

# Family background and academic achievement: The mediating role of school absenteeism

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- Persistent or growing SES gaps in academic achievement (Chmielewski, 2019; Reardon, 2011)
- Multiple mechanisms may include school absences → school absenteeism focus of educational research but not much emphasis on potential link to SES-achievement gaps
- School absences more pronounced among low-SES students (Gubbels et al., 2019)
  - Family/individual mechanisms (e.g., health problems, behavioural problems, parental involvement)
  - Neighbourhood mechanisms (e.g., air pollution, exposure to crime)

- School absenteeism associated with poor academic achievement (e.g. Gottfried, 2009, 2010, 2014; Ready, 2010)
  - Faucet theory (Alexander et al., 2001): Students enhance skills through exposure to schooling; stop making educational gains once exposure turned off
- Theory of compensatory advantage (Bernardi, 2014) → Absences may cause greater harm to low-SES students
  - Research on “summer learning gap” (e.g. Alexander et al., 2007; Downey et al., 2004; Hippel et al., 2018)

- Multidimensionality of SES and absences not considered
  - Focus on free- or reduced-price lunch (e.g., Morrissey et al., 2014)
- Studies mainly focus on impact of overall absences on achievement (Hancock et al., 2017; Gottfried, 2009)
  - More precise reasons inform us about potential mechanisms (unauthorised absences, e.g. truancy → substance abuse, delinquency; authorised absences, e.g. sickness absences → health/greater internalizing behaviour)
- Sparse evidence on the moderating role of SES for link between school absences and academic achievement (e.g. Ready, 2010; Smerillo et al., 2018)
- Few studies examined the extent to which school absenteeism mediates SES-achievement gap (e.g. Gershenson et al., 2017)

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- RQ3: Does SES moderate the association between absenteeism and academic achievement?



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- RQ2: Is school absenteeism negatively associated with academic achievement?
  - RQ2b: Does the association vary with the reason for absenteeism (truancy, sickness absence, exceptional domestic circumstances, family holidays)?
- RQ3: Does SES moderate the association between absenteeism and academic achievement?
- RQ4: To what extent does school absenteeism mediate the association between SES and academic achievement?

# Data: Scottish Longitudinal Study (SLS)

- Large-scale, anonymised linkage study using data from current Scottish administrative and statistical sources:
  - **Census data** (1991, 2001, 2011)
  - Vital events data (births, deaths, marriages, etc.)
  - NHS central register (migration into and out of Scotland)
  - **School education data (school census, attendance and exclusion, SQA, 2007-2013)**
  - Pollution and weather data
- Designed to capture 5.5 per cent of the Scottish population
- Sample selected using 20 semi-random birthdates
- NHS health data (e.g., maternity and birth records) can be linked but are not part of the core SLS database

# Our SLS sample

Table 1. Structure of School Census Data by cohort

STAGE COHORT	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13
2007 School Census				p1	p2	p3	p4	p5	p6	p7	s1	s2	s3	s4	s5	s6
2007 Exam results expected																
2008 School Census			p1	p2	p3	p4	p5	p6	p7	s1	s2	s3	s4	s5	s6	
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<b>Number of pupils</b>	cohort -2	cohort -1	cohort 0	cohort 1	cohort 2	cohort 3	cohort 4	cohort 5	cohort 6	cohort 7	cohort 8	cohort 9	cohort 10	cohort 11	cohort 12	cohort 13
<b>All</b>	3005	2878	2903	3020	2994	3001	2919	3050	3226	3206	3412	3261	3376	3367	2582	1535

Source: Raab (2013)

- SLS sample: two student cohorts in S4 in 2007 and 2008 who were followed into S5 and S6 (cohorts 10 and 11).
- Sample restrictions
  - Presence during Census 2001
  - Mother and/or father identified from household information
  - SQA achievement records available

- **Academic achievement** at the end of S4 (compulsory schooling) and S5/S6 (postcompulsory schooling): Unified Points Score Scale (extended version of the UCAS Scottish Tariff points system) taking into account number of subjects, level of difficulty and grade
- **SES**: parental class (NS-SeC), parental education, housing tenure (social rented vs. owned/private rented), free school meal registration, Scottish Index of Multiple Deprivation (SIMD)

- Overall and specific forms of **school absences** (truancy, sickness, exceptional domestic circumstances, family holidays) were measured as the proportion of days a pupil was absent in S4 (and S5)
- **Covariates**: ethnicity, place of residence, child's sex, child's age, mother's age at birth (RQ1-RQ4); family structure, number of siblings, , child health, parental health, parental caring status, child's additional support needs, temporary school exclusion (RQ2-RQ4)

# Analytic strategy

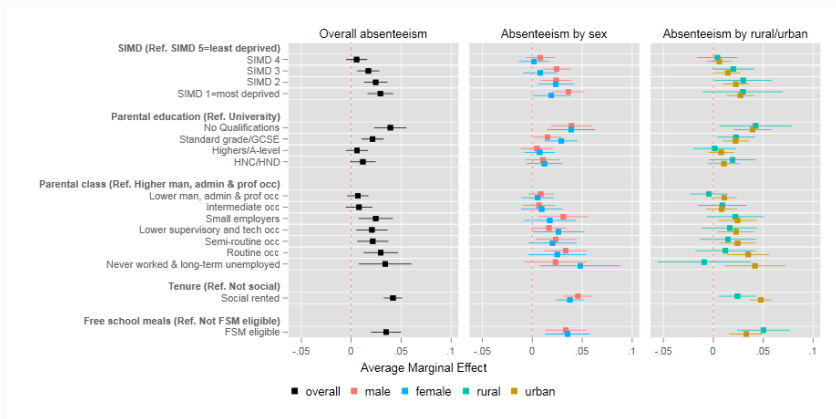
- **RQ1** SES and school absenteeism: Fractional logistic regressions (DV: proportion of days absent)
- **RQ2)** school absenteeism and academic achievement
  - OLS predicting tariff score in S4
  - WLS predicting tariff score in S5/S6 adjusting for S4 achievement; weighted by inverse probability of school continuation
  - First difference model predicting achievement growth (S4 to S5/S6) from absenteeism change (S4 to S5)
- **RQ3** Moderation by SES: interaction terms between absenteeism and socioeconomic dimensions
- **RQ4** Counterfactual mediation analysis estimating Average Natural Direct Effect (ANDE) and Average Natural Indirect Effect (ANIE) using a regression-with-residuals approach (Wodtke and Zhou, 2020)

# Summary statistics (n = 4,419)

	Mean/Proportion	SD
<b>Academic achievement S4</b>		
Tariff score	181.77	73.78
<b>Absenteeism forms S4</b>		
Overall	0.14	0.12
Truancy	0.02	0.05
Sickness absence	0.05	0.07
Temporary exclusion	0.05	
Except. domestic circumst.	0.11	
Family holidays	0.15	

Source: Scottish Longitudinal Study, own calculations

# RQ1: SES and school absenteeism



Source: Scottish Longitudinal Study, own calculations

- Similar findings for specific forms of absenteeism except for family holidays



## RQ2: Absenteeism and academic achievement

	S4	M1	M2	S5/S6	M1	M2	FD	M1	M2
Overall absences		-0.03 (0.00)***			-0.02 (0.00)***			-0.02 (0.00)***	
Truancy			-0.04 (0.00)***			-0.02 (0.00)***			-0.03 (0.00)***
Sickness			-0.04 (0.00)***			-0.01 (0.00)*			-0.02 (0.00)***
EDC			-0.02 (0.00)**			-0.05 (0.02)**			-0.04 (0.01)**
Family holidays			-0.03 (0.00)*			-0.02 (0.01)*			-0.01 (0.01)
Achievement S4					0.01 (0.00)***	0.01 (0.00)***			
N		4,419	4,419		3,135	3,135		3,135	3,135

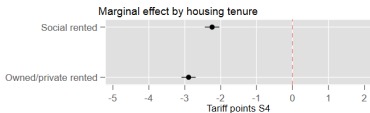
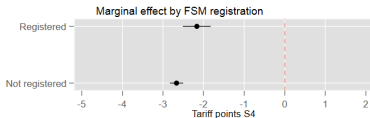
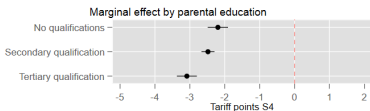
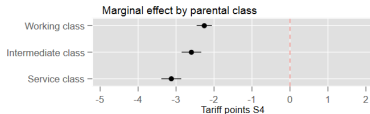
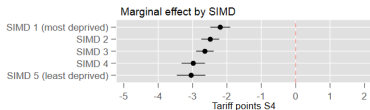
Source: Scottish Longitudinal Study, own calculations

Notes: EDC = Exceptional domestic circumstances; FD = First difference model; Tariff scores in S4 and S5/S6 standardised; proportions of days absent transformed into percentages; S4 and S5/S6 analyses adjust for covariates; S5/S6 analyses weighted by inverse probability of censoring weights; First difference models adjust for time-varying measures of free school meal registration and additional support needs

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ ; Cluster-robust standard errors in parentheses.

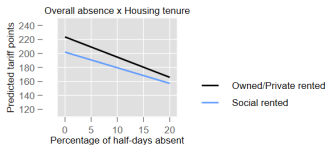
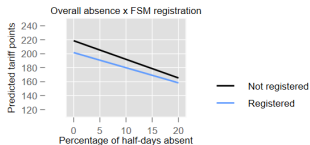
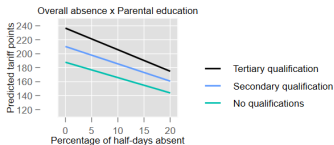
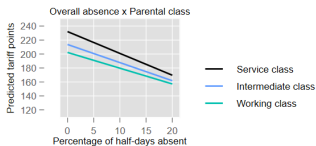
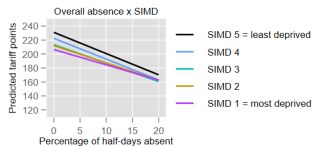
# RQ3: SES moderation: Marginal effects

## Overall absenteeism



Source: Scottish Longitudinal Study, own calculations

# RQ3: SES moderation: Predicted tariff scores



Source: Scottish Longitudinal Study, own calculations

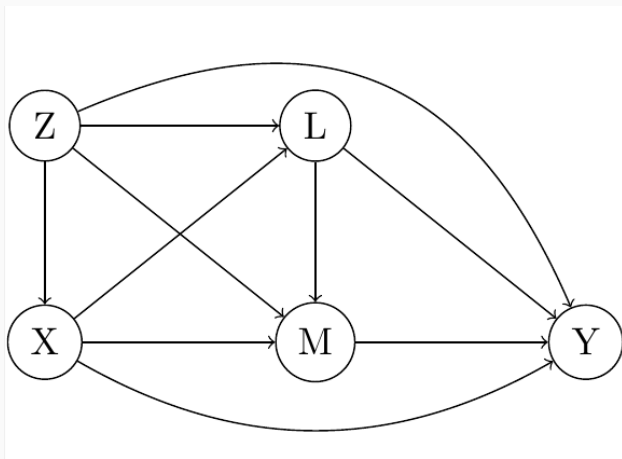
- Issue 1: Exposure-Mediator Interaction
  - Link between absenteeism and achievement varies with SES (see RQ3 findings)
  - Not modelling interaction may lead to erroneous conclusions regarding mediation
  - Effect decomposition into direct and indirect effects breaks down because of multiple direct effects across categories of the mediator
- Solution: Counterfactual definitions of direct and indirect effects

$$ANDE = E \left( Y^{xm^{x'}} \right) - E \left( Y^{x'm^{x'}} \right) \quad (1)$$

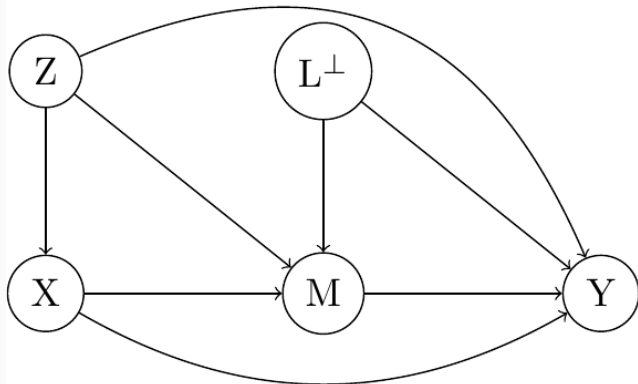
$$ANIE = E \left( Y^{xm^x} \right) - E \left( Y^{xm^{x'}} \right) \quad (2)$$

- Issue 2: Exposure-induced mediator-outcome confounders
  - Non-causal association between M and Y by not conditioning on M-O confounders (e.g., child health)
  - Non-causal association between X (SES) and Y (achievement) by conditioning on M (school absences)
  - Controlling for M-O confounders leads to overcontrol bias if there causal pathways between X (SES) via M-O confounders (e.g. child health) to Y (achievement)
- Solution: Regression-with-residuals approach (Wodtke and Zhou, 2020)

## Exposure-induced mediator-outcome confounders



## Residualized mediator-outcome confounders



## Discussion and implications

- Multiple SES dimensions independently associated with forms of school absence
- "Problematic" absenteeism (truancy, temporary exclusion) and authorised absences (sickness) lead to poorer achievement
  - Suggests health, behavioural and psychosocial pathways
- However, not all forms of absence negatively impact achievement (e.g., family holidays)
- Contrary to hypothesis, impact of absenteeism on attainment larger among higher SES groups
  - Low-SES students' performance on exams may be less affected by missing school if opportunity to learn is already diminished by their socioeconomic circumstances.
  - Traditional mediation analysis (difference method, product method) not feasible



# Disclaimer

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The LSCS is supported by the ESRC/JISC, the Scottish Funding Council, the Chief Scientist's Office and the Scottish Government. The authors alone are responsible for the interpretation of the data. Census output is Crown copyright and is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.

For more information on the SLS, please visit: <http://sls.lscs.ac.uk>

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Thank you!