Children's Task and Finish Group: update to 17th December 2020 paper on children, schools and transmission[1]

Background and purpose

This paper provides an updated view on evidence relating to children and schools from the Children's Task and Finish group. This is in response to a request from the Department for Education (DfE), as an update to the previous papers on Children, Schools and Transmission[2,2] and should be read in line with the purpose of those and the discussion at SAGE 73 and 65. Previous papers were published prior to data becoming available relating to the new variant (VOC 202012/01; variant B.1.1.7) and other variants of concern.

SAGE has advised previously that the opening and closing of schools is likely to have an impact on transmission and R, and that policymakers will need to consider the balance of risks and harms: including the potential direct health risks to children and staff from COVID-19 and the wider impact of school opening on community transmission; and the direct risks to student mental health, wellbeing, development, educational attainment and health outcomes from school closure.

New evidence and data considered as part of this update includes:

- The latest updates on prevalence from the ONS COVID-19 Infection Survey (CIS)
- The latest updates on prevalence from the REACT-1 survey
- ONS analysis of COVID-19 mortality risk by occupation
- The latest CoMix data on contact rates for those under 18 years
- School attendance data from DfE
- NHS test and trace data
- Data from CO-CIN and Qresearch on COVID-19 mortality risk for children
- NERVTAG assessment of B1.1.7
- Updated evidence and analysis provided by SPI-B

[1] This paper was presented at SAGE 80 on 11 Feb 2021 and finalised with amendments agreed by SAGE on 21 Feb 2021

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/935125/tfc-covid-19-children-transmission-s0860-041120.pdf

[2]https://www.gov.uk/government/publications/tfc-children-and-transmission-update-paper-17-december-2020

Brief summary of updated evidence

Susceptibility to infection / infectiousness for children and younger people

- **Overall, children can be susceptible to SARS-Cov-2 infection and can be infectious.**
- **A range of analyses suggest that children's susceptibility to infection appears less than adults** (high confidence).
- **Recent modelling of the impact on R of school opening/closures suggests that infectivity and/or susceptibility to infection is lower in children than among adults.**
- **There is some evidence that there are differences in susceptibility to infection between older and younger children; with evidence from contact tracing studies suggesting that pre-school and primary aged children are less susceptible to infection than adults, and more mixed evidence for secondary aged and older children, who may have higher levels of susceptibility to infection** (medium confidence).

Susceptibility to clinical disease for children and younger people

- **There continues to be strong evidence that children and younger people (<19 years) are much less susceptible to severe clinical disease than older people (high confidence).**
- **Whilst rates were very low, there is some evidence that Asian children were more likely to be admitted to hospital and intensive care for COVID-19 than White children and Black and Mixed/other children were more likely to have had longer hospital admissions (medium confidence).**

Impact of school closures on children and younger people

- **There is still clear evidence of the negative educational impact of missing school, particularly for younger children (high confidence)**
- **There remains evidence that the pandemic has negatively impacted the mental health of children and young people, and that school closures cause impairment to the physical and mental health of children (high confidence).**

Role of children and schools in transmission

- Education is a major part of children and young people's lives, and compared to wider national restrictions, **the opening of schools is associated with increases in contact rates. Transmission to children and young people can occur in household, community and educational settings (high confidence**).
- The opening of school settings does not only affect children and staff, but also impacts parental behaviour and other contacts outside of school. For example, SPI-M-O suggest **the return of younger children to school may catalyse further adult contacts** – for example, by enabling parents and carers to return to their workplace
- **SPI-M-O's consensus view is that the opening of primary and secondary schools is likely to increase effective R by a factor of 1.1 to 1.5 (10% to 50%). In further modelling of increasing cohorts of pupils returning to school, the relative impact on R increases as additional cohorts of children return.**
- Schools cannot be viewed in isolation and must be considered in the context of the trajectory of the epidemic, other non-pharmaceutical interventions (NPIs), and the impact on the NHS. If other NPIs are relaxed at the same time that schools are opened,

there *could* be a cumulative interaction between the effect of each measure, with the overall impact being greater than each considered individually. Depending upon what other measures are or not being sustained, the relative role played by schools may be larger or smaller than that seen in e.g. November 2020[3].

Implementation of preventive measures in schools

- **Differences in the school environment and the level of mitigations in place will influence the potential for transmission in schools.** Mitigations such as ventilation, social distancing and handwashing (and others) are important in all school settings to reduce transmission through aerosols, close-range interactions and via surfaces.
- **Survey evidence and HSE spot checks indicate that the majority of schools have a good understanding of guidance and what it means to be 'COVID-secure'. However, some mitigations such as maintaining social distancing (in students and staff) and ventilation have been identified as challenging to implement and areas of concern in at least a small number of schools.**

Impact of variants

- **The B1.1.7 variant leads to higher infection rates, but is not particularly adapted to any age group (medium confidence).** There is insufficient information to make any statement about B1.1.7 severity in children.

Risk to staff

- As noted by the SAGE EMG-Transmission working group[4], **age is the highest risk factor associated with mortality from COVID-19 (high confidence). Within sectors that have remained active during restrictions, evidence suggests that people who work in some specific occupations and roles have increased risks of being infected or hospitalised**. **This is higher in many occupations where people have to attend a workplace compared with people in occupations who can work from home** (high confidence). Transmission risk is a complex combination of environmental and human factors that are associated with the likelihood of infection (high confidence), and for many occupations, it is difficult to disentangle the effects of transmission that relate to working as opposed to travelling and living conditions (medium confidence)[5].
- **ONS analysis between 1 Sept 2020 – 7 Jan 2021, which adjusts for reported ability to socially distance in the workplace and work from home, finds evidence of difference in the likelihood of testing positive for COVID-19 across 25 occupations presents as a continuum,** which can be seen in comparisons between different occupations. Within this, there are a group of occupations at the upper end of the continuum which have no significant difference with the majority of other occupations, but do show a higher probability of testing positive compared to some of those at the lower end. At the upper end are: Caring personal service occupations, Protective service occupations, Teaching and other education professionals, Secretarial and related occupations, and Other managers and proprietors; while at the lower end are Skilled agricultural and related

[3] SPI-M-O; Consensus Statement on COVID-19, 10th Feb 2021
[4] SAGE 80: COVID-19 Risk by Occupation and Workplace
[5] SAGE 80

trades; Science, research, engineering and technology professionals; Business, media and public service professionals; Textiles, printing and other skilled trades.

- **ONS analysis suggests rates of death involving COVID-19 in men and women working in teaching and educational locations is comparable to other professional occupations**, and lower than rates of death in the wider population (low confidence). However, further analyses suggest that men working in secondary education may have a higher risk of COVID-19 mortality (39.2 per 100,000) than men of the same age in other professional occupations (17.6 per 100,000) (low confidence).
- Four case control studies[6] using NHSTT data have been conducted by PHE at approximately monthly intervals between August and December 2020. Whilst evidence from the first study period (August) found no evidence of an association, the subsequent periods showed statistical evidence of an association between working in *or* attending an educational setting and becoming a COVID-19 case (aORs 1.52, 2.03, 5.02 for studies 2-4 respectively). These studies may be affected by selection bias as only cases who were tested are included and controls were recruited from Market Research Panels. There is potential misclassification of exposure impacting all NHSTT data. Whilst models were adjusted for confounding of all available demographic variables, some residual confounding is likely to persist. Some of these studies also found evidence that working in healthcare, social care, or hospitality was associated with testing positive for COVID-19.

[6] https://www.medrxiv.org/content/10.1101/2020.12.21.20248161v1; SAGE 80 EMG-Transmission Group: COVID-19 Risk by Occupation and Workplace

Evidence updates presented to SAGE

Role of children, young people and schools in transmission

- ONS CIS data to 6th Feb 2021[7] show that **estimates of the percentage of people testing positive for COVID-19 in England remain high but have decreased recently in all age groups.** There has been a substantial decrease in estimated positivity for those aged 11/12 (school year 7) to 15/16 (school year 11) which reduced between 20 Dec-2 Jan (3.73%; 3.25-4.26% 95% CI) and 17 Jan-30 Jan (1.86%; 1.57%-2.18%). Rates are decreasing across age groups in most regions to 6th Feb (see annex A), although there has been considerable variation previously, for example with those in London reporting higher estimated positivity for the period 17th-30th Jan (over 3% for those aged 2-11 years and 12-16 years) which has now reduced (high confidence).
- **REACT-1 data[8] between 6th-22nd January 2021** (Round 8; during national restrictions in England) finds the highest national prevalence in 18-24 year olds (2.44%; 1.96-3.03% 95% CI) and the second highest in 13-17 year olds (2.25%; 1.85-2.73%) (high confidence). Prevalence in 5-12 year olds was lower at 1.59% (1.32-1.93%). **Compared to a those aged 35-44, those aged 13-17 and 18-24 had increased odds of swab-positivity.** Considerable variation by region was seen, with those aged 13-17 and 18-24 in London with prevalence over 4%. Overall, levels of infection during this period remained much higher than seen during national restrictions in May 2020 with a shallower downward trajectory.
- Education is a major part of children and young people's lives, and compared to wider national restrictions, **the opening of schools is associated with increases in contact rates. Transmission to children and young people can occur in household, community and educational settings (high confidence**). We cannot fully separate out the infection risk from behaviours and contacts within schools from the wider 'end to end' behaviours and contacts associated with school attendance but taking place outside the school.
- **CoMix data to 31 Jan 2021 suggests that mean contacts for individuals aged 5-17 years remained low during the period 21 Dec 2020 – 30th Jan 2021 (see Annex C), having reduced substantially during the school holidays (Annex C).** For children under 4, contacts dipped during the Christmas period and returned to levels seen before 21st Dec 2020, consistent with early-years settings remaining open despite school closures. Using data to 18 Jan 2021, **school-related contacts amongst children appeared much higher in the second lockdown (when schools were open), than in the third lockdown[9]**. Additionally, reports by parents suggest there were slightly higher mean rates of contacts between younger children (pre-and primary school aged) in the third lockdown than in the first lockdown (medium confidence; see annex C for detail). The CoMix behavioural survey is a broadly representative sample of the UK adult population.
- **Recent attendance in schools is reduced compared to the Autumn term but is higher than in May 2020**. On-site attendance[10] in state-funded schools was 16% on 4th Feb 2021, up from 14% overall on both 13 and 21 January. On 4th Feb attendance was 23% in

[7] https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveypilot/12february2021

[8] https://spiral.imperial.ac.uk/handle/10044/1/85703

[9] https://cmmid.github.io/topics/covid19/reports/comix/Comix%20Weekly%20Report%2043.pdf

[10] https://explore-education-statistics.service.gov.uk/find-statistics/attendance-in-education-and-early-years-settings-during-the-coronavirus-covid-19-outbreak

state-funded primary schools, 5% in state-funded secondary schools and 35% in state-funded special schools. This is a decrease from 86% during the 2020/21 autumn term, following the restriction of attendance to vulnerable children and children of critical workers only. However, on 4th Feb over 99% of state-funded schools were open to children of critical workers and vulnerable children, which is higher than in May 2020 when around 80% of schools were open. Attendance in May 2020 was approximately 4% in state-funded primaries, 1% in state-funded secondaries, and 8% in state-funded secondary schools.

- The opening of school settings does not only affect children and staff, but also impacts parental behaviour and other contacts outside of school. For example, SPI-M-O suggest **the return of younger children to school may catalyse further adult contacts** – for example, by enabling parents and carers to return to their workplace. This is consistent with the Avon Longitudinal Study of Parents and Children (ALSPAC)[11], which finds that parents with children who are attending nursery and school report higher numbers of contacts than parents whose children are not attending nursery or school (medium confidence).
- Children can transmit within households as well as in educational settings. Previous analysis of ONS data discussed at SAGE 65 indicated that children aged 12-16 were playing a higher role in introducing infection into households than those 17 or over (i.e. being the index case). The update of this analysis with data until 2nd Dec 2020[12] previously discussed at SAGE still supports this, but at a reduced level (medium confidence). The difference remains less marked for those under 12 (medium confidence). Further work is underway to update this including with data covering the Christmas period and Jan 2021 national restrictions.
- As discussed in SAGE 65 and 73 **there is evidence from contact tracing studies that pre-school and primary aged children are less susceptible to infection than adults** (medium confidence). The evidence is more mixed for secondary aged and older children, who may have higher levels of susceptibility to infection. Analysis of ONS data on household transmission risk to 2nd Dec 2020 also indicates that children aged 16 or under are less susceptible to infection from others in their household than those 17 or over (medium confidence).
- **Modelling of the impact on R of school opening/closures also supports differences in susceptibility to infection between children and adults**. Given CoMix mixing patterns in November 2020 and Jan 2021, estimated values of R for the periods considered, and a broadly plausible range for the effect of the new variant, one SPI-M modelling group finds that **an assumption of equal susceptibility and infectivity for children and adults is not consistent with the observed R** from these periods[13].
- Evidence from multiple PHE surveillance and outbreak data sources (annex D) (which are likely to underestimate asymptomatic cases and transmission, particularly among children) suggest that the levels of risk of infections and outbreaks in educational settings is strongly associated with community infection rates (weak evidence, low-medium confidence). Between 31 Aug and 18 October 2020, secondary schools were more likely to report a COVID-19 outbreak to PHE; in these outbreak investigations. In this analysis, attack rates were found to be higher in staff than students, particularly

[11] http://www.bristol.ac.uk/alspac/
[12] https://www.gov.uk/government/publications/tfc-children-and-transmission-update-paper-17-december-2020
[13] SPI-M-O; Consensus Statement on COVID-19, 10th Feb 2021

among primary school teaching staff, although this difference may be due to children being less likely to show symptoms and access testing.

- The COVID-19 surveillance in school KIDs (sKIDS) study found that only 3-4% of SARS-CoV-2 antibody negative staff and students in primary schools in the study developed antibodies from June to early December 2020, suggesting low infection rates in this setting even after the full return of pupils in September 2020 (see Annex D). Notably, antibody positivity in primary school staff was similar to the students in this setting, although the samples may not be representative of primary schools, staff and students.
- According to NHS Test & Trace data on contacts associated with cases in different educational settings (annex D), from week 43 (just prior to autumn half term) until week 52 (start of school Christmas holidays), the greatest number of contacts were within secondary schools, followed by primary schools. However, from week 1 of 2021 onwards, most contacts were reported within nurseries, followed by primary schools. This likely reflects the impact of the closure of schools (but not of nurseries) in the most recent national restrictions, introduced in week 1 of 2021.

Implementation of preventive measures in schools

- No two schools are the same, with differences for example in class sizes, structures and ventilation, among other things. Differences in the school environment and the level of mitigations in place will influence the potential for transmission in schools. Mitigations such as ventilation, social distancing and handwashing (and others) are important in all school settings to reduce transmission through aerosols, close-range interactions and via surfaces.
- A survey study[14] of implementation of preventive measures in the context of limited school reopenings in 105 English schools plus interviews with 14 heads reports variable implementation of measures, with major challenges and limited implementation of distancing within bubbles and implementing intensive cleaning, and general challenges relating to resources and space. Head and staff commitment, a positive and pragmatic attitude and effective communication facilitated implementation. Measures such as regular handwashing and stopping assemblies, were considered easy to implement. Majorly challenging measures included distancing between individuals (for students: 51%, N=99; for staff: 34%; N=98; for parents: 26%, N=100), spacing out desks (34%, N=99), keeping same staff assigned to each student group (33%, N=97) and staggering break times (25%, N=99).
- HSE spot checks in 5000 and inspections in 1000 primary and secondary schools between September and December 2020 identified that around 80% had a good understanding of the guidance and what it means to be “COVID-secure”. Where there were issues these were minor, with < 1% requiring any formal improvement.
- Best practices identified included using coloured lanyards to identify bubbles, using markers in playgrounds to support adult social distancing at drop-off/collection times, using school science projects to support hygiene behaviour, using seating plans to identify any pupils who may need to isolate, using video walkthroughs to explain measures to pupils and parents, using click-and-collect apps to purchase canteen food and avoid queuing

[14] *Sundaram et al. 2020:* Implementation of health-promotion measures to prevent COVID-19: a national study of English primary schools in summer 2020 (under review)

- Areas of concern in a small number of schools included social distancing in staff rooms and kitchen/canteens, cleaning regimes and ventilation in school buildings. Other areas advised on included generic risk assessments which lacked school specific details, lack of monitoring and review of risk assessments, fire doors being propped open for ventilation, inappropriate rooms used to isolate suspected cases, arrangements for managing visitors.
- Most schools have relied on windows and doors being open for long periods of time for ventilation. Balancing room temperature with the need for adequate ventilation is a common issue. Updated guidance from DFE, Welsh Government and HSE aims to help schools strike this balance.
- A previous smaller inspection over August/Sept also identified the majority of schools were implementing guidance effectively. In a small number of schools issues with social distancing were identified, and the challenge of providing sufficient ventilation and balancing this with comfort was also flagged.
- A cross-sectional study[15] of infections and implementation of preventive measures in the context of limited school re-openings in 24 Berlin schools reports few infections, high rate of acceptance of preventive measures and adequate implementation of measures, with better results in primary than secondary schools.

<u>Effect of school reopening on transmission</u>

- As set out previously, **SPI-M-O's consensus view is that the opening of primary and secondary schools is likely to increase effective R by a factor of 1.1 to 1.5 (10% to 50%)**[16]. One modelling group explored this further by assessing the relative impact of increasing cohorts of pupils returning to schools on R, based on analysis of contact patterns reported in CoMix during November (national restrictions) and January (second national lockdown) in England. During these periods, schools were open in the former but largely closed in the latter. **In this modelling, the relative impact on R increases as additional cohorts of children return to school.** The largest relative difference arises from the return of non-exam years secondary pupils. Rather than this group being key for transmission per se, this largely results from compounding the impact from other groups of pupils who have already returned. Furthermore, if contacts with and between older children are more COVID-secure, then the relative difference will change.
- In this modelling[17], the effect of varying levels of adult mixing between that observed in January to those in November, when schools were open is relatively small. The exception to this is the two cohorts including only primary school-age children (reception & key stage 1, and all primary years) where there is an increased impact on relative R from the levels of adult mixing associated with schools being open.
- The modelling cited above takes the national restrictions in November 2020 as the model for mixing when schools are open. As such, it assumes that all change in contacts between Nov 2020 – Jan 2021 is attributable to the impact of schools being open or closed. The restrictions in November may not be representative of social mixing and the

[15] *Hommes et al, medRxvi, Dec 2020.*
SARS-CoV-2 infection, risk perception, behaviour, and preventive measures at schools in Berlin, Germany, during the early post-lockdown phase: A cross sectional study.
[16] SAGE 78; SPI-M-O: Statement on relaxation of NPIs and the re-opening of schools
[17] JUNIPER: Impact of partial school openings, provided to SAGE 10th Feb 2021

impact of schools returning in the future if there are increased levels of mixing beyond that seen in November. Similarly, there may be a seasonal impact, with more social mixing associated with schools during warmer weather.

- As noted in previous advice[18], **multiple data sources show a reduction in transmission in children following schools closing for half term in late 2020, and transmission rates increasing again following the post-half term return to school** (medium confidence).
- A submitted systematic review of observational studies[19] on the effects of school closures on SARS-CoV-2 transmission identified **substantial heterogeneity between studies regarding evidence of impact**. Three studies, including the two at lowest risk of bias, reported no impact of school closures on SARS-CoV-2 transmission; whilst the other seven reported protective effects. Effect sizes ranged from no association to substantial and important reductions in community transmission. Studies were at risk of confounding and collinearity from other non-pharmacological interventions implemented close to school closures. The review is currently being updated, including to incorporate two recent empirically informed ecological studies by Li et al and Haug et al that do suggest an association.
- Schools cannot be viewed in isolation and must be considered in the context of the trajectory of the epidemic, other non-pharmaceutical interventions (NPIs), and the impact on the NHS. As other NPIs are relaxed, it is likely that there will be interaction between measures and the relative role played by schools may be larger or smaller than that seen in e.g. November 2020[20]. If other NPIs are relaxed at the same time that schools are opened, there *could* be a cumulative interaction between the effect of each measure, with the overall impact being greater than each considered individually

Impacts on teachers and school staff

- As noted by the SAGE EMG-Transmission working group[21], transmission is a continuous risk which can occur in any setting (including but not limited to workplaces), and is affected by factors such as frequency/length/proximity of exposures or contacts with infected individuals, infectiousness of individuals, emission rates of virus, ratio of virus transmitted via different routes, use and efficacy of mitigating controls, and socioeconomics, amongst others. **Age is the highest risk factor associated with mortality from COVID-19 (high confidence).**
- Work-related exposures over time have been modified by mitigations and restrictions impacting sectors, and it is difficult to separate out transmission risk within specific workplace settings from related social, household and transport exposures. **Within sectors that have remained active during restrictions, evidence suggests that people who work in some specific occupations and roles have increased risks of being infected or hospitalised** (see SAGE 80 EMG-Transmission group paper). **This is higher in many occupations where people have to attend a workplace compared with people in occupations who can work from home** (high confidence).

[18] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/948617/s0998-tfc-update-to-4-november-2020-paper-on-children-schools-transmission.pdf
[19] *Walsh et. Al.*
Do school closures reduce community transmission of COVID-19? A systematic review of observational studies
[20] SPI-M-O; Consensus Statement on COVID-19, 10th Feb 2021
[21] SAGE 80: EMG-Transmission Group, COVID-19 Risk by Occupation and Workplace

- ONS have provided updated analysis of CIS data[22] (Annex A) across 25 occupations for the period 1st Sept 2020 – 7th Jan 2021 looking at the variation in the likelihood of testing positive for COVID-19 adjusting for differences in age, sex, region, the interaction between region and ethnicity, household size, multigenerational households, index of multiple deprivation, ease of social distancing in the workplace and ability to work from home. This finds that over 25 occupations, the likelihood of testing positive for COVID-19 between 1st Sept 2020 – 7th Jan 2021 ranged from 2.1% to 4.8%. The mean likelihood across the 25 occupations was 3.9% and half of the occupations had likelihoods between 3.5% and 4.2%. There was no statistical evidence of a difference in the likelihood of testing positive for COVID-19 between the majority of occupations (226 of 300 comparisons), and for any specific occupation there was no statistical evidence of a difference with at least 15 of the 24 remaining groups. Evidence of difference presents as a continuum, which can be seen in the comparisons between different occupations. Within this, there are a group of occupations at the upper end of the continuum which have no significant difference with the majority of other occupations, but do show a higher probability of testing positive compared to some of those at the lower end. At the upper end are: Caring personal service occupations, Protective service occupations, Teaching and other education professionals, Secretarial and related occupations, and Other managers and proprietors; while at the lower end are Skilled agricultural and related trades; Science, research, engineering and technology professionals; Business, media and public service professionals; Textiles, printing and other skilled trades. During this period of time there was a national lockdown in England between 5 November and 1 December and varying local tier restrictions in place. There was also a significant rise in the positivity rate across the country, including that related to the new variant. This analysis should be understood in that context as opposed to the reducing prevalence currently being experienced.
- In the above analysis, there was no evidence of a difference in the probability of testing positive between teaching and other educational professionals and 15 of the 24 other occupations. There was strong statistical evidence ($p<0.01$) of a higher probability of testing positive for COVID-19 compared to 6 of the other occupations (business and public service associate professionals; culture, media and sports occupations; business, media and public service professionals; textiles, printing and other skilled trades; science, research, engineering and technology professionals; skilled agricultural and related trades) and limited statistical evidence ($p<0.05$) compared to 3 of the other occupations (health professionals; corporate managers and directors; customer service occupations). Testing positive is impacted by many complex factors including contacts and behaviours inside and outside of work.
- **ONS analysis suggests rates of death involving COVID-19 in men and women working in teaching and educational locations is comparable to other professional occupations**, and lower than rates of death in the wider population (low confidence). However, further analysis suggests that men working in secondary education may have a higher risk of COVID-19 mortality than men of the same age in other professional occupations (low confidence).

[22] ONS Coronavirus (COVID-19) Infection Survey: characteristics of people testing positive for COVID-19 in England, 19 Feb 2021. Release date 22 Feb 2021.

- ONS analysis[23] indicates that rates of death involving COVID-19 registered between 9 March and 28 December among working age (20-64 years) men and women who worked as teaching and educational professionals[24] (18.4/9.8 per 100,000 for males/females) were statistically significantly lower than the rates of death involving COVID-19 among those of the same age and sex in the wider population (31.4/16.8 per 100,000). Rates of death involving COVID-19 among all teaching and educational professionals were not statistically significantly different to rates in other 'professional occupations' as a whole (17.6/12.8 per 100,000 for males/females).
- For specific teaching and education professions, it was only possible to calculate a reliable rate for secondary education professionals. Rates of death involving COVID-19 in all secondary teaching professionals (39.2/21.2 per 100,000 for males/females) were not statistically significantly different to those of the same age and sex in the wider population. The rate of death involving COVID-19 in male secondary education professionals (39.2 per 100,000) was however statistically significantly higher than the rate of death involving COVID-19 for men of the same age in professional occupations (17.6 per 100,000).
- The above analysis adjusted for age and sex, but not for other factors such as ethnic group, place of residence, deprivation, or the occupation of others who live in the same household. As such some caution is needed in interpreting findings as reported differences may not conclusively relate to differences in occupational exposure. Occupation data was taken from two sources: as reported on death certificates at the time of death registration and from the 2019 annual population survey (for population counts). There could be some misalignment between these: reported occupation at death may reflect main lifetime occupation which could differ from that at the time of death; and analysis could be impacted if there has been a rapid increase or decrease in the number of workers in specific occupation(s) since 2019.
- Four case control studies[25] using NHSTT data have been conducted by PHE at approximately monthly intervals between August and December 2020. Whilst evidence from the first study period (August) found no evidence of an association, the subsequent periods showed statistical evidence of an association between working in *or* attending an educational setting and becoming a COVID-19 case (aORs 1.52, 2.03, 5.02 for studies 2-4 respectively). These studies also found strong evidence that working in healthcare (aORs 2.81, 2.72, 3.08, 7.41 for studies 1-4 respectively), social care (aORs 5.41, 5.06, 2.46, 10.6 for studies 1-4 respectively) or hospitality (aORs 2.53, 2.63, 2.01 for studies 1-3 respectively) was associated with testing positive for COVID-19. The 4th study period took place during the time of national lockdown, when especially hospitality venues were closed (and a decrease in aOR for the association between working in hospitality and becoming a case was seen). These studies may be affected by selection bias as only cases who were tested are included and controls were recruited from Market Research Panels. There is potential misclassification of exposure impacting all NHSTT data. Whilst models were adjusted for confounding of all available demographic variables, some residual confounding is likely to persist.

[23] https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/causesofdeath/bulletins/coronaviruscovid19relateddeathsbyoccupationenglandandwales/deathsregisteredbetween9marchand28december2020

[24] Those qualified to teach in settings from primary schools to university level education, not including other jobs such as administration

[25] https://www.medrxiv.org/content/10.1101/2020.12.21.20248161v1; SAGE 80 EMG-Transmission Group: COVID-19 Risk by Occupation and Workplace

Impacts on children and young people

Direct impacts of COVID-19

- **There continues to be strong evidence that children and younger people (<19 years) are much less susceptible to severe clinical disease than older people (high confidence).** CO-CIN data[26] shows no significant increase in the proportion of deaths in children under 19 years old when comparing wave 1 (Jan 17th-July 3rd 2020) with a time period including wave 2 (Jan 17th - Dec 31st 2020). For wave 1, 651 (0.94%) of 69,516 hospitalised patients of all ages were under 19 years; of these there were 8 deaths. Including wave 2, 1,618 (1.08%) of 149,738 hospitalised patients of all ages were under 19 years, of these there were 11 deaths. The median age on admission has increased from 4.8 (IQR 0.4-13.8) to 9.0 (0.8-15.1) years, but this may reflect less anxiety over admitting positive infants and not a true change in the biology of the virus.
- **CIS data suggests that the B1.1.7 variant leads to higher infection rates, but is not particularly adapted to any age group (medium confidence)**[27]. Between 21 December 2020 and 2 January 2021, there was no evidence of variation by age group in the percentage of positives that showed S-gene target failure (SGTF) and those that did not. **There was no evidence of difference in growth rates for SGTF vs non-SGTF positives in those up to high school age i.e. under 15/16 years (5% (1-8%)) vs. older individuals (6% (4-9%))**[28].
- Although current SAGE and NERVTAG advice states that there is a realistic possibility that infection with B1.1.7 is associated with a small increase in absolute risk of death compared to wild type variants[29], and any relative increase in CFR appears to be apparent across age groups[30], **there is insufficient information to make any statement on B1.1.7 severity in children.** Preliminary analysis is limited due to representativeness of death data and as COVID-related death in children is so rare it is not yet possible to provide any information on severity in children. Anecdotal situation analyses from the Royal College of Paediatrics & Child Health and NHSE report no signal of increased severity of COVID-19 disease in children in early 2021[31].
- Data provided to SAGE from March-June 2020 indicate that Paediatric Multisystem Inflammatory Syndrome (PIMS) which is temporally associated with COVID-19 is rare with an estimated 45 cases per 100,000 proven SARS-CoV-2 infections in 0-14 year olds[32].
- **CIS data to 26 Jan 2021 suggest that there is an effect of age on symptoms at the time of a positive test. Lower proportions of individuals reported symptoms at younger and older ages.** This is consistent with other studies. There was a small effect of ethnicity with individuals who identify as a non-white ethnicity being slightly less likely to report symptoms at all ages.
- A QResearch report on ethnicity and COVID-19 outcomes in children (Annex B) shows that of 26,322 children who tested positive for SARS-CoV-2, 343 were admitted to hospital (1.3%). Of those admitted, 53.6% (184/343) remained in hospital for less than 36 hours,

[26] Dynamic reports provided to SAGE; https://www.bmj.com/content/370/bmj.m3249
[27] NERVTAG update note on variants of concern, 21/01/2021; SAGE 77
[28] https://www.medrxiv.org/content/10.1101/2021.01.13.21249721v1.full.pdf
[29] SAGE 77
[30] NERVTAG note on B1.1.7 severity, 21/01/2021; SAGE 77
[31] Anecdotal reports provided to SAGE
[32] Data provided to CMO and SAGE by RCPCH, 11 Feb 2020

46.4% (159/343) remained in hospital for 36 hours or longer and 21% (73/343) were admitted to intensive care. This is a population-based study, using a large, nationally representative cohort of 0–18-year-olds.

- There was ethnicity-specific variation in testing, with children from minority ethnic groups having lower uptake of testing and being more likely to test positive than those from White population groups. Whilst rates were very low, **Asian children were more likely to be admitted to hospital and intensive care for COVID-19 than White children** (adjusted odds ratios (ORs): 1.62 (95%CI:1.12-2.36) and 2.11 (95%CI:1.07-4.14), respectively), **and Black and Mixed/other children were more likely to have had longer hospital admissions** (≥36 hours; adjusted ORs: 2.31 (95% CI:1.08-4.94) and 2.14 (95%CI:1.25-3.65)); (medium confidence).

Broader impacts of school closures to Children and Young People (CYP)

- **There is still clear evidence of the negative educational impact of missing school, particularly for younger children**[33], as investments in children's learning tend to accumulate and consolidate over time (high confidence).
- **There remains evidence that the pandemic has negatively impacted the mental health of children and young people, and that school closures cause impairment to the physical and mental health of children**. Evidence suggests that the mental health of adolescents is particularly affected (high confidence).
- A systematic review concluded that **school closures as part of broader social distancing measures are associated with considerable harms to CYP health and wellbeing**[17]**.** These harms occurred at a time when access to health and social care was very markedly reduced and at a time when CYP were much less visible to protective systems. All COVID-19 data included in this review are short-term, and data on the medium and longer-term impacts are urgently needed, both for the whole population and also for potentially vulnerable groups.
    - Mental health and wellbeing – the review identified **impacts across the range of emotional, behavioural and restlessness/inattention problems and overall psychological wellbeing**. Representative and large convenience studies across high-income and LMIC found that 18-60% of CYP scored above thresholds. However, some studies found reduced anxiety.
    - Child abuse - the review found **a fall in child protection referrals by 30-40%**, with halving of referrals from schools.
    - Socioeconomic status – certain studies included in the review reported suggestions of greater impact in poorest children, plus widening of inequalities.

Further work

- Further analysis of the ONS Schools Infection Survey is ongoing to include follow-up testing within households of a positive case; further analysis of the headteachers questionnaire on the differences in practice in different schools. This analysis will aim to

[33] E.g. *SPI-B/DfE, Nov, 2020.*
Benefits of remaining in education: Evidence and considerations.
[17]*Viner et al. 2021* Draft systematic review of broader health impacts of unscheduled school closure

assess whether differences in practice lead to different levels of infection, however schools being closed makes this more challenging

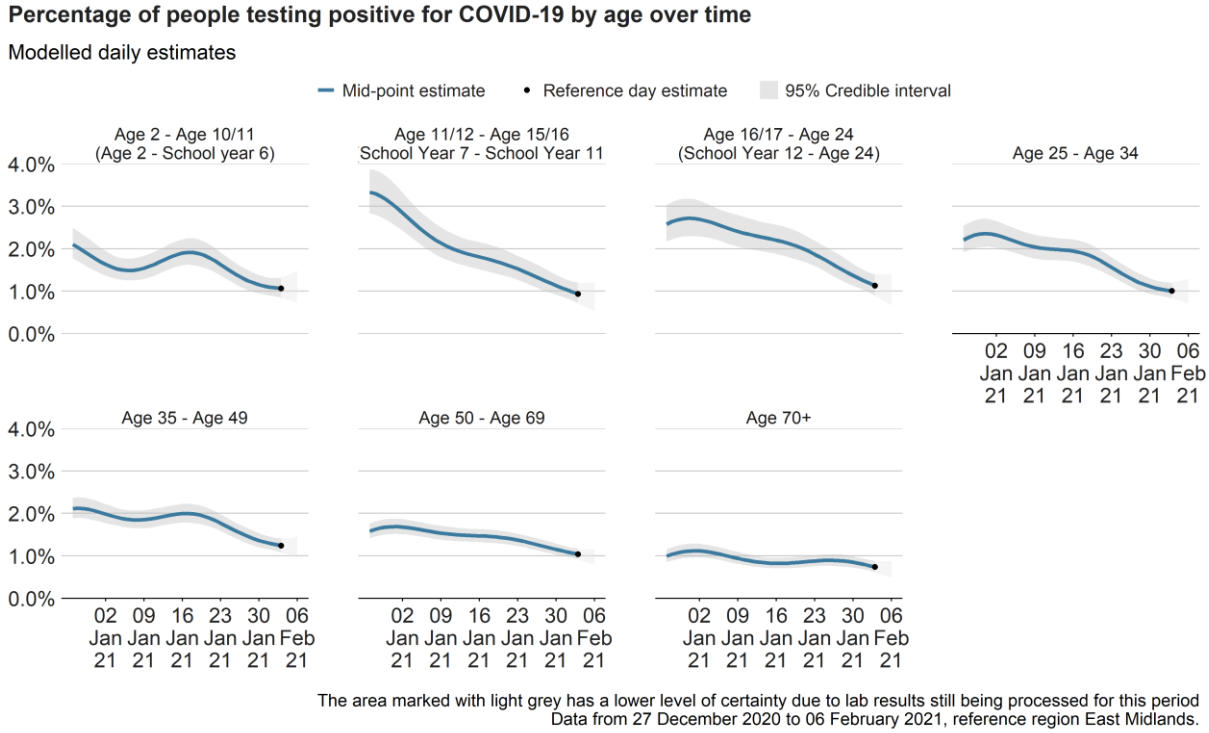
- The Uni. Of Manchester household analysis is being further refined to look more closely at the September to November period, more recent data, and to look at whether onward transmission in households from children is within younger age groups only or also into older household members.

Annex A: ONS Data

ONS CIS data below (to 6th Feb 2021)[34]

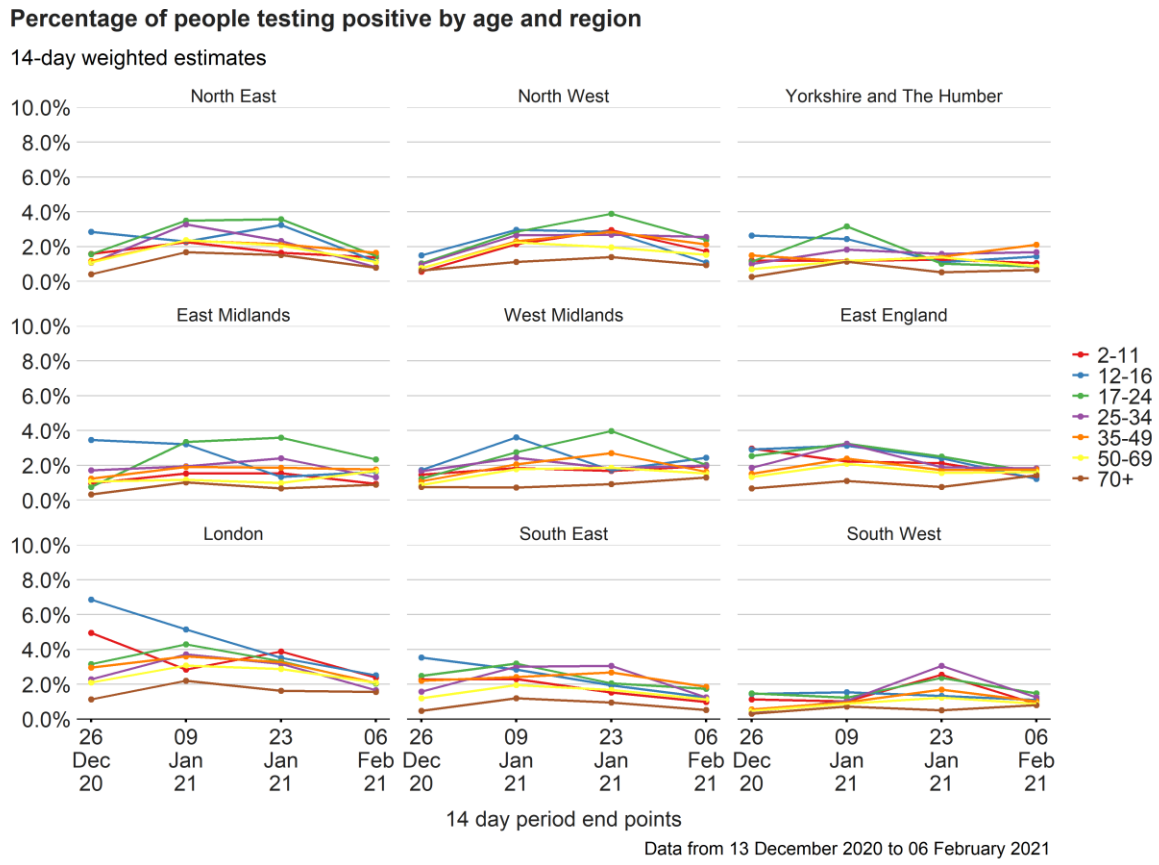
Age over time, England

- In the most recent week, the percentage of people testing positive has decreased in all age groups.
- Caution should be taken in over-interpreting any small movements in the latest trend.



[34] See e.g. https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/datasets/coronaviruscovid19infectionsurveydata/2021/covid19infectionsurveydatasets20210219.xlsx

Age by region over time (weighted)



ONS CIS

Modelled probability of testing positive for the coronavirus (COVID-19) by occupation, adjusting for work location and ability to social distance, England

between 1 September 2020 and 7 January 2021

2-digit Standard Occupation Classification (SOC) Code	2-digit Standard Occupation Classification (SOC) Title	Number tested positive for COVID-19	Sample size	Estimated probability of testing positive (%)	Lower Credible Interval (95%)	Upper Credible Interval (95%)
33	Protective service occupations	110	2,042	4.79%	3.88%	5.70%
61	Caring personal service occupations	386	7,498	4.56%	4.07%	5.06%
42	Secretarial and related occupations	119	2,876	4.42%	3.62%	5.22%
23	Teaching and other educational professionals	511	10,673	4.39%	3.99%	4.79%
12	Other managers and proprietors	208	5,109	4.33%	3.74%	4.91%
62	Leisure, travel and related personal service occupations	64	1,391	4.23%	3.18%	5.27%
92	Elementary administration and service occupations	232	4,794	4.15%	3.60%	4.70%
53	Skilled construction and building trades	120	2,757	4.03%	3.30%	4.77%
31	Science, engineering and technology associate professionals	90	2,165	4.02%	3.19%	4.84%
41	Administrative occupations	532	13,972	4.00%	3.66%	4.34%
32	Health and social care associate professionals	102	2,461	3.98%	3.19%	4.76%
52	Skilled metal, electrical and electronic trades	154	3,603	3.92%	3.29%	4.55%
81	Process, plant and machine operatives	83	1,949	3.90%	3.05%	4.75%
82	Transport and mobile machine drivers and operatives	115	2,690	3.86%	3.14%	4.59%
71	Sales occupations	190	4,144	3.85%	3.29%	4.41%
11	Corporate managers and directors	383	10,901	3.70%	3.33%	4.07%
22	Health professionals	284	7,012	3.68%	3.23%	4.12%

91	Elementary trades and related occupations	30	745	3.64%	2.35%	4.93%
35	Business and public service associate professionals	468	13,547	3.54%	3.21%	3.87%
34	Culture, media and sports occupations	136	3,995	3.39%	2.81%	3.97%
24	Business, media and public service professionals	408	12,862	3.34%	3.01%	3.67%
72	Customer service occupations	68	1,933	3.26%	2.48%	4.04%
21	Science, research, engineering and technology professionals	298	10,170	2.97%	2.62%	3.32%
54	Textiles, printing and other skilled trades	45	1,450	2.87%	2.03%	3.72%
51	Skilled agricultural and related trades	20	1,091	2.09%	1.18%	2.99%

Notes:

1.. All results are provisional and subject to revision.

2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes or other institutional settings.

3. Occupation is based on Standard Occupational Classification (SOC) and relates to the self-reported role indicated by the survey respondents.

4. This table is based on analysis of nose and throat swabs.

5. This analysis only includes working age adults (aged 16-74 years old) in work.

6. This logistics regression model adjusts for age, sex, region, the interaction between region and ethnicity, household size, multigenerational households, index of multiple deprivation, face coverings, work from home and ease of distancing at work.

In the analysis cited in the main text the assessment of statistical evidence is based on the comparison between occupations in the logistic regression model. There is statistical evidence of a difference between two occupations if the 95% confidence interval around the difference does not overlap with zero. These tests can also be accumulated across occupations to assess whether there is statistical evidence of an overall effect of a factor with several occupations. Because these results are from a sample survey, sometimes differences can be due to chance. Statistical evidence of difference only assesses the degree to which the differences observed are due to chance given the numbers studied; it does not imply anything about the size of the differences. A difference can be supported by statistical evidence but can be small in size. This statistical test used to determine differences between pairs of occupations identifies strong ($p<0.01$) and limited ($p<0.05$) evidence of difference. This is a more precise method than comparing overlapping confidence intervals of the probabilities for each occupation. Caution should be taken when considering the conclusions drawn from this analysis, as many of the occupations have lower sample sizes relative to others. To aid interpretation, rather than presenting results as odds ratios from the logistic model, we present results as overall probabilities that participants will test positive over the period included in the analyses, averaged over their other characteristics. Uncertainty in these estimated probabilities is estimated using an approximate method, the 95% confidence intervals around these probabilities are not the same as the comparisons within the models themselves on which assessment of statistical evidence is based.

Table 2b

Strength of the likelihood of testing positive for the coronavirus (COVID-19) by occupation, adjusting for work location and ability to social distance, England between 1 September 2020 and 7 January 2021

Strong evidence of higher probability (p<0.01)	SEH
Limited evidence of higher probability of testing positive (p<0.05)	LEH
No evidence of difference in probability of testing positive	
Limited evidence of lower probability of testing positive (p<0.05)	LEL
Strong evidence of lower probability (p<0.05)	SEL

Likelihood of individuals in a given occupation testing positive, in comparison to individuals in the comparison occupation:

	Comparison 2-digit SOC occupation																							
2-digit SOC occupation	Protective service occupations	Caring personal service occupations	Secretarial and related occupations	Teaching and other educational professionals	Other managers and proprietors	Leisure, travel and related personal service occupations	Elementary administration and service occupations	Skilled construction and building trades	Science, engineering and technology associate professionals	Administrative occupations	Health and social care associate professionals	Skilled metal, electrical and electronic trades	Process, plant and machine operatives	Transport and mobile machine drivers and operatives	Sales occupations	Corporate managers and directors	Health professionals	Elementary trades and related occupations	Business and public service associate professionals	Culture, media and sports occupations	Business, media and public service professionals	Customer service occupations	Science, research, engineering and technology professionals	Textiles, printing and other skilled trades	Skilled agricultural and related trades

Protective service occupations																LEH	LEH		SEH	SEH	SEH	LEH	SEH	SEH	SEH
Caring personal service occupations																SEH	SEH		SEH	SEH	SEH	LEH	SEH	SEH	SEH
Secretarial and related occupations																			LEH	LEH	SH	LEH	SEH	LEH	SEH
Teaching and other educational professionals																LEH	LEH		SEH	SEH	SEH	LEH	SEH	SEH	SEH
Other managers and proprietors																			LEH	LEH	SH	LEH	SEH	LEH	SEH
Leisure, travel and related personal service occupations																							LEH	LEH	SEH
Elementary administration and service occupations																					LEH		SEH	LEH	SEH
Skilled construction and building trades																							SEH		SEH
Science, engineering and technology associate professionals																							LEH		SEH
Administrative occupations																					SEH		SEH	LEH	SEH
Health and social care associate professionals																							LEH		SEH
Skilled metal, electrical and electronic trades																							SEH		SEH
Process, plant and machine operatives																							LEH		LEH
Transport and mobile machine drivers and operatives																							LEH		SEH
Sales occupations																							SEH		SEH
Corporate managers and directors	LEL	SEL		LEL																			SEH		LEH
Health professionals	LEL	SEL		LEL																			LEH		LEH
Elementary trades and related occupations																									
Business and public service associate professionals	SEL	SEL	LEL	SEL	LEL																		LEH		LEH
Culture, media and sports occupations	SEL	SEL	LEL	SEL	LEL																				LEH
Business, media and public service professionals	SEL	SEL	SEL	SEL	SEL		LEL			SEL															LEH
Customer service occupations	LEL	LEL	LEL	LEL	LEL																				
Science, research, engineering and technology professionals	SEL	SEL	SEL	SEL	SEL	LEL	SEL	SEL	LEL	SEL	LEL	SEL	LEL	LEL	SEL	SEL	LEL		LEL						

Textiles, printing and other skilled trades	SEL	SEL	LEL	SEL	LEL	LEL	LEL			LEL															
Skilled agricultural and related trades	SEL	SEL	SEL	SEL	SEL	SEL	SEL	SEL	SEL	SEL	SEL	SEL	LEL	SEL	SEL	LEL	LEL		LEL	LEL	LEL				

Notes:

1.. All results are provisional and subject to revision.

2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes or other institutional settings.

3. Occupation is based on Standard Occupational Classification (SOC) and relates to the self-reported role indicated by the survey respondents.

4. This table is based on analysis of nose and throat swabs.

5. This analysis only includes working age adults (aged 16-74 years old) in work.

6. Analysis from table 2a was used to establish the relationship between pairs and create this table.
7. Pairs of work sectors/occupations with a p-value equal to or less than 0.01 have strong statistical evidence of a difference in the likelihood of testing positive. Pairs with a p-value between 0.01 and 0.05 have limited statitical evidence of a difference, and pairs with a p-value of more than 0.05 have no statistical evidence of a difference.
8. The logistic regression model used to create this table adjusts for age, sex, region, the interaction between region and ethnicity, household size, multigenerational households, index of multiple deprivation, face coverings, work from home and ease of distancing at work.
9. This table can be read each row at a time, taking the occupation indicated in the row and identifying from the columns how it compares to other occupations, for example people working in Caring personal service occupations have a strongly higher risk of testing positive for COVID-19 compared to Health professionals, but the risk is no different from those working in Administrative occupations.

Annex B: QResearch report on ethnicity and COVID-19 outcomes in children:

Ethnicity and COVID-19 outcomes in children: a longitudinal cohort study of 2.6 million children

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Executive summary

- Ethnic disparities in COVID-19 outcomes are known to exist in adults but not children
- This population-based study used a large, nationally representative cohort of 0-18 year olds
- Testing proportions were highest in White children and lower in children from other ethnic minority populations
- In those tested, children from ethnic minority backgrounds were more likely to have a positive test compared to White children
- Asian children were more likely to be hospitalised and admitted to ICU than White children
- Black and Mixed/Other ethnicity children were more likely to have longer hospital stay

Introduction

Children (0-18 years old) constitute between 11% and 13% of novel coronavirus disease 2019 (COVID-19) diagnoses[1 2], and while children with COVID-19 largely experience asymptomatic or mild disease, the cumulative hospitalisation rates are steadily rising[3]. Understanding risk factors for hospitalisation and severe outcomes in children is critical to reduce the impact of the novel coronavirus pandemic.

Ethnicity has been associated with higher morbidity and mortality in adults, with Black and Asian populations tending to have poorer outcomes than the White population[4-6]. Whether a similar association between ethnicity and severe COVID-19 exists in children is not well established.

Current insight into the association between ethnicity and COVID-19 outcomes in children is based largely on small descriptive studies from the UK and USA. A population-level approach utilising individual-level data linkages from primary care, national testing data and hospitalisation registries offers an opportunity to more comprehensively analyse rates of SARS-CoV-2 infection and COVID-19 hospitalisations in the UK by ethnic categories, whilst accounting for sociodemographic and pre-existing chronic diseases.

Methods

A cohort study was undertaken using the QResearch Database, a primary care data source, linked at the individual-level to Public Health England RT-PCR SARS-CoV-2 testing, hospital admissions, and Office for National Statistics death registry data. A cohort of children (aged 0-18years) between on the 24th January 2020 was identified (date of first confirmed case of COVID-19 in UK, with follow-up until 31st October 2020 (for COVID-19-related hospital admissions), or 30th November 2020 (for positive test results).

Data regarding demographics (ethnicity, quintile of Townsend deprivation index, geographical region, household size) were extracted, as well as the presence of recorded comorbidities that are understood to differ in prevalence across ethnic groups (i.e., type 1 diabetes, sickle cell disease, congenital heart disease and neurological disorders [epilepsy and cerebral palsy]). Due to small event counts in this population, ethnicity groups were White, Black, Asian and Mixed/Other.

Outcomes included: SARS-CoV-2 testing, positive SARS-CoV-2 test, hospital contact due to COVID-19 (attendance +/- admission), COVID-19 related hospital admission, COVID-19-related intensive care admission, and the duration of hospital admission (<36hrs v. 36hrs+). COVID-19 related hospital admission can be defined by either positive test or clinical diagnosis.

Multivariable logistic regression models were used to model the effect of ethnicity on each outcome of interest, adjusting for the aforementioned factors. Clustered standard errors were used to account for clustering of children within individual general practices. Odds ratios with 95% CIs are reported. All analyses were run using multiple imputation to handle missing data – 10 imputations were generated to replace missing values for ethnicity, deprivation quintile, and household size.

Results

The cohort included 2,576,353 children (0-18 years). Median age was 9 years (interquartile range 5-14 years). The majority were school aged children [above 5 years, 71% (1,827,809/2,576,353)]. Ethnic minority populations (non-white backgrounds) consisted of 20% of the cohort, which is representative of the UK population[12].

410,726 (15.9%) were tested for SARS-CoV-2, of which 26,322 (6.4%) were positive. 0.07% (1853/2,576,353) of children in the cohort had a recorded hospital contact and 0.01% (343/2,576,353) were admitted to hospital (Table 1). Of those admitted, 53.6% (184/343) remained in hospital for less than 36 hours, 46.4% (159/343) remained in hospital for 36 hours or longer and 21% (73/343) were admitted to intensive care.

There was ethnicity-specific variation in testing (Table 1): children from White backgrounds had the highest percentage of SARS-CoV-2 testing [17.1% (223,701/1,311,041)], whilst children from Asian [13.6% (33,213/243,545)], Mixed/Other [12.9% (18,971/147,529)] and Black [8.3% (7727/93,620)] ethnic backgrounds had lower percentages. In children that were tested, those from Asian [10.8%, (3576/33,213)], Black [7.8%, (601/7727)] and Mixed/Other [6.3%, (1197/18971)] backgrounds had a higher proportion of positive test results compared to White children [5.8%, (13,043/223,701)].

In maximally adjusted logistic regression models, compared to White children (Figure 1): 1) children from all ethnic minority backgrounds were significantly more likely to test positive for SARS-CoV-2, 2) Asian children were more likely to have hospital and intensive care admissions for COVID-19 (adjusted odds ratios (ORs): 1.62 (95%CI:1.12-2.36) and 2.11 (95%CI:1.07-4.14), respectively) and, 3) Black and Mixed/Other children (adjusted ORs: 2.31 (95% CI:1.08-4.94) and 2.14 (95%CI:1.25-3.65), respectively) had longer hospital admissions (≥36 hours).

Discussion

This study provides new evidence for an association between ethnicity, childhood infection with SARS-CoV-2 infection and severity of outcomes from COVID-19 in England. This is an important consideration in the national response to the novel coronavirus pandemic.

Table 1. Baseline characteristics, COVID-19 testing and hospital outcomes of children (aged 0-18 years) between 24th January and 31st October (for hospital data) and 30th November 2020 (for testing data), by ethnicity.

	Total (n= 2,576,353)	White (n= 1,311,041)	Asian (n= 243,545)	Black (n=93,620)	Mixed/Other (n=147,529)
Age Categories, n(%)					
0-3 months	61,116 (2.4)	17,610 (1.3)	3,185 (1.3)	978 (1.0)	2,469 (1.7)
3-12 months	130,110 (5.1)	46,371 (3.54)	7,789 (3.2)	2,492 (2.7)	6,020 (4.1)
2-5 years	557,318 (21.6)	235, 825 (18.0)	42,132 (17.3)	14,756 (15.8)	29,725 (20.2)
6-10 years	725,819 (28.2)	408,287 (31.1)	74,710 (30.7)	27,329 (29.2)	44,984 (30.5)
11- 15 years	707,095 (27.5)	431,266 (32.9)	78,460 (32.2)	31,868 (34.0)	33,024 (29.8)
16- 18 years	394,895 (15.3)	171,682 (13.1)	37,269 (15.3)	16,197 (17.3)	20,307 (13.8)
Female, n (%)	1,257,260 (48.8)	639,720 (48.8)	118,676 (48.7)	46,064 (49.2)	72,029 (48.8)
Townsend deprivation quintile, n(%)					
1 (least deprived)	527,452 (20.5)	323,136 (24.9)	21,676 (9.0)	2,677 (2,9)	13,415 (9.2)
2	547,532 (21.3)	315,037 (24.2)	32,429 (13.4)	5,521 (6.0)	19,051 (13.0)
3	542,116 (21.0)	282,253 (21.7)	52,332 (21.6)	12,679 (13.7)	28,923 (19.1)
4	509,671 (19.8)	232,034 (17.8)	67,645 (28.0)	24,033 (25.9)	36,641 (25.1)
5 (most deprived)	429,060 (16.7)	148,049 (11.4)	67,942 (28.1)	47,858 (51.6)	49,223 (33.7)
Comorbidities, n (%)					
None of relevant comorbidities	2,348,326 (91.1)	1,187,099 (90.5)	218,118 (89.6)	84,4947 (89.7)	134,374 (91.1)
Asthma	183,089 (7.1)	106,217 (8.1)	21,647 (8.9)	7,016 (7.5)	10,649 (7.2)
Diabetes (type 1)	4916 (0.2)	2937 (0.2)	288 (0.1)	203 (0.2)	256 (0.2)
Cerebral Palsy	3927 (0.2)	2245 (0.2)	344 (0.1)	151 (0.2)	203 (0.1)
Epilepsy	12,972 (0.5)	722 (0.56)	1228 (0.5)	587 (0.6)	735 (0.5)
Congenital heart disease	21,523 (0.8)	11,645 (0.9)	1883 (0.8)	651 (0.7)	1001 (0.7)
Sickle cell disease	1600 (0.1)	176 (0.01)	37 (0.02)	705 (0.8)	311 (0.2)
Test Outcome					
Ever tested, n (% population)	410,726 (15.9)	223,701 (17.0)	33,213 (13.6)	7727 (8.3)	18,971 (12.9)
Tested positive, if tested n(% tested)	26,322 (6.4)	13,043 (5.8)	3576 (11.2)	601 (7.8)	1197 (5.9)
Hospital Outcome					
Any hospital contact, n(% population)	1,853 (0.07)	839 (0.06)	236 (0.10)	67 (0.07)	108 (0.07)
Hospital admission, n(% population)	343 (0.01)	125 (0.01)	47 (0.02)	20 0.02)	30(0.02)
<36hrs	184 (0.01)	62 (0.005)	24 (0.01)	10 (0.01)	11 (0.01)

≥36hrs	159 (0.01)	63 (0.005)	23 (0.01)	10 (0.01)	19 (0.01)
Intensive Care admission, n (% population)	73 (0.003)	24(0.002)	15(0.006)	5 (0.005)	6 (0.004)

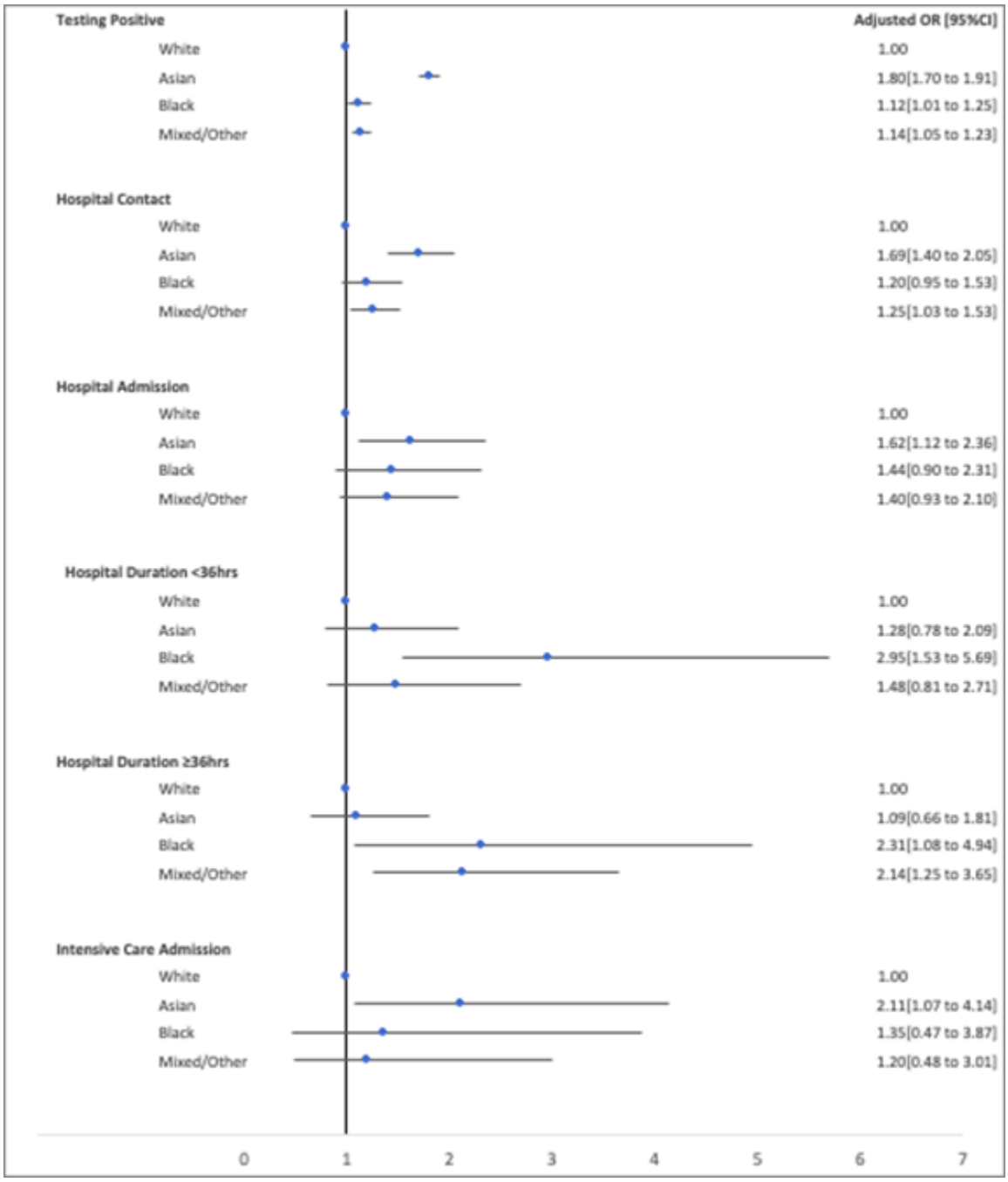

Figure 1 | Maximally adjusted regression analysis exploring the association between ethnicity and outcomes of interest (positive SARS-CoV-2 testing, hospital contact (admission or attendance), hospital

admission, hospitalisation duration and intensive care admission). Adjustments for demographics (age, sex, deprivation level, region and household size) and all relevant comorbidities (asthma, type 1 diabetes, cerebral palsy, congenital heart disease, epilepsy, sickle cell disease)

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Annex C: Comix data (week 45 and week 43)

Extract from CoMix report, week 45

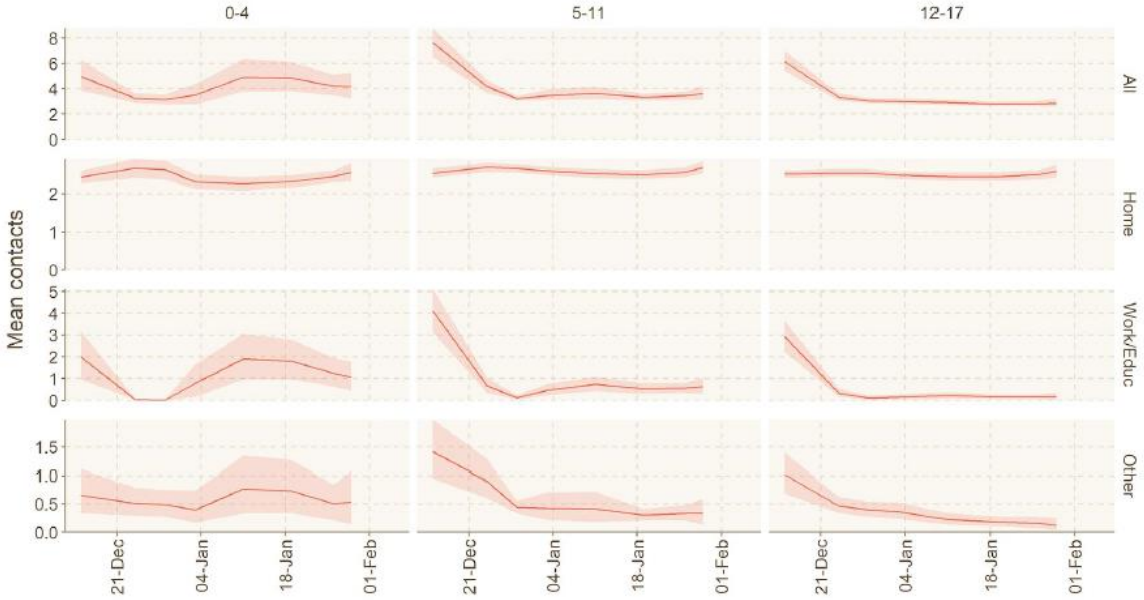
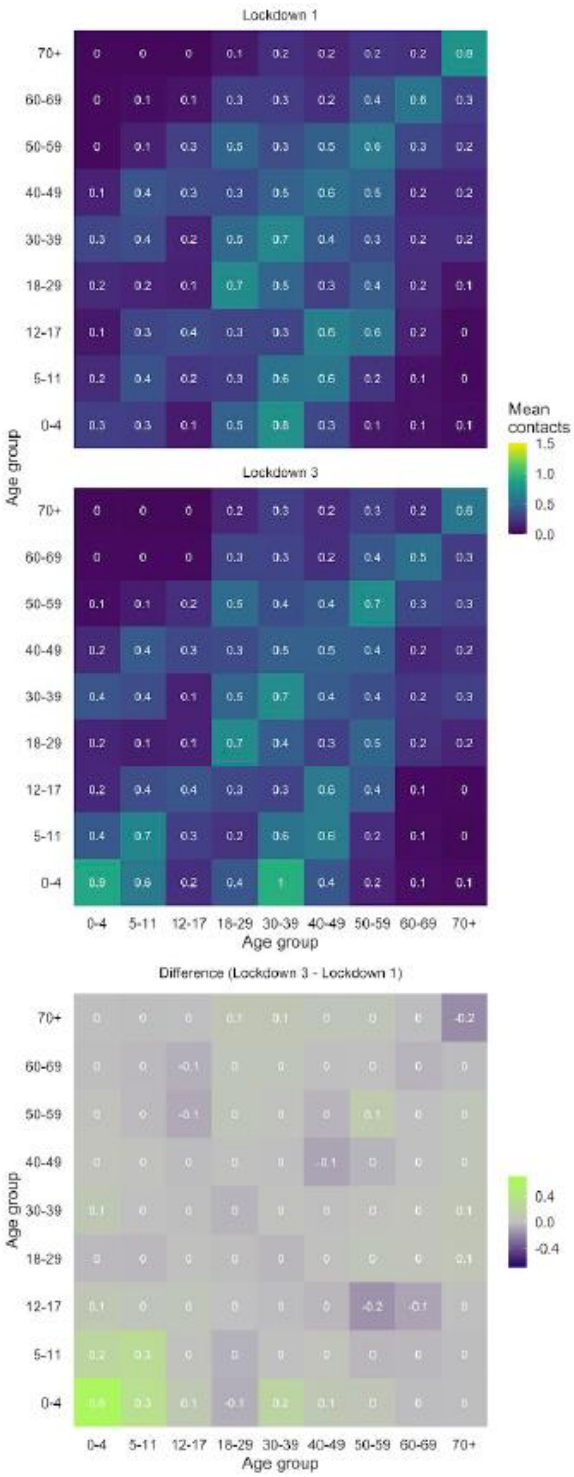


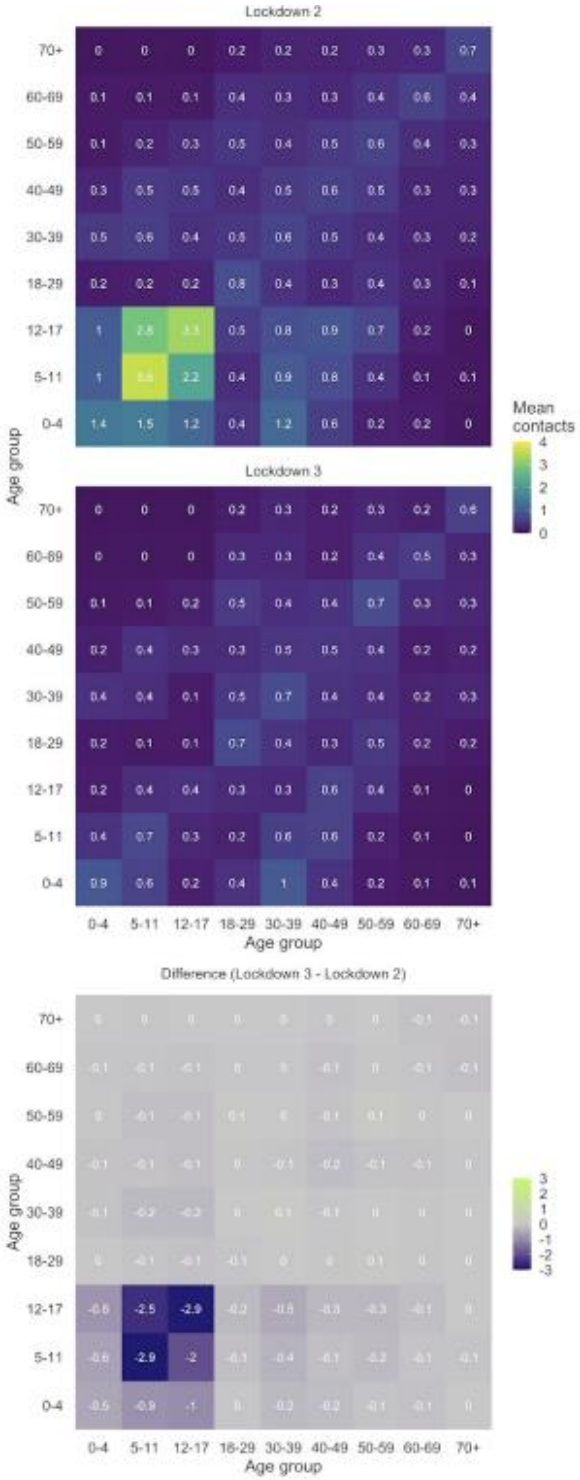
Figure S2: Setting-specific mean contacts by age-group for children over time. Uncertainty calculated using bootstrapping. Contacts truncated to 50 contacts per participant. Observations are smoothed over two weeks to account for panel effects. Educ = educational setting. Date on x axis refers to the midpoint of the survey period.

Extract from CoMix report, week 43

Below left: Contact matrix for all contacts in England by age comparing Lockdown 1 and Lockdown 3 and the absolute difference of the cells of the matrices. Contacts truncated to 50 contacts per participant. Lockdown 1 data from 23rd of March to 3rd of June 2020 Lockdown 3 data from 5th to 18th of January 2021.

Below right: Contact matrix for all contacts in England by age comparing Lockdown 2 and Lockdown 3 and the absolute difference of the cells of the matrices. Contacts truncated to 50 contacts per participant. Lockdown 2 data from 5th November to 2nd December 2020 and Lockdown 3 data from 5th to 18th of January 202.





Annex D: PHE - summary of latest contributions to evidence on COVID-19 and children / educational settings

Date: 08/02/2021

Key findings:

- Maintaining low community infection rates is critical for keeping schools open during the pandemic
- sKIDs: antibody study to measure SARS-CoV-2 infection in primary schools found that only 3-4% of staff and students who were SARS-CoV-2 antibody negative developed antibodies by early December 2020, even after all pupils returned to school in September 2020. Notably, antibody positivity rates in primary school students was similar to that in the staff
- Secondary schools (estimated 15% of schools) were more likely to be affected by a COVID-19 outbreak than primary schools (estimated 3% of schools) in the first half-term and to experience larger outbreaks across multiple school years. The higher attack rate among teaching staff during school outbreaks suggests that additional protective measures may be needed.
- Although evidence suggests low transmission in schools, greater awareness of the potential risks of COVID-19 transmission between secondary school students, their peers, teachers and household members may increase adherence to infection control measures within and outside schools.
- PIMS-TS is a rare condition affecting the heart and coronary arteries in children. We found that the condition typically occurs 2-4 weeks after SARS-CoV-2 infection but is associated with good outcomes
- Follow-up of childhood COVID-19 cases in June 2020 found that only 2.7% of children had persistent symptoms more than a month after testing positive for SARS-CoV-2 infection, which is reassuring compared to the higher rates of long COVID reported in adults

1. **SARS-CoV-2 infections in children following the re-opening of schools and the impact of national lockdown during Autumn 2020: prospective, national observational cohort surveillance, England**
   Pre-print: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3761920

   - National data analysed until the end of November 2020 (prior to new variant)
   - In school-aged children, SARS-CoV-2 infections followed the same trajectory as but lagged behind adult cases and only declined after national lockdown was implemented whilst keeping schools open.
   - Maintaining low community infection rates is critical for keeping schools open during the pandemic

2. **COVID-19 outbreaks following full reopening of primary and secondary schools in England: retrospective, cross-sectional national surveillance**

   - Data from the first school half-term

- Secondary schools (estimated 15% of schools) were more likely to be affected by a COVID-19 outbreak than primary schools (estimated 3% of schools) and to experience larger outbreaks across multiple school years.
- The higher attack rate among teaching staff during an outbreak suggests that additional protective measures may be needed.

3. **Perceptions of adolescents on the COVID-19 pandemic and returning to school: qualitative questionnaire survey, England 2020**

    - Younger students were less concerned about catching and transmitting SARS-CoV-2 and were less likely to adhere to protective measures.
    - Although evidence suggests low transmission in schools, greater awareness of the potential risks of COVID-19 transmission between secondary school students, their peers, teachers and household members may increase adherence to infection control measures within and outside schools.

4. **Paediatric Multisystem Inflammatory Syndrome temporally associated with SARS-CoV-2 (PIMS-TS): prospective, national surveillance, UK and Ireland, 2020**

    - Paediatric multisystem inflammatory syndrome temporally associated with SARS-CoV-2 (PIMS-TS), first identified in April 2020, shares features of both Kawasaki disease (KD) and toxic shock syndrome (TSS).
    - Public Health England initiated prospective national surveillance of PIMS-TS through the British Paediatric Surveillance Unit.
    - There were 216 cases with features of PIMS-TS alone, 13 with features of both PIMS-TS and KD, 28 with features of PIMS-TS and TSS and 11 with features of PIMS-TS, KD and TSS
    - There was a strong geographical and temporal association between SARS-CoV-2 infection rates and PIMS-TS cases.
    - 118 children (44·0%) required intensive care, which was more common in cases with a TSS phenotype
    - Three of five children with cardiac arrest had PIMS-TS/TSS phenotype. Three children (1·1%) died.

5. **Prospective active national surveillance of preschools and primary schools for SARS-CoV-2 infection and transmission in England, June 2020 (sKIDs: COVID-19 surveillance in school KIDs)**
   Pre-print: http://ssrn.com/abstract=3764198

    - Data from June/July 2020
    - 12,026 participants (59.1% students, 40.9% staff) in 131 schools had 43,091 swabs taken.
    - Weekly SARS-CoV-2 infection rates were 3.9 (1/25,537; 95% CI, 0.10-21.8) and 11.3 (2/17,554; 95% CI, 1.4-41.2) per 100,000 students and staff.

- At recruitment, N-antibody positivity in 45 schools was 11.1% (91/817; 95%CI, 9.2-13.5%) in students and 15.1% (209/1381; 95%CI, 13.3-17.1%) in staff, similar to local community seroprevalence.
- Seropositivity was not associated with school attendance during lockdown or staff contact with students.
- Round 2 participation was 73.7% (1,619/2,198) and only five (4 students, 1 staff) seroconverted.
- In round 3, when 61.9% (1,361/2,198) of round 1 participants were re-tested, seroconversion rates were 3.4% (19/562; 95%CI, 2.0-5.2) in students and 3.9% (36/930; 95%CI, 2.7-5.3) in staff.
- Conclusions: SARS-CoV-2 infection rates, assessed using nasal swabs for acute infection and serum antibodies for prior infection, were low following partial and full reopening of primary schools in England.

6. SARS-CoV-2 infections in primary school aged children following partial re-opening of schools in England

- During June 2020, 25,432 SARS-CoV-2 infections were confirmed in England and primary school-aged children accounted for 446 (1.8%) cases.
- Follow-up of 259 cases identified nine children (2%) presenting to hospital with COVID-19 symptoms, of whom three were hospitalised; no fatalities
- Seven children (2.7%) reported excessive fatigue (n=4), dyspnoea (n=1), body aches (n=1) or brain fog (n=1) >1 month later.
- Conclusion: during low community SARS-CoV-2 incidence, reopening of some primary schools was not associated with an increase in COVID19 cases; most children had mild infection and hospitalisations were rare.

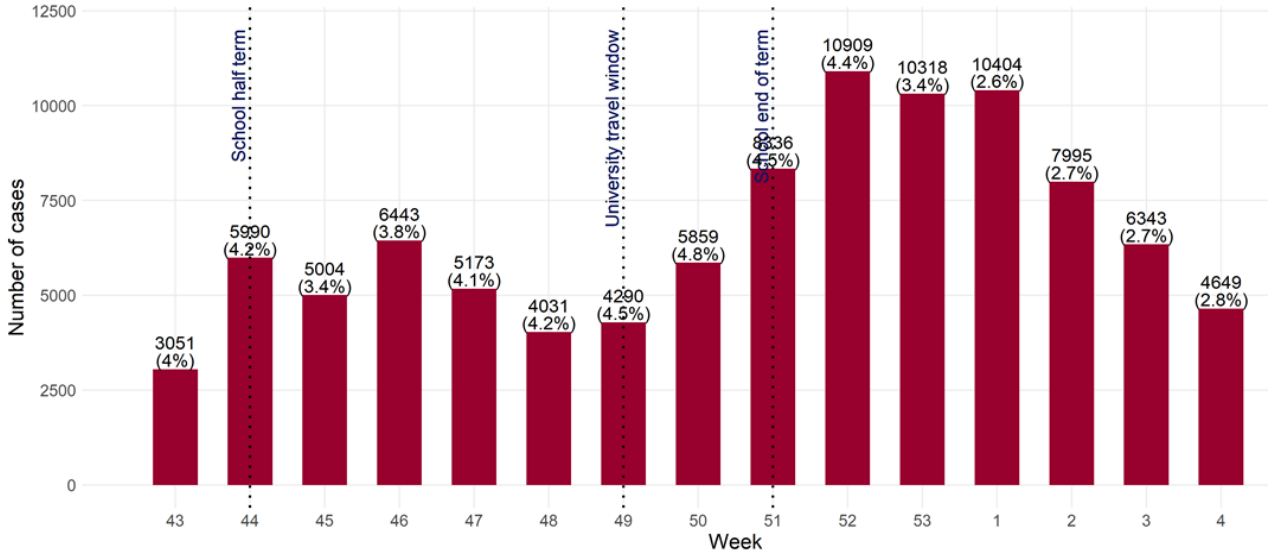
PHE:

New data: case control study, information from NHS Test and Trace contact tracing service.

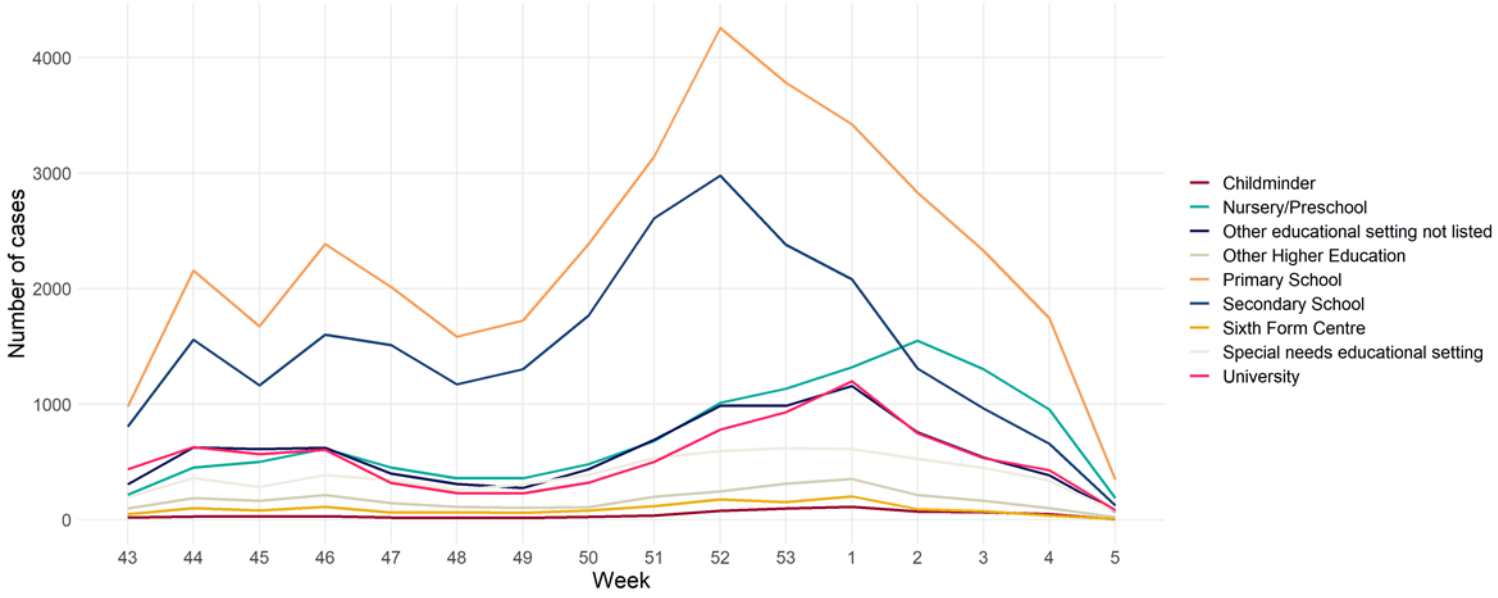
- In week 4 (25th January – 31st January 2021):
    - The proportion of cases that reported attending an educational setting remained low (6.5%) Primary school was the most commonly reported setting amongst cases who had attended an educational setting
    - The proportion of cases who reported working at an educational setting remained low (2.8%), despite the introduction of lateral flow device (LFD) testing for teachers in primary and secondary schools. Primary school was also the most commonly reported setting amongst cases who had worked at an educational setting
    - Educational settings were the second most frequent common setting for COVID-19 cases (23%), following supermarkets (38%).
- Three case-control studies found that working or attending educational settings was associated with higher odds of becoming COVID-19 case
- Note: Information on people attending or working in an education setting does not infer that transmission occurred in that setting

NHS T&T data – In total, from 23 October to 31 January 98,795 cases reported working in an education setting from 23 October (week 43, 2020) to 31 January (week 4, 2021) ranged from 2.6-4.8% of all cases reported each week. This was again highest in week 50, just before end of school term before the Christmas break, and lowest in January.
The most commonly reported educational setting reported by cases working in an educational setting was primary school. This was followed by secondary schools until the second week of 2021, when more cases reported working in nursery/preschool. This could partly reflect the roll-out of lateral flow device (LFD) testing to teachers, which started with weekly testing in secondary schools on 4th January 2021, which became twice weekly and included primary schools from 25th January. This is likely to increase case ascertainment of teachers from this time onwards.

Number of cases, and percentage of the total number of cases each week, who worked at an educational setting by week, England, October 23 - 03 February (1)



Number of cases who worked at an educational setting by week stratified by education setting type, England, October 23 - 03 February (1) Note: Week 5 data incomplete at time of report



- NHS Test & Trace data show the number of contacts associated with cases in different educational settings could reflect the scale of transmission in different settings. If a case attended or worked in an education setting when potentially infectious, NHS Test and Trace will record close named contacts associated with that setting. According to NHS Test & Trace data, from week 43 (just prior to autumn half term) until week 52 (start of school Christmas holidays), the greatest number of contacts were within secondary schools, followed by primary schools (1). However, from week 1 of 2021 onwards, most contacts were reported within nurseries, followed by primary schools. This likely reflects the impact of the closure of schools (but not of nurseries) in the most recent lockdown, introduced in week 1.

Number of contacts of cases who attended or working in an educational setting, stratified by education setting type, England, October 23 - 03 February (1) Note: Week 5 data incomplete at time of report