COVID-19 SPECIAL PUBLIC HEALTH SURVEILLANCE BULLETIN

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FOREWORD

Children and adolescents are generally less susceptible to the SARS-CoV-2 virus than other age groups, and are less likely to be hospitalized following infection. This has been demonstrated using data from the first and second COVID-19 waves in South Africa as described in this and previous reports. These data were collected using the DATCOV platform, a hospital surveillance system set up by the National Institute for Communicable Diseases to monitor the ongoing COVID-19 epidemic in South Africa. This report also highlights the need for adherence to non-pharmaceutical interventions within households and schools, especially for individuals aged ≤19 years who have underlying medical conditions.

Prof Basil Brooke, Editor

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EPIDEMIOLOGY AND CLINICAL CHARACTERISTICS OF LABORATORY-CONFIRMED COVID-19 AMONG INDIVIDUALS AGED ≤19 YEARS, SOUTH AFRICA, 1 MARCH 2020 – 2 JANUARY 2021

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Summary

- As of 2 January 2021, individuals aged ≤19 years made up 9.2% of laboratory-confirmed COVID-19 cases and 3.9% of all COVID-19-associated admissions in South Africa.
- The cumulative incidence of laboratory-confirmed COVID-19 cases aged ≤19 years was 469.9 per 100 000 population, 5.7 times lower than that in those aged >19 years (2673.4 per 100 000 population) while incidence of admission was 14.1 times lower (230.3 per 1 million vs 3702.5 per 1 million).
- The weekly incidence of laboratory-confirmed COVID-19 cases aged ≤19 years increased in all provinces from week 43-49, mirroring trends among adults aged >19 years. An increase in weekly incidence was observed in all age groups.
- There were no consistent changes in incidence trends associated with the timing of opening or closing of schools.
- Among individuals aged ≤19 years, cases in the second wave were more likely to be in an older age group, be male, be diagnosed in a public sector laboratory and be in the KwaZulu-Natal Province or Western Cape Province. This is possibly related to behaviour changes, differences in testing patterns or true differences between successive COVID-19 waves.
- There were 5743 reported COVID-19-associated admissions among individuals aged ≤19 years.

  The cumulative rate of admission was highest in individuals aged <1 year at 919.2 per 1 million population, followed by individuals aged 15-19 years at 462.0 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 394 (6.7%) individuals admitted into intensive care units (ICU) at some point during admission, and 129 (2.3%) were ventilated.
- Data on in-hospital outcome were available for 5287 (92.1%) individuals aged ≤19 years. Among these, there were 152 in-hospital deaths giving an in-hospital case fatality risk of 2.9% (152/5287). Of these deaths, 63 (41.5%) were adolescents aged 15-19 years and 49 (32.2%) were under one year of age. Among 100 (65.8%) in-hospital deaths who had available data on underlying conditions, 72 (72%) reported ≥1 such condition.

- Among hospitalised individuals aged ≤19 years, the median length of hospital stay was shorter in the second wave compared to the first wave [3 days (IQR 1- 6days) vs 5 days (IQR 2- 10 days).
- Among hospitalised individuals aged ≤19 years, the second COVID-19 wave was not independently associated with an increased likelihood of admission to a public hospital, admission to ICU, or dying in hospital.
- There were no differences in the proportion of children admitted to public hospitals, admitted to ICU, or dying in hospital during the first and second COVID-19 waves.

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 have been reported in 213 countries and territories with more than 83.3 million individuals infected and 1.8 million deaths reported to World Health Organization as of 3 January 2021.[1] The first case of COVID-19 in South Africa was reported on 5 March 2020 in KwaZulu- Natal Province.[2] On 2 January 2021, the country reported a cumulative total of 1 088 889 positive cases and 29 175 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 also 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 include the entire compulsory school-going age – considered as 7- 15 years.[5]

Since November 2020, South Africa has experienced an increase in COVID-19 cases in several provinces.[2] Associated with these increases in case numbers is a new lineage of SARS-CoV-2 that was detected and found to be predominant in the Eastern Cape, Western Cape and KwaZulu-Natal provinces. 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 will help to determine how long this lineage has been circulating and in which geographic areas.

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

Methods

Data collection procedures

Data extraction for the report was done on 7 January 2021. Data on laboratory results from public and private laboratories submitted to the National Institute for Communicable Diseases (NICD) were extracted from the line list. Limited demographic and epidemiological data as collected at the time of specimen collection were available for analysis. Data on children and adults admitted to hospitals were collected using the DATCOV platform – an online data collection system.[7] Healthcare 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 2 January 2021, there were 625 hospitals submitting admissions data into DATCOV. This included 250 private hospitals and 375 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 a hospital 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 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 and second COVID-19 waves, first between ≤19 years vs >19 years and then among different age groups aged ≤19 years. Univariate and multivariable logistic regression were used to determine factors independently associated with the first wave compared to the second wave. For the analysis of new cases, the first wave was determined as the period from incidence of 8 cases per 100 000 population to peak incidence (epidemiologic week 25- 28, corresponding to 14 June – 11 July 2021) and second wave period from incidence of 8 cases per 100 000 to the end of the reporting period (epidemiologic week 47- 53, corresponding to 15 November 2020 – 2 January 2021).

For the analysis of admissions, the first COVID-19 wave was determined as the period from an admission rate of 8 admissions per 1 million population to peak admission rate (epidemiologic weeks 25-29, corresponding to 14 June – 18 July 2020) and second wave period from admission rate of 8 cases per 1million population to end of this reporting period (epidemiology week 49- 53, corresponding to 5 December 2020 – 2 January 2021).

Results

Incidence of COVID-19 among individuals aged ≤19 years

At data extraction, there were 1 121 805 laboratory-confirmed cases of COVID-19 with date of specimen collection on or before 2 January 2021 captured on the national line list. Of these, 8 798 (0.8%) were missing age information. Of the 1 113 007 with known age, 102 554 (9.2%) were aged ≤19 years. This represents a 44.3% increase in the number of new cases aged ≤19 years from 71 074 in the previous reporting period (ending 21 November 2020). These increases were mainly driven by increases of 74.1%, 71.6% and 45.1% in KwaZulu-Natal, Western Cape and Eastern Cape provinces, with the other provinces having below national average increases. The median age of individuals aged ≤19 years was 14.0 years (interquartile range [IQR] 9.0 – 17.0 years) with 3359 (3.3%) aged <1 year and 46 735 (45.6%) aged ≥15 years. There were 45 367 (44.2%) males and 2 117 (2.1%) cases were missing information on gender.

The majority of cases (88 957/102 554 (86.6%) were in five provinces – Eastern Cape (19.3%), Free State (7.4%), Gauteng (23.4%), KwaZulu-Natal (23.6%) and Western Cape (13.1%). The cumulative incidence of laboratory-confirmed COVID-19 among individuals aged ≤19 years was 5.7 times lower compared to individuals aged >19 years – 469.9 per 100 000 population vs. 2673.4 per 100 000 population. The cumulative incidence among individuals aged ≤19 years ranged from 114.0 per 100 000 in Limpopo province to 713.8 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 increasing to 39.8 in week 53. All provinces showed increasing weekly incidences, except Eastern Cape Province which had experienced increases in earlier reporting periods but where weekly incidence has been declining since week 50 (Figure 1).

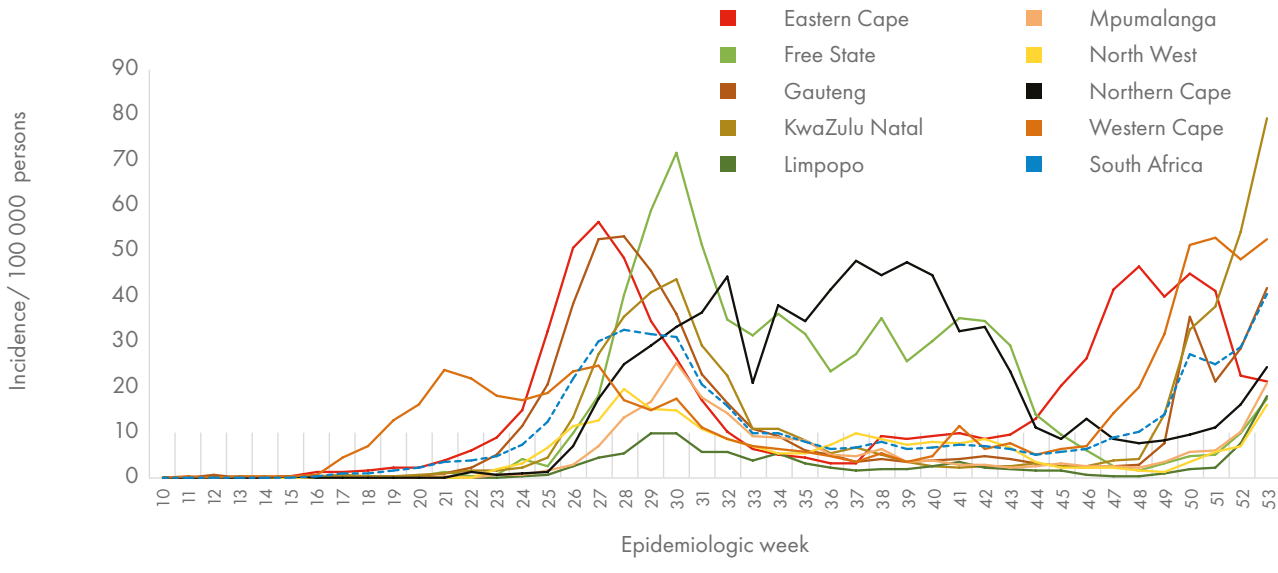

Figure 1. Weekly incidence per 100 000 population of laboratory-confirmed COVID-19 among individuals aged ≤19 years by epidemiologic week and province, South Africa, 1 March 2020- 2 January 2021 (N=102 554).

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 by province, South Africa, 1 March 2020-2 January 2021.

Province	Total 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 1million population[12]
Eastern Cape	6734001 (11.3)	2818181 (12.9)	41.9	173016 (15.5)	19807 (19.3)	11.4	3912.6	702.8	23852 (16.4)	787 (13.7)	3.3	279.3
Free State	2928903 (4.9)	1082712 (5.0)	37.0	63675 (5.7)	7556 (7.4)	11.9	3039.7	697.9	8430 (5.8)	306 (5.3)	3.6	27.8
Gauteng	15488137 (26.0)	4710102 (21.6)	30.4	297646 (26.7)	23981 (23.4)	8.1	2539.1	509.1	37460 (25.7)	1409 (24.5)	3.8	298.7
KwaZulu Natal	11531628 (19.3)	4709686 (21.6)	40.8	221642 (19.9)	24224 (23.6)	10.9	2893.9	514.3	25667 (17.6)	1052 (18.3)	4.1	222.9
Limpopo	5852553 (9.8)	2510790 (11.5)	42.9	29557 (2.7)	2797 (2.7)	9.5	800.8	111.4	3004 (2.1)	120 (2.1)	4.0	17.1
Mpumalanga	4679786 (7.8)	1773075 (8.1)	37.9	38901 (3.5)	3831 (3.7)	9.8	1206.5	216.1	3459 (2.4)	143 (2.5)	4.1	75.6
North West	4108816 (6.9)	1528001 (7.0)	37.2	41408 (3.7)	3521 (3.4)	8.5	1468.0	230.4	7522 (5.2)	554 (10.0)	7.4	359.3
Northern Cape	1292786 (2.2)	481364 (2.2)	37.2	25801 (2.3)	3436 (3.4)	13.3	2756.3	713.8	2491 (1.7)	106 (1.9)	4.3	209.8
Western Cape	7005741 (11.8)	2211623 (10.1)	31.6	221361 (19.9)	13401 (13.1)	6.1	4337.8	605.9	33792 (23.2)	1266 (22.0)	3.8	527.4
All provinces	59622350 (100)	21825534 (100)	36.6	1113007 (100)	102554 (100)	9.2	2673.4	469.9	145667 (100)	5743 (100)	3.9	263.1

1. Provincial populations according to Statistics South Africa 2020 mid-year population estimates. The denominator for percentage is total population of South Africa;

2. 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. Percentage of population aged ≤19 years. Denominator is total provincial population[1] and numerator is provincial population aged ≤19 years[2];

4. Total number of COVID-19 cases reported in South Africa during the reporting period by province. The denominator is total number of cases in the country;

5. Total number of COVID-19 cases among individuals ≤19 years reported in South Africa during the reporting period by province. The denominator is total number of cases among individuals aged ≤19 years.

6. Percentage of provincial COVID-19 cases aged ≤19 years. The denominator is provincial total number of COVID-19 cases.[4]

7. 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. 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. Total number COVID-19 associated admissions reported through the DATCOV platform in all age groups by province. The denominator is the total number of admissions at national level.

10. Total number COVID-19 associated admissions among individuals aged ≤19 years reported through the DATCOV platform by province. The denominator is the total number of admissions among individuals aged ≤19 years at national level.

11. Percentage of provincial COVID-19 - associated admissions aged ≤19 years. The denominator is the provincial total number of COVID-19 associated admissions.[9]

12. 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]

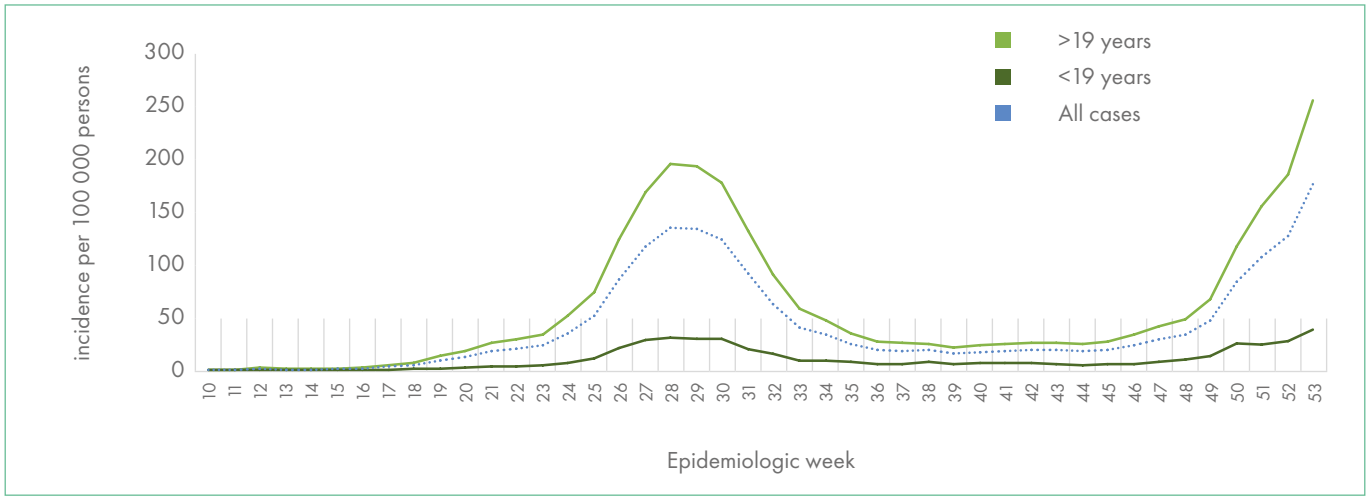

Figure 2a. Weekly incidence per 100 000 population of laboratory-confirmed COVID-19 in individuals aged ≤19 years compared to individuals aged >19 years, South Africa, 1 March 2020 – 2 January 2021 (N=1 113 007).

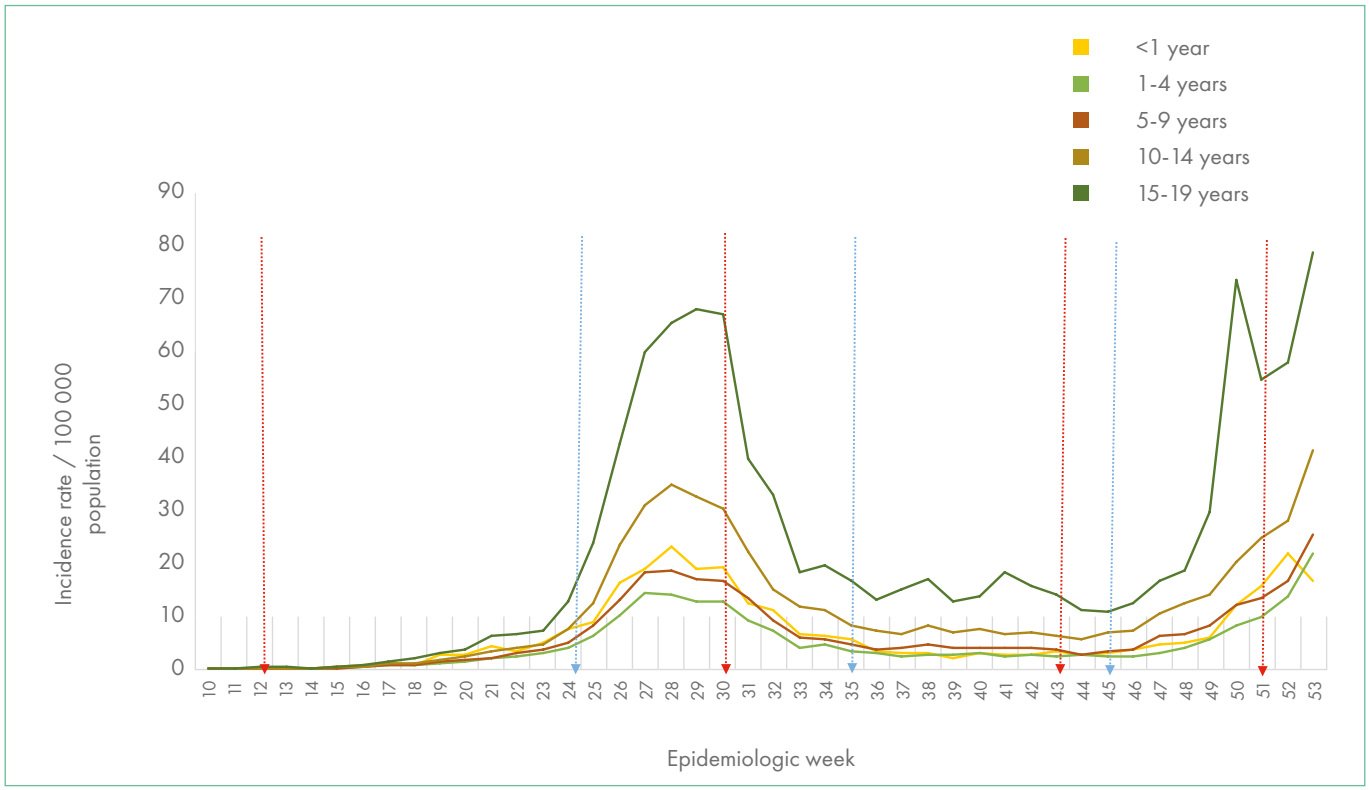

Figure 2b. Weekly incidence per 100 000 population of laboratory-confirmed COVID-19 in individuals aged ≤19 years by age group, South Africa, 1 March 2020 – 2 January 2021 (N=102 554). The red arrows indicate schools closing and blue arrows indicate schools opening.[8]

The overall weekly incidence trend for individuals aged ≤19 years was similar in shape to that of individuals aged >19 years although the magnitude of the peaks in weekly incidence was much lower (Figure 2a). 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.

The cumulative incidence generally increased with age among individuals aged >1 year from 208.3 per 100 000 among individuals aged 1-4 years to 978.8 per 100 000 among those aged 15-19 years. The overall cumulative incidence was higher among females than males (510.1 per 100 000 vs 411.3 per 100 000). Cumulative incidence was higher among males in the <1 year age group and higher in females in age categories 5-9 years, 10- 14 years and 15- 19 years (Figure 3). An increase in weekly incidence was noted in the 15-19 year age group in week 50, reducing in week 51, and was related to a documented cluster of cases following the matric 'Rage' (school-leavers group celebration) events.[9] Weekly incidence in week 53 exceeded peak weekly incidence in the first COVID-19 wave in all age groups except among <1 year olds, similar to that observed in individuals aged >19 years.[10] While there were some fluctuations in weekly case numbers, there were no consistent changes in incidence trends related to the timing of opening or closing of schools (Figure 2b).

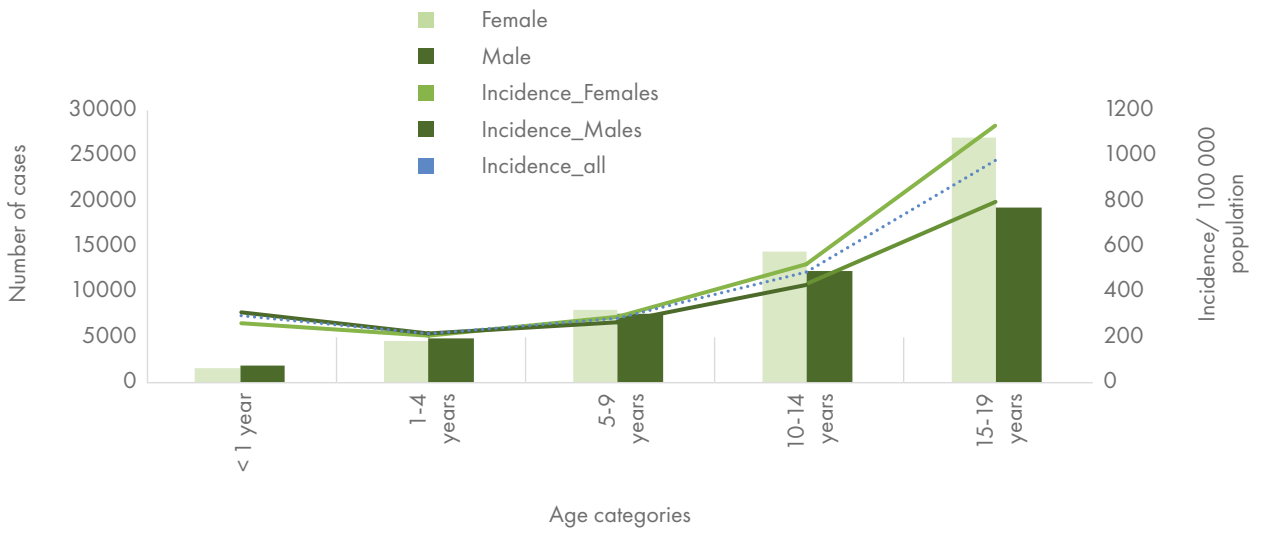

Figure 3. Cumulative incidence per 100 000 population of laboratory-confirmed COVID-19 among individuals aged ≤19 years by age group and birth gender, South Africa, 1 March 2020- 2 January 2021, (N= 102 554).

Among individuals of all ages with laboratory-confirmed COVID-19, the proportion of individuals aged ≤19 years was slightly higher in the first COVID-19 wave compared to the second wave [8.9% vs 9.1%, adjusted odds ratio (aOR) 1.02 (95% confidence interval [CI] 1.00- 1.04) in a model adjusting for age, 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 Province or Western Cape Province (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=54 052.

Characteristic	Wave 1 (N=20922)	Wave 2 (N=33130)	Univariable OR (95% CI)	Multivariable OR (95% CI)
Age group (years)				
<1	782 (3.7)	951 (2.9)	1.00	1.00
1-4	2046 (9.8)	3006 (9.1)	1.21 (1.08- 1.35)	1.28 (1.14- 1.43)
5-9	3296 (15.8)	5034 (15.2)	1.26 (1.13- 1.39)	1.36 (1.22- 1.51)
10- 14	5671 (27.1)	8409 (25.4)	1.22 (1.10- 1.35)	1.30 (1.17- 1.44)
15- 19	9127 (43.6)	15 730 (47.5)	1.42 (1.28- 1.56)	1.56 (1.41- 1.73)
Sex, (n, %)	9173(43.8)	15015 (45.3)		
Female	11351 (54.2)	17298 (52.2)	1.00	1.00
Male	9173 (43.8)	15015 (45.3)	1.07 (1.04- 1.11)	1.12 (1.08- 1.16)
Unknown	938 (1.9)	817 (2.5)	1.35 (1.19- 1.52)	1.21 (1.07- 1.38)
Province, (n, %)				
Eastern Cape	5200 (24.9)	7151 (21.6)	1.10 (1.03- 1.17)	1.03 (0.97- 1.10)
Gauteng	7636 (36.5)	6482 (19.6)	0.68 (0.64- 0.72)	0.71 (0.66- 0.75)
KwaZulu Natal	3745 (17.9)	10457 (31.6)	2.23 (2.09- 2.38)	2.21 (2.07- 2.36)
Western Cape	1825 (8.7)	5893 (17.8)	2.58 (2.40- 2.78)	2.57 (2.38- 2.77)
Other provinces	2516 (12.0)	3159 (9.5)	1.00	1.00
Tested at public laboratory	8997 (43.0)	17040 (51.4)	1.40 (1.36- 1.45)	1.25 (1.20- 1.30)

First wave = epidemiologic weeks 25- 28; second wave = epidemiologic weeks 47- 53. Both defined as periods from weekly incidence >8 cases/ 100 000 population to peak incidence (first wave) or week 53 (second wave).

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

As of 2 January 2021, data on 147 293 COVID-19-associated admissions had been captured on DATCOV. Of these admissions, 1 616 (1.1%) were missing age information. Among the remainder of admissions with available age information (N= 145 677), 5 743 (3.9%) were among individuals aged ≤19 years. The proportion of all COVID-19-associated admissions that were individuals aged ≤19 years varied across provinces from 3.3% in Eastern Cape Province to 7.4% in North West Province, possibly reflecting variation in clinical practice or the effect of clusters of cases (Table 1). There was a 42.1% increase in the number of admissions from the previous reporting period ending 21 November 2020 (4042 cases were reported up to 21 November 2020). This increase was driven by increases in all provinces ranging from 12.8% in North West Province, 14.6% in Free State Province, 27.7% in Northern Cape and Mpumalanga provinces, 39.5% in Limpopo Province, 48.0% in Gauteng Province, 48.1% in Western Cape Province, 51.9% in Eastern Cape Province and 55.2% in KwaZulu-Natal Province. The majority of the admissions were in five provinces: Gauteng (25.5%), Western Cape (22.0%), KwaZulu Natal (18.3%), Eastern Cape (13.7%) and North West (9.7%), together accounting for 88.3% of all admissions (N=5068) (Figure 4a). The cumulative admission rate by province ranged from 17.1 per 1 million population to 572.4 per 1 million population with an overall rate of 263.1 per 1 million. This overall admission rate among individuals ≤19 years was however 14.1 times lower than that among individuals >19 years (263.1 per 1 million population vs 3702.5 per 1 million population). In most provinces, the number of admissions peaked during weeks 25- 31 (Figure 4a), declined and started increasing again from week 43. The admission rate on the other hand peaked at 12.1 per million in week 29, declining to 4.1 per 1 million in week 42 before increasing to 12.6 per million in week 50 (Figure 4b).

The number of admissions was highest in individuals aged 15-19 years - 2206 (38.4%), <1 year - 1072 (18.7%), 1- 4 years - 992 (17.3%), 10 - 14 years – 877 (15.3%) and lowest among individuals aged 5-9 years – 596 (10.4 %) (Table 3). The 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 COVID-19 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] The sharp increase in admissions in the age group 15-19 years in week 50 is possibly related to the matric Rage event.[9] It is unclear what proportion of these admissions were for medical indications as these data were not available, nor were data on possible exposure sources for individual cases. Throughout the epidemic period, weekly admission rates were highest among individuals aged <1 year (Figure 5b). The rate of admission in infants aged <1 year has increased markedly in recent weeks. The reason for this is unclear but could reflect increased testing, increasing transmission in women of childbearing age, or other factors. Data are not available on what proportion of these admissions are for medical indications as compared to precautionary reasons.

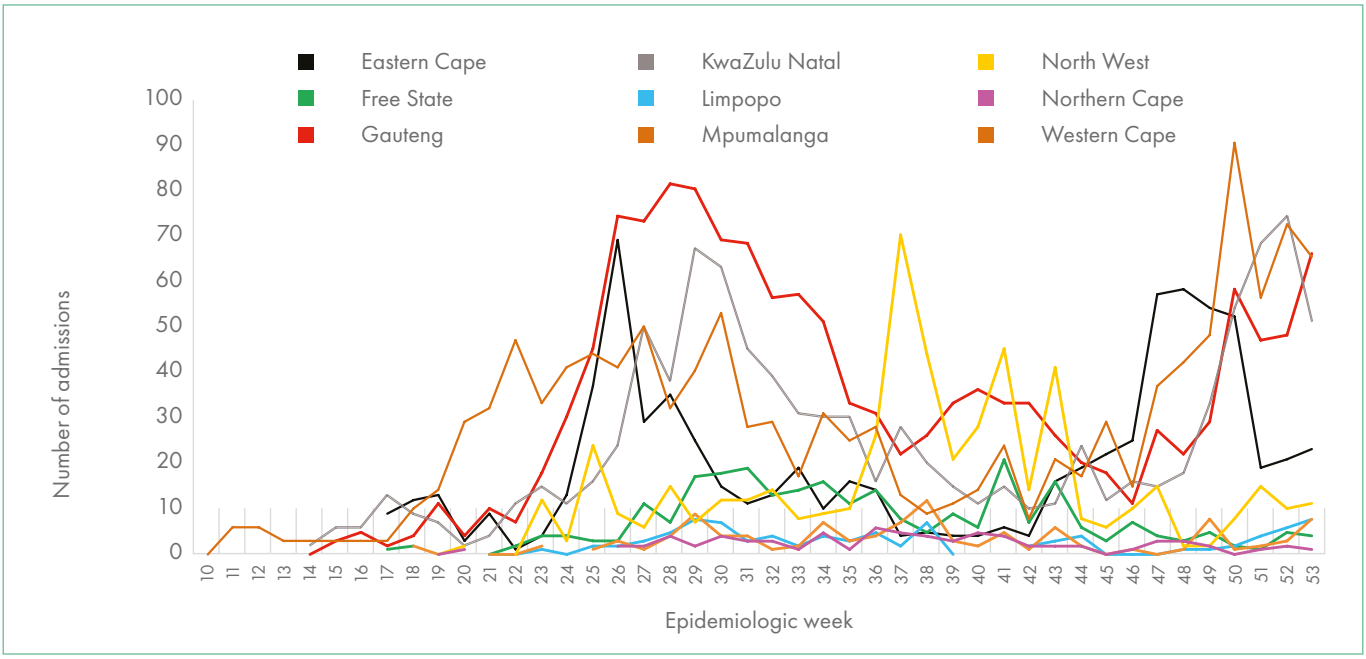

Figure 4a. Numbers of COVID-19-associated admissions aged ≤19 years by epidemiologic week and province, South Africa, DATCOV, 1 March 2020 – 2 January 2021 (N=5743).

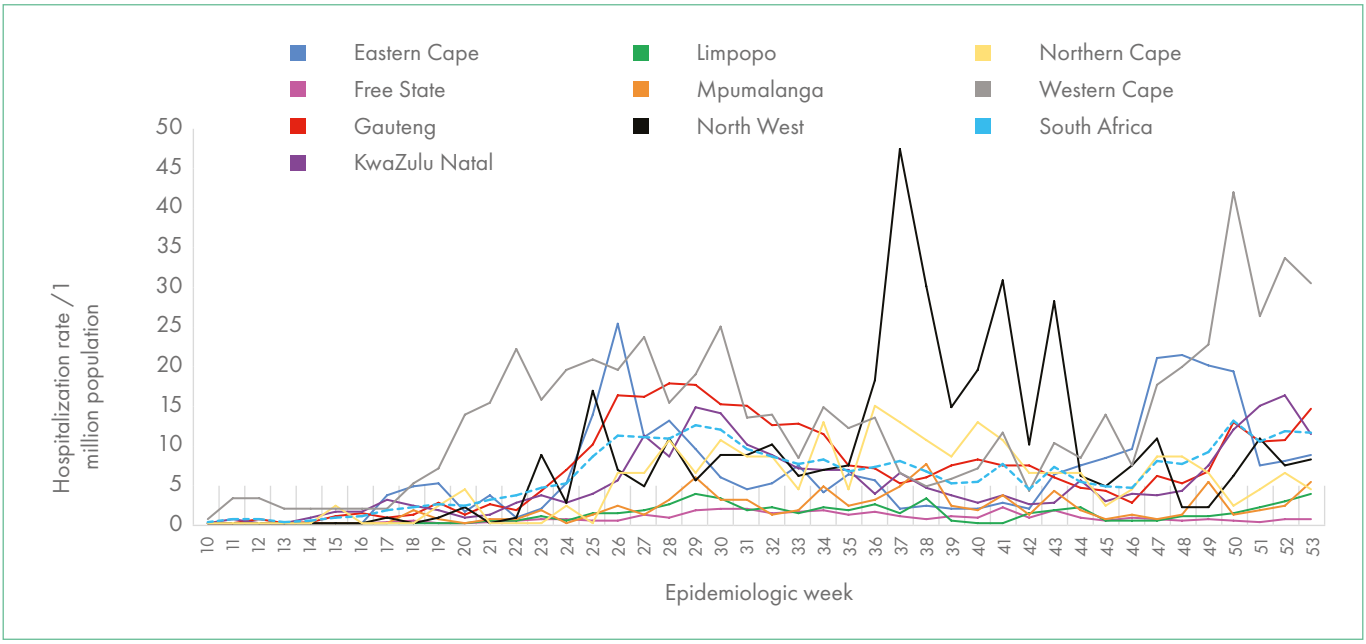

Figure 4b. Rate of COVID-19-associated admission per million population among individuals aged ≤19 years by epidemiologic week and province, South Africa, DATCOV, 1 March 2020 – 2 January 2021 (N=5743).

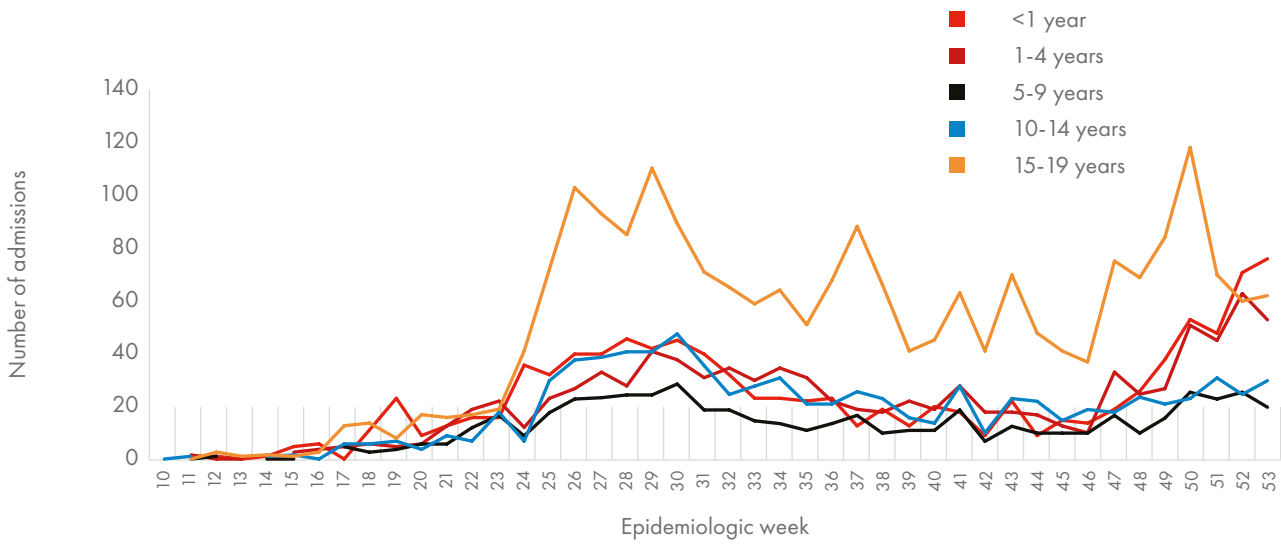

Figure 5a. Number of COVID-19-associated admissions among individuals aged ≤19 years at by epidemiologic week and age group, South Africa, DATCOV, 1 March 2020 – 2 January 2021 (N=5743).

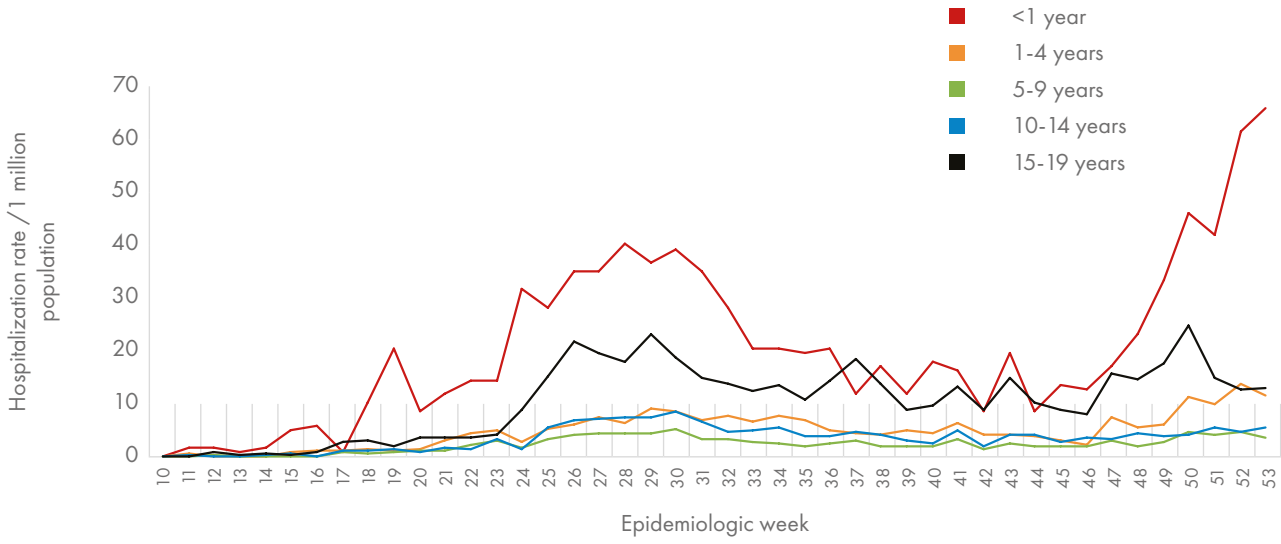

Figure 5b. Rate of COVID-19-associated admissions per 1 million population among individuals aged ≤19 years by epidemiologic week and age group, South Africa, DATCOV, 1 March 2020 – 2 January 2021 (N=5743).

Of the 5743 admitted individuals included in the analysis, the median age was 11.5 years (IQR 1.8 -17.3 years) and 2664 (46.5%) were male. Figure 6 shows the distribution of the admissions by age and sex. The majority of individuals aged ≤19 years were admitted at hospitals in the public sector (3392, 59.1%). 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, 3654 (63.4%) had data on underlying conditions available. Of these, 794 (22.7%) 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).

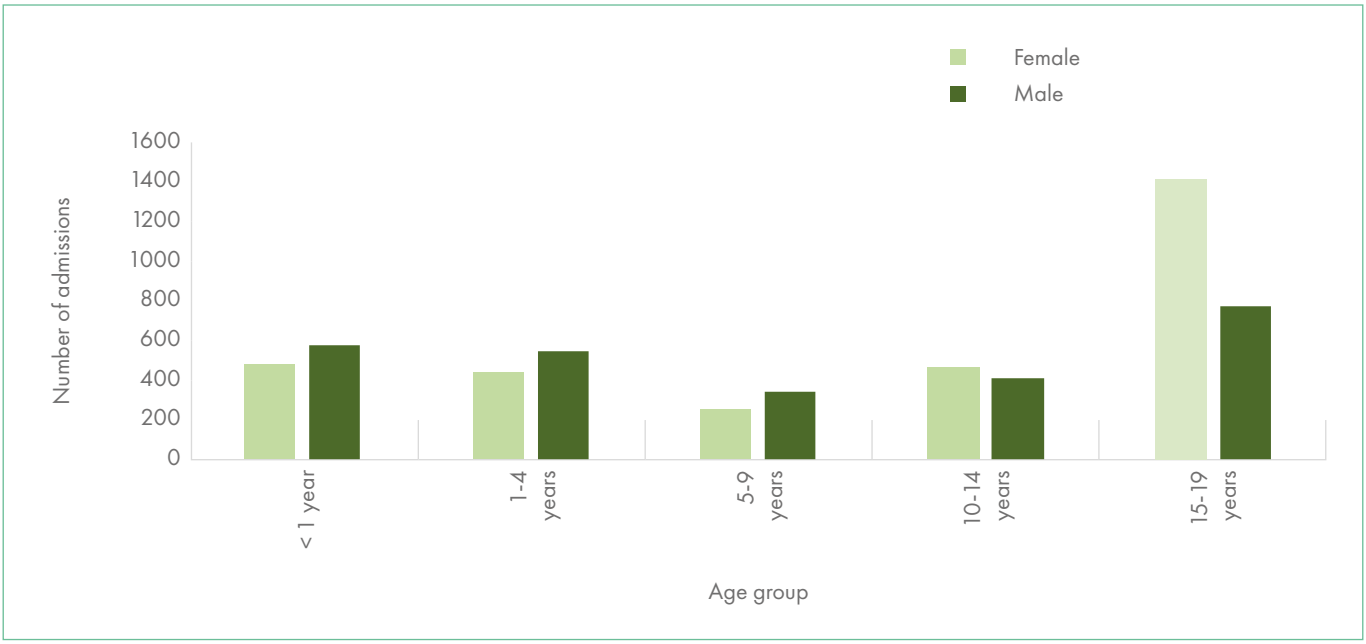

Figure 6. Numbers of COVID-19-associated admissions aged ≤19 years by age group and sex, South Africa, DATCOV, 1 March 2020 – 2 January 2021 (N=5743).

Table 3. Characteristics of COVID-19-associated admissions aged ≤19 years, South Africa, DATCOV, 1 March 2020- 2 January 2021 (N=5743).

Variable	<1 year (n=1072) (18.7%)	1-4 years (n=992) (17.3%)	5-9 years (n=596) (10.4%)	10-14 years (n=877) (15.3%)	15-19 years (n=2206) (38.4%)	Overall (n=5743) (100%)
Age (median, IQR)	2.9 mons. (0.9- 6.7mons)	2.2 yrs. (1.5- 3.2yrs)	7.6 yrs. (6.2- 8.7yrs)	12.9 yrs. (11.5- 14.0yrs)	18.0 yrs. (16.7- 19.0yrs)	11.5 yrs. (1.8-17.3 yrs.)
Male (n, %)	582 (54.6)	549 (55.3)	342 (57.4)	411 (46.9)	780 (35.4)	2664 (46.5)
Admitted at a public hospital, (n, %)	661(61.7)	434 (43.8)	311 (52.2)	533 (60.8)	1453 (65.9)	3392 (59.1)
Data on underlying conditions available, (n, %)	559 (52.2)	631 (63.6)	378 (63.4)	565 (64.4)	1525 (69.1)	3658 (63.7)
Has ≥1 underlying conditions, (n/N, %)*	130/559 (23.2)	121/631 (19.2)	100/378 (26.5)	126/565 (22.3)	317/1525 (20.8)	794/3658 (21.7)
Length of stay (median, IQR)**	4 (2-8)	3 (1-5)	3 (1-8)	5 (2-9)	5 (2-8)	4 (2-8)
ICU admission	114 (10.6)	47 (4.7)	53 (8.9)	64 (7.3)	116 (5.3)	394 (6.9)
Ventilation	47 (4.4	13 (1.3)	17 (2.9)	18 (2.1)	34 (1.5)	129 (2.3)
Died	50 (4.7)	10 (1.0)	13 (2.2)	17 (1.9)	63 (2.9)	153 (2.7)
Discharged alive	894 (83.4)	896 (90.3)	551 (92.5)	798 (91.0)	1995 (90.5)	5134 (89.4)
Transferred to another hospital	30 (3.0)	13 (1.3)	9 (1.5)	23 (2.6)	64 (2.9)	139 (2.4)
Still admitted	98 (9.1)	73 (7.4)	23 (3.9)	39 (4.5)	84 (3.8)	317 (5.5)

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

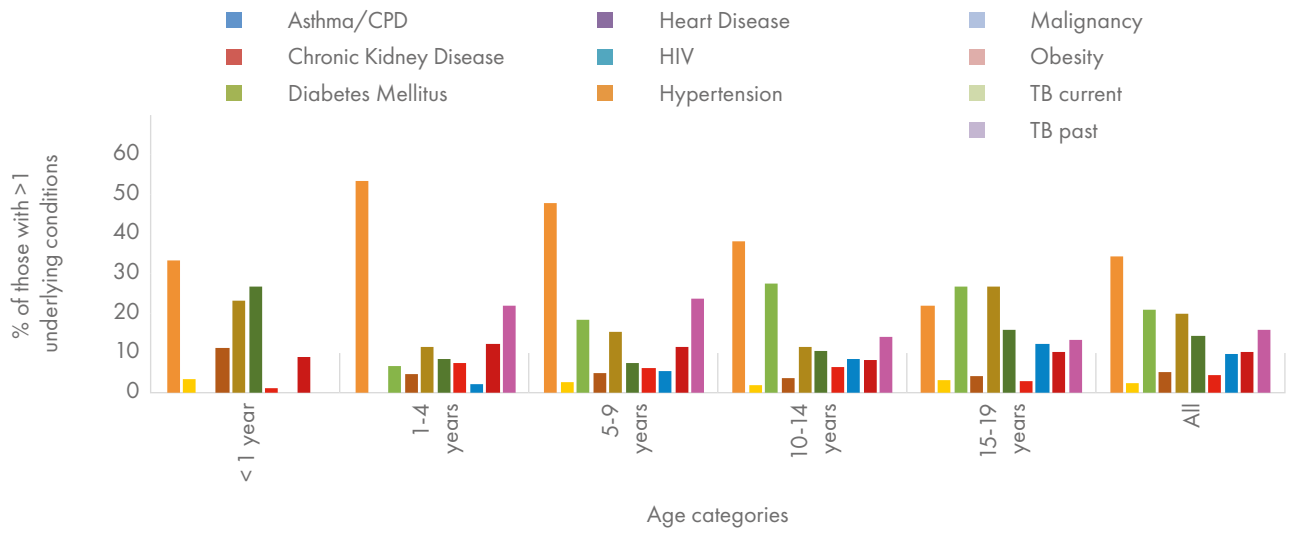

Figure 7. Distribution of underlying conditions among COVID-19-associated admissions aged ≤19 years with ≥1 underlying condition, South Africa, DATCOV, 1 March 2020 – 2 January 2021 (N=794)*.

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

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

Of the 5743 COVID-19-associated admissions among individuals aged ≤19 years, 394 (6.7%) were admitted into ICU and 129 (2.3%) were ventilated at some point during admission. At analysis, 5134 (89.4%) had been discharged, 317 (5.5%) were still admitted, 139 (2.4%) had been transferred to other facilities and 153 (2.7%) had died during admission, including one death confirmed as unrelated to COVID-19. Among individuals with outcome data available, the in-hospital case fatality risk (CFR) was 2.9% (152/5287). The overall median length of hospital stay was 4 days (IQR 2- 8 days), and was 4 days (IQR 1- 10 days) for those who died. Of the 152 COVID-19-associated in-hospital deaths, 100 (65.8%) individuals had data on underlying conditions available. Of these 72 (72%) 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 152 individuals who died in hospital. Males, aged <1 year and those aged 15-19 years were overrepresented among those who died compared to those who did not die, as were those with one or more underlying conditions. Males made up 51% of in-hospital deaths vs 46.5% of all admissions; individuals <1 year made up 32.2% of deaths vs 18.7% of admissions, while individuals 15- 19 years made up 41.5% of deaths vs 38.4% of admissions (Tables 3 & 4). 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 COVID-19 waves, 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 similar in the first wave compared to the second wave [3.3% vs 3.1%, aOR 0.98 (95% 0.90- 1.06) in a model adjusting for age, sex, province and admission at a public hospital (model not shown)]. Among hospitalised individuals aged ≤19 years, cases in the second wave were less likely to be aged 10-14 and 15-19 years and more likely to be from KwaZulu-Natal or Western Cape provinces (Table 5). The median length of hospital stay was shorter in the second wave compared to the first wave [3 days (IQR 1- 6days) vs 5 days (IQR 2- 10days)]. The second wave was not independently associated with an increased likelihood of admission to a public hospital, 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- 2 January 2021 (N=152).

Characteristic	**n (%)**
Age (median, IQR*),	11.3 years (0.4– 17.8 years)
Age group, n (%)	
< 1 year	49 (32.2)
1 - 4 years	10 (6.6)
5- 9 years	13 (8.6)
10- 14 years	17 (11.2)
≥15 years	63 (41.5)
Male, n (%)	77 (51.0)
Province, n (%)	
Eastern Cape	34 (22.4)
Free State	11 (7.2)
Gauteng	42 (22.6)
KwaZulu-Natal	22 (14.5)
Limpopo	4 (2.6)
Mpumalanga	6 (4.0)
North West	4 (2.6)
Northern Cape	0 (0.0)
Western Cape	29 (10.1)
Intensive care unit admission, n (%)	53 (34.9)
Data on underlying conditions available, n (%)	100 (65.8)
Had one or more underlying conditions**, n (%)	
Yes	72/100 (72.0)
Specific underlying conditions, n (%)	
Asthma/ chronic pulmonary disease	3 (4.7)
Chronic kidney disease	5 (7.8)
Diabetes mellitus	12 (18.8)
HIV	14 (21.9)
Heart disease	8 (12.5)
Hypertension	8 (12.5)
Malignancy	8 (12.5)
Obesity	4 (6.3)
Tuberculosis past	7 (10.9)
Tuberculosis current	9 (14.1)
Other	
(acute appendicitis, anaemia, biliary atresia, cerebral palsy, epilepsy, hypokalaemia, hypocalcaemia, Prader Willi syndrome, pneumonia, prematurity, ileus, HIV-exposure, substance abuse)	33 (51.6)

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

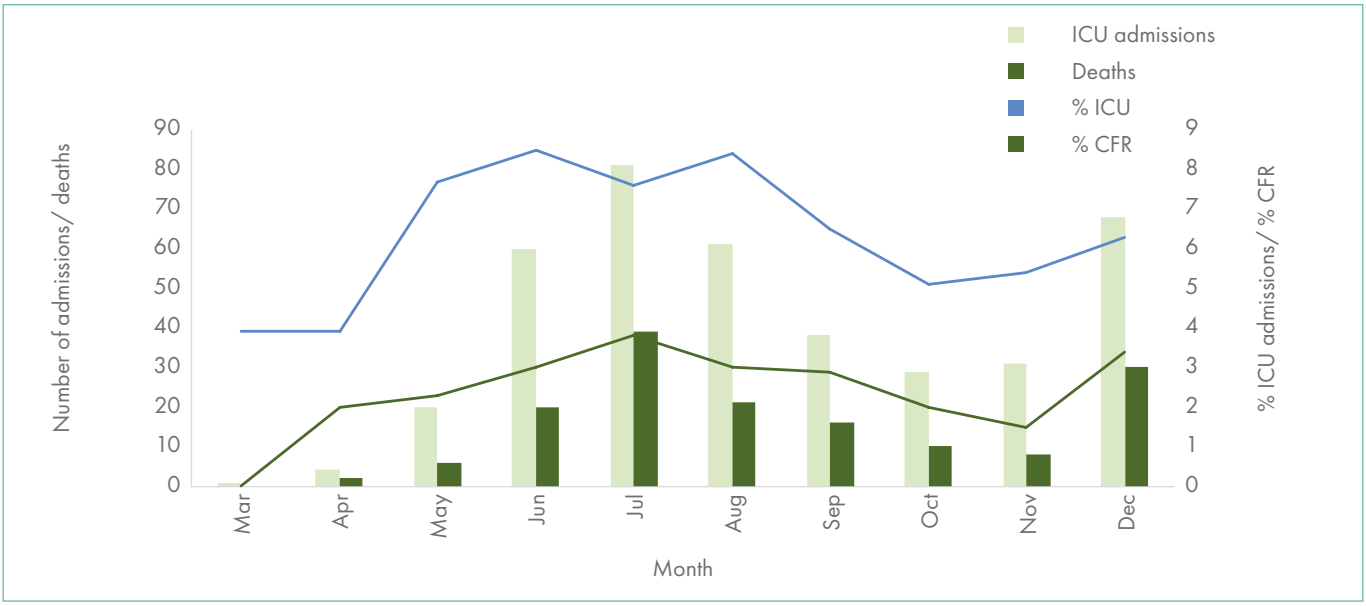

Figure 8. Case fatality ratio (CFR) among individuals aged ≤19 years by epidemiological month, South Africa, DATCOV, 1 March 2020– 2 January 2021 (N=5743)*. CFR measured among 5287 with complete follow-up.

Table 5. Comparison of characteristics of COVID-19 admissions aged ≤19 years between the first and second wave, South Africa, N= 2329.

Characteristic	Wave 1 (N=1144)	Wave 2 (N=1185)	Univariate OR (95% CI)	Multivariate OR (95% CI)	Multivariate OR **(95% CI)
Age category, (n, %)					
<1	205 (17.9)	291 (24.6)	1.00	1.00	1.00
1-4 years	157 (13.7)	244 (20.6)	1.09 (0.84- 1.43)	1.07 (0.81- 1.41)	1.15 (0.84- 1.56)
5-9 years	120 (10.5)	116 (9.8)	0.68 (0.50- 0.93)	0.68 (0.50- 0.94)	0.78 (0.55- 1.10)
10- 14 years	194 (17.0)	135 (11.4)	0.49 (0.37- 0.65)	0.52 (0.39- 0.70)	0.58 (0.42- 0.80)
15- 19 years	468 (40.9)	399 (33.7)	0.60 (0.48- 0.75)	0.64 (0.51- 0.81)	0.74 (0.57- 0.96)
Male, (n, %)	513 (44.8)	564 (47.8)	1.13 (0.96- 1.33)	1.06 (0.90- 1.26)	1.10 (0.91- 1.33)
Province, (n, %)					
Eastern Cape	200 (17.5)	174 (14.7)	1.10 (0.82- 1.50)	1.14 (0.84- 1.56)	1.20 (0.86- 1.68)
Gauteng	358 (31.3)	253 (21.4)	0.90 (0.68- 1.18)	0.84 (0.63- 1.11)	0.77 (0.58- 1.04)
KwaZulu Natal	200 (17.5)	285 (24.1)	1.81 (1.36- 2.41)	1.68 (1.26- 2.26)	1.47 (1.07- 2.01)
Western Cape	212 (18.5)	336 (28.4)	2.01 (1.52- 2.57)	1.86 (1.39- 2.50)	1.79 (1.31- 2.45)
Rest of provinces	108 (9.4)	86 (7.3)	1.00	1.00	1.00
Admitted in public sector, (n, %)	652 (57.0)	666 (56.2)	0.97 (0.82- 1.14)	0.95 (0.80- 1.22)	0.87 (0.71- 1.06)
ICU admission, (n, %)	77 (6.7)	69 (5.8)	0.86 (0.61- 1.20)	0.86 (0.61- 1.22)	0.70 (0.45- 1.09)
One or more underlying conditions, (n, %)	147 (12.9)	153 (12.9)	1.00 (0.79- 1.28)	0.93 (0.72- 1.20)	0.82 (0.62- 1.10)
Died*, (n, %)	29 (2.5)	30 (2.5)	1.21 (0.72- 2.03)	--	1.49 (0.83- 2.66)
Length of stay (in days)* (median, IQR)	5 (2- 10)	3 (1-6)	0.93 (0.91- 0.95)	--	0.95 (0.93- 0.96)

First wave = epidemiologic week 25- 29; second wave = epidemiologic week 49- 53. Both defined as periods from weekly incidence of admission >8 cases/ 1 million population to peak incidence (first wave) or week 53 (second wave);* variables included only in analysis of individuals with complete follow-up (N=2048). ** Model including individuals with complete follow-up (N=2048).

Discussion

Individuals aged ≤19 years made up 9.2% of all laboratory-confirmed COVID-19 cases reported in South Africa and 3.9% 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 5.7 times lower than that of individuals >19 years (2673.4 per 100,000) during the same period, while incidence of admission was 14.1 times lower. The data also showed recent increasing trends in new laboratory-confirmed COVID-19 cases and COVID-19-associated admissions among individuals ≤19 years in all provinces, but particularly in Eastern Cape, Western Cape, KwaZulu Natal and Gauteng provinces, reflecting national trends among older individuals.[9]

The overall in-hospital case fatality risk was 2.9% among individuals aged ≤19 years with complete outcome data, and in-hospital death was more likely among individuals with underlying medical conditions. Similar to the trend among adults, numbers of cases and admissions in several provinces exceeded peak numbers in the first wave although the magnitude of the increases were much lower than in adults. 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, namely <1 year, 1-4 years and 15-19 years. While there were some fluctuations in weekly case numbers, there were no consistent changes in incidence related to the timing of opening or closing of schools.

These 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 clinicians being more likely to admit as precaution in this younger population. We also confirmed the 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 not specifically associated with any COVID-19 deaths. 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 on whom data on underlying conditions was available.

The trend in incidence of laboratory-confirmed COVID-19 and admission did not vary consistently with the opening and closing of schools. Internationally, school closures have had a mixed impact on COVID-19 epidemics but have been associated with adverse social and learning outcomes in children.[15] Given these adverse outcomes, school closures have been recommended only as a last resort. Countries have been encouraged to consider interventions such as hybrid school attendance with remote learning and teaching for at-risk learners and teachers, physical distancing in schools and reduced interaction, mask-wearing and respiratory hygiene.[16]

Among laboratory-confirmed COVID-19 cases of all ages, cases in the second wave were slightly (approximately 2%) more likely to be aged ≤19 years, while those admitted to hospital were no more likely to be aged ≤19 years in second wave than in the first. Among individuals aged ≤19 years with laboratory-confirmed COVID-19, 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 KwaZulu-Natal Province or Western Cape Province, possibly related to behaviour changes, different testing patterns or true differences between COVID-19 waves.

Reassuringly, among hospitalised individuals aged ≤19 years, there was no difference in the likelihood of being admitted to ICU or 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 first wave.

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 is the case with individuals who were not tested. Testing approaches in South Africa have changed as the epidemic has progressed, potentially biasing characteristics of detected cases. Secondly, the national laboratory-based reporting system lacks complete information on symptoms or contact history to determine source of infection. Thirdly, 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 for COVID-19 disease, for isolation purposes, or for other diseases.

In conclusion, children and adolescents remain substantially less likely to be diagnosed or hospitalised with COVID-19 compared to adults. While increases in cases have been observed in recent weeks, these follow national trends and trends in older age groups. There is a need to ensure high compliance with respect to non-pharmaceutical interventions within households and schools, especially for individuals aged ≤19 years with underlying conditions.

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