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Schools: still a gaping hole in the English covid strategy

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In August, one of us (CP) wrote about schools being the gaping hole in the English covid strategy. This was written in the face of the highly transmissible delta covid-19 variant.¹ Three failings were identified: delayed vaccination of 12-15 year olds; lack of public health measures in schools such as masks and ventilation; and continued high community transmission leaving schools vulnerable. So what happened? And what needs to happen next?

What happened

Vaccines were finally rolled out to 12-15 year olds towards the end of September, three weeks into the start of term.² Unlike the roll out in Scotland, vaccines were initially offered in school settings and progress was slow. As of 19 December, only 47% of 12-15 year olds have received one dose.³ Meanwhile, the US Food and Drugs Administration (FDA) approved vaccines for 5-11 year olds at the end of October and the European Medicines Agency did so a month later.⁴ The UK Medicines and Healthcare products Regulatory Agency (MHRA) and Joint Committee on Vaccination and Immunisation (JCVI) have yet to make a decision, but recent indications are that JCVI will only recommend vaccination for clinically extremely vulnerable 5-11 year olds.⁶

Schools have navigated this term with essentially no nationally required mitigation measures except for isolation for children who test positive. Carbon dioxide (CO₂) monitors were promised to all schools in September, but most had still not been delivered by November.⁷ HEPA filters and germicidal ultraviolet light to reduce airborne transmission are being trialled in schools in Bradford, but have not been rolled out more generally.⁸ Community transmission rates have remained high all autumn: 32 000 cases have been reported daily on average in England since 1 September.

The consequence has been very high rates of infection in children. Over one million children under 16 years have had a confirmed infection since 1 September 2021, more than the rest of the pandemic combined.⁹ Rates in 5-19 year olds have been the highest across all age groups since September. The Office of National Statistics Infection Survey has reported the highest prevalence in primary and secondary school children since the start of the pandemic (in two October weeks almost 10% of secondary school children tested positive each week).¹⁰ Prevalence has been consistently more than three times as high as adults. As more teenagers became vaccinated over the autumn, primary school children saw the highest infections among all age groups for the first time in the pandemic.¹⁰ Schools suffered a lot of disruption as students and teachers fell sick.¹¹ Over 2,000 6-17 year olds have been admitted to hospital with covid-19 since 1 September and 10 5-14 year olds have

died with covid as contributing cause, compared to 720 and two respectively over the same period in 2020.¹²¹³ Children are reporting rising cases of long covid too—a trend only likely to get worse as data come in from the last few months of the year.¹⁴

High cases in children have also spilled over into their parents' generation—cases in 35-49 year olds have consistently been the highest among adults and have risen and fallen together with cases in school age children.¹⁰

The omicron spanner in the works

The omicron variant is now dominant in England. It is both highly transmissible and immune evasive.¹⁵ It has been doubling every two days in England and has resulted in record cases over recent days—far higher than last January's peak.¹⁶¹⁷ Previous infection or two vaccine doses do not provide much protection from infection with omicron.¹⁸ While three doses of vaccines are required to provide significant protection from omicron infection, any dose is expected to provide at least some protection from severe outcomes.¹⁹ Chris Whitty, England's chief medical officer, and Jenny Harries, head of the UK Health Security Agency (UKHSA) have both warned of a substantial new wave of infections over the coming weeks. As of 19 December, almost 40% of 16-17 year olds and over 50% of 12-15 year olds remain unvaccinated.³ Under 12s remain unvaccinated. As the new term starts in January therefore, children are the population at highest risk of a large new wave of infection, this time driven by omicron and not delta.

What needs to happen next

Vaccines

Over seven million doses have been administered to 5-11 year olds in the USA. So far, there have been only eight reports of myocarditis, all mild.²⁰ Many European countries have now started vaccinating primary school age children since EMA approval in November.²⁰ We had given a first dose to 50% of 16 and 17 year olds by end of September 2021 and this age group did not see a large spike in the autumn term.³²¹ We had given a first dose to a third of 12-15 year olds by early November and by December case rates were higher in primary school children than secondary school children for the first time in the pandemic.³¹⁰ Vaccines are safe and they work. By reducing the chance of primary infection, vaccines reduce cases, transmission, long covid, and school disruption. They also protect children from becoming severely ill. With omicron the dominant variant for next term, we cannot rely on previous infection to prevent a new wave of infections in schools. We must offer as many teenagers as possible their second dose before term starts. The Joint Committee on Vaccinations and Immunisation (JCVI) are reported to have decided that only clinically vulnerable

children should be offered the vaccine.⁵ With the most recent ONS infection survey reporting almost 6% prevalence in under 12s and over 3% of primary school children off with covid at the end of December, we urge the JCVI to reconsider.^{10 22}

Clean air

We can lower covid transmission using methods that work against other airborne pathogens; they are all carried on respiratory aerosol particles released into the room by breathing and talking, and disease spreading is contained by cleaning these particles from the air.²³ There are different ways to achieve this; some are quick, inexpensive improvements to current classrooms, and some require longer term investment. As each covid variant is more transmissible than the last, clean air becomes an ever more important—and long lasting—defence.

We need **more CO₂ monitors**. Most UK classrooms rely on natural ventilation through windows or doors.²⁴ The ventilation delivered depends on the weather and is hard to guess, but teachers need to manage window opening in real time to stop too much exhaled air building up, while keeping the classroom at a reasonable temperature. Having a visible CO₂ display in the room helps achieve this.²⁵ We therefore recommend a CO₂ monitor for every naturally ventilated classroom, rather than the current one to two shared across a school.

Further adjustments can be made to provide cleaner air. Windows bolted shut could be opened with restrictors for safety; and **ventilation can be enhanced using fans placed by windows.**²⁶ Where **ventilation is still insufficient, HEPA units can provide clean air** by filtering out the infectious respiratory particles. The technology was shown to be effective against covid in hospitals, and many low-cost home “air purifiers” have the required H13 filter standard and can deliver enough clean air with several units per classroom.²⁷ With guidance on sources and numbers required, schools can quickly take advantage of these, rather than being limited by the two models currently recommended by the government.²⁸ In the longer term, infrastructure upgrades combining clean air with energy efficiency represent a good investment for the future.

Other public health protections

Finally, while vaccination and clean air are the foundations of safer schools, there are many other protections we can implement—and which are increasingly important given omicron’s high **transmissibility. Masks need to be worn inside and outside of classrooms wherever possible by both students and staff, preferably high quality FFP₂ masks that could be provided (with funding support) by schools at the entrance.** With the higher risk of transmission from the omicron variant to household members of an index case, children who have a household member with covid should isolate for 10 days and be supported to learn remotely, otherwise chains of transmission are just prolonged.²⁹ We also need better surveillance testing. **Lateral flow tests** have been an important intervention, but they are unpleasant, easy to do badly and too many students do not do them at all. There are more efficient ways to monitor large scale settings such as schools. Pooled testing using saliva based swabs have been found to be very effective in the United States and Germany, and has been successfully implemented, for instance in Massachusetts.³⁰⁻³²

Last term we failed our children—schools, in combination with the delta variant, became a vehicle for infecting hundreds of thousands of children, and then, their parents. The same gaps in school policy identified in August remain today and are now even more important in the face of a new omicron wave in schools in January. Children

are the least protected group in England and their needs are being forgotten as we race to boost adults. Another term of infection and disruption would be a dereliction of duty.

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- Christina Pagel. Schools—a gaping hole in the English covid strategy. *The BMJ*. 2021. <https://blogs.bmj.com/bmj/2021/08/20/christina-pagel-schools-a-gaping-hole-in-the-english-covid-strategy/>
- NHS England. NHS rolls out COVID-19 jab to children aged 12 to 15. <https://www.england.nhs.uk/2021/09/nhs-rolls-out-covid-19-jab-to-children-aged-12-to-15/>
- Vaccinations in England | Coronavirus in the UK. <https://coronavirus.data.gov.uk/details/vaccinations?areaType=nation&areaName=England>
- Commissioner O of the. FDA Authorizes Pfizer-BioNTech COVID-19 Vaccine for Emergency Use in Children 5 through 11 Years of Age. FDA. 2021. <https://www.fda.gov/news-events/press-announcements/fda-authorizes-pfizer-biontech-covid-19-vaccine-emergency-use-children-5-through-11-years-age>
- BERBECE C. Comirnaty COVID-19 vaccine: EMA recommends approval for children aged 5 to 11. European Medicines Agency. 2021. <https://www.ema.europa.eu/en/news/comirnaty-covid-19-vaccine-ema-recommends-approval-children-aged-5-11>.
- Stewart H, Walker P. JCVI set to recommend vaccinating only vulnerable five- to 11-year-olds. *The Guardian*. 2021. <https://www.theguardian.com/society/2021/dec/22/jcvi-set-to-recommend-vaccinating-vulnerable-five-to-11-year-olds>
- COVID-19. Majority of CO₂ monitors not yet delivered to schools as coronavirus-related absences rise. *Sky News*. <https://news.sky.com/story/covid-19-majority-of-co2-monitors-not-yet-delivered-to-schools-as-coronavirus-related-absences-rise-12460709>
- Covid: Air purifier and UV light pilot to combat school virus spread. *BBC News*. 2021. <https://www.bbc.com/news/uk-england-leeds-58190189>.
- New cases by age in England - Government daily Covid-19 dashboard. 2021. <https://api.coronavirus.data.gov.uk/v2/data?areaType=nation&areaCode=E92000001&metric=newCasesBySpecimenDateAgeDemographics&format=csv>
- Coronavirus (COVID-19) Infection Survey, UK Statistical bulletins - Office for National Statistics. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurvey/pilot/previousReleases>
- Weale S, Davis N. English schools struggle to cope as Covid wreaks havoc. *The Guardian*. 2021. <https://www.theguardian.com/world/2021/oct/22/english-schools-struggling-to-cope-as-covid-wreaks-havoc>
- Download data | Coronavirus in the UK. <https://coronavirus.data.gov.uk/details/download>
- Deaths registered weekly in England and Wales by age and sex - Office for National Statistics. <https://www.ons.gov.uk/datasets/weekly-deaths-age-sex/editions/covid-19/versions/4>
- Prevalence of ongoing symptoms following coronavirus (COVID-19) infection in the UK - Office for National Statistics. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/prevalenceofongoingsymptomsfollowingcoronavirus-covid19infectionintheuk/2december2021>
- 15 December 2021 Risk assessment for SARS-CoV-2 variant: Omicron VOC-21NOV-01 (B.1.1.529).
- Omicron daily overview: 21 December 2021.
- Daily Covid-19 cases in the UK exceed 100 000 for first time. *BBC News*. 2021. <https://www.bbc.com/news/uk-59758757>
- Omicron largely evades immunity from past infection or two vaccine doses | Imperial News | Imperial College London. Imperial News. <https://www.imperial.ac.uk/news/232698/omicron-largely-evades-immunity-from-past/>
- Andrews N, Stowe J, Kirsebom F, *et al*. Effectiveness of COVID-19 vaccines against the Omicron (B.1.1.529) variant of concern.
- European Union starts drive to vaccinate children against COVID | Reuters. <https://www.reuters.com/business/healthcare-pharmaceuticals/european-union-starts-drive-vaccinate-children-against-covid-2021-12-15/>
- Weekly_COVID-19_and_Influenza_Surveillance_Graphs_W50.pdf. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1041446/Weekly_COVID-19_and_Influenza_Surveillance_Graphs_W50.pdf
- Attendance in education and early years settings during the coronavirus (COVID-19) pandemic, Week 50 2021. <https://explore-education-statistics.service.gov.uk/find-statistics/attendance-in-education-and-early-years-settings-during-the-coronavirus-covid-19-outbreak>.
- Tellier R, Li Y, Cowling BJ, Tang JW. Recognition of aerosol transmission of infectious agents: a commentary. *BMC Infect Dis* 2019;19:101. doi: 10.1186/s12879-019-3707-y. pmid: 30704406
- Korsavi SS, Montazami A, Mumovic D. Ventilation rates in naturally ventilated primary schools in the UK: Contextual, Occupant and Building-related (COB) factors. *Build Environ* 2020;181:107061. doi: 10.1016/j.buildenv.2020.107061.
- Di Gilio A, Palmisani J, Pulimeno M, *et al*. CO₂ concentration monitoring inside educational buildings as a strategic tool to reduce the risk of Sars-CoV-2 airborne transmission. *Environ Res* 2021;202:111560. doi: 10.1016/j.envres.2021.111560. pmid: 34224708

- 26 Savage M, Packham A. England's schools in urgent need of repairs, say heads. *The Observer*. 2021.<https://www.theguardian.com/education/2021/aug/28/england-schools-in-urgent-need-of-repairs-say-heads>
- 27 Conway-Morris A, Sharrocks K, Bousfield R, et al. The removal of airborne SARS-CoV-2 and other microbial bioaerosols by air filtration on COVID-19 surge units. 2021. doi: 10.1101/2021.09.16.21263684
- 28 The trouble with DfE-approved air purifiers. *Tes Magazine*. <https://www.tes.com/magazine/news/general/heads-shock-over-expensive-dfe-air-purifiers>
- 29 SARS-CoV-2 variants of concern and variants under investigation.
- 30 Joachim A, Dewald F, Suárez I, et al. B-FAST study group. Pooled RT-qPCR testing for SARS-CoV-2 surveillance in schools - a cluster randomised trial. *EClinicalMedicine* 2021;39:101082. doi: 10.1016/j.eclinm.2021.101082. pmid: 34458708
- 31 Mendoza RP, Bi C, Cheng H-T, et al. Implementation of a pooled surveillance testing program for asymptomatic SARS-CoV-2 infections in K-12 schools and universities. *EClinicalMedicine* 2021;38:101028. doi: 10.1016/j.eclinm.2021.101028. pmid: 34308321
- 32 Coronavirus/COVID-19. COVID-19 Testing Program. <https://www.doe.mass.edu/covid19/testing/>
- 33 Reuters. Eight heart inflammation cases among young kids who got COVID-19 shot - U.S. CDC. Reuters. 2021. <https://www.reuters.com/world/us/eight-heart-inflammation-cases-seen-among-young-kids-who-got-covid-19-shot-us-2021-12-16/>