EPIDEMIOLOGY AND CLINICAL CHARACTERISTICS OF LABORATORY-CONFIRMED COVID-19 AMONG INDIVIDUALS AGED ≤19 YEARS, SOUTH AFRICA, 1 MARCH 2020 – 13 FEBRUARY 2021

NICD COVID-19 and DATCOV teams

Summary

- As of 13 February 2021, individuals aged ≤19 years made up 9.2% of laboratory-confirmed COVID-19 cases and 3.8% of all COVID-19-associated admissions.
- The cumulative incidence of laboratory-confirmed COVID-19 cases aged ≤19 years was 623.8 per 100 000 population, 5.7 times lower than that in those aged >19 years (3551.2 per 100 000 population) while incidence of admission was 14.5 times lower (365.9 per 1 million vs 5301.0 per 1 million).
- 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, mirroring trends among adults aged >19 years. The decrease in weekly incidence was observed in all age groups.
- Among individuals aged ≤19 years, cases in the second wave compared with the first wave, were more likely to be in an older age groups (age 1-19) compared to <1 year, be male, be diagnosed in a public sector laboratory and be in the KwaZulu-Natal or Western Cape Province, possibly related to behaviour changes, schools being closed, differences in testing patterns or true differences between waves
- There were 7 987 reported COVID-19-associated admissions among individuals aged ≤19 years.
- The cumulative rate of admission was highest in individuals aged <1 year at 1423.4 per 1 million population, followed by individuals aged 15-19 years at 600.1 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 538 (6.7%) individuals admitted into intensive care units (ICU) at some point during admission and 183 (2.3%) having been ventilated.
- Data on in-hospital outcome were available for 7255 (90.8%) individuals aged ≤19 years. Among these, there were 260 in-hospital deaths giving an in-hospital case fatality risk of 3.6% (260/7255). Among all deaths, 102 (39.2%) were among adolescents aged 15-19 years and 86 (33.1%) were aged under one year. Among 162 (62.3%) in-hospital deaths who had available data on underlying conditions, 98 (62.3%) reported ≥1 underlying conditions.
- There was a 9% increase in the proportion of all admissions aged ≤19 years admitted to hospital during the second wave compared with the first wave. However, among hospitalised individuals aged ≤19 years, the second wave was not independently associated with an increased likelihood of admission to a public hospital, into ICU or dying in hospital.

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 108 million individuals infected and 2.4 million deaths reported to World Health Organization as of 14 February 2021. (1) The first case of COVID-19 in South Africa was reported on 5 March 2020 in KwaZulu- Natal Province.(2) On 13 February 2021 , the country reported a cumulative total of 1 490 063 positive cases and 47 821 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).
Beginning in November 2020, South Africa experienced an increase in cases of COVID-19 in all the provinces. (2) Associated with these increases in case numbers, a new lineage of SARS-CoV-2, was detected and found to be predominant in the Eastern Cape, Western Cape and KwaZulu-Natal Provinces and spreading to all provinces in the country. This lineage, named 501Y.V2, possesses several mutations that were not previously identified in viruses from South Africa (2, 6). Sequencing of additional samples from other provinces is ongoing to determine for how long this lineage has been circulating and in what geographic areas. The number of new cases has declined since mid-January likely related to strengthened non-pharmaceutical interventions implemented since 30 December 2020 and increasing population immunity.

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 17 February 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. (7) 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 the 13 February 2021, there were 637 hospitals submitting admissions data into DATCOV. This included 250 private hospitals and 387 public hospitals.

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 was 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 size 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 year 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 ≤19 years vs >19 years then among different age groups aged ≤19 years. Univariate and multivariable logistic regression were used to determine factors independently associated with first wave compared to second wave. For the analysis of new cases, the first wave and second waves were determined as the periods during which weekly incidence continuously exceeded > 8 cases per 100 000 population were reported. These were epidemiologic weeks 25- 34 (14 June – 22 August 2020) for wave 1 and epidemiologic weeks 47 of 2020- week 4 of 2021 (15 December – 30 January 2021) for wave 2. For the analysis of admissions, the first wave was determined as the period from an admission rate of 8 admissions per 1 million population among children , epidemiologic week 25- 34 (14 June – 22 August 2020) and second wave period from admission rate of 8 cases per 1 million population to end of this reporting period - epidemiologic week 47- 53 of 2020 and week 1-6 of 2021 (15 December 2020 – 13 February 2021).

Results

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

At data extraction, there were 1 491 860 laboratory-confirmed cases of COVID-19 with date of specimen collection on or before 13 February 2021 captured on the national linelist. Of these, 13 480 (0.9%) were missing age information. Of the 1 478 380 with known age, 136 153 (9.2%) were aged ≤19 years. The median age of the individuals aged ≤19 years was 14.0 years (interquartile range [IQR] 8.0 – 17.0 years) with 3586 (2.6%) aged <1 year and 60 052 (44.1%) aged 15- 19 years. There were 60 206 (44.2%) males with 3 133 (2.3%) missing information on gender. The majority of cases 115 623/136 153 (84.9%) were in five provinces – Eastern Cape (16.1%), Free State (6.7%), Gauteng Province (22.6%), KwaZulu Natal (27.7%) and Western Cape (11.9%). The cumulative incidence of laboratory-confirmed COVID-19 among individuals aged ≤19 years was 5.7 times lower compared to individuals aged >19 years –623.8 per 100 000 population vs. 3551.2 per 100 000 population. The cumulative incidence among individuals aged ≤19 years ranged from 187.3 per 100 000 in Limpopo province to 899.3 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, 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 55.2 per 100 000 in week 1 and declining in all provinces since then. KwaZulu Natal had the highest weekly incidence at 100 per 100 000 population during the peak of wave 2. (Figure 1).

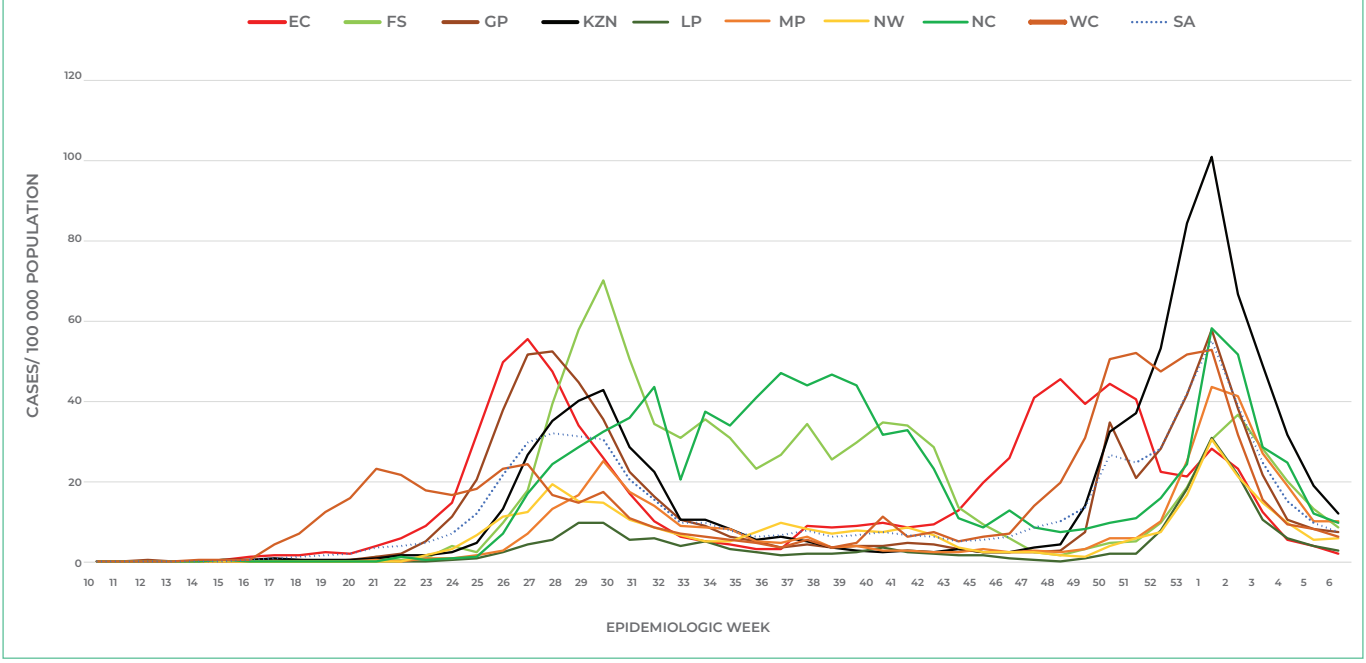

Figure 1. Weekly incidence per 100 000 population of laboratory-confirmed COVID-19 among individuals aged ≤19 years by epidemiologic week and province, South Africa 1 March 2020- 13 February 2021 (N=136 153)

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.

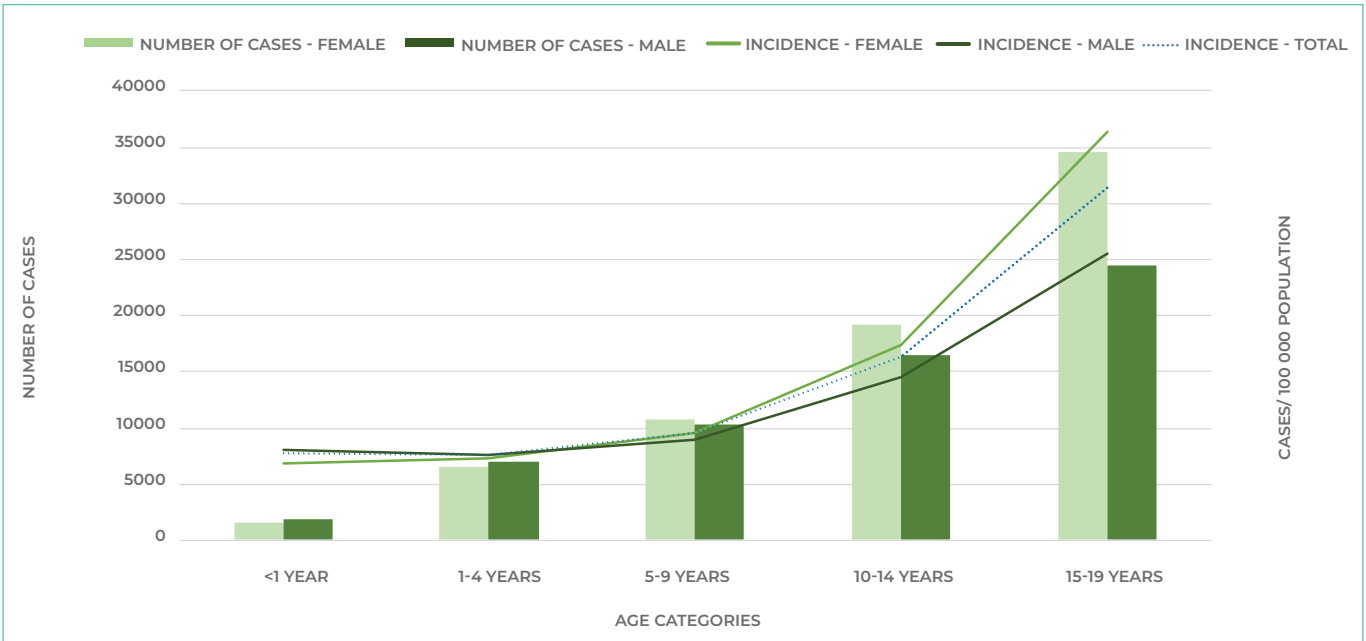

Figure 2. Cumulative incidence per 100 000 population of laboratory-confirmed COVID-19 in individuals aged ≤19 years by age group and sex, South Africa, 1 March 2020 – 13 February 2021 (N=136 153)

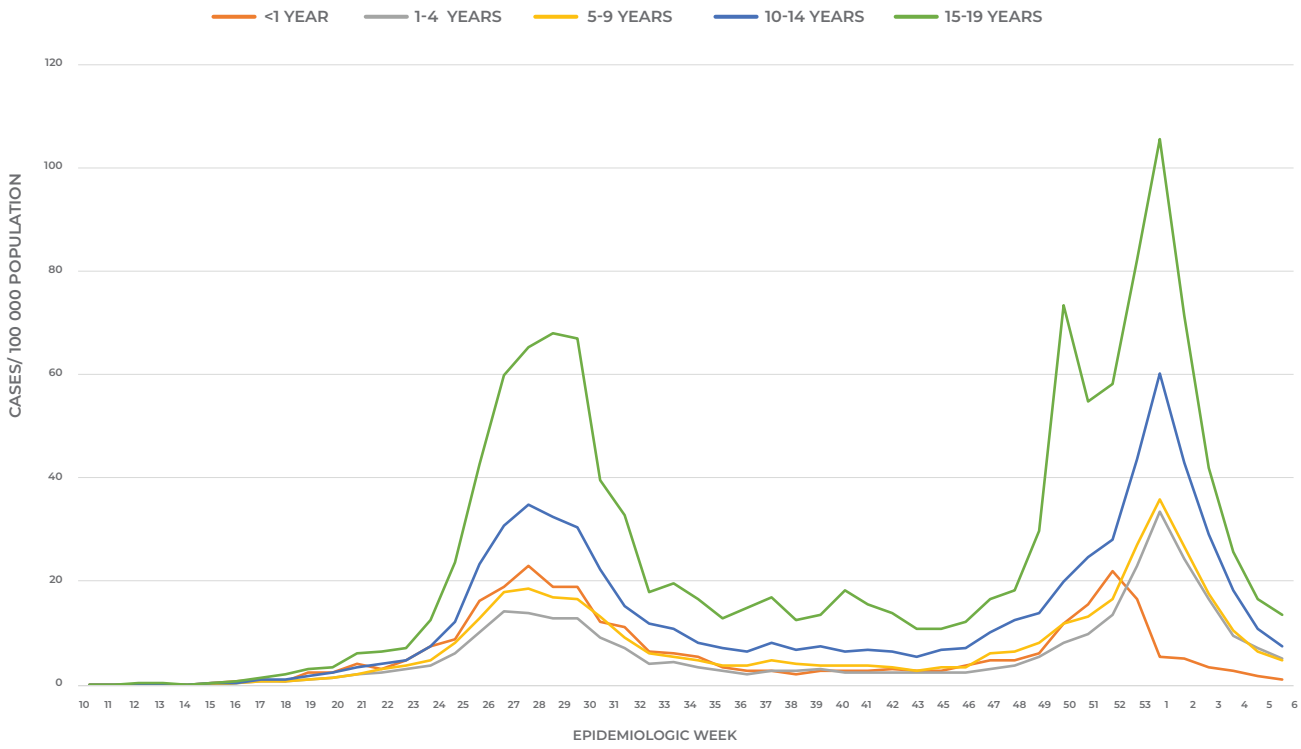

Figure 3. Weekly incidence per 100 000 population of laboratory-confirmed COVID-19 in individuals aged ≤19 years by age group, South Africa, 1 March 2020 – 13 February 2021 (N=136 153)

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- 13 February 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	191341 (12.9)	21940 (16.1)	11.5	4326.1	778.5	29 382 (14.1)	931 (11.7)	3.2	330.4
Free State	2928903 (4.9)	1082712 (5.0)	37.0	78392 (5.3)	9063 (6.7)	11.6	3755.2	837.1	11 528 (5.5)	397 (5.0)	3.4	366.7
Gauteng	15488137 (26.0)	4710102 (21.6)	30.4	393113 (26.6)	30782 (22.6)	7.8	3361.8	653.5	55 422 (26.6)	2 189 (27.4)	4.0	464.7
KwaZulu Natal	11531628 (19.3)	4709686 (21.6)	40.8	321718 (21.8)	37693 (27.7)	11.7	4163.4	800.3	39 400 (18.9)	1529 (19.1)	3.9	324.7
Limpopo	5852553 (9.8)	2510790 (11.5)	42.9	60522 (4.1)	4703 (3.5)	7.8	1670.3	187.3	6 989 (3.4)	247 (3.1)	3.5	98.4
Mpumalanga	4679786 (7.8)	1773075 (8.1)	37.9	67917 (4.6)	6592 (4.8)	9.7	2109.8	371.8	7 388 (3.6)	265 (3.3)	3.6	149.5
North West	4108816 (6.9)	1528001 (7.0)	37.2	58873 (4.0)	4906 (3.6)	8.3	2091.1	321.1	10 650 (5.1)	661 (8.3)	6.2	432.6
Northern Cape	1292786 (2.2)	481364 (2.2)	37.2	32851 (2.2)	4329 (3.2)	13.2	3515.1	899.3	3 562 (1.7)	154 (1.9)	4.3	319.9
Western Cape	7005741 (11.8)	2211623 (10.1)	31.6	273653 (18.5)	16145 (11.9)	5.9	5371.3	730.0	44 028 (21.1)	1 614 (20.2)	3.7	729.8
All provinces	**59622350 (100)**	**21825534 (100)**	**36.6**	**1478380 (100)**	**136,153 (100)**	**9.2**	**3551.2**	**623.8**	**208 349 (100**	**7 987 (100)**	**3.8**	**365.9**

[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 306.5 per 100 000 among individuals aged 1-4 years to 1257.7 per 100 000 among those aged 15-19 years – Figure 2. The cumulative incidence was higher among females compared to males (674.3 per 100 000 vs 546 per 100 000). An increase in weekly incidence was noted in the age group 15-19 years in week 50, reducing slightly in week 51 and peaking in week 1 2021 (Figure 3). The smaller peak in week 50 was related to a documented cluster of cases following the matric Rage events. (9) Weekly incidence in week 1 exceeded peak weekly incidence in the first wave in all age groups, similar to what is observed in individuals aged >19 years. (10)

With respect to individuals of all ages with laboratory-confirmed COVID-19, the proportion of individuals aged ≤19 years, was slightly higher in the second wave compared to the first wave [8.8% vs 9.2%, adjusted odds ratio (aOR) 1.02 (95% confidence interval [CI] 1.01 - 1.04) 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 years), 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 new COVID-19 cases aged ≤19 years between first wave and second wave in South Africa, N=111 646

Characteristic	Wave 1 (N=46 524)	Wave 2 (N=65 122)	Univariable OR (95% CI)	Multivariable OR (95% CI)
Age group (years				
<1	1 648 (3.5)	1 167 (1.8)	1.00	1.00
1-4	4 364 (9.4)	7 289 (11.2)	2.35 (2.16- 2.55)	2.53 (2.32- 2.76)
5-9	7 154 (15.4)	10 714 (16.5)	2.11 (1.95- 2.92)	2.25 (2.07- 2.45)
10- 14	12 538 (27.0)	17 583 (27.0)	1.98 (1.83- 2.14)	2.10 (1.94- 2.28)
15- 19	20 820 (44.8)	28 399 (43.6)	1.93 (1.78- 2.08)	2.10 (1.94- 2.27)
Sex, (n, %)				
Female	25 431 (54.7)	34 161 (52.3)	1.00	1.00
Male	20 223 (43.5)	29 168 (44.8)	1.07 (1.05- 1.10)	1.10 (1.07- 1.13)
Unknown	870 (1.9)	1 793 (2.8)	1.53 (1.41- 1.67)	1.31 (1.20- 1.42)
Province, (n, %)				
Eastern Cape	7 975 (17.1)	9 223 (14.2)	1.05 (1.00- 1.09)	0.97 (0.93- 1.01)
Gauteng	14 181 (30.5)	12 931 (19.9)	0.82 (0.79- 0.85)	0.92 (0.88- 0.95)
KwaZulu Natal	11 068 (23.8)	23 362 (35.9)	1.91 (1.84- 1.98)	1.85 (1.78- 1.91)
Western Cape	3 257 (7.0)	8 494 (13.0)	2.36 (2.25- 2.47)	2.51 (2.39- 2.64)
Other provinces	10 043 (21.6)	11 112 (17.1)	1.00	1.00
Tested at public laboratory	**21 166 (45.5)**	**37 029 (56.7)**	**1.58 (1.54- 1.62)**	**1.49 (1.46- 1.53)**

First wave = epidemiology week 25- 34; second wave = epidemiology week 47- week 4 2021. Both defined as periods with weekly incidence >8 cases/ 100 000 population

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

As of 13 February 2021, data on 210 084 COVID-19-associated admissions had been captured on DATCOV. Of these admissions, 1 735 (0.8%) were missing age information. Among the remainder of admissions with available age information (N= 208 439), 7987 (3.8%) 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 3.2% in Eastern Cape to 6.2% 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 ≤19 years were in five provinces; Gauteng (27.4%), Western Cape (20.2%), KwaZulu Natal (19.1%), Eastern Cape (11.7%) and North West (8.3%) provinces together accounting for 86.7% of all admissions (N=6924) (Table 1).

The cumulative admission rate among individuals aged ≤19 years by province ranged from 98.4 per 1 million population in Limpopo Province to 729.8 per 1 million population in Western Cape with an overall rate of 365.9 per 1 million. However this overall admission rate among individuals aged ≤19 years was 14.5 times lower than that among individuals aged >19 years (365.9 per 1 million population vs 5301 per 1 million population). In most provinces, the weekly admission rate among those aged ≤19 years peaked at 12.3 per 1 million population in week 30 (Figure 4), declined in most provinces except Free State and North West and started increasing again since week 43, peaking at 19.3 per million in week 1 of 2021.

Number of admissions were highest in individuals aged 15-19 years - 2865 (35.9%), <1 year- 1660 (20.8%), 1- 4 years- 1449 (18.1%), 10- 14 years – 1177 (14.7%) and least among individuals aged 5-9 years – 836 (10.5 %) (Table 3). Weekly number of admissions in all age groups increased in weeks 24- 25, reducing from week 32 and increasing again from week 47 (Figure 5a). 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.(9) Throughout the surveillance period, weekly admission rates were highest among individuals aged <1 year (Figure 5b). The rate of admission in infants aged <1 year increased markedly during the second wave. 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.

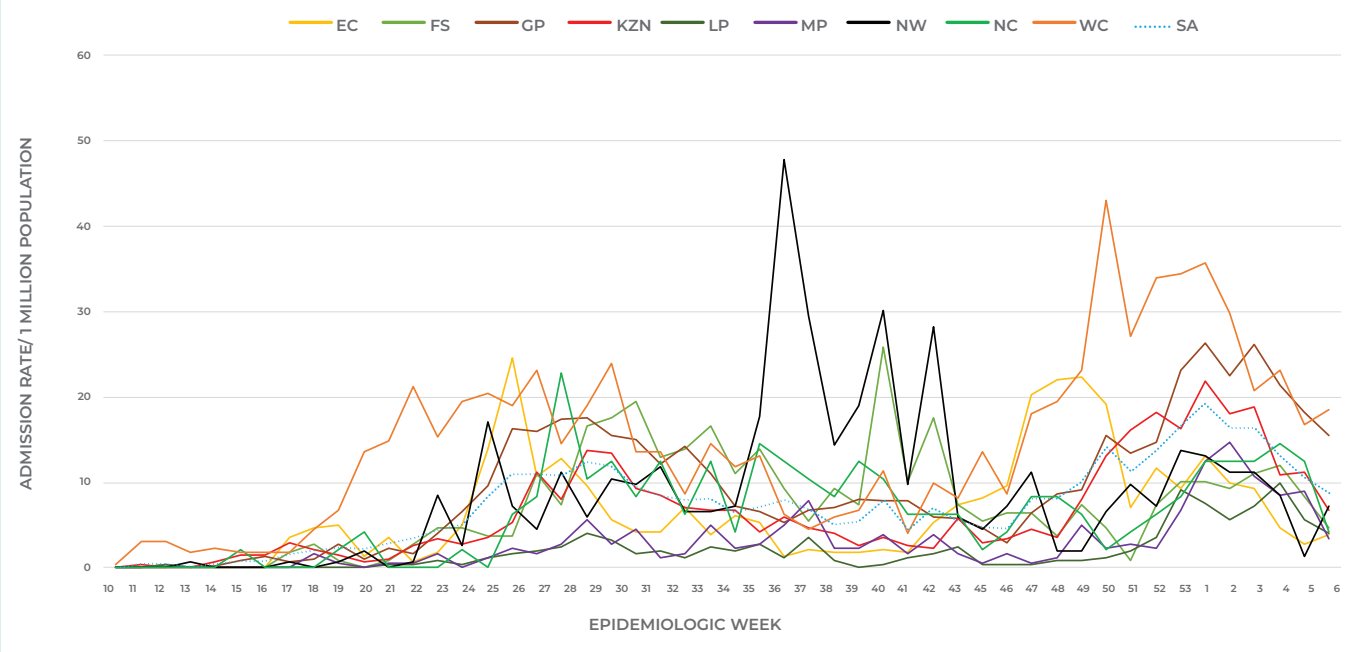

Figure 4. Rate of COVID-19-associated admission per million population among individuals aged ≤19 years by epidemiologic week and province, South Africa, DATCOV, 1 March 2020 – 13 February 2021 (N=7987)

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.

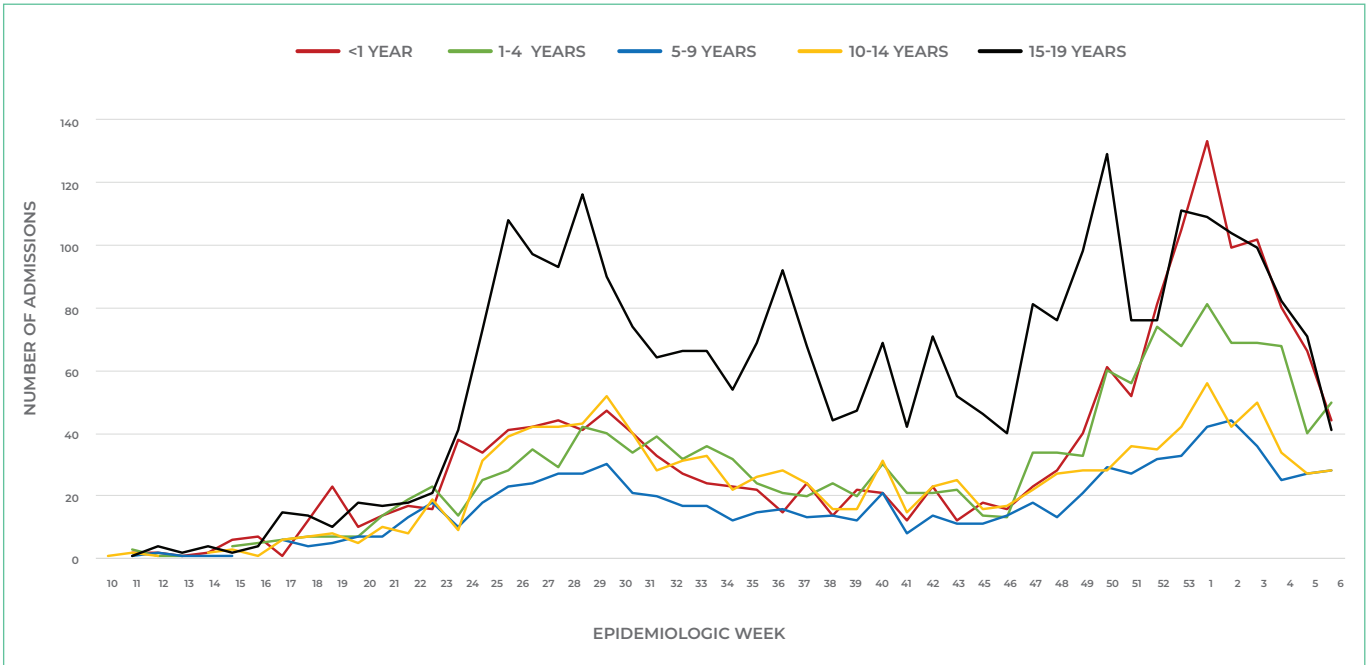

Figure 5a. Number of COVID-19-associated admissions among individuals aged ≤19 years at by epidemiologic week and age group, South Africa, DATCOV, 1 March 2020 – 13 February 2021 (N=7987)

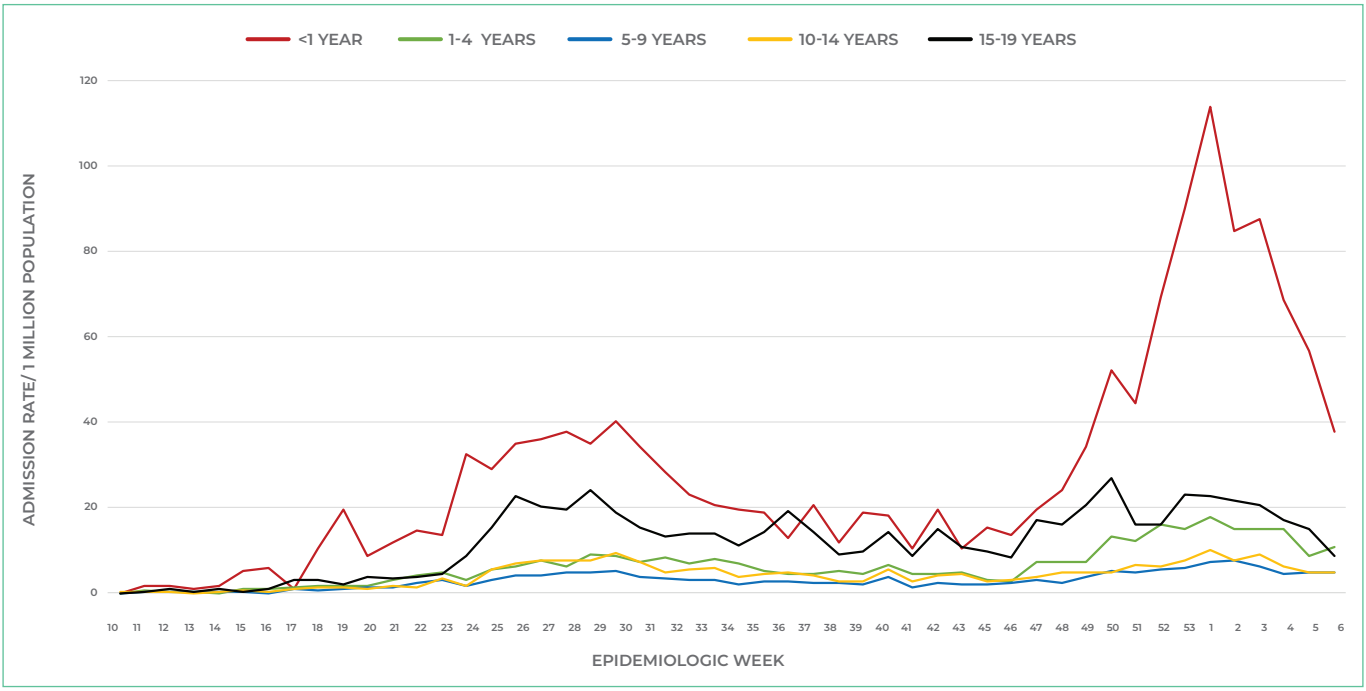

Figure 5b. Rate of COVID-19-associated admissions per 1 million population among individuals aged ≤19 years by epidemiologic week and age group, South Africa, DATCOV, 1 March 2020 – 13 February 2021 (N=7987)

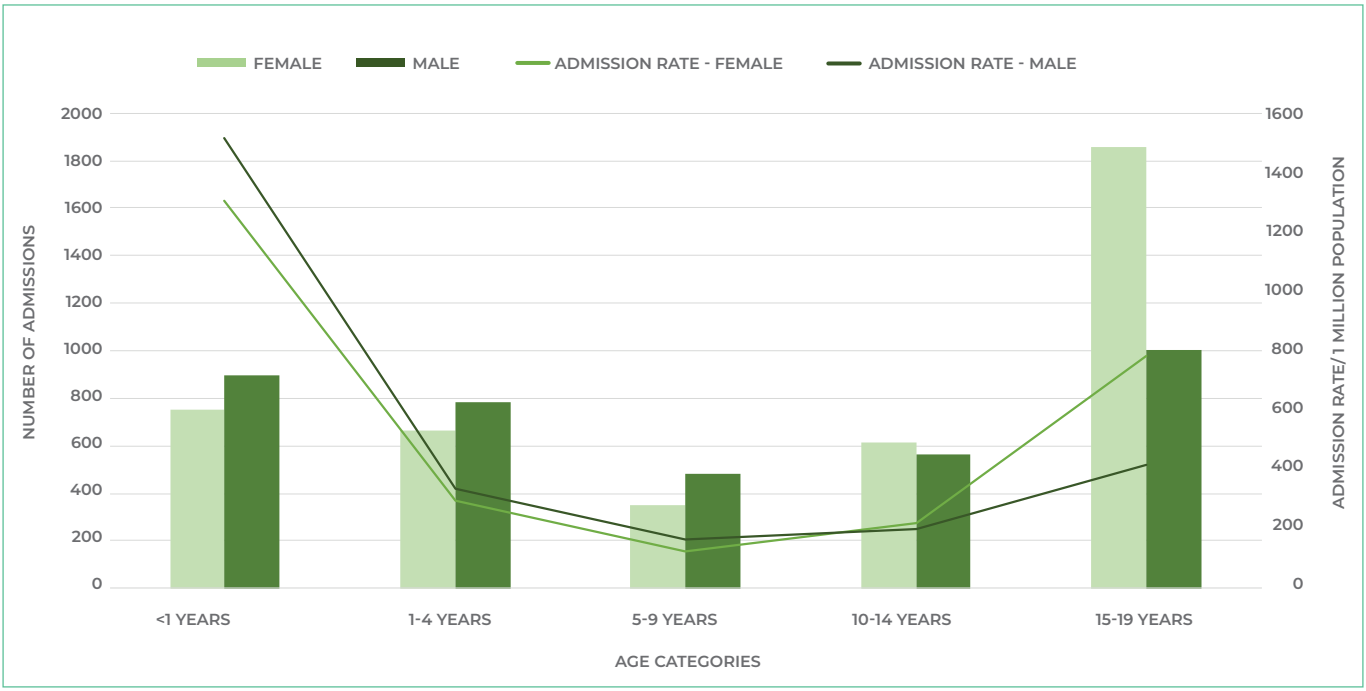

Figure 6. Rate of COVID-19-associated admissions aged ≤19 years by age group and sex, South Africa, DATCOV, 1 March 2020 – 13 February 2021 (N=7987)

Table 3. Characteristics of COVID-19-associated admissions aged ≤19years, South Africa, DATCOV, 1 March 2020- 13 February 2021 (N=7987)

Variable	<1year (n=1660) (20.8%)	1- 4 years (n=1449) (18.1%)	5- 9 years (n=836) (10.5%)	10- 14 years (n=1177) (14.7%)	15- 19 years (n=2865) (39.5%)	Overall (n=7987) (100%)
Age (median, IQR*)	2.8 mons (0.9- 6.6mons)	2.2 yrs. (1.5- 3.2yrs)	7.5 yrs. (6.2- 8.8yrs)	12.8 yrs. (11.5- 14.0yrs)	17.9yrs. (16.7- 19.0yrs)	10.2 yrs. (1.4-17.0 yrs.)
Male (n, %)	894 (54.3)	783 (54.1)	483 (58.0)	561 (47.7)	1003 (35.1)	3724 (46.7)
Admitted at a public hospital, (n, %)	1051 (63.3)	625 (43.1)	449 (53.7)	716 (60.8)	1924 (67.2)	4765 (59.7)
Data on underlying conditions available, (n, %)	864 (52.1)	937 (67.4)	522 (62.4)	764 (64.9)	1971 (68.8)	5058 (63.3)
Has ≥1 underlying conditions, (n/N, %)*	151/864 (17.5)	159/937 (17.0)	130/522 (24.9)	174/764 (22.8)	426/1971 (21.6)	1040/5058 (20.6)
Length of stay (median, IQR)**	4 (2-9)	3 (1-5)	3 (1-8)	4 (2-9)	5 (2-8)	4 (2-8)
ICU admission	162 (9.8)	80 (5.5)	62 (7.4)	81 (6.9)	153 (5.3)	538 (6.7)
Ventilation	67 (4.0)	24 (1.7)	18 (2.2)	23 (2.0)	51 (1.8)	183 (2.3)
Died	87 (5.2)	24 (1.7)	20 (2.4)	29 (2.5)	102 (3.6)	262 (3.3)
Discharged alive	1374 (82.8)	1268 (87.5)	750 (89.7)	1055 (89.6)	2548 (88.9)	6995 (87.6)
Transferred to another hospital	63 (3.8)	26 (1.8)	19 (2.3)	40 (3.4)	84 (2.9)	232 (2.9)
Still admitted	136 (8.2)	131 (9.0)	47 (5.6)	53 (4.5)	131 (4.6)	498 (6.2)

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 7987 admitted individuals included in the analysis, the median age was 10.2 years (IQR 1.4 -17.0 years) and 3724 (46.7%) 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 (4765, 59.7%). 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 5058 (63.3%) had data on underlying conditions available. Of these 1040 (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).

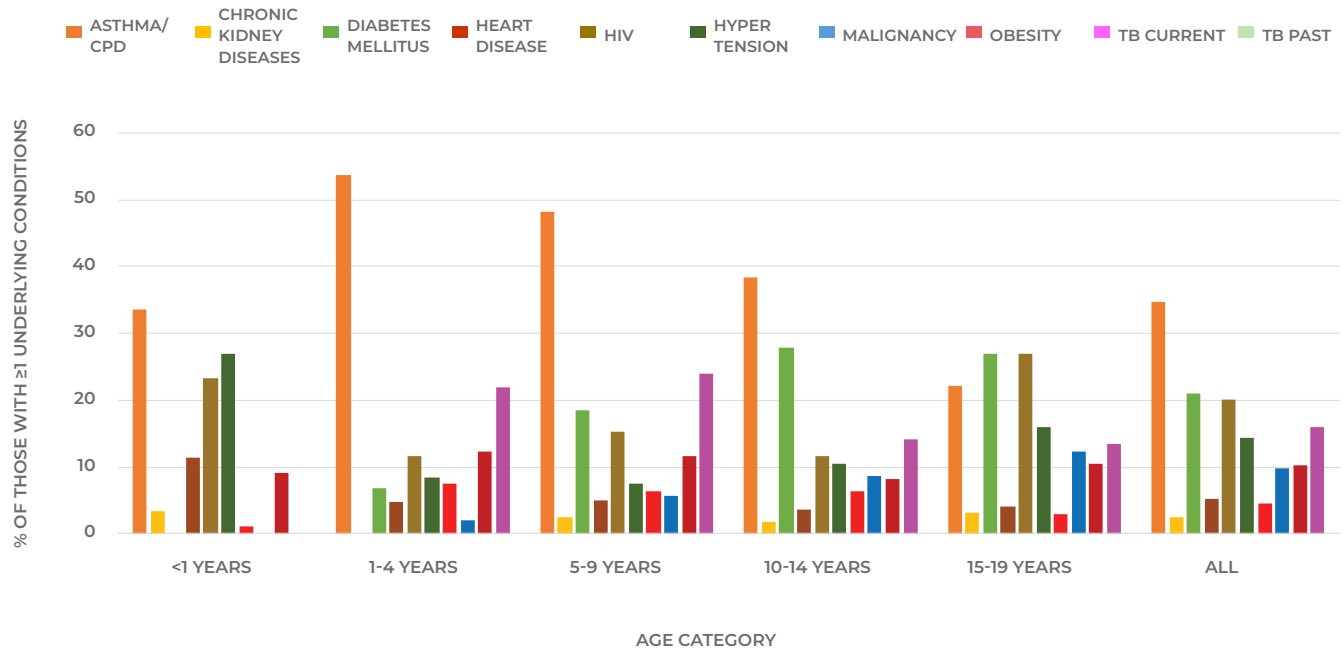

Figure 7. Distribution of underlying conditions among COVID-19-associated admissions aged ≤19years with ≥1 underlying conditions, South Africa, DATCOV, 1 March 2020 – 13 February 2021 (N=1040)*

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

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

Of the 7987 COVID-19-associated admissions among individuals aged ≤19 years, 538 (6.7%) were admitted into ICU and 183 (2.3%) were ventilated at some point during admission. At analysis, 6995 (87.6%) had been discharged, 498 (6.2%) were still admitted, 232 (2.9%) had been transferred to other facilities and 262 (3.3%) had died during admission including two deaths confirmed as unrelated to COVID-19. Among individuals with outcome data available, the in-hospital case fatality risk (CFR) was 3.6% (260/7255) compared with 23.7% (44 419/ 187 415) 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 260 COVID-19 associated in-hospital deaths, 162 (62.3%) individuals had data on underlying conditions available. Of these 98 (60.5%) 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. 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 32.2% of deaths vs 18.7% 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 (60.5% vs 20.6%). The proportion of individuals aged ≤19 years 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 8).

Among hospitalised individuals of all ages with laboratory confirmed COVID-19, the proportion of individuals aged ≤19 years, was slightly higher in the second wave compared with the first [3.2% vs 3.5%, aOR 1.09 (95% 1.03- 1.15) 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 Eastern Cape, 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 5 days (SD 6days)] vs 9 days (SD 16.2days)]. The second wave was not independently associated with an increased likelihood of admission to a public hospital, 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- 13 February (N=260)

Characteristic	n (%)
Age (median, IQR*),	10.0 years (0.3– 17.2 years)
Age group, n (%)	
< 1 year	86 (33.1)
1 - 4 years	24 (9.2)
5- 9 years	20 (7.7)
10- 14 years	28 (10.8)
≥15 years	102 (39.2)
Male, n (%)	123 (47.3)
Province	
Eastern Cape	44 (16.9)
Free State	14 (5.4)
Gauteng	64 (24.6)
KwaZulu-Natal	50 (19.2)
Limpopo	26 (10.0)
Mpumalanga	15 (5.8)
North West	6 (2.3)
Northern Cape	2 (0.8)
Western Cape	39 (15.0)

Intensive care unit admission, n (%)	77 (29.6)
Data on underlying conditions available, n (%)	162 (62.3)
Had one or more underlying conditions**, n (%)	28/50 (56.0)
Specific underlying conditions, n (%)	
Asthma/ Chronic Pulmonary Disease	9 (9.2)
Chronic Kidney Disease	6 (6.1)
Diabetes mellitus	15 (15.3)
HIV	22 (22.4)
Heart Disease	8 (8.2)
Hypertension	14 (14.3)
Malignancy	10 (10.2)
Obesity	5 (5.1)
Tuberculosis past	12 (12.2)
Tuberculosis current	12 (12.2)
Other *Acute appendicitis, Anaemia, Biliary atresia, Cerebral palsy, Epilepsy, Hypokalaemia, Hypocalcaemia, Prayer Willi Syndrome, pneumonia, Prematurity, Ileus, HIV-exposure, substance abuse)*	37 (37.8)

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

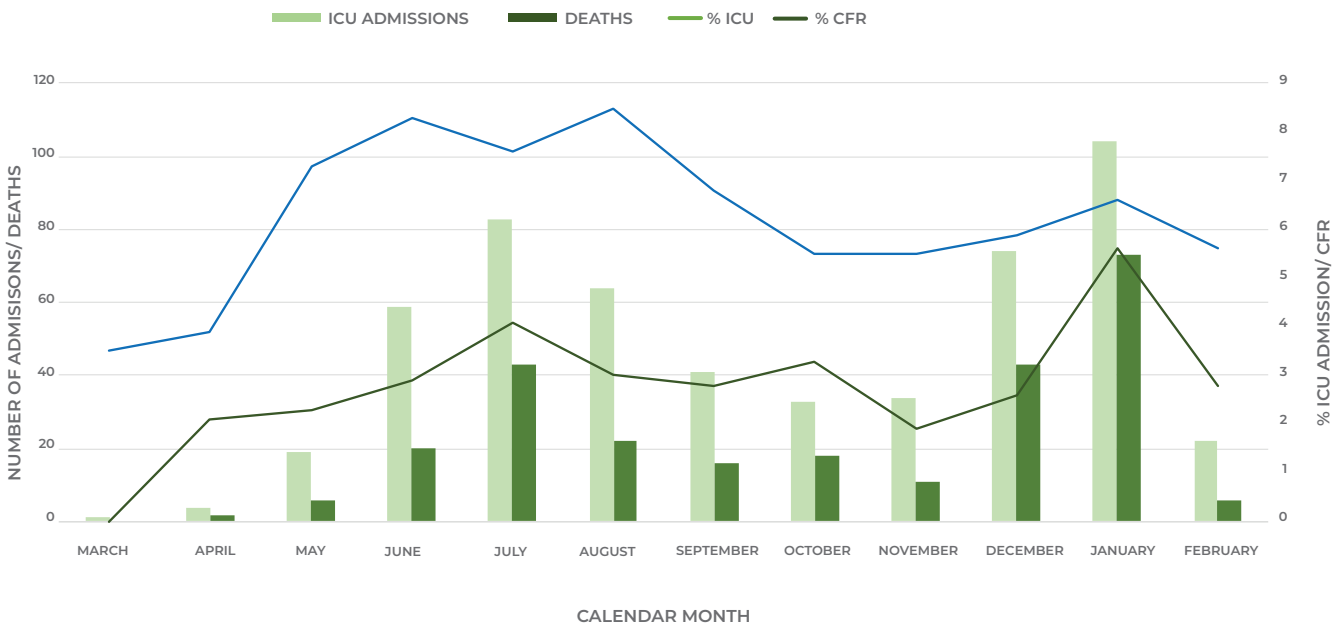

Figure 8. Case fatality ratio among individuals aged ≤19 years by epidemiological month, South Africa, DATCOV, 1 March 2020– 13 February 2021 (N=7987)*

* CFR measured among 7255 with complete follow up

Table 5. Comparison of characteristics of COVID-19 admissions aged ≤19 years between first wave and second wave in South Africa N= 5798

Characteristic	Wave 1 (N=2165)	Wave 2 (N=3633)	Univariate OR (95% CI)	Multivariate OR (95% CI)	Multivariate OR **(95% CI)
Age category, (n, %)					
<1	373 (17.2)	914 (25.2)	1.46 (1.19- 1.80)	1.46 (1.19- 1.79)	1.44 (1.16- 1.79)
1-4 years	340 (15.7)	736 (20.3)	1.29 (1.05- 1.59)	1.32 (1.07- 1.63)	1.29 (1.04- 1.61)
5-9 years	224 (10.4)	375 (10.3)	1.00	1.00	1.00
10- 14 years	381 (17.6)	455 (12.5)	0.71 (0.58- 0.88)	0.73 (0.59- 0.90)	0.74 (0.59- 0.91)
15- 19 years	847 (39.1)	1153 (31.7)	0.81 (0.67- 0.98)	0.81 (0.67- 0.98)	0.82 (0.68- 1.01)
Male, (n, %)	988 (45.7)	1701 (47.0)	1.05 (0.95- 1.18)	0.99 (0.89 - 1.10)	0.95 (0.84- 1.06)
Province, (n, %)					
Eastern Cape	272 (12.6)	438 (12.1)	1.13 (0.93- 1.38)	1.17 (0.96- 1.43)	1.25 (1.02- 1.54)
Gauteng	682 (31.5)	1041 (28.7)	1.07 (0.92- 1.26)	0.99 (0.85- 1.17)	0.85 (0.72- 1.01)
KwaZulu Natal	410 (18.9)	790 (21.8)	1.36 (1.14- 1.61)	1.29 (1.09- 1.54)	1.21 (1.01- 1.45)
Western Cape	376 (17.4)	760 (20.9)	1.42 (1.19- 1.69)	1.28 (1.07- 1.53)	1.37 (1.14- 1.65)
Rest of provinces	425 (19.6)	604 (16.6)	1.00	1.00	1.00
Admitted in public sector, (n, %)	1217 (56.2)	2151 (59.2)	1.13 (1.02- 1.26)	1.15 (1.03- 1.30)	1.01 (0.90- 1.14)
ICU admission, (n, %)	164 (7.6)	221 (6.1)	0.79 (0.64- 0.97)	0.80 (0.61- 0.94)	
One or more underlying conditions, (n, %)	281 (13.0)	448 (12.3)	0.94 (0.80- 1.11)	0.94 (0.76- 1.11)	0.89 (0.76- 1.06)
Died*, (n, %)	74 (3.4)	127 (3.5)	1.17 (0.87-1.56)	--	1.14 (0.84- 1.54)

First wave = epidemiology week 25- 34; second wave = epidemiology week 47 2020 – week 6 2021. Both defined as periods from weekly incidence of admission >8 cases/ 1 million population);* variables included only in analysis of individuals with complete follow up (N=5188). ** Model including individuals with complete follow up (N=5188).

Discussion

This report presents data on the epidemiology and clinical features of laboratory-confirmed COVID-19 among individuals aged ≤19 years using data from two surveillance systems established for monitoring the COVID-19 pandemic in South Africa. The data presented showed that individuals aged ≤19 years made up 9.2% of all laboratory-confirmed COVID-19 cases reported in South Africa and 3.8% of COVID-19 associated admissions, despite comprising almost 37% of the population. The cumulative incidence of laboratory confirmed COVID-19 cases this population was 5.7 times lower than that of individuals >19 years during the same period while incidence of admission was 14.5 times lower. The data also showed peaking 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 (9). The overall in-hospital case fatality risk was 3.6% among individuals aged ≤19 years with complete outcome data. Children who were very young <1 year, those aged 15- 19 years and those with underlying conditions were over-represented among those who died.
Similar to the trend among adults, numbers of cases and admissions in several provinces exceeded peak numbers in the first wave. The increase in cases and admissions in the second wave was observed in all age groups, particularly in the age groups with the highest overall incidence, <1 year, 1-4 years and 15-19 years. However compared with the first wave, cases in the second wave were likely to be in an older age groups (1-19 years), be male, be diagnosed in a public sector laboratory and be in the KwaZulu-Natal or Western Cape Province, possibly related to behaviour changes, schools being mostly closed in the second wave and differences in testing patterns or true differences between waves. Admissions in the second wave on the other hand were more likely to be in younger age groups (aged <5 years) and to be in Eastern Cape, KwaZulu Natal or Western Cape provinces. The differences in admissions could be as a result of health providers being more cautious or differential effect of the new variants in the youngest children.
Reassuringly, among hospitalised individuals aged ≤19 years there was no difference in the likelihood of being admitted to ICU or who dying in hospital during the first wave compared to the second wave and length of stay in hospital was shorter in the second wave. The proportion of individuals admitted to ICU and the case fatality risk increased during the peak of the first wave and again with the second wave. This increase in severity of disease and case fatality may reflect an overburdened hospital system resulting in relatively poorer outcomes as observed during the peak of the both wave.

Our data confirm what has been shown in studies of COVID-19 among children elsewhere in the world. Individuals ≤19 years particularly those aged <10 years are less likely to be infected with SARS-CoV-2 when exposed, less likely to develop severe disease following infection and much less likely to die from COVID-19 once hospitalized with severe disease. (11-14) The incidence of admission 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 precaution in this younger population. We also showed that children with underlying conditions were over-represented among those who died suggesting higher risk of mortality among children with underlying medical conditions. (14) Respiratory underlying conditions – asthma and chronic pulmonary disease – were the most common underlying conditions documented among admitted individuals aged ≤19 years but were associated with deaths in two instances. 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. Second, the national laboratory based reporting system lacks complete information on symptoms or contact history to determine source of infection. Third, information on underlying medical conditions is incomplete in the two surveillance systems. 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 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. Like in adults, the peak of the second wave passed during this current surveillance period and decreases in cases have been observed in recent weeks. There is a need to ensure high compliance with respect to non-pharmaceutical interventions within households and schools of individuals aged ≤19 years with underlying conditions.

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SOUTH AFRICA | 09 OCTOBER 2020