Received: 2 February 2023 | Accepted: 8 December 2023

DOI: 10.1111/bjep.12656

the british psychological society
promoting excellence in psychology

ARTICLE

The impact of school exclusion in childhood on health and well-being outcomes in adulthood: Estimating causal effects using inverse probability of treatment weighting

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Funding information
Economics and Econometrics Research Institute; Economic and Social Research Council, Grant/Award Number: 1811EP001/LH7

Abstract

Background: Previous evidence has suggested a strong association between school exclusion and health outcomes. However, as health risks are themselves related to the risk of experiencing a school exclusion, it has been challenging to determine the extent to which school exclusion impacts later health outcomes, as opposed to reflecting a marker for pre-existing risks.

Aim: The aim of the current study was to address this challenge in estimating the medium-to-long-term impact of school exclusion of health and well-being outcomes.

Methods: To this end, we used an inverse propensity weighting approach in the Next Steps data set ($N = 6534$, from wave 1, 2014, to wave 8, 2015).

Results: We found that after weighting for propensity of treatment scores estimated based on a wide range of factors, including previous health indicators, there was a significant effect of school exclusion on a wide range of health and well-being outcomes.

Discussion: These results provide some of the most robust evidence to date that school exclusion harms long-term health outcomes.

Conclusion: The findings suggest that policies should aim to reduce exclusion and ensure access to preventative health support for those who experience a school exclusion.

KEYWORDS

health, inverse probability of treatment weighting, longitudinal, school exclusion, well-being

BACKGROUND

In recent years, health issues globally have been on the rise and this trend has been exacerbated by the COVID-19 pandemic (Daly et al., 2020). Illuminating the malleable factors that increase the risk of health issues is important for informing policies that can help reverse this trend. Previous research has pointed to the role of educational experiences, especially school exclusions in engendering long-term health risk; however, this research has faced considerable challenges in estimating the effects of school exclusion on health outcomes. Such evidence is needed to provide a more robust evidentiary basis for informing interventions to reduce school exclusions and its possible health impacts. In this study, we, therefore, use a counterfactual approach to estimate the direct effects of school exclusion on later health outcomes.

According to the 2021 report by the Department for Education (DfE, 2021), the rate of permanent exclusions in secondary schools gradually decreased from 2006–2007 (.23%) to 2012–2013 (.12%) but then gradually increased again by year 2018–2019 (.20%). According to the DfE (2023) report, the absolute numbers of permanent exclusions from 2021/22 to 2022/23 increased from 2100 to 3100, that is, a 47.6% increase in only one year. These numbers suggest that school exclusions are increasing and affect a significant number of young people. Notably, they do not include so-called 'illegal', unrecorded or unofficial exclusions which complicates attempts to understand the full scope and impact of exclusions (Children's Commissioner, 2013; Daniels et al., 2019).

A school exclusion approach to dealing with disruptive behaviours is, however, likely to be counterproductive considering that these behaviours may themselves be a marker of health risks (Parker et al., 2019). School exclusion may thus not only fail to address the behavioural issues but also further perpetuate health difficulties in these young people (Ford et al., 2018). However, this inter-relatedness between school exclusion and pre-existing risks for health issues makes it challenging to estimate the impact of school exclusion on long-term health outcomes. For example, available evidence suggests that school exclusion tends to be used disproportionately with the most vulnerable students, including young people from disadvantaged socio-economic backgrounds and ethnic minorities (Welsh & Little, 2018), children in care (Luke & O'Higgins, 2018), children in need (Sebba et al., 2015), young people with statements of special educational needs (Paget et al., 2018), young people with social emotional and mental health needs (Thompson et al., 2021) and those in receipt of free school meals (Munn & Lloyd, 2005). A recent study by Paget et al. (2018) based on the Avon Longitudinal Study of Parents and Children identified a set of child, family and school-related factors that are linked to higher rates of school exclusion. The identified characteristics included male gender, lower socio-economic status, maternal psychopathology, lower parental engagement with education, poor relationship with teacher, low educational attainment, antisocial activities, bullying/being bullied and also health and behavioural difficulties, psychiatric disorder and special educational needs. As such, it can be difficult to disentangle the impact of school exclusion from other risk factors and to estimate the extent to which it is a causal factor, as opposed to a marker of other pre-existing risks, for mental health.

Health issues themselves have been highlighted as strongly associated with school exclusion. In a systematic review by Whear et al. (2014), the odds of having some type of health problem were up to 31.9 times greater in those who were excluded compared to those who were not. According to a subsequent systematic review on the link between psychopathology and later school exclusion, Parker et al. (2015) found that the odds of being excluded were up to 45.6 times greater for those young people who suffered from impairing psychopathology compared to those without any psychopathology. Neither review was, however, able to determine the direction of effects. In addition, the authors of both reviews emphasized the limited number and the poor quality of existing studies, and called for caution in interpreting the available findings.

Following up on these findings with secondary analyses of the British Child and Adolescent Health Surveys 2004 and 2007, Parker et al. (2019) found that young people with diagnosed but also with undiagnosed or subthreshold health problems were excluded disproportionately more than their peers without any diagnosis. Analysing the same data set, Ford et al. (2018) found bidirectional

links between school exclusion (both temporary and permanent) and health problems, suggesting that young people who were excluded were also subsequently more likely to report health difficulties. More recently, similar bidirectional effects were reported by Tejerina-Arreal et al. (2020) who applied adjusted linear mixed effects models to the Avon Longitudinal Study of Parents and Children controlling for family adversity, special educational needs and ethnicity. A recent interview-based qualitative study supported these findings (Martin-Denham, 2020). Thus, it seems that schools seem to be excluding already vulnerable children which set them up for failure and on the pathway to further health problems and other difficulties. This bidirectionality makes it important to isolate the effects of school exclusion on health outcomes from effects in the opposite direction when estimating the former (Gill et al., 2017).

In sum, the available research suggests links between school exclusion and health problems in both directions. However, the current quantitative evidence does not offer strong evidence on isolating the direct effects of school exclusion on health outcomes.

The current study

To help address this gap, in this study, we applied an Inverse Probability of Treatment Weighting approach to an existing population-based longitudinal data set (Longitudinal Study of Young People in England) to assess whether school exclusion between the ages of 13/14 and 16/17 results in poor health in adulthood, at age 25/26. In addition, consistent with positive psychology theory (Seligman, 2019) and given growing evidence that when it comes to mental health, it does not represent only an absence of mental illness but also a range of positive attributes, we also focused on indicators of well-being such as happiness and self-confidence. Therefore, in this study, we focus on indicators of physical as well as mental health and well-being. Based on previous correlational evidence available thus far, we hypothesized that those who have experienced school exclusion will be at an increased risk of health problems and lower well-being net of a set of individual and contextual variables including previous health indicators and background demographic characteristics.

METHODS

Data/sample/participants

We utilized the 'Longitudinal Study of Young People in England' (LSYPE) also known as the 'Next steps' consisting of individuals born between 1989 and 1990. The LSYPE is a prospective panel data set comprising eight waves collected annually from age 13/14 until age 19/20, with a measurement wave again at age 25/26. Our analytic sample includes young people for whom information from wave 8 (age 25/26) was available. Notably, this subsample did not include any excluded students from independent schools (i.e. private institutions); thus, our study only examines the impact of school exclusion on students who had attended mainstream schools. After attrition and deletion of cases with missing information in at least one key variable used in the models, our resulting sample consisted of 6534 respondents of which 690 were temporarily excluded/suspended (i.e. 11%) and 81 were permanently excluded from school at least once (i.e. 1.2%) between the age of 13/14 (wave 1) and 16/17 (wave 4).

Health and well-being outcomes

At age 25/26 (wave 8), participants completed the *General Health Questionnaire* (GHQ-12; Goldberg & Williams, 1988). This is a screening instrument that consists of 12 items assessing broader components

of mental health/illness rated on a dichotomous scale for presence or absence (YES/NO). Positively worded items are recoded, and a total score is calculated with a possible range from 0 (symptoms of mentally ill health are 'not at all present') to 12 symptoms are 'present much more than usual'. The measure also allows for a recoding into an ordinal scale comprising of three levels/groups denoted as 'none' (0), 'moderate risk of health issues' (1–3) and 'severe risk of health issues' (4+). Both scales were utilized in the analyses.

In addition, participants completed the *Alcohol Use Disorders Identification Test Consumption* (AUDIT-C) module at age 25/26. The AUDIT-C captures both alcohol use and dependency. From this module is possible to obtain an additive scale that yields a total score ranging from 0 to 12 based on answers to the following three questions: (*1*) *How often a drink has containing alcohol* (*Never = 0*, *Monthly or less*, *2–4 times a month*, *2–3 times a week*, *4 or more times a week = 4)*; (*2*) *how many drinks containing alcohol have on a typical day of drinking* (*1–2 drinks = 0*, *3–4 drinks*, *5–6 drinks*, *7–9 drinks*, *10 plus drinks = 4)*; (*3*) *how often had six or more drinks on one occasion in the past year* (*Never = 0*, *Less than monthly*, *Monthly*, *Weekly = 4*). Participants chose one response category per question and the sum of these three questions provides a scale that ranges from 0 (no risk) to 12 (higher risk drinking). See Table S1 for the frequencies on both ordinal scales.

Finally, at wave 8, participants answered a set of additional questions that tapped key aspects and indicators of health and well-being. Namely, the questions asked participants about their overall self-reported health: poor health (scored Yes/No); longstanding health issues (Yes/No); inflicted self-harm in the past year (Yes/No); slept less than 4 hr per night in the last 4 weeks (Yes/No); smoke cigarettes every day (Yes/No); practice sports at least once a week (Yes/No); and overall life satisfaction (scored on a Likert scale, from 1 'Very satisfied' to 5 'Very dissatisfied'). Consistent with the response style of the majority of variables, the latter variable was also dichotomized (1–4 = 0; 5 Very dissatisfied = 1).

School exclusion variable

For school exclusion, we classified students whose parents/guardians reported their suspensions/exclusions from the age of 13/14 until the age of 16/17 (between years 2004 and 2007) into (a) those who never experienced a temporary suspension or exclusion, (b) those who were temporarily suspended at least once and then (c) those who were permanently excluded from school at least once. This follows the classification adopted by the Department of Education in their reports (see DfE, 2011). We also created a binary variable representing the treatment status that is those who were permanently excluded from school at least once over the 3-year period and the control status consisting of those who have never experienced any suspension or exclusion. When this variable was employed in the counterfactual models, those only temporarily suspended from school were excluded from the analysis.

Covariates

We included 11 variables assessed at age 13/14 (wave 1) as well as six variables assessed at ages 14/15 and 15/16 (waves 2 and 3) as control variables for regression adjustment and estimation of the propensity scores in the Inverse of Probability Treatment Weighting models. These variables were selected based on past research and theory as they may be plausible predictors of or have been identified as risk factors for permanent school exclusion and/or poor health outcomes (Ford et al., 2018; Strand & Fletcher, 2014; Tejerina-Arreal et al., 2020). These were participant's previous health indicators, namely a measure of quality of health in the last 12 months measured at age 14/15 (wave 2) and age 15/16 (wave 3), experiences of depression during adolescence—measured at age 14/15 (wave 2) as well as exposure to health-related risk factors (such as alcohol, drugs and antisocial behaviours) also measured at ages 14/15 and 15/16. We also included the young person's attitude to school at age 14/15 index recoded into four quartiles: Q1 = very good attitudes; Q2 = good attitudes; Q3 = bad attitude; Q4 = very bad attitudes. This is a derived index already available in the original data and was constructed by summing the answers

that the young person has given to 12 attitudinal questions relating to how they feel about school: (1) Feelings about school: I am happy when I am at school; (2) Feelings about school: School is a waste of time for me; (3) Feelings about school: School work is worth doing; (4) Feelings about school: Most of the time I don't want to go to school; (5) Feelings about school: People think my school is a good school; (6) Feelings about school: On the whole I like being at school; (7) Feelings about school: I work as hard as I can in school; (8) Feelings about school: In a lesson, I often count the minutes till it ends; (9) Feelings about school: I am bored in lessons; (10) Feelings about school: The work I do in lessons is a waste of time; (11) Feelings about school: The work I do in lessons is interesting to me; (12) Feelings about school: I get good marks for my work. In addition, we included the following variables from wave 1 (age 13/14) participants' gender, the number of siblings and other adult members in the household; an ethnicity dummy variable which identifies Black Caribbean respondents; whether English is the main language of the household; mother's age; whether the respondent grew up in single parent household; social service involvement regarding the child's behaviour and whether respondents were ever identified as having special educational needs (SEN). Finally, we included two indexes that capture family resources and contextual disadvantages in the residential neighbourhood. That is, a 'Socio-Economic Status index' (SES) derived from a principal component analysis using highest parental educational attainment, parental class (obtained from the NS-SEC classification) and housing tenure status. And then, the 'Income Deprivation Affecting Children index' (IDACI) which measures the proportion of children under the age of 16 who live in low-income households in the local area of residence. This variable was constructed by the DfE and already provided in the data.

Statistical procedure

We began by estimating the associations between school exclusion status and health and well-being outcomes at the age of 25/26 via regression analysis. We used OLS/linear probability model (LPM) regression for our three ordinal scales (GHQ-12, AUDIT-C and life satisfaction) and dichotomous outcomes. For the ease of interpretation and avoiding scaling issues in the comparison of nonlinear coefficients between groups and across models, we used this linear specification for the dichotomous outcomes as well (Breen et al., 2018; Mood, 2010). We also included the dichotomous transformation of the GHQ-12 and life satisfaction scales (i.e. probability of severe symptoms of poor health and being very dissatisfied in life). We initially fit unconditional regression to observe the average differences between groups. We then estimated models that adjusted for the full set of control variables discussed in the previous section to reduce potential unobserved heterogeneities. All these models also included survey weights to account for attrition issues.

Finally, to test the causal impact of school exclusion on health and well-being, we also employed a counterfactual approach. For this, we employed an inverse probability of treatment weighting (IPTW, Robins et al., 2000; Thoemmes & Ong, 2016) estimator. In brief, this involves first estimating the probability of receiving the treatment given a series of observed covariates and then reweighting the sample using these estimated propensity scores to restore the balance between groups. In other words, the IPTW approach aims to reduce differences between excluded and non-excluded students using observational data. In our study, we want to estimate the impact of permanent school exclusion (the treatment) on later health outcomes. However, permanent exclusion is not randomly assigned—certain characteristics like gender, family background, ethnicity and SEN status make a student more likely to be excluded (Ford et al., 2018; Strand & Fletcher, 2014; Tejerina-Arreal et al., 2020). To address this issue, we first used logistic regression to estimate each student's propensity score—their probability of being permanently excluded based on observed characteristics like gender, ethnicity, socioeconomic status, SEN, etc. Students with similar scores have similar chances of exclusion, regardless of whether they were actually excluded or not.

We then used the propensity scores to weight the sample—increasing the weights for excluded youth (who tended to have higher propensity scores) and decreasing weights for non-excluded youth

(who tended to have lower scores). This rebalances the two groups, making them more comparable. Essentially by weighting, we created a pseudo-population in which permanent exclusion is unrelated to the observed covariates.

Finally, we can estimate the impact of permanent exclusion on health outcomes in this reweighted, balanced sample (i.e. comparing two groups who were similarly 'at risk' due to their background and past behaviours). Since exclusion is now unrelated to factors also associated with later health outcomes, the estimated difference in outcomes between excluded and non-excluded groups, we can more confidently say this was a consequence of the school exclusion itself rather than other factors.

We opted for this approach instead of, for example, matching approaches such as propensity score matching (PSM) because our exposure (an event, in this case school exclusion) is a very rare event and IPTW utilizes all the data available without discarding any observations in the treatment (excluded youths) and controls (non-excluded youths) groups in contrast to PSM (e.g. the number of units lost depends on the calliper chosen; for the strictest calliper, our calculations show that we could lose up to 32% of the permanent excluded pupils). Furthermore, it has been recently shown that PSM might increase imbalance between control and treatment groups and model dependence due to the impossibility of determining the exact moment when pruning should be terminated (King & Nielsen, 2019). We complemented the standard IPTW with regression adjustment (IPTW-RA) to address residual confounding as selection bias can affect both treatment and outcome. In addition, the IPTW-RA estimator has a double-robust property, which means that the estimates of the effects will be consistent if either the treatment model or the outcome model—but not both—are mis-specified. For this second part of the analysis, we restricted the sample to individuals who never experienced a suspension/exclusion (i.e. the control group, $D = 0$) and those who experienced a permanent exclusion from school (i.e. the treatment group, $D = 1$). We did not include any control for education and employment status since these variables are likely to be affected by our treatment (post-treatment confounders) and would induce further endogeneity.

Missingness and attrition

To deal with non-random missingness and attrition, the data release for LYPSE provides attrition and non-response weights that can be used to adjust analyses. We incorporated these following the recommendation provided in the technical documents of LYPSE and by Anders (2012). We also compared the social background characteristics of our sample before and after selecting those who have remained in the last wave available. Although we found that boys who grow up in a disadvantaged background and experienced school exclusion events were more likely to not participate in wave 8, these percentage differences were not substantively different among the two samples, suggesting that non-random attrition may not be a major biasing factor for our analyses.

RESULTS

Descriptive statistics

Table 1 displays descriptive statistics of the control and outcome variables by school exclusion status.

These suggest that boys and young people from disadvantaged backgrounds (i.e. low socio-economic status, deprived neighbourhoods, etc). Black Caribbean and students with a SEN status were also more likely to be excluded from school.

In addition, permanently excluded students were more likely to experience worse health and well-being outcomes than those who had been temporarily excluded and never excluded students. Also, the permanently excluded pupils reported higher levels of life dissatisfaction (7% vs. 3% and 2%, respectively) and had a higher probability of reporting lifestyle behaviours that negatively impact on health such as smoking and low engagement with sports.

TABLE 1 Summary statistics for all control and outcome variables by school exclusion status.

	Never suspended/ excluded			Temp. exclusion			Perm. excluded		
	Mean (*SD*)	Min	Max	Mean (*SD*)	Min	Max	Mean (*SD*)	Min	Max
Socio-demographics characteristics									
Man	.42 (.49)	0	1	.62 (.48)	0	1	.60 (.49)	0	1
No. of siblings	1.55 (1.12)	0	9	1.66 (1.23)	0	9	1.80 (1.34)	0	8
No. of household members	4.44 (1.31)	1	14	4.43 (1.45)	1	12	4.53 (1.69)	2	12
Family SES	−.09 (.95)	−2	2	.26 (.97)	−2	2	.65 (.89)	−2	2
English is not main language	.10 (.29)	0	1	.06 (.24)	0	1	.11 (.32)	0	1
Black Caribbean	.03 (.17)	0	1	.05 (.23)	0	1	.12 (.33)	0	1
Mother age	41.78 (5.30)	14	68	40.39 (5.26)	22	57	40.19 (6.12)	23	64
Grew with Lone parent	.20 (.40)	0	1	.33 (.47)	0	1	.46 (.50)	0	1
IDACI	.21 (.17)	0	1	.26 (.18)	0	1	.29 (.16)	0	1
Identified as SEN	.16 (.37)	0	1	.33 (.47)	0	1	.41 (.49)	0	1
Parents contacted by social services	.02 (.14)	0	1	.11 (.31)	0	1	.28 (.45)	0	1
Covariates at age 14/15									
Health: very good	.45 (.50)	0	1	.43 (.50)	0	1	.34 (.48)	0	1
Health: fairly good	.52 (.50)	0	1	.51 (.50)	0	1	.62 (.49)	0	1
Health: not very good/not good at all	.03 (.17)	0	1	.06 (.23)	0	1	.04 (.19)	0	1
Depression: Not at all	.42 (.49)	0	1	.39 (.49)	0	1	.34 (.48)	0	1
Depression: No more than usual	.33 (.47)	0	1	.31 (.46)	0	1	.34 (.48)	0	1
Depression: Rather more than usual	.16 (.37)	0	1	.17 (.37)	0	1	.22 (.42)	0	1
Depression: Much more than usual	.09 (.28)	0	1	.13 (.33)	0	1	.10 (.30)	0	1
School attitudes: Q1	.26 (.44)	0	1	.48 (.50)	0	1	.61 (.49)	0	1
School attitudes: Q2	.24 (.43)	0	1	.24 (.43)	0	1	.14 (.35)	0	1
School attitudes: Q3	.25 (.43)	0	1	.17 (.37)	0	1	.11 (.31)	0	1
School attitudes: Q4	.25 (.43)	0	1	.10 (.31)	0	1	.14 (.35)	0	1
Exposed to Risk factors: 0	.55 (.50)	0	1	.24 (.43)	0	1	.21 (.41)	0	1
Exposed to Risk factors: 1/3	.38 (.49)	0	1	.47 (.50)	0	1	.37 (.49)	0	1
Exposed to Risk factors: 4/6	.06 (.24)	0	1	.25 (.43)	0	1	.33 (.47)	0	1
Exposed to Risk factors: 7/8	.01 (.08)	0	1	.04 (.19)	0	1	.10 (.30)	0	1
Covariates at age 15/16									
Health: very good	.63 (.48)	0	1	.55 (.50)	0	1	.41 (.50)	0	1
Health: fairly good	.34 (.47)	0	1	.41 (.49)	0	1	.57 (.50)	0	1
Health: not very good/not good at all	.03 (.16)	0	1	.04 (.19)	0	1	.02 (.13)	0	1

TABLE 1 (Continued)

	Never suspended/ excluded			Temp. exclusion			Perm. excluded		
	Mean (*SD*)	Min	Max	Mean (*SD*)	Min	Max	Mean (*SD*)	Min	Max
Exposed to Risk factors: 0	.49 (.50)	0	1	.20 (.40)	0	1	.22 (.42)	0	1
Exposed to Risk factors: 1/3	.43 (.50)	0	1	.52 (.50)	0	1	.35 (.48)	0	1
Exposed to Risk factors: 4/6	.08 (.26)	0	1	.24 (.43)	0	1	.35 (.48)	0	1
Exposed to Risk factors: 7/8	.01 (.08)	0	1	.05 (.21)	0	1	.09 (.29)	0	1
Health and well-being outcomes at age 25/26									
GHQ12 Scale (0–12)	2.22 (3.03)	0	12	2.35 (3.21)	0	12	3.19 (3.65)	0	12
GHQ dichotomous: Severe symptoms	.24 (.43)	0	1	.25 (.43)	0	1	.35 (.48)	0	1
AUDIT Scale (0–12)	3.28 (2.45)	0	12	3.66 (2.77)	0	12	3.09 (2.85)	0	11
Overall self-reported health: Poor	.02 (.13)	0	1	.03 (.17)	0	1	.06 (.24)	0	1
Longstanding health issues	.08 (.26)	0	1	.10 (.30)	0	1	.16 (.37)	0	1
Overall life satisfaction (1–5)	2.12 (.90)	1	5	2.30 (.99)	1	5	2.48 (1.11)	1	5
Overall life satisfaction dichotomous: Very dissatisfied	.02 (.13)	0	1	.03 (.17)	0	1	.07 (.26)	0	1
Inflicted self-harm in the past year	.03 (.18)	0	1	.04 (.20)	0	1	.09 (.28)	0	1
Sleeps less than 4 hr per night (last 4 weeks)	.02 (.14)	0	1	.03 (.17)	0	1	.12 (.33)	0	1
Smoke cigarettes every day	.12 (.33)	0	1	.35 (.48)	0	1	.38 (.49)	0	1
Practice sports at least once a week	.64 (.48)	0	1	.62 (.48)	0	1	.54 (.50)	0	1
Observations	5763			690			81		

Note: Socio-Economic Status (SES) index ranges from −2 = most advantaged families to 2 = most disadvantaged families. IDACI ranges between 0 = less deprived and 1 = highly deprived. Weighted data.

Regression adjustment and inverse probability of treatment weighting analyses

Table 2 provides the results the IPTW-RA approach including at the top the Average Treatment Effects on Treated (ATT) for the continuous outcomes and at the bottom those for the dichotomous ones (OLS/LPM results are provided in Table S2 for comparison). These suggest a significant effect of permanent exclusion for the majority of health outcomes examined. Furthermore, we observed larger ATT effects for most outcomes compared to those obtained through simple regression adjustment. This highlights the crucial need to account for the selection of the treatment (i.e. exposure) and outcome. Exceptions to this trend were found, however, in smoking, sleeping and sport, where both models yielded similar estimates. This suggests that potential selection concerns might not be as prominent for these outcomes, or there could be reporting bias leading to smaller estimates. Nevertheless, significant effects were still identified for these three outcomes. Basically, ATT measures the average effect of

TABLE 2 Average treatment effects of treated—IPTW-RA results.

Continuous/ordinal outcomes	**ATT (*SE*)**	***N***
GHQ-12 Scale (0–12)	1.28*** (.36)	5844
AUDIT-C Scale (0–12)	−.47 (.27)	5844
Life Satisfaction Scale (0–5)	.29** (.12)	5844
Dichotomous outcomes	**ATT (*SE*)**	***N***
GHQ-12 Scale: Severe symptoms	.13*** (.05)	5844
Self-reported overall health: poor	.04* (.02)	5844
Longstanding health issues	.14*** (.04)	5844
Life satisfaction: very dissatisfied	.10*** (.03)	5844
Inflicted self-harm in the past year	.05* (.03)	5844
Slept less than 4 hr (last 4 weeks)	.10*** (.03)	5844
Smokes every day	.18*** (.05)	5844
Practice sport at least one time per week	−.13*** (.05)	5844

Note: *$p < .1$, **$p < .05$, ***$p < .01$; Non-excluded versus permanently excluded students.

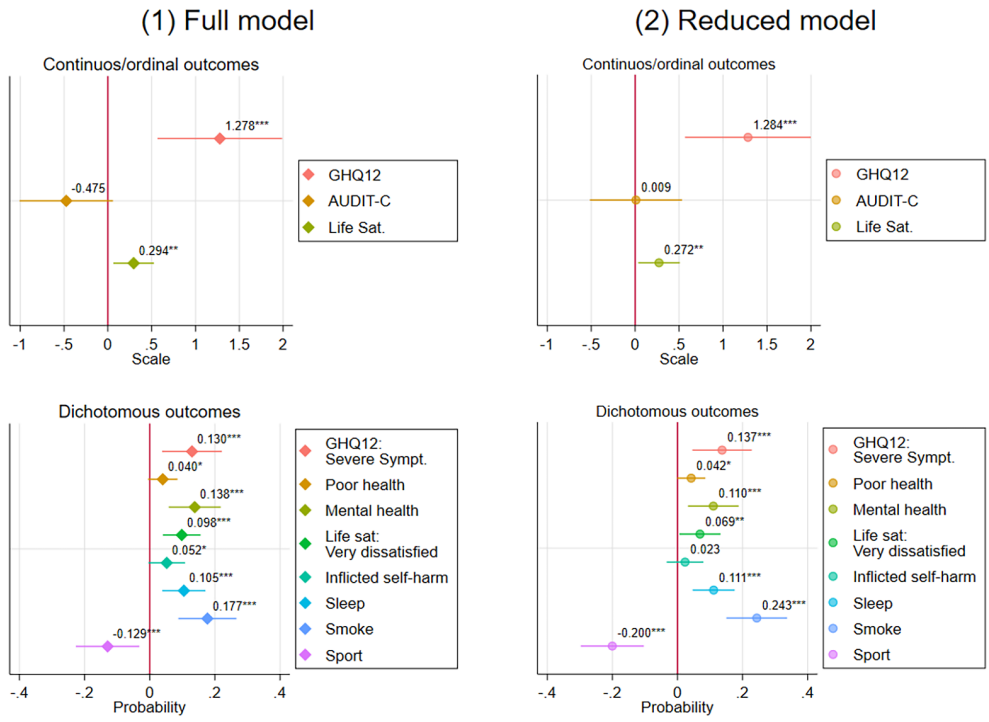

FIGURE 1 Full model includes all the variables described in the covariates section. Reduced model includes only the socio-demographics controls (gender, ethnicity, number of siblings, socio-economic status of origin (SES), English not first language, mother age, single parent, IDACI score, special education needs (SEN), and parents contacted by social services).

being excluded from school on certain outcomes for the students who were 'actually excluded'. In simple terms, the ATT shows how much worse off the actual excluded students' health outcomes were, on average, compared to if they had not been excluded.

These findings suggest that permanent school exclusion had a negative impact on health and well-being outcomes at the age of 25/26. Focusing on the lower part of the table (dichotomous outcomes), we find that excluded pupils are .13 percentage points (p.p.) more likely to report severe symptoms of

health distress and .14 p.p. more likely to experience long-term health issues. Furthermore, they are also very dissatisfied with their life (.10 p.p.) and have sleeping (.10 p.p.) as well as smoking issues (.18 p.p.) and practice less sport (−.13 p.p.) than those who never experience school exclusions. We did not find any significant difference for alcohol consumption and risk of inflicting self-harm between permanently excluded and never excluded groups. Furthermore, in the Appendix S1 section, we also report the results of a balancing test to evaluate whether the re-weighting procedure removes the differences between exposed and non-exposed groups. For this purpose, we computed the standardized difference and the variance ratio for the raw (unweighted) and weighted samples. A variance relatively close to 0 and variance ratio close to 1 indicate the sample is balanced across the observed characteristics. Table S1 suggests that the reweighting procedure successfully balanced the sample. The only variables that still had some small differences are ethnicity, single parent and IDACI. However, the regression adjustment performed in the second step of the IPTW-RA model reduced the residual differences as these variables were also included as controls. To check the robustness of these findings we re-estimated the model without the controls. The estimates from this reduced model were similar to those from the full specification (see Figure 1) for the estimates comparison.

DISCUSSION

The rate of permanent and fixed-period school exclusions has evidenced a small but steady increase since 2012–2013. Health problems have been highlighted as one of the key risk factors as well as adverse consequences of being excluded from school and correlation research supports these links (Children's Commissioner OCC, 2013). However, the direct directional impact of school exclusion on health outcomes remains unclear. Using inverse probability of treatment weighting, our study thus examined the extent to which school exclusion in childhood appears to lead to later health problems in adulthood.

Our findings suggested a negative impact of permanent school exclusion in mid to late adolescence on a range of health and well-being outcomes at the age of 25/26. We found that young people who experienced a permanent school exclusion between the ages of 13/14 and 16/17 were, compared to those who were not exposed to this disciplinary strategy, significantly more prone to severe psychological ill health symptoms, had overall longstanding health issues and were more dissatisfied with their life, had poorer sleep, smoked more and engaged in fewer sports.

These findings alongside the vast literature pointing to the disproportionate use of school exclusion with those young people who are particularly vulnerable (e.g. those from minority groups) highlight the acute need to address school exclusion as a disciplinary strategy. This could involve interventions at the level of policy and law as well as school-based interventions such as 'whole school approaches' that have been shown to improve health and well-being in schools (O'Reilly et al., 2018; Weare, 2019). Our findings also point to the importance of ensuring that pupils who are excluded are provided with access to relevant (preventive) health support and be subject to regular health monitoring.

Future research will be needed to investigate the specific mechanisms through which the long-term impact of school exclusion on health outcomes occurs. For example, it is likely that having fewer and less optimal educational opportunities following a permanent exclusion may lead to poorer academic achievement and limit further educational and/or vocational options leading to a compounding of pre-existing disadvantage and escalation of risks for health issues. It is also likely that young people who are excluded from school, experience a broader social exclusion (Gill et al., 2017), which is an established risk factor for poor health and well-being. This may occur as social exclusion may result in social isolation and loneliness that may prevent young people from seeking support from close others or services when needed (Arslan, 2018) thus risking poor physical and/or mental health and well-being.

Importantly, exclusion from school also does not afford young people exposure to key protective factors available in schools such as, positive teacher–student relationships and school belonging; both of which have been shown to contribute to positive long-term outcomes (Obsuth et al., 2021;

Porter et al., 2021). School belonging refers to the sense of connectedness and identification that students feel with their school environment. When students feel a sense of belonging at school, it can have positive effects on various aspects of their health and well-being and this can happen via a range of mechanisms. For instance, a strong sense of school belonging is often associated with positive peer and teacher–student relationships. Supportive relationships may provide emotional support, validation and encouragement that can contribute to emotional well-being and act as a buffer against stress. School belonging may also positively impact self-esteem (Ibrahim & El Zaatari, 2020), as students who feel valued and accepted are more likely to develop a positive self-image; this in turn may protect them from a host of mental health difficulties. A supportive school environment can also help reduce stress levels (Hoferichter et al., 2022) which in turn positively affects physical health. Students with a strong sense of school belonging may be less likely to engage in risky behaviours such as substance abuse (Ahmadi et al., 2020) and may also be more likely to engage in health-promoting behaviours, such as regular exercise and a balanced diet. When these habits are learnt in school from individuals whom students see as positive role models, these may likely continue into adulthood and contribute to health and well-being. Understanding these mechanisms further will represent important targets for interventions to reduce the health sequalae of school exclusion.

Interestingly, our findings did not reveal a significant impact of permanent school exclusion on alcohol consumption and the risk of inflicting self-harm. These two outcomes are most likely influence by a variety of factors including individual ones such as emotion regulation difficulties and coping, family dynamics, socio-economic status and community environment. The impact of school exclusion may be overshadowed by these broader influences. We have also not controlled for these factors specifically; it is therefore possible that the lack of a treatment effect on these outcomes is due to the unobserved similarities in these outcome measures between the two groups.

Two additional limitations should be noted. Utilizing an existing data set, we relied on available variables. As a result, our measures of existing health problems used as controls were not gold standard and they were (potentially) measured concurrently with the treatment, exposure to school exclusion, as this information was not fully available for the period prior to when then 'exposure' (school exclusion reported between waves 1 and 4) occurred. One potential risk is that these variables induce over-controlling bias which would result in smaller estimates. Therefore, as robustness check, we re-estimated the model without these variables (i.e. a reduced model). The estimates from this reduced model were very similar to those from the full specification (see Figure 1 for the estimates comparison), indicating that this should not be a major concern. Nevertheless, future studies would benefit from a panel design with several pre- and post-exposure measures of health and analysing specific health trajectories as well as within individuals changes. Second, we also relied on questionnaire indicators of health and well-being rather than clinical interviews and it will be important to establish whether these findings replicate based on gold standard measures of physical and mental health.

CONCLUSION

Using an inverse probability of treatment approach, our study suggests that there is a detrimental long-term effect of school exclusion on health. Our findings suggest that policies should ensure access to relevant health support for pupils who experience a school exclusion but more importantly they should strongly discourage the use of school exclusion as a disciplinary strategy. Instead, a multidisciplinary collaborative approach between professionals such as clinical psychologists, school counsellors, special education teachers, youth workers and community mental health providers, working alongside the families should be adapted to ensure a coordinated and holistic approach to the student's needs and well-being. Specific approaches may include: a comprehensive assessment to identify the underlying mental health issues, possible learning difficulties or other individual, family

or community factors that may contribute to the young person's behaviour that places them at risk of exclusion. In collaboration with educators, parents and other professionals, a behavioural support plan may be developed and implemented. This may address specific behaviours as well as underlying reasons contributing to the risk of exclusion and provide strategies for positive behaviour reinforcement. The behavioural support plan may include individual therapeutic interventions tailored to the specific needs of the young person and/or their family. Engaging with families is key to understand the home environment and dynamics. It is important to collaborate with parents or guardians to provide psychoeducation, support and strategies for managing the child's behaviour and needs at home. In or for crisis situations, the team may provide immediate crisis intervention and support during times of acute distress or behavioural crises via developing safety plans and strategies to de-escalate challenging situations. An open communication atmosphere within the school needs to be implemented, whereby teachers, administrators and other school staff are informed and understand the young person's challenges and strengths. School-based and school-wide mental health programmes may be implemented that may include preventive measures, early intervention strategies and mental health promotion initiatives.

AUTHOR CONTRIBUTIONS

Ingrid Obsuth: Conceptualization; methodology; investigation; writing – original draft; writing – review and editing; data curation; supervision. **J. Madia:** Data curation; formal analysis; writing – review and editing; writing – original draft. **A. Murray:** Writing – review and editing; conceptualization. **I. Thompson:** Writing – review and editing; funding acquisition; conceptualization. **Harry Daniels:** Conceptualization; funding acquisition; writing – review and editing.

ACKNOWLEDGEMENTS

This work was supported by the Economic and Social Research Council (grant number 1811EP001/LH7).

CONFLICT OF INTEREST STATEMENT

The authors do not have a conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Obsuth, I., Madia, J. E., Murray, A. L., Thompson, I., & Daniels, H. (2024). The impact of school exclusion in childhood on health and well-being outcomes in adulthood: Estimating causal effects using inverse probability of treatment weighting. *British Journal of Educational Psychology*, *94*, 460–473. https://doi.org/10.1111/bjep.12656