at national level
[11]This is percentage of provincial COVID-19 - associated admissions who are aged ≤19 years. The denominator is the provincial total number of COVID-19 associated admissions (9)
[12] This is admission rate (i.e. incidence of admission) among individuals aged ≤19 years and determined as total COVID-19- associated admissions among individuals aged ≤19 years (10) divided by the size of this population (2);

Among individuals aged ≤19 years, the incidence was highest among individuals aged 15-19 years throughout the epidemic although trends were similar in all age groups. Generally, the cumulative incidence increased with age among individuals aged >1 years from 324.6 per 100 000 among individuals aged 1-4 years to 1358.7 per 100 000 among those aged 15-19 years – Figure 2. The cumulative incidence was higher among females compared to males (736.4 per 100 000 vs 596.9 per 100 000). An increase in weekly incidence was noted in the age group 15-19 years in week 50 of 2020, reducing slightly in week 51 and peaking in week 1 2021 (Figure 3a). The smaller peak in week 50 of 2020 was related to a documented cluster of cases following the matric Rage events. (11) Weekly incidence in week 1 of 2021 exceeded peak weekly incidence in the first wave in all age groups, similar to what is observed in individuals aged >19 years. (9) The changes in weekly incidence of cases in the first and second waves were unrelated to school closings and openings. In week 17 of 2021, the weekly incidence remained below 20 cases per 100 000 in all age groups (Figure 3a). The overall odds of being ≤19 years old compared to >19 years among SARS-CoV-2 cases by month throughout the pandemic, were lowest during the first and second waves, and higher outside of those waves (Figure 3b) suggesting under-detection of cases among children during resurgences. This could also reflect possible true changes in the case of age distribution in cases between the peaks and inter-peak periods, although reasons, why this might occur, are unclear.

With respect to individuals of all ages with laboratory-confirmed COVID-19, there was no difference between the proportion of individuals aged ≤19 years in the second wave compared to the first wave [8.7% vs 9.1%, adjusted odds ratio (aOR) 1.02 (95% confidence interval [CI] 1.00 - 1.03) in a model adjusting for sex, province and testing at a public laboratory (model not shown)]. Among individuals aged ≤19 years, cases in the second wave were more likely to be in an older age group (compared to age group <1 year), be male, be diagnosed in a public sector laboratory and be in the KwaZulu-Natal or Western Cape Provinces (Table 2).

Table 2. Comparison of characteristics of new COVID-19 cases aged ≤19 years between the first wave and second wave in South Africa, N=113,476

Characteristic	Wave 1 (N=48 161)	Wave 2 (N=65 315)	Univariable OR (95% CI)	Multivariable OR (95% CI)
Age group (years				
<1	1 745 (3.6)	1 172 (1.8)	1.00	1.00
1-4	4 545 (9.4)	7 278 (11.1)	2.38 (2.19- 2.59)	2.58 (2.37- 2.81)
5-9	7 437 (15.4)	10 731 (16.4)	2.15 (1.98- 2.33)	2.31 (2.13- 2.51)
10- 14	12 974 (26.9)	17 632 (27.0)	2.02 (1.87- 2.19)	2.19 (2.01- 2.37)
15- 19	21 460 (44.6)	28 502 (43.6)	1.98 (1.83- 2.13)	2.19 (2.03- 2.37)
Sex, (n, %)				
Female	26 288 (54.6)	34 255 (52.5)	1.00	1.00
Male	20 978 (43.6)	29 265 (44.8)	1.07 (1.05- 1.10)	1.10 (1.07- 1.13)
Unknown	895 (1.9)	1 795 (2.8)	1.54 (1.42- 1.67)	1.29 (1.19- 1.41)
Province, (n, %)				
Eastern Cape	8 391 (17.4)	9 266 (14.2)	0.76 (0.73- 0.79)	0.69 (0.66- 0.72)
Free State	3 820 (7.9)	1 891 (2.9)	0.34 (0.32- 0.36)	0.32 (0.30- 0.34)
Gauteng	14 785 (30.7)	12 975 (19.9)	0.60 (0.58- 0.63)	0.67 (0.64- 0.69)
KwaZulu Natal	11 183 (23.2)	23 397 (35.8)	1.44 (1.39- 1.50)	1.37 (1.31- 1.42)
Western Cape	3 627 (7.5)	8 555 (13.1)	1.62 (1.54- 1.71)	1.71 (1.62- 1.80)
Other provinces	6 355 (13.2)	9 231 (14.1)	1.00	1.00
Tested at public laboratory	21 770 (45.2)	37 148 (56.9)	1.60 (1.56- 1.64)	1.55 (1.51- 1.59)

First wave = epidemiology week 24- 34; second wave = epidemiology week 47- week 5 2021. Both defined as periods with weekly incidence risk >5 admissions per 100 000 population in the total population among all individuals.

COVID-19-associated admissions in individuals aged ≤19 years

As of 1 May 2021, data on 237 720 COVID-19-associated admissions had been captured on DATCOV. Of these admissions, 1 485 (0.6%) were missing age information. Among the remainder of admissions with available age information (N= 236 235), 9918 (4.2%) were among individuals aged ≤19 years. The proportion of all COVID-19-associated admissions which were among individuals aged ≤19 years varied across provinces from 3.3% in Eastern Cape to 7.0% in North West Province, possibly reflecting variation in clinical practice or the effect of clusters of cases (Table 1). The majority of the admissions among individuals aged ≤19 years were in five provinces; Gauteng (27.7%), KwaZulu Natal (20.0%), Western Cape (19.0%), Eastern Cape (10.0%) and North West (9.5%) provinces together accounting for 86.2% of all admissions (N=8545) (Table 1).

The cumulative admission rate among individuals aged ≤19 years by province ranged from 110.7 per 1 million population in Limpopo Province to 850.5 per 1 million population in Western Cape with an overall rate of 454.4 per 1 million. This overall admission rate among individuals aged ≤19 years was 13.3 times lower than that among individuals aged >19 years (454.4 per 1 million population vs 6027 per 1 million population). In most provinces, the weekly admission rate among those aged ≤19 years peaked in week 30 of 2020 and began to decrease after (Figure 4). Most provinces except Free State and North West started increasing again from week 43 of 2020 to week 1 of 2021. In week 16 of 2021, there was a slight increase in the numbers of admissions in Free State and North West, however the following week the rate decreased for all provinces (Figure 4).

Weekly numbers of admissions, as well as the admission rates in the second wave, exceeded those in the first wave in individuals aged <1 year, 1-4 years and 15- 19 years, similar to the trend observed in adults. Throughout the surveillance period, weekly admission rates were highest among individuals aged <1 year (Figure 5). The rate of admission in infants aged <1 year increased markedly during the second wave, then declined from the 2nd week of 2021. The reason for this is unclear but could reflect increased testing among young infants and neonates, high transmission among women of childbearing age with transmission to infants or other factors. Data are not available on what proportion of these admissions are for medical indications as compared to precautionary reasons or incidental findings. The rate of admission has remained below 20 per 1 million for all ages since week 2 of 2021 (Figure 5).

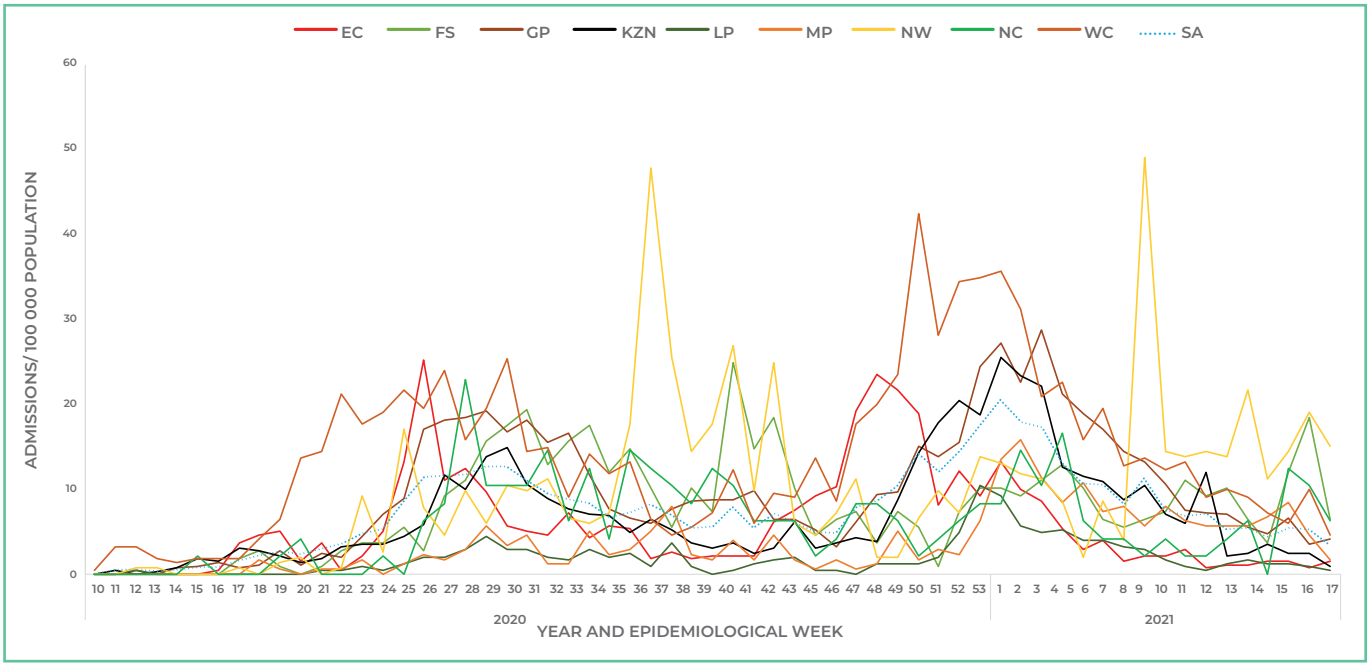

Figure 4. Rate of COVID-19-associated admission per million population among individuals aged ≤19 years by epidemiologic week and province, South Africa, DATCOV, 1 March 2020 – 1 May 2021 (N=9918)

EC= Eastern Cape, FS= Free State, GP= Gauteng Province, KZN= KwaZulu Natal, LP= Limpopo Province, MP = Mpumalanga province, NW= North West Province, NC= Northern Cape, WC= Western Cape.

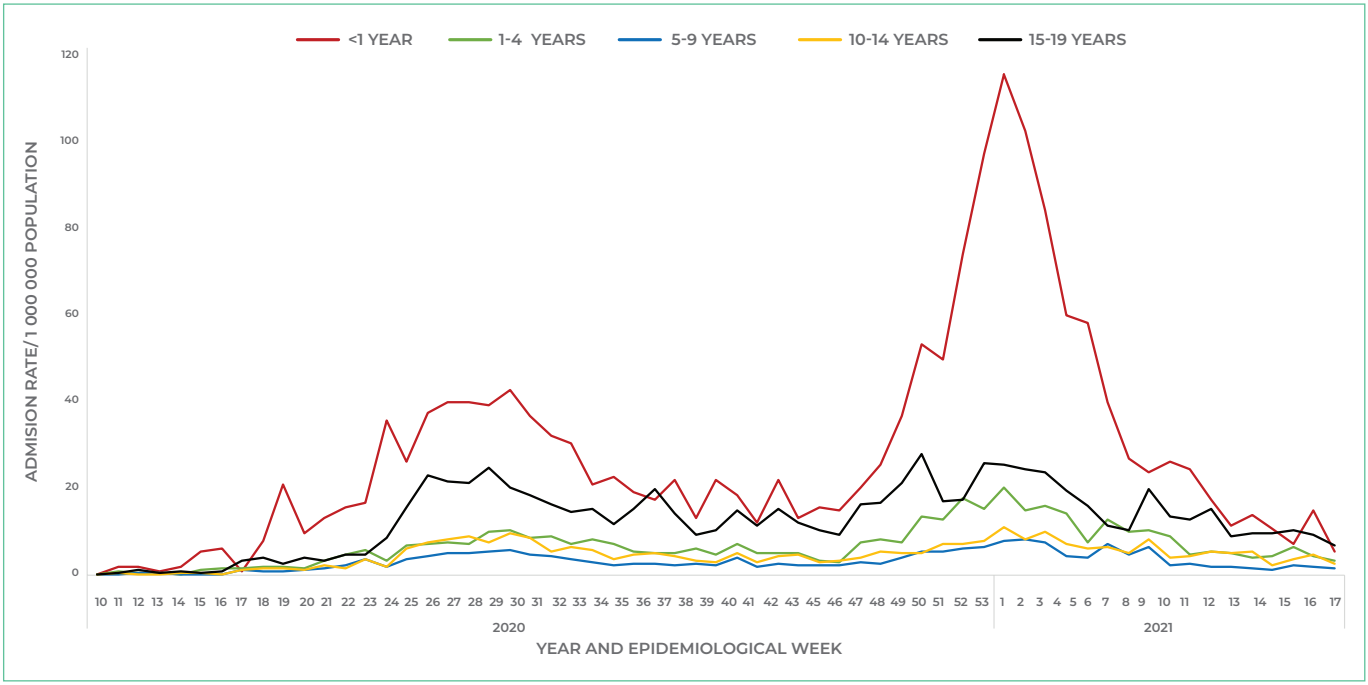

Figure 5. Rate of COVID-19-associated admissions per 1 million population among individuals aged ≤19 years by epidemiologic week and age group, South Africa, DATCOV, 1 March 2020 – 1 May 2021 (N=9918)

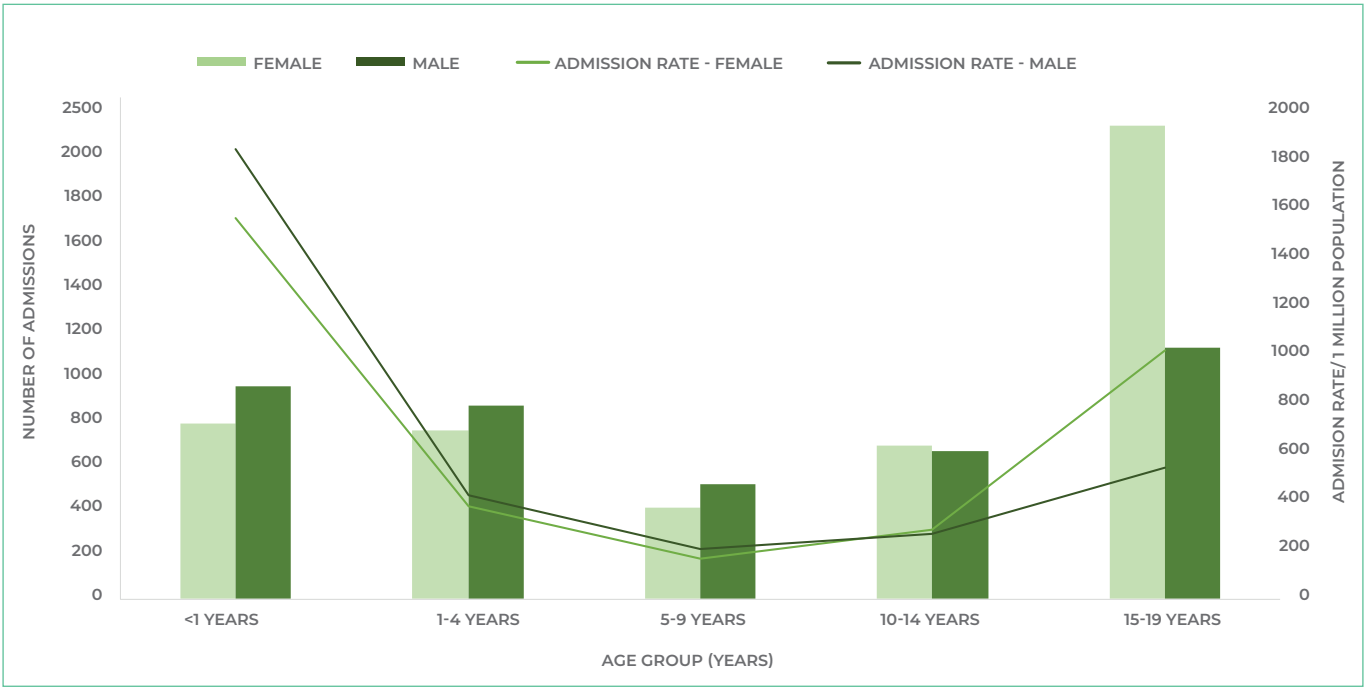

Figure 6. Rate of COVID-19-associated admissions aged ≤19 years by age group and sex, South Africa, DATCOV, 1 March 2020 – 1 May 2021 (N=9918; 1485 missing sex)

Table 3. Characteristics of COVID-19-associated admissions aged ≤19years, South Africa, DATCOV, 1 March 2020 - 1 May 2021 (N=9918)

Variable	<1year (n=1945) (19.6%)	1- 4 years n=1806) (18.2%)	5- 9 years (n=1040) (10.5%)	10- 14 years (n=1508) (15.2%)	15- 19 years (n=3619) (36.5%)	Overall (n=9918) (100%)
Age (median, IQR*)	3.3 mons (1.2- 7.2 mons)	2.2 yrs. (1.5- 3.2yrs)	7.5 yrs. (6.2- 8.7yrs)	12.9 yrs. (11.5- 14.0yrs)	17.9yrs. (16.7- 19.0yrs)	10.7 yrs. (1.6-17.0yrs.)
Male (n, %)	1060 (54.7)	964 (53.5)	577 (55.6)	741 (49.1)	1257 (34.8)	4599 (46.5)
Admitted at a public hospital, (n, %)	1279 (65.8)	835 (46.2	599 (57.6)	992 (65.8)	2544 (70.3)	6249 (63.0)
Data on underlying conditions available, (n, %)	1157 (59.5)	1192 (66.0)	675 (64.96)	1021 (67.7)	2553 (70.5)	6598 (66.5)
Has ≥1 underlying conditions, (n/N, %)*	212/1157 (18.3)	209/1192 (17.5)	154/675 (22.8)	232/1021 (22.7)	550/2553 (21.5)	1357/6598 (20.6)
Length of stay (median, IQR)**	4 (2-9)	3 (2-6)	3 (1-8)	5 (2-9)	5 (2-9)	4 (2-8)
ICU admission	180 (9.3)	93 (5.2)	68 (6.5)	94 (6.2)	184 (5.1)	619 (6.2)
Ventilation	78 (4.0)	27 (1.5)	20 (1.9)	29 (1.9)	67 (1.9)	221 (2.2)
Died	128 (6.6)	54 (3.0)	28 (2.7)	51 (3.4)	146 (4.0)	407 (4.1)
Discharged alive	1712 (88.0)	1657 (91.8)	968 (93.1)	1378 (91.4)	3321 (91.8)	9036 (91.1)
Transferred to another hospital	72 (3.7)	48 (2.7)	21 (2.0)	56 (3.7)	87 (2.4)	284 (2.9)
Still admitted	33 (1.7)	47 (2.6)	23 (2.2)	23 (1.5)	65 (1.8)	191 (1.9)

Mons= months; Yrs. = years; IQR= interquartile range; ICU = intensive care unit; *Individual can have more than one comorbidity and denominator is those with available data on underlying conditions; ** among those who died, transferred or discharged

Of the 9918 admitted individuals included in the analysis, the median age was 10.7 years (IQR 1.6 -17.0 years) and 4599 (46.5%) were male. Figure 6 shows the distribution of the number and admission rates by age and sex. A majority of individuals aged ≤19 years were admitted at hospitals in the public sector (6249, 63.0%). Table 3 shows the demographic and clinical characteristics of COVID-19-associated admissions among individuals aged ≤19 years overall and stratified by age group. Overall 6598 (66.5%) had data on underlying conditions available. Of these 1357 (20.6%) had one or more underlying conditions. Asthma or chronic pulmonary diseases were the most frequently reported underlying conditions followed by diabetes, HIV and previous or active tuberculosis (Figure 7).

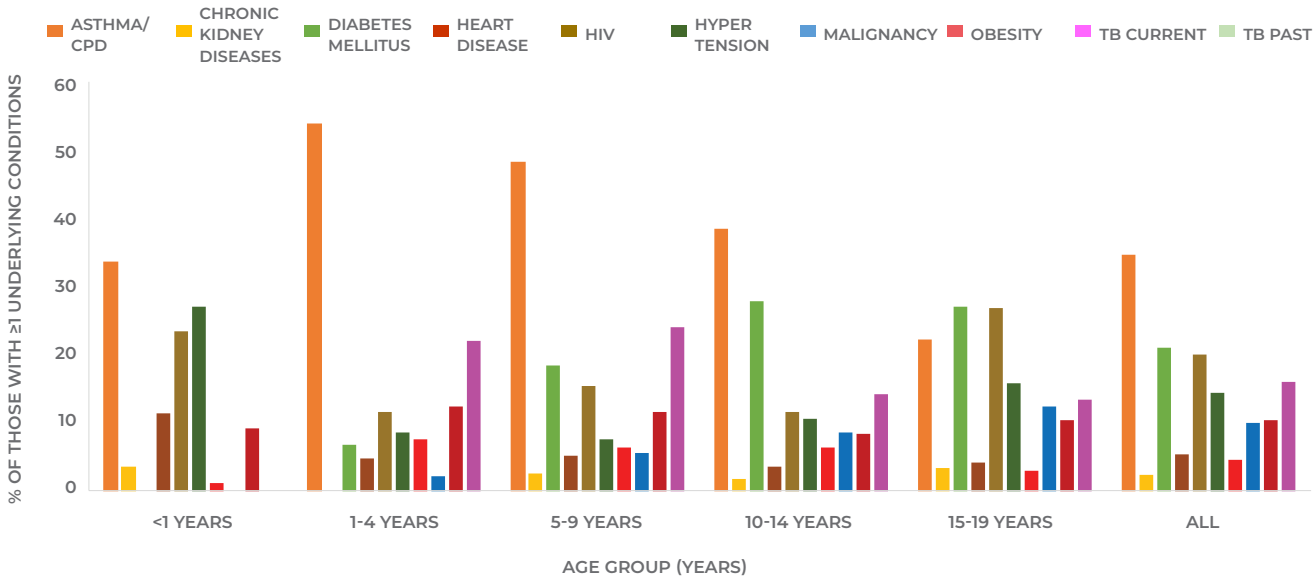

Figure 7. Distribution of underlying conditions among COVID-19-associated admissions aged ≤19years with ≥1 underlying conditions, South Africa, DATCOV, 1 March 2020 – 1 May 2021 (N=1357)*

CPD= chronic pulmonary disease; HIV= human immunodeficiency virus; TB= tuberculosis; *individuals could have more than one underlying condition.

Outcomes of COVID-19-associated admissions among individuals aged ≤19 years

Of the 9918 COVID-19-associated admissions among individuals aged ≤19 years, 619 (6.2%) were admitted into ICU and 221 (2.2%) were ventilated at some point during admission. At analysis, 9036 (91.1%) had been discharged, 191 (1.9%) were still admitted, 284 (2.9%) had been transferred to other facilities and 407 (4.1%) had died during admission including six deaths confirmed as unrelated to COVID-19. Among individuals with outcome data available, the in-hospital case fatality risk (CFR) was 4.2% (401/9443) compared with 24.4% (53 344/ 218 576) among individuals aged >19 years. The overall median length of hospital stay was 4 days (IQR 2- 8 days) and was 4 days (IQR 1- 9 days) for those who died. Of the 401 COVID-19 associated in-hospital deaths, 245 (61.1%) individuals had data on underlying conditions available. Of these 148 (60.4%) reported ≥1 underlying condition. HIV infection, diabetes mellitus, malignancy and heart disease were the most frequently reported among those who had underlying conditions and died in-hospital. Table 3 includes descriptions of these outcomes by age categories while Table 4 describes the 260 individuals who died in hospital. The case fatality risk was highest in the <1 year age group at 7.0% and lowest in the 4-9 years age group at 2.8% (Figure 8). Children aged <1 year and those with one or more underlying conditions were overrepresented among those who died compared to those who did not die. Individuals aged <1 year made up 31.2% of deaths vs 19.6% of admissions (Table 3 and 4). Among individuals ≤19 years who were admitted and had data on underlying conditions available, more children who died had ≥1 underlying conditions compared with those who did not die (60.4% vs 19.0%). Among hospitalised individuals aged ≤19 years, the proportion admitted into ICU and the CFR increased during months with increased numbers of admissions during the first and second wave and decreased in the period between the two waves (Figure 9). Similar to the analysis of all SARS-CoV-2 cases, the odds of being aged ≤19 years compared to >19 years among SARS-CoV-2 hospitalisations was lowest during the months of the first and second waves and higher during months falling outside of those waves (Figure 10).

Among hospitalised individuals of all ages with laboratory-confirmed COVID-19, the proportion of individuals aged ≤19 years, was the same in the second and first wave [3.4% vs 3.4%, aOR 0.99 (95% 0.94- 1.04) in a model

adjusting for sex, province and admission at a public hospital (model not shown)]. Among hospitalised individuals aged ≤19 years, cases in the second wave were more likely to be aged <1 year and 1-4 years compared with age 5-9 years but less likely to be aged 10-14 years or 15-19 years, more likely to be from KwaZulu-Natal or the Western Cape Province compared to the rest of the provinces (Table 5). The median length of hospital stay was shorter in the second wave compared to the first wave [mean 8.3 days (SD 9.3days)] vs 9.5 days (SD 13.5days) (p-value <0.001]. The second wave was not independently associated with an increased likelihood of admission into ICU or dying in hospital.

Table 4. Characteristics of COVID-19-associated hospitalised individuals aged ≤19 years who died in hospital, South Africa, DATCOV, 1 March 2020 - 1 May 2021 (N=401)

Characteristic	n (%)
Age (median, IQR*),	9.3 years (0.6– 17.2 years)
Age group, n (%)	
< 1 year	125 (31.2)
1 - 4 years	53 (13.2)
5- 9 years	27 (6.7)
10- 14 years	50 (12.5)
≥15 years	146 (36.4)
Male, n (%)	187 (46.9)
Province	
Eastern Cape	58 (14.5)
Free State	18 (4.5)
Gauteng	121 (30.2)
KwaZulu-Natal	95 (23.7)
Limpopo	20 (5.0)
Mpumalanga	26 (6.5)
North West	8 (2.0)
Northern Cape	4 (1.0)
Western Cape	51 (12.7)
Intensive care unit admission, n (%)	103 (25.7)
Data on underlying conditions available, n (%)	245 (61.1)
Had one or more underlying conditions**, n (%)	148/245 (60.4)
Specific underlying conditions, n (%)	
Asthma/ Chronic Pulmonary Disease	13 (13.5)
Chronic Kidney Disease	7 (7.6)
Diabetes mellitus	30 (29.4)
HIV	34 (34.0)
Heart Disease	14 (14.6)
Hypertension	48 (41.7)
Malignancy	7 (7.8)
Obesity	8 (12.7)
Tuberculosis past	14 (16.3)
Tuberculosis current	13 (14.1)
Other *Acute appendicitis, Anaemia, Biliary atresia, Cerebral palsy, Epilepsy, Hypokalaemia, Hypocalcaemia, Prayer Willi Syndrome, pneumonia, Prematurity, Ileus, HIV-exposure, substance abuse)*	41 (27.7)

*IQR= interquartile range; **the two individuals who died with respiratory conditions also had other underlying conditions.

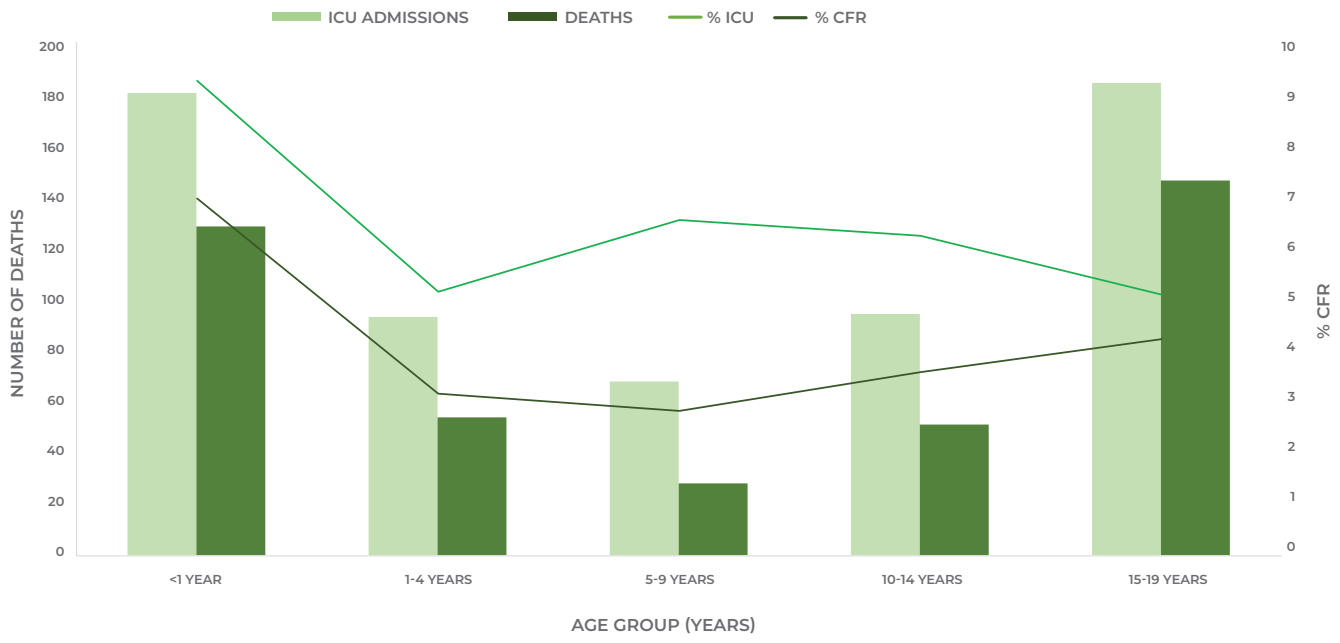

Figure 8. Case fatality ratio and number of deaths among individuals aged ≤19 years, South Africa, DATCOV, 1 March 2020– 1 May 2021 (N=9918)*

* CFR measured among 9443 with complete follow up

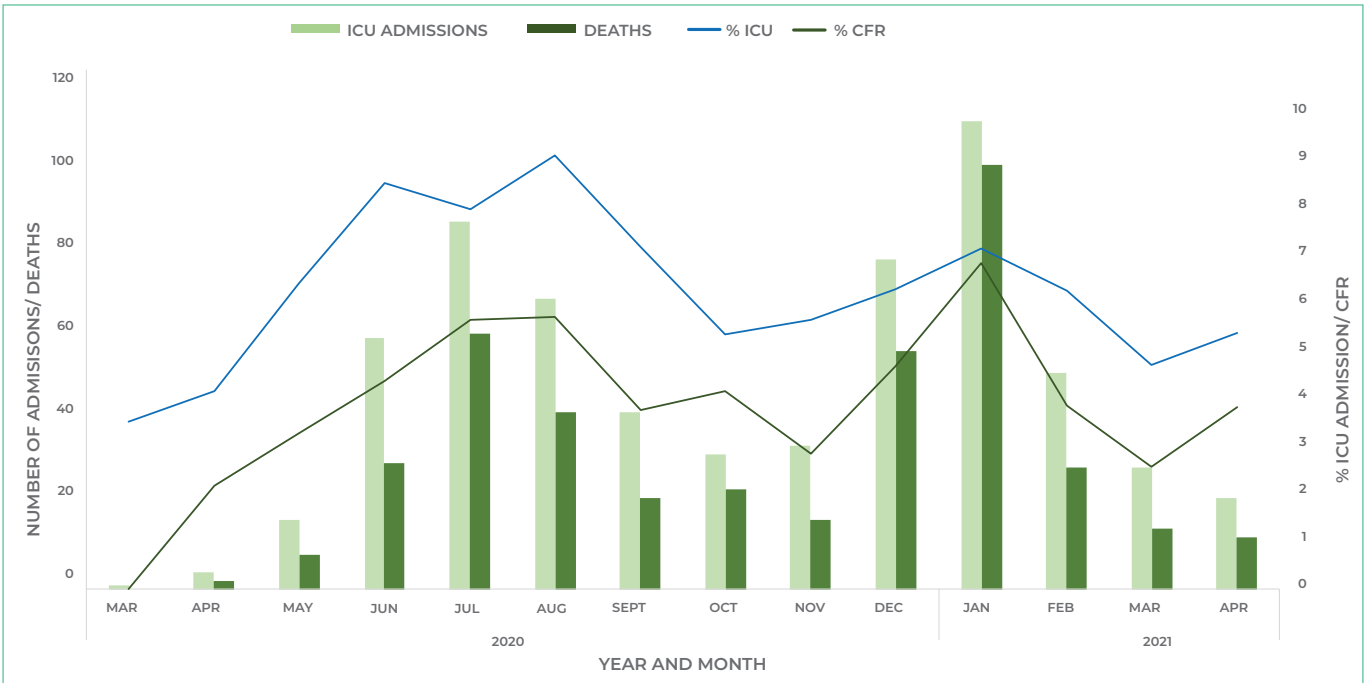

Figure 9. Case fatality ratio and proportion of cases admitted to ICU among individuals aged ≤19 years by month, South Africa, DATCOV, 1 March 2020– 1 May 2021 (N=9918)*

* CFR measured among 9443 with complete follow up. ICU-intensive care unit

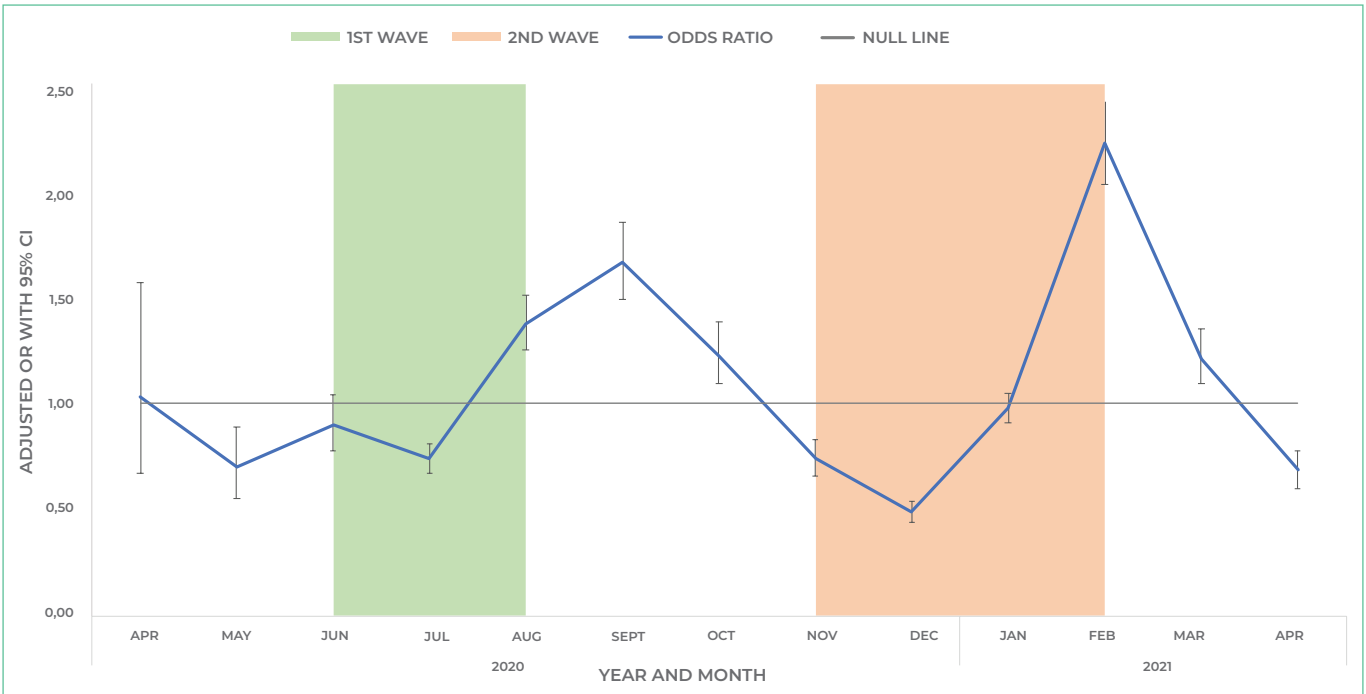

Figure 10. Adjusted odds of being aged ≤19 years compared to >19 years among hospitalised individuals with COVID-19 by month compared to the preceding month, South Africa, 1 March 2020 – 1 May 2021 (N=9918)*

* The model adjusted for sex, province, health facility sector, ICU admission and one or more underlying conditions reported. OR – odds ratio, CI – confidence interval

Table 5. Comparison of characteristics of COVID-19 admissions aged ≤19 years between the first wave and second wave in South Africa N= 6001

Characteristic	Wave 1 (N=2420)	Wave 2 (N=3581)	Univariate OR (95% CI)	Multivariate OR (95% CI)	Multivariate OR **(95% CI)
Age category, (n, %)					
<1	438 (18.1)	893 (24.9)	1.46 (1.20- 1.77)	1.47 (1.20- 1.79)	1.45 (1.19- 1.78)
1-4 years	379 (15.7)	694 (19.4)	1.31 (1.07- 1.60)	1.36 (1.11- 1.68)	1.38 (1.12- 1.70)
5-9 years	255 (10.5)	357 (10.0)	1.00	1.00	1.00
10- 14 years	413 (17.1)	457 (12.8)	0.79 (0.64- 0.97)	0.80 (0.65- 0.99)	0.81 (0.65- 0.99)
15- 19 years	935 (38.6)	1180 (33.0)	0.90 (0.75- 1.08)	0.89 (0.74- 1.07)	0.89 (0.74- 1.08)
Male, (n, %)	1114 (46.0)	1663 (46.6)	1.02 (0.92- 1.13)	0.97 (0.87- 1.08)	0.96 (0.86- 1.07)
Province, (n, %)					
Eastern Cape	290 (12.0)	429 (12.0)	0.97 (0.78- 1.19)	0.95 (0.77- 1.17)	0.96 (0.77- 1.18)
Free State	142 (5.9)	104 (2.9)	0.48 (0.36- 0.64)	0.47 (0.35- 0.63)	0.40 (0.29- 0.54)
Gauteng	787 (32.5)	1000 (27.9)	0.83 (0.70- 0.99)	0.76 (0.64- 0.91)	0.73 (0.61- 0.87)
KwaZulu Natal	462 (19.1)	861 (24.0)	1.22 (1.01- 1.46)	1.15 (0.95- 1.38)	1.11 (0.92- 1.34)
Western Cape	436 (18.0)	723 (20.2)	1.08 (0.90- 1.31)	0.96 (0.79- 1.16)	0.94 (0.77- 1.15)
Rest of provinces	303 (12.5)	464 (13.0)	1.00	1.00	1.00
Admitted in public sector, (n, %)	1429 (59.0)	2248 (62.8)	1.17 (1.05- 1.30)	1.20 (1.07- 1.34)	1.18 (1.05- 1.32)
ICU admission, (n, %)	179 (7.4)	217 (6.1)	0.81 (0.66- 0.99)	0.77 (0.62- 0.95)	--
One or more underlying conditions, (n, %)	348 (14.4)	489 (13.7)	0.94 (0.81- 1.09)	0.93 (0.80- 1.09)	0.93 (0.79- 1.09)
Died*, (n, %)	115 (4.8)	169 (4.7)	0.99 (0.78-1.27)	--	0.95 (0.74- 1.22)

First wave = epidemiology week 24- 34; second wave = epidemiology week 47- week 5 2021. Both defined as periods with weekly incidence risk >5 admissions per 100 000 population in the total population among all individuals; * variables included only in analysis of individuals with complete follow up (N=5792). ** Model including individuals with complete follow up (N=5792).

Discussion

This report presents data on the epidemiology and clinical features of individuals aged ≤19 years with laboratory-confirmed COVID-19 using data from two surveillance systems established for monitoring the COVID-19 pandemic in South Africa. The data presented showed that, as of 1 May 2021, individuals aged ≤19 years made up 9.5% of all laboratory-confirmed COVID-19 cases reported in South Africa and 4.2% of COVID-19 associated admissions, despite comprising almost 37% of the population. The cumulative incidence of laboratory-confirmed COVID-19 cases in this population was 5.5 times lower than that of individuals >19 years during the same period while the incidence of admission was 13.3 times lower. The data also showed increasing and decreasing trends in new laboratory-confirmed COVID-19 cases and COVID-19-associated admissions among individuals ≤19 years in all provinces reflecting national trends among older individuals (7). The overall in-hospital case fatality risk was 4.2% among individuals aged ≤19 years with complete outcome data. Very young children aged <1 year, those aged 15- 19 years and those with underlying conditions were over-represented among those who died. Case fatality risk and percentage admitted to ICU largely declined between January and March 2021 following the end of the second wave but increased during the month of April 2021.

Reassuringly, the data shows that peaks in cases in the first and second wave did not appear to be related to the timing of the opening of schools and that cases remained low during the period when schools were open. Since the end of the second wave, it appears there have been cluster outbreaks associated with increased incidence and admissions among those ≤19 years in the Northern Cape province during week 9-12 and 14-17 of 2021 and in the Free State province during weeks 14-17 of 2021. There is a need to maintain heightened vigilance and consistent implementation of non-pharmaceutical interventions within schools, community and mass gatherings involving young people as case numbers have been increasing in several provinces in recent weeks.

The odds of being aged ≤19 years vs >19 years among laboratory-confirmed COVID-19 cases and admissions were reduced during the first and second waves, increasing after the end of the waves suggesting possible under-detection of COVID-19, under-admission of cases among children during peak periods of transmission, possibly as a result of pressure on hospitals or limited resources or differing admitting and testing criteria for children who are thought to have a milder form of the disease. Both waves were preceded by a reduction in the odds of being aged ≤19 years reflecting the shift to diagnosing cases aged >19 years. At the end of the current surveillance period, there was a decline in the odds of being aged ≤19 years among both cases and admissions suggesting the possible beginning of a resurgence. These findings could reflect two major hypotheses. The first is that adults drive infection and the wave in children follows after. The second is that changes in testing or admission patterns in peaks are as a result of severe cases in adults overwhelming health services. Subsequent reports will confirm whether these trends are sustained.

The incidence of admission, the proportion admitted to ICU and case fatality risk was much higher among infants <1 year which might reflect more severe disease, increased admission and testing for non-COVID indications or more clinicians being more likely to admit as a precaution in this younger population. Being aged <1 was also associated with a 47% increased likelihood of admission during the second wave compared to the first wave. We also showed that children with underlying conditions were over-represented among those who died suggesting a higher risk of mortality among children with underlying medical conditions. (16) Respiratory underlying conditions – asthma and chronic pulmonary disease – were the most common underlying conditions documented among admitted individuals aged ≤19 years. On the other hand, diabetes mellitus, HIV and malignancy appeared to be the most commonly documented underlying conditions among

older individuals aged ≤19 years who died and had data on underlying conditions available.

This analysis was subject to several limitations. First, both surveillance systems included only SARS-CoV-2-confirmed or tested COVID-19 cases or admissions and therefore, asymptomatic cases would have been missed as well as individuals who were not tested. Testing approaches in South Africa have changed as the epidemic progressed, potentially biasing characteristics of detected cases. In particular, recent changes to increased use of antigen detection testing may bias numbers as individuals diagnosed with antigen tests are less likely to be reported and captured by surveillance systems as they may require manual reporting. Second, the national laboratory-based reporting system lacks complete information on symptoms or contact history to determine the source of infection. Third, information on underlying medical conditions is incomplete in the two surveillance systems and the section on underlying conditions has a generic list of specified underlying conditions which are not specific for children. Additional information on underlying conditions among admitted individuals aged ≤19 years is always being sought from reporting hospitals. Lastly, the indications or reasons for admission are mostly not provided. These would allow determination of whether the admission was due to COVID-19 disease, for isolation purposes or other diseases.

In conclusion, children and adolescents remain substantially less likely to be diagnosed or hospitalised with COVID-19 compared to adults. In recent weeks the case number in children have remained low following the second wave except for the Northern Cape and Free State provinces, whereas cases in adults have been increasing. There is a need to ensure high compliance with respect to non-pharmaceutical interventions within households and schools of individuals aged ≤19 years, especially those with underlying conditions.

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