YDG CYMRU | ADR WALES

Data Insight

STAFF-PUPIL COVID-19 INFECTION PATHWAYS IN SCHOOLS: A POPULATION LEVEL LINKED DATA APPROACH

Lead Authors: Professor Ronan Lyons & Dr Richard Fry

Date: March 2021

This Data Insight explores the likelihood of pupils and staff testing positive for Covid-19 when there has been a positive case among staff, pupils and their households. It uses anonymised data on all staff, pupils and associated household contacts in Wales to understand the likely transmission pathways into and through educational settings.

What we did

We created the first population-level study of transmission between pupils and staff in a school environment during the Covid-19 pandemic. We assessed the likelihood of test positivity in pupils and staff in relation to other recent cases in linked pupils, staff or their households over the period from August to December 2020.

This study used linked data anonymised at individual and household level for the population of Wales, held within the Secure Anonymised Information Linkage (SAIL) Databank.

The creation of an e-Cohort

We created an e-cohort of school children (ages 4-17), school staff, and linked household members for both children and staff. The sample size of tests, and numbers of infections was substantial, covering the entire staff and pupil records in Wales other than those within the privately educated sector, which is very small in Wales (75 private schools).

Background

The role schools play in the transmission of Covid-19 needs investigation. Following prolonged periods of school closures as a measure to reduce transmission, pupils and staff are returning to school across the UK. Whilst current evidence suggests that younger children are less susceptible to infection[1] and have considerably milder effects compared to adults[2], there is limited evidence of the role of schools in transmission between pupils and staff.

In the UK, enhanced surveillance was undertaken following the reopening of schools during the 2020 summer half-term. It confirmed that whilst overall risk of infection was low among pupils and staff, there was a higher risk of Covid-19 infection among staff, with staff to staff transmission most commo[3,4]. Emerging research from the UK Office for National Statistics (ONS) COVID-19 Infection Survey (CIS) and Schools Infection Survey (SIS)[5] reports an increased transmission amongst school staff and school-aged children, particularly in those aged 12 and above against a background of high community prevalence towards the end of 2020.

However, the evidence base is still limited and does not cover the dynamics of transmission and infection from households to schools, and within the school setting.

To create this we linked:

- Our primary health data cohort, the Welsh COVID-19 e-cohort, which consists of all people alive and known to the NHS in Wales on or after the 1st January 2020.
- The School Workforce Annual Census (SWAC), which details all individuals who work in a publicly funded school covering 1,498 out of 1,502 schools in Wales.
- The Pupil Level Annual School Census (PLASC), which includes annual returns on 1,480 out of 1,502 schools.
- COVID-19 antigen testing data. This data combined pillar 1 and pillar 2 data collected by Public Health Wales (PHW). Pillar 1 is swab testing in PHW labs and NHS hospitals for those with a clinical need, and health and care workers; and pillar 2 is swab testing for the wider population, as set out in government guidance.

Using a School Anonymised Linking Field (SALF), we linked pupils, staff and their linked household members in Wales linked via educational settings. We followed participants from the 1st August to the 25th December 2020. Our educational setting data is recent up to the end of the academic year 2019-2020. Therefore, we removed pupils who: finished primary school (year 6) in the school year 2019/20; finished secondary school (year 11) in the school year 2019/20 from the statistical models, because it is not possible to confirm their linked education setting over the period. Staff members contracted to multiple schools were also removed because it was not possible to determine durations within each school.

What we found

- In unadjusted analyses we found significantly increased risk of testing positive across all outcomes, following known cases in linked schools and households. However, after adjusting for age, sex, rurality, school type, household case exposure, and numbers of staff/pupils in school/household, we found that total numbers of cases in the preceding 14-days in the school was associated with a lower risk of testing positive.
- The strongest signal in the data (for both staff and pupils) related to exposure to known cases in the household. We also found a significant association with the wider bubble of cases in any household linked to the school.
- Staff members in primary and special schools had a higher odds of a Covid-19 positive test compared with middle and secondary schools, and staff had higher odds of a positive outcome compared to the reference level of pupils.
- The odds of staff testing positive for Covid-19 infection were not significantly increased in the 14-day period after case detection in the school.
- When stratifying by pupils, and adjusting for covariates (including household cases), the total number of cases in the school was not associated with increased risk of test positivity.
- In contrast, the number of cases in pupils within the same year group was significantly associated with testing positive.
- Schools opening between September and December 2020 was not associated with an increased subsequent risk of testing positive in staff.
- The total number of cases in a school was not associated with a subsequent increase in the risk of testing positive.

Figure 1: Fully adjusted multivariable logistic regression results (Model1 Staff and Pupils; Model2 Stratified by Staff; Model3 Stratified by Pupils). Adjustments for age, sex, residential settlement type, number of pupils and staff within the linked school, and number of people within linked household are included in the models. Odds ratios are calculated per individual case of known exposure.

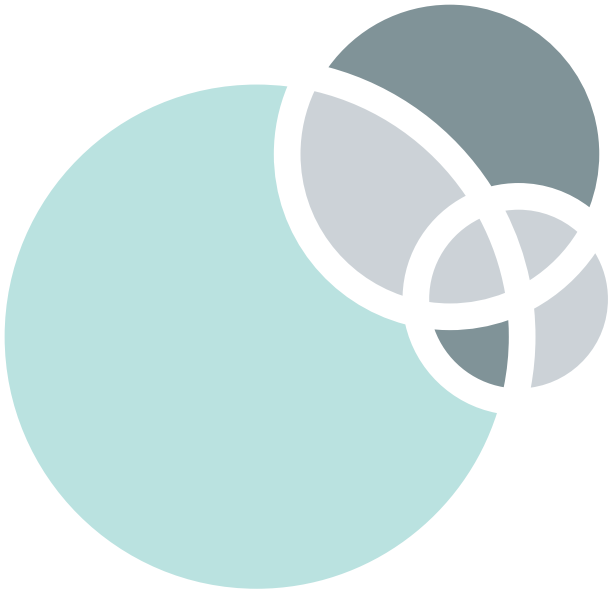
Exposure variable (within last 14 days)	Model1 Staff and Pupil Outcomes (n = 83,004)	Model2 – Staff Outcomes (n = 13,543)	Model3 – Pupil Outcomes (n = 69,461)
Count of cases within own household	11.81*** (11.02 – 12.15)	39.86*** (35.01 – 45.38)	9.39*** (8.94 – 9.88)
Count of staff member cases within the linked school	0.93*** (0.89 – 0.97)	0.92' (0.85 – 1.00)	0.97 (0.91– 1.01)
Model1 and Model2: Count of pupil cases within the linked school	0.97*** (0.95 – 0.98)	0.98 (0.93 – 1.02)	-
Model3: Count of non-year group pupil cases within the linked school	-	-	0.92*** (0.89 – 0.94)
Count of pupil cases in the linked school within the same year group	-	-	1.12*** (1.08 – 1.15)
Count of cases in staff member's homes linked to the school.	1.11*** (1.07 – 1.15)	1.09** (1.02 – 1.17)	1.17*** (1.12 – 1.22)
Count of cases in pupils' homes linked to the school.	1.07*** (1.06 – 1.09)	1.04* (1.01 – 1.07)	1.08*** (1.06 - 1.10)

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '' 0.1 ' ' 1**

Why it matters

As schools reopen across the UK following prolonged periods of school closures, evidence is required that examines the role of the school setting in transmission between pupils and school staff. Findings from this study suggest that pupil to pupil Covid-19 transmission is likely but the absolute effects on the wider school population and staff can be minimised through the implementation of current mitigation measures, albeit measures that have been strict.

We conclude that there is good evidence that the numbers of cases in pupils is associated with exposure to previous pupil cases within the school year group, consistent with pupil-to-pupil transmission linked to schools. A wide range of extensive mitigation measures in our study population have likely reduced the potential for further spread within the wider school pupil population and from pupil to staff.



What next?

This study has examined plausible transmission pathways within a school environment and not the risk of staff or pupils becoming moderately or seriously ill from COVID-19. As there is a paucity of evidence on the effectiveness of the vaccines on the reduction of transmission it is beyond the scope of this paper to assess whether educational staff should be re-prioritised for vaccination.

However, as the vaccine programme is rolled out further urgent work is warranted to examine the effectiveness of vaccines in reducing transmission within educational settings. Whilst this study has been conducted in Wales it is highly likely that the findings can be generalised to the UK and many parts of the world in temperate climates where schools have around 30 pupils per class and are largely educated indoors.

Authors

Daniel A Thompson
Hoda Abbasizanjani
Richard Fry
Emily Marchant
Lucy Griffiths
Ashley Akbari
Joe Hollinghurst
Laura North
Jane Lyons
Fatemeh Torabi
Gareth Davies
Mike B Gravenor
Ronan Lyons

Further details of the study can be found here.

Acknowledgements

This work uses data provided by patients and collected by the NHS as part of their care and support. The study authors wish to acknowledge all data providers who make anonymised data available for research and the collaborative partnership that enabled acquisition and access to the de-identified data, which led to this output.

The collaboration was led by the Swansea University Health Data Research UK team under the direction of the Welsh Government Technical Advisory Cell (TAC) and includes the following groups and organisations: the Secure Anonymised Information Linkage (SAIL) Databank, Administrative Data Research (ADR) Wales, NHS Wales Informatics Service (NWIS), Public Health Wales, NHS Shared Services Partnership and the Welsh Ambulance Service Trust (WAST). All research conducted has been completed under the permission and approval of the SAIL independent Information Governance Review Panel (IGRP) project number 0911.

References

[1] Viner RM, Mytton OT, Bonell C, Melendez-Torres GJ, Ward J, Hudson L, et al. Susceptibility to SARS-CoV-2 Infection among Children and Adolescents Compared with Adults: A Systematic Review and Meta-analysis. JAMA Pediatrics. 2020.

[2] Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. Vol. 109, Acta Paediatrica, International Journal of Paediatrics. 2020.

[3] Ismail SA, Saliba V, Lopez Bernal J, 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;

[4] COVID-19 Schools Infection Survey Round 1, England - Office for National Statistics [Internet]. [cited 2021 Feb 2]. Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/covid19schoolsinfectionsurveyround1england/november2020

[5] Coronavirus (COVID-19) Infection Survey, UK Statistical bulletins - Office for National Statistics [Internet]. [cited 2021 Feb 2]. Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveypilot/previousReleases

HDRUK
Health Data Research UK

Population Data Science
at Swansea University

YDG CYMRU | ADR WALES

Produced by ADR Wales

Website: ADRUK.org
Twitter: @ADR_Wales

ADR Wales brings together specialist teams, data science experts, and statisticians as part of the Economic and Social Research Council (part of UK Research and Innovation) funded ADR UK. Our team is made up of specialists in their field from Swansea University Medical School, the Wales Institute of Social and Economic Research, Data and Methods (WISERD) at Cardiff University and the SAIL Databank at Swansea University with statisticians, economists and social researchers from Welsh Government. Together ADR Wales develops new evidence which supports the Welsh Government's national strategy, Prosperity for All to improve the lives of people in Wales.

For further information please contact
Cathrine.E.Richards@Swansea.ac.uk

ADR Wales Partners

Cardiff University
Prifysgol Caerdydd

Swansea University
Prifysgol Abertawe
Medical School
Ysgol Feddygaeth

Llywodraeth Cymru
Welsh Government

SAIL DATABANK

WISERD

ADR UK
Data-driven change

UKRI
Economic and Social Research Council