COVID-19, children and schools: overlooked and at risk

In reply: I thank Munro et al, Britton et al, Ryan et al, and Gray et al for their interest in my article and for the opportunity to further highlight complexities in the data which have hindered our understanding of the epidemiology of coronavirus disease 2019 (COVID-19) in children.

Schools remain overlooked as sites of risk. For example, the government of the United Kingdom continues to maintain face masks are unnecessary in these settings,[1] despite high levels of community transmission. The household contact studies referred to by Munro and colleagues, are overwhelmingly based on the results of polymerase chain reaction (PCR) tests, and are affected by the biases I previously described.[2] However, when serology is assessed, similar secondary attack rates in children, adolescents and adults are observed.[3]

Munro and colleagues point out mortality is very low in children. This is not in dispute. However, it should be noted that the outcomes they present occurred in the setting of unprecedented non-pharmaceutical interventions. As such, it would be premature to draw comparisons with influenza. In addition, the long term outcomes of multisystem inflammatory syndrome — a rare but serious complication of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection — are unknown.[4]

Britton et al and Ryan et al highlight a systematic review and meta-analysis by Viner and colleagues,[5] which appears to show children are less likely to be infected than adults. However, as acknowledged by Viner et al, the studies reviewed were predominantly of low to medium quality. Additionally, the authors of the meta-analysis make analytical errors which further question their findings. With regard to the study by Wang et al,[6] Viner and colleagues mistakenly classified adult index cases as contacts. Furthermore, for the study by van der Hoek et al,[7] Viner and colleagues erroneously reported zero cases in children when there were at least 24 cases. Furthermore, of the 14 studies included in the meta-analysis, three did not test all contacts,[6,8,9] and in another two[10,11] it is unclear if all persons were tested. Two studies included in the meta-analysis explicitly state non-high risk contacts were only tested if they developed symptoms.[8,9] These limitations are problematic given children are much more likely to be asymptomatic than adults. Importantly, there is evidence that this bias was differential. For example, children were less likely than adults to be tested in the study by Wang et al.[6]

Similar biases also apply to the review by Goldstein and colleagues,[12] referred to by both Munro et al and Ryan et al. It is surprising to note the review's conclusion, that children aged under 10 years are at most half as susceptible as adults, is based on a single unpublished study. Other studies find children and adults are similarly likely to be infected.[3,13] Nonetheless, Goldstein and colleagues[12] call for the implementation of risk-reduction strategies in schools, with which I agree.

It is beyond the scope of this letter to comment on the Journal's policy with regard to preprints. However, given the rapidly evolving situation in Australia at the time of publication, one would think the timely communication of material that enhanced our understanding of the epidemiology of COVID-19 would have merit.

Since publication of the Perspective, further studies have provided evidence children may transmit SARS-CoV-2 at similar rates to adults. These comprise a study from India of 84 965 cases and 575 071 close contacts[14] and a prospective study of 101 households in Tennessee and Wisconsin conducted by the Centers for Disease Control and Prevention.[15] The Victorian data[16] referred to by Ryan et al are interesting, but lack precision. While the data indicate children may be less likely to initiate outbreaks in childcare centres than adults (with the caveat that some cases may have gone undetected since not all children may have been tested), no statistically significant difference is observed with regard to primary and secondary schools (Box).

Furthermore, the authors of the Victorian report note 66% of infections in childcare centres and schools were limited to a single case, but fail to note this is an expected consequence of the overdispersed nature of SARS-CoV-2 transmission. About 5–20% of primary cases are responsible for 80% of secondary infections, and about 70% of people do not infect anyone.[14,17,18] What was seen in Victorian schools is therefore typical for adults and children alike.

Ryan and colleagues describe asymptomatic infection as not uncommon in children. In fact, their own data show it is very common: in Victoria, 33% of

Childcare and school events occurring in Victoria (January–August 2020) and proportion resulting in an outbreak[16]

Setting and age of first case	Total number of events	Additional cases identified		Proportion resulting in an outbreak (95% CI)	*P*
		No	Yes		
Childcare					0.005
Child 0–5 years	54	47	7	13.0% (5.4–24.9%)	
Adult ≥ 19 years	52	33	19	36.5% (23.6–51.0%)	
School					0.716
Child 6–12 years	55	38	17	30.9% (19.1–44.8%)	
Adolescent 13–15 years	22	13	9	40.9% (20.7–63.6%)	
Adolescent 16–18 years	75	45	30	40.0% (28.9–52.0%)	
Adult ≥ 19 years	65	40	25	38.5% (26.7–51.4%)	

P values are for χ^2 test. Data are sourced from the report into coronavirus disease 2019 (COVID-19) in Victorian childcare centres and schools.[16] Confidence intervals (CIs) and *P* values were calculated by the author. Testing was initially restricted to symptomatic persons. In addition, some close contacts may not have been tested. As such, transmission may be underestimated.[16]

children were asymptomatic compared with 17% of adults.[16] This is likely to hinder case-finding. Indeed, the Victorian report notes that "[a]s children tend to be asymptomatic or develop only mild symptoms, it is harder to detect infection in this age group".[16] The report goes on to state that "[a] surveillance strategy that tests only symptomatic children will fail to identify children who are silently shedding the virus, and who may be infectious".[16] Furthermore, the international data referred to by Ryan et al is a single 4–6 week study conducted at a time of low community transmission, comprising only three active cases.[19] In contrast, more recent data from Europe show SARS-CoV-2 infections in children are frequent. Random testing of the general community in England shows children (aged 5–12 years) and teenagers (aged 13–17 years) are currently more likely to be infected than any other age group.[20] Additionally, compared with persons aged 17 years or over, children (aged < 12 years) and adolescents (aged 12–16 years) are now more likely to be the first case in English households, and are more than twice as likely to infect their household contacts.[21]

I agree school closures are associated with harms. Unfortunately, difficult choices must be made with regard to weighing those harms against the consequences of failing to adequately suppress transmission. Modelling suggests elimination of COVID-19 in Victoria would have taken longer to achieve if school closures had not been part of the response.[22] Morbidity and mortality attributable to COVID-19 would inevitably have been greater under such conditions.

Gray and colleagues make a valuable point that children have also been overlooked in health education campaigns. Health education and health promotion are vital tools we must deploy against the pandemic. To succeed, we require a diverse, multidisciplinary approach based on a sound understanding of the epidemiology of COVID-19 in children.

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