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The role of schools and school-aged children in SARS-CoV-2 transmission

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Schools form a fundamental part of our society. They are crucial for passing on knowledge and values to younger generations and essential for the mental wellbeing of children and parents alike. Unfortunately, they also present a seemingly excellent environment for the spread of respiratory infections through high-frequency and close contacts in often poorly ventilated environments.[1,2]

In their assessment of the partial reopening of educational settings in the UK in June and early July, when SARS-CoV-2 prevalence was relatively low, Sharif Ismail and colleagues' study published in *The Lancet Infectious Diseases* reassuringly found that despite a median of 928 000 children attending educational settings daily, few SARS-CoV-2 outbreaks were identified.[3] Where secondary cases linked to within-school exposure were found, these were more frequently among teaching and administrative staff.

The authors did, however, find some evidence of within-school transmission in 55 (31%) of 177 instances where cases were identified. This was in the context of small class or bubble sizes, half empty schools, and extensive hygiene measures. Also, as children rarely display obvious symptoms and are likely to have been missed by the largely passive case finding that was in place at the time, it is likely that more transmission among children occurred than was recorded. In fact, in most instances where further symptom-agnostic testing was initiated in response to detection of a case, a substantial number of additional cases were identified. Notably, the probability for an outbreak following at least one index case was higher in secondary schools (seven [39%] of 18 events) than in primary schools (27 [26%] of 102 events), despite much lower attendance rates in secondary schools over the period of study.

Although the study makes a clear case for the need to improve infection control for staff in schools, one might be tempted to infer from the comparatively small proportion of reported infections in children that within-school transmission among children plays a negligible role in the COVID-19 pandemic. However, given the disproportional role of super-spreading events in reported transmission chains[4] and the low probability for COVID-19 symptoms and disease among children,[5] such a conclusion could be flawed. Two large-scale, population-based swabbing studies have been set up in the UK in which households[6] or individuals[7] are randomly selected and offered a test for the presence of SARS-CoV-2. Both studies have shown that since September, when schools, universities, and colleges have been fully open, the highest rates of infection have been observed in young adults (about 18–25 years old). However, the next highest prevalence has been observed in secondary school children (11–18 years old), suggesting that they are likely to be an important source of infection to peers and others rather than a sink. Yet, primary school children (5–11 years old) have been found to have an infection prevalence comparable to that of working-aged adults.[6,7]

Ismail and colleagues identified a child as the potential source of infection in only 29% of child cases and 17% of staff cases in school outbreaks, again suggesting a potentially minor role of children in the transmission of SARS-CoV-2 within schools and beyond. However, widespread symptom-agnostic screening among university students has long shown rapidly expanding infection prevalence on campus following the reopening of universities, indicating effective transmission of SARS-CoV-2 among young adults, some of whom are only marginally older than secondary school-aged children.[8] Similarly, a multiday overnight camp for 6–19 year olds that was largely closed off to infections from the outside reported a large-scale outbreak. When screening the school-age attendees subsequently, attack rates close to 50% were found, suggesting substantial within-camp transmission among the children despite its largely outdoor-focused activities.[9] Additional evidence for effective transmission between children stems from the use of mathematical models. An analysis of large-scale contact tracing data collected in India identified a high prevalence among same-age contacts of children infected with SARS-CoV-2 that, in combination with highly age-assortative mixing in that age group, can be best explained by effective transmission among children.[4] Furthermore,

preliminary modelling analyses based on data from the UK Office for National Statistics's COVID-19 infection survey[6] found that secondary school-aged children are about eight times more likely to introduce an infection to a household than adults.[10] If restricted to only data up to September, when secondary schools were predominantly closed, that probability was only marginally higher than that of adults.

So how can we reconcile the growing evidence that children attending school seem to have an important role in transmission of SARS-CoV-2 with the evidence from Ismail and colleagues' study? The answer is likely to lie in the low probability that children will experience disease that would have been picked up by the passive surveillance during the study period. This would imply that many outbreaks would have been missed and have been larger than identified. Furthermore, the partial reopening of schools in June and July with small bubbles and much fewer children attending, particularly in secondary education, might have led to considerably less within-school transmission than the reopening of schools to all children after the summer. In summary, Ismail and colleagues' study supports the notion that opening of schools despite SARS-CoV-2 circulation in the community is largely safe for children, but secondary schools in particular might nevertheless play a considerable role in transmission between households.

WJE reports attending SAGE and has contributed to overall advice to the UK Government about school openings as a means to control SARS-CoV-2 transmission.

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1 Cauchemez S, Valleron A-J, Boëlle P-Y, Flahault A, Ferguson NM. Estimating the impact of school closure on influenza transmission from Sentinel data. *Nature* 2008; **452:** 750–54.
2 Mossong J, Hens N, Jit M, et al. social contacts and mixing patterns relevant to the spread of infectious diseases. *PLoS Med* 2008; **5:** e74.
3 Ismail SA, Saliba V, Bernal JL, Ramsay ME, Ladhani SN. SARS-CoV-2 infection and transmission in educational settings: a prospective, cross-sectional analysis of infection clusters and outbreaks in England. *Lancet Infect Dis* 2020; published online Dec 8. https://doi.org/10.1016/S1473-3099(20)30882-3.
4 Laxminarayan R, Wahl B, Dudala SR, et al. Epidemiology and transmission dynamics of COVID-19 in two Indian states. *Science* 2020; **370**: 691–97.
5 Salje H, Kiem CT, Lefrancq N, et al. Estimating the burden of SARS-CoV-2 in France. *Science* 2020; **369:** 208–11.
6 UK Office for National Statistics. Coronavirus (COVID-19) Infection Survey, UK: 13 November 2020. Nov 13, 2020. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveypilot/13november2020 (accessed Nov 20, 2020).
7 Riley S, Ainslie KEC, Eales O, et al. High prevalence of SARS-CoV-2 swab positivity and increasing R number in England during October 2020: REACT-1 round 6 interim report. *medRxiv* 2020; published online Nov 3. https://doi.org/10.1101/2020.10.30.20223123 (preprint).
8 Yamey G, Walensky RP. Covid-19: re-opening universities is high risk. *BMJ* 2020; **370**: m3365.
9 Szablewski CM. SARS-CoV-2 Transmission and infection among attendees of an overnight camp—Georgia, June 2020. *MMWR Morb Mortal Wkly Rep* 2020; **69:** 1023–25.
10 UK Government. TFC: Children and transmission, 4 November 2020. Nov 13, 2020. https://www.gov.uk/government/publications/tfc-children-and-transmission-4-november-2020 (accessed Nov 13, 2020).

Transcriptomic signatures have a place in short-term prediction of incident tuberculosis

Latent tuberculosis infection (LTBI) is a major global health issue, with an estimated 25% of the world's population affected[1] and a 10% risk of progression to active tuberculosis.[2] Hence, predicting who among the people who are infected will progress to active disease is a burning research question, in particular coupled with the issue of being able to prevent this progression with tuberculosis preventive therapy (TPT).

Traditionally, the tuberculin skin test and the IFNγ release assays are used to identify people with LTBI—eg, in contacts of active tuberculosis cases—but they are poor predictors for the risk of developing active tuberculosis.[3] Whole blood RNA expression have provided some promising results,[4] and blood RNA signatures have therefore been viewed as a possible host-related biomarker.

In *The Lancet Infectious Diseases*, Thomas J Scriba and colleagues[5] assessed the use of RISK11, a transcriptomic signature by whole blood RNA sequencing, for identification of individuals at high risk of developing tuberculosis and ability to target and prevent active tuberculosis. In this trial, individuals with a positive RISK11 signature were randomly assigned to treatment with isoniazid and rifapentine for 12 weeks (3HP), or no treatment. Individuals with a negative RISK11 signature were assigned to


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