

Age-related differences in SARS-CoV-2 testing in the Northern Region of New Zealand

Aakash V Chhibber, Sharmini Muttaiyah, Gary McAuliffe, Shivani Fox-Lewis, Mary De Almeida, Matthew Blakiston, Veronica Playle, Andrew Fox-Lewis, Sally Roberts

ABSTRACT

AIM: There is concern the low incidence of coronavirus disease 2019 (COVID-19) in children reflects under-testing in this population. This study sought to describe the age-distribution of SARS-CoV-2 testing in the Northern Region of New Zealand.

METHODS: A retrospective single-centre review of all SARS-CoV-2 tests performed at LabPLUS, Auckland City Hospital, between 12 February and 18 April 2020.

RESULTS: A total of 22,333 tests were performed, with 313 (1.40%) positive results. The age-adjusted SARS-CoV-2 testing rate was three times higher in adults than in children. The overall proportion of positive tests was lower in children (0.86%) than adults (1.45%). However, within the paediatric population the proportion of tests positive differed significantly between those <10 years old (0.08%) and those 10–14 years old (2.6%).

CONCLUSION: The lower proportion of tests positive in children <10 years of age suggests they are appropriately tested relative to their rates of disease. A large high school-associated cluster makes the higher proportion of tests positive in children 10–14 years old difficult to interpret. Older children may have a higher risk of infection and increasing testing in intermediate and high school aged children may be indicated.

New Zealand's first case of coronavirus disease 2019 (COVID-19) due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was confirmed on 28 February 2020 at Auckland City Hospital in an adult who had recently travelled overseas.¹ As of 18 April there were 1,105 confirmed cases across New Zealand including 400 in the Northern District Health Board (DHB) Region (encompassing Auckland Metropolitan and Northland DHB catchments).² Children (<15 years of age) have accounted for only 19 (4.8%) of these 400 confirmed cases.²

In response to the COVID-19 pandemic, the New Zealand Government has implemented a nationwide elimination strategy. One component of this strategy is widespread testing of individuals who meet

the suspect case definition. This definition has broadened with time reflecting the rapidly changing global and local epidemiology. Briefly, in February, individuals with mild symptoms of an acute respiratory tract infection (ARI) required fever and an epidemiological link (travel to a 'country of concern' within the last 14 days or contact with a suspected/confirmed/probable case). On 14 March, any travel outside of New Zealand met the epidemiological criteria and allowances were also made for testing with clinician discretion outside of the case definition. Since 1 April, anyone with symptoms of ARI is considered a suspected case and testing is recommended regardless of their age or travel history.³

Globally, cases of COVID-19 have been less commonly reported in children and

they are more likely to have milder disease and lower mortality than adults.^{4,5} Despite their typically mild illness, contact tracing data suggests they may still have similar risk of SARS-CoV-2 infection as the general population.^{4,6} Their role in the transmission of SARS-CoV-2 is still uncertain, however emerging data suggests it may be relatively minor.⁷⁻⁹

There is uncertainty as to whether the low number of SARS-CoV-2 infections reported in New Zealand children reflects a lower rate of infection and/or clinical illness versus under-reporting due to lower rates of testing in the paediatric population. To explore the latter possibility, a retrospective review of SARS-CoV-2 testing performed at LabPLUS, Auckland City Hospital, New Zealand was conducted to compare testing rates and the proportion of tests positive across age groups in the Northern DHB Region.

Methods

All SARS-CoV-2 tests performed between 12 February and 18 April 2020 at LabPLUS, along with associated demographic data (age, requester location), was extracted from the laboratory information system. During the time period evaluated, the majority of SARS-CoV-2 testing in the Northern DHB Region was performed at LabPLUS, Auckland City Hospital.

Tests were categorised by age group, population testing rates were estimated for each age group (for each age group, the number of tests performed was divided by the number people of usually resident within the DHB catchment areas) using 2013 NZ census data,¹⁰ and the proportion of tests positive for each age group was calculated. For the purposes of this study children were defined as 14 years of age or less (<15 years) at the time of sampling. Samples without a date of birth available were excluded (n=2).

The SARS-CoV-2 real-time reverse transcription polymerase chain reaction

(RT-PCR) test at LabPLUS detects the envelope protein (E) gene of SARS-CoV-2 (based on the protocol published by Charité Virology, Berlin, Germany).¹¹ Data analysis was performed using the STATA statistical software package (College Station, Texas, US). Groups were compared using chi-square tests as appropriate. The Auckland DHB institutional research office approved this study.

Results

Between 12 February and 18 April 2020 a total of 22,333 SARS-CoV-2 tests from 21,392 individuals were performed at LabPLUS. Of these, 313 (1.40%) tests from 307 patients were SARS-CoV-2 positive. Children < 15 years of age accounted for 1,748 (7.8%) tests and 15 (4.9%) of positive results.

20,007 (89.6%) of the samples were taken in the community. The proportion of samples taken in the community was significantly higher ($p < 0.001$) for adults (90.4%) than children (79.5%). During the study period, the number of tests performed increased over time. However, the relative proportion of testing performed in children remained largely unchanged over time, despite changes in the suspect case definition (Figure 1).

The SARS-CoV-2 population age-group-specific testing rates in adults (1,647 tests per 100,000 population) was significantly higher ($p < 0.001$) than in children (525 tests per 100,000 population) (Table 1). Conversely, the overall proportion of tests positive was significantly ($p = 0.044$) lower in children (0.86%) than adults (1.45%) (Table 1, Figure 2). However, within the paediatric population the proportion of positive tests differed significantly ($p < 0.001$) between those <10 years old (0.08%) and those 10–14 years old (2.6%) (Table 1, Figure 2). A further breakdown of testing rates and the proportion of positive tests by age categories are given in Table 1.

Figure 1: Daily SARS-CoV-2 testing at LabPLUS and percentage of tests performed in children (<15 years of age).

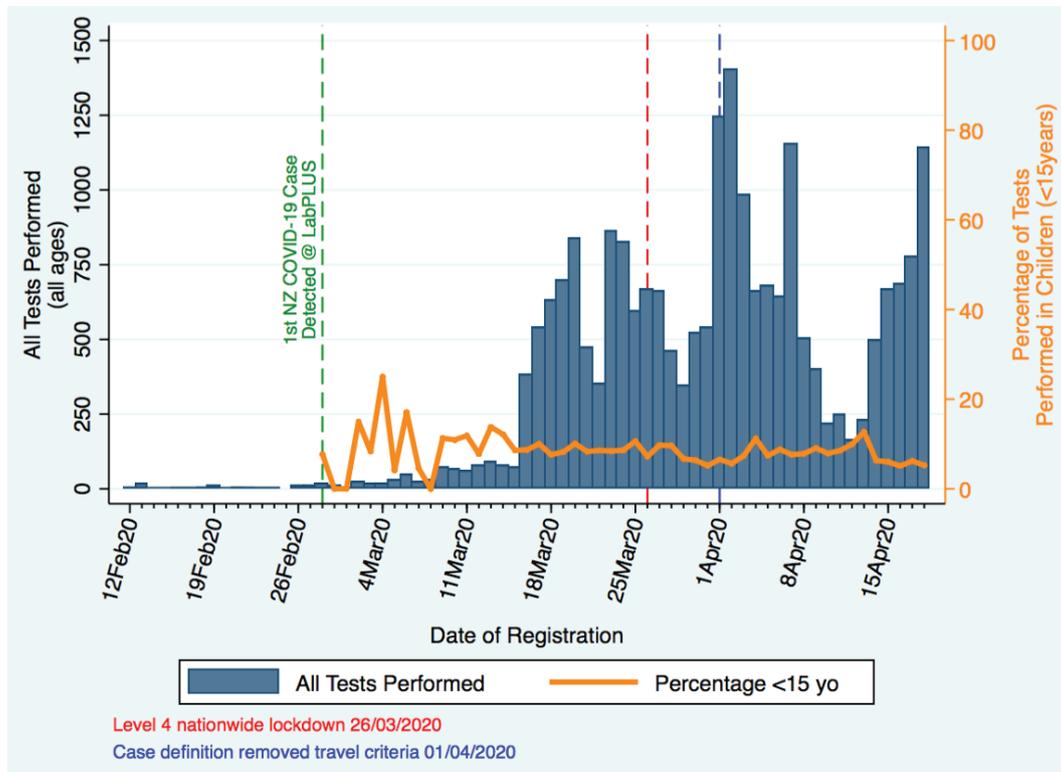
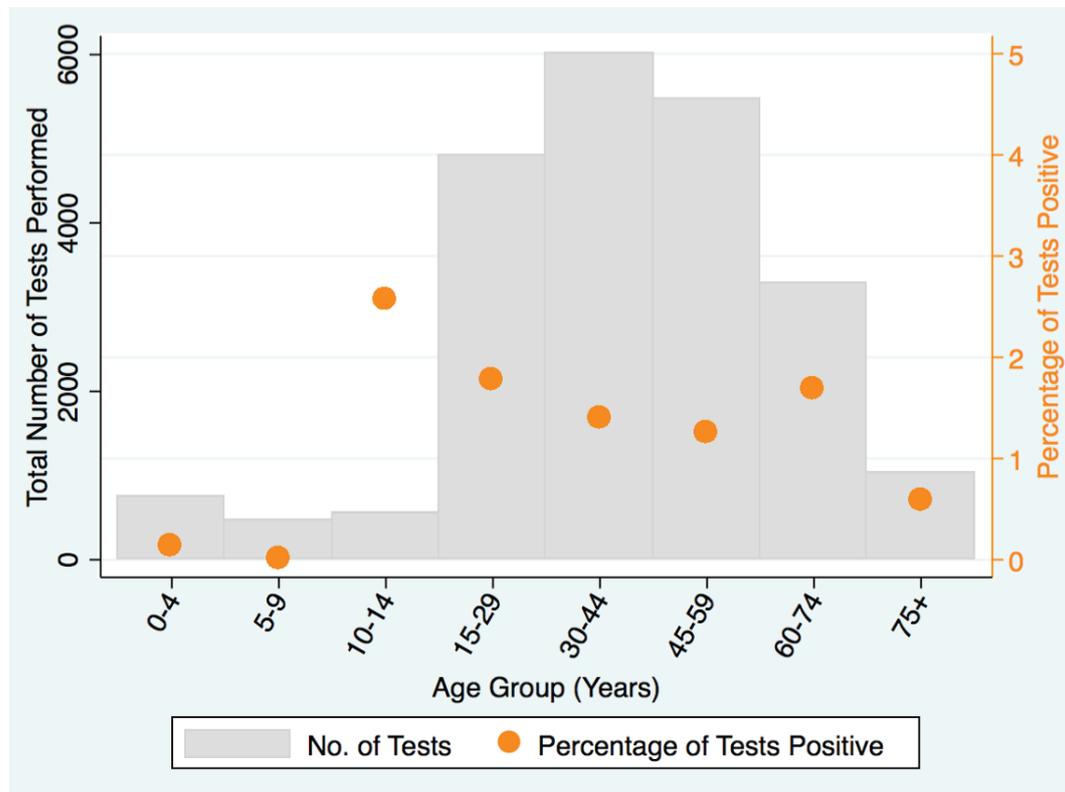


Table 1: SARS-CoV-2 PCR tests performed in Northern DHB Region.

Age group	Number of tests performed	Number of tests positive (%)	Tests per 100,000 population*	Positive tests per 100,000 population*
Total, all ages	22,333	313 (1.40)	1,410.9	19.8
Children (<15 years)	1,748	15 (0.86)	525.2	4.5
0–4 years	733	1 (0.14)	641.7	0.9
5–9 years	370	0 (0.0)	427.8	0
10–14 years	545	14 (2.57)	501.1	12.9
Adults (≥15 years)	20,585	298 (1.45)	1,646.8	23.8
15–29 years	4,797	85 (1.77)	1,423.9	25.2
30–44 years	6,011	84 (1.40)	1,834.4	25.6
45–59 years	5,472	68 (1.24)	1,747.6	21.7
60–74 years	3,270	55 (1.68)	1,697.6	28.6
75 years +	1,035	6 (0.58)	1,298.2	7.5

*Usually resident population in Northern DHB Region, NZ Census data 2013.

Figure 2: SARS-CoV-2 tests performed and percentage positive by age group.



Discussion

Low numbers of COVID-19 cases have been reported in children in New Zealand. This retrospective review of laboratory data compared SARS-CoV-2 testing rates and the proportion of tests positive across age groups in the Northern Region of New Zealand.

The rate of SARS-CoV-2 testing was substantially lower in children than adults. This is despite ARIs being more common in children¹² and the non-specific clinical presentation of COVID-19 making reliable clinical differentiation from other common causes of ARI challenging. Epidemiological aspects of the case definition would likely have limited testing in children in the early phase of the national response. However, subsequent changes in case definition, in particular the removal of the prerequisite for international travel, had little impact on the relative rate of testing in children. In addition other factors, such as the publicised lower impact in children, a reluctance of parents to seek medical attention for common mild childhood respiratory symptoms, limited

current circulation of Influenza and Respiratory Syncytial Virus, and difficulties with nasopharyngeal sampling in children, may have all contributed to the discrepant testing rates observed.

Reassuringly, children <10 years of age had a lower proportion of tests positive for SARS-CoV-2 than adults. This may reflect the local epidemiology (high contribution of international travel) during this time period, but is nonetheless consistent with the reported lower rates of SARS-CoV-2 infection in young children globally.^{13,14} The lower proportion of tests positive suggests that despite lower testing rates in children <10 years of age, they are not being under-tested relative to their rates of disease and that current testing patterns are appropriate as part of COVID-19 control strategies in New Zealand at the present time.

Children aged 10–14 years had a notably higher proportion of tests positive compared to younger children and adults overall. A large high school associated cluster in the Auckland Region makes this finding difficult to interpret. This data, however, does support international literature that

suggests higher risk of infection in older children; in an Icelandic cohort for instance the positivity rates steadily increased to adult levels between 10 and 20 years of age.¹³ Higher risk of infection and this clustering event emphasise the importance of ensuring high rates of testing in intermediate and high school aged children.

This study has a number of limitations including the absence of clinical or epidemiological data to contextualise findings and the diagnostic limitations of RT-PCR for SARS-CoV-2 infections. Additionally, the population structure may have changed since the 2013 Census, however the 2018 Census data is less robust (limiting its utility). We also recognise that the findings

may not be generalisable to other locations with different patterns of infection acquisition, epidemic stages or different levels of community disease. Nevertheless, population age-stratified testing data is useful to evaluate the appropriateness of regional and national testing strategies, and we recommend the continued publication of robust and transparent laboratory data.

We found that, in the Northern Region of New Zealand, rates of SARS-CoV-2 testing are lower in children compared with adults. The proportion of tests positive was higher in children ≥ 10 years compared to children < 10 years of age and adults. This merits further investigation as schools reopen and physical distancing measures are relaxed.

Competing interests:

Nil.

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