Examination of bidirectional association of conduct and emotional problems with school exclusion and truancy: Evidence from the UK Millennium Cohort Study

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ABSTRACT

Background: This study examines school exclusion and truancy in relation to both conduct and emotional problems. It considers these mental health problems both as predictors and as outcomes of school exclusion and truancy.

Method: The sample included 15,236 individuals from the Millennium Cohort Study, a UK longitudinal birth cohort study. Using subscales of the Strengths and Difficulties Questionnaire, conduct and emotional problems were assessed through childhood to adolescence (age 3, 5, 7, 11, 14 and 17 years), and reports of school exclusion and truancy were collected at age 11 and 14.

Results: Conduct problems during childhood were associated with subsequent exclusion and truancy in early adolescence in both males and females, but childhood emotional symptoms showed no such association. Prior exclusion was associated with an increase in conduct problems at age 14 for both genders, and for males it was also associated with an increase in emotional symptoms both at age 14 and 17. Prior truancy was associated with an increase in conduct problems at age 14 for both genders, and for females also at age 17, and it was associated with increased emotional symptoms at age 14 and 17 for both genders.

Conclusion: Overall results indicate a bidirectional association between conduct problems and school exclusion and truancy. For emotional symptoms, the association is unidirectional as these symptoms do not lead to exclusions or truancy. However, an increase in emotional symptoms may be a consequence of exclusion and truancy.

Keywords: school exclusion; truancy; conduct problems; emotional symptoms; Millennium Cohort Study

INTRODUCTION

School exclusion is relatively widely used in school settings, with recent (pre-pandemic) statistics showing that it affects around one in 20 of the overall school population in England, with fixed term exclusions being the most prevalent type (5.35%) and permanent exclusion being much less common (0.10%) (National Statistics, 2020a). As for truancy or unauthorised absence, 0.9% of school sessions (a session is half a day) were missed without authorisation in the academic year 2018/19 (excludes illness at 2.5% and unauthorised family holidays at 0.4%), whereas persistent absentees (i.e. missing 10% or more of their sessions for any reason) applied to 10.9% of pupils (National Statistics, 2020b).

Both school exclusion and truancy are causes for concern as they are associated with poorer child outcomes, including lower educational achievement and socioemotional development (Daniels et al., 2003; Heyne, Gren-Landell, Melvin, Gentle-Genitty, & Practice, 2019; Parsons, Hayden, Godfrey, Howlett, & Martin, 2001), with lasting impact on individuals' lives that translate into long-term societal costs (Brookes, Goodall, & Heady, 2007; Gill, Quilter-Pinner, & Swift, 2017).

Both exclusion and truancy have been linked with child mental health. Administrative school statistics reveal that persistent disruptive behaviour or physical assault are the main reasons for exclusion, and figures also show that having an identified special educational need (SEN), which includes mental health difficulties , is a risk factor for both exclusion and truancy (National Statistics, 2020a, 2020b). Several empirical studies, which offer more robust and nuanced measurements of mental health, have examined exclusion and truancy in relation to child mental health. The most recent mental health survey of children in England aged 5-16 found that reaching diagnostic threshold for a mental health disorder is associated with both truancy and exclusion (Mandalia et al., 2018). Specifically, 5.7% of those with a conduct

disorder, and 1.6% of those with an emotional disorder had been excluded, compared to 0.5% of those without a disorder. As for truancy, 11.2% of those with a conduct disorder, and 9.7% of those who had an emotional disorder had truanted from school, compared to 0.8% of children without a disorder. Also across the wider literature, these are well established associations, with several systematic reviews and meta-analyses indicating that both conduct problems and emotional problems are associated with school exclusion and truancy (Finning et al., 2019; Gubbels, van der Put, & Assink, 2019; Parker et al., 2015; Whear et al., 2014). However|, as highlighted consistently by review authors, many studies are cross-sectional where exclusion and truancy has occurred prior to the measurement of mental health. The interpretation in many examinations nevertheless highlights the role of mental health as a driver of school exclusion and truancy, rather than considering the reverse association. Only few studies have explicitly examined the directions of the association between mental health and exclusion and truancy. One study found that whilst child mental health was predictive of later exclusion, exclusion also predicted mental health (Ford et al., 2018). Another study examined trajectories of mental health difficulties both prior to and after the occurrence of exclusion, and found that children who would go on to be exclude by age 16, had significantly higher mental health difficulties from the age of 9 years and onwards, and after exclusion girl's mental health deteriorated further (Tejerina-Arreal et al., 2020). These studies therefore suggest bidirectionality between child mental health and exclusion and truancy. However, in these examinations there is no distinction between conduct and emotional problems as these dimensions of child mental health are combined as an overall measure. Currently, there is therefore little evidence on how specific dimensions of mental health relate to school exclusion and truancy, and whether associations are unidirectional or bidirectional. It is enormously useful in terms of policy and practice to provide clearer evidence as to which

aspects of mental health are precursors to exclusion and truancy, and whether exclusion and truancy have onward consequences for emotional problems as well as for conduct problems.

Current study

The aim of the current study is to contribute to the existing literature by examining the longitudinal relationship between child mental health and school exclusion and truancy. We examine child mental health as a predictor of school exclusion and truancy, and also consider whether these school events are associated with subsequent mental health functioning. Importantly, this study examines conduct problems and emotional symptoms separately to pinpoint whether specific dimensions of child mental health are associated with exclusion and truancy and the direction of any association. Analyses are carried out using a large UK longitudinal birth cohort study. As well as providing estimated for the sample overall, analyses are carried out by gender given known differences in exclusion, truancy and mental health, and because a previous study that has indicated gender differences (Tejerina-Arreal et al., 2020).

METHODS

Data

The data in the current analyses is from the UK nationally representative Millennium Cohort Study (MCS), which is an ongoing longitudinal birth cohort study with an initial sample of over 19,000 individuals born between September 2000 and January 2002 (Joshi & Fitzsimons, 2016). The sample was draw from each of the four UK countries, which were stratified by electoral wards, with further stratification by area deprivation, and in England also ethnic minority concentration, and wards were oversampled on both of these factors. The child benefit register, which is almost universal as everyone with a child under 16 is eligible, was used to identify children living in the selected wards (Plewis, Calderwood, Hawkes,

Hughes, & Joshi, 2007). Following the first survey when children were aged 9 months, follow-up surveys have taken place at age 3, 5, 7,11, 14 and most recently at 17 years. Parents were the main reporters in early childhood but with age children have provided an increasing amount of data themselves, including their experiences at school. The current study included a total of 15,236 children, with a small variation between the analytical sample for exclusion (N=15,044) and truancy (N=14,848).

Measures

Child mental health

Mental health of children was assessed with the widely used and validated Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997), which was administered to the main parent at age 3, 5, 7, 11, 14 and 17 years. The subscales conduct problems and emotional symptoms were used in the current study, each of which have five items with scores ranging from 0-10, with higher values indicating a greater level of problems. The means for each of the subscales at each of the assessment points, overall and by gender, is shown in Table S1 (Supplemental Material).

School exclusion and truancy

The main parent reported at age 11 and age 14 whether their child had ever been temporarily or permanently suspended from school. A binary measure was derived for experiencing either type of exclusion between the age of 11 and 14. Those who had been excluded already by age 11 were dropped from the analytical sample, meaning that the measure captures new or first-time school exclusion between age 11 and 14.

Children themselves reported at age 11 whether they had ever missed school without parental permission, and at age 14 they reported any truancy in the past twelve months. A binary was

derived that captured first time truancy between age 11 and 14, and again those admitting to truancy by age 11 were dropped from the analytical sample.

Being able to temporally specify the first occurrence of exclusion and truancy (after age 11 but prior to age 14) is important analytically in models that predict these outcomes using prior mental health (age 3 to 11 average), and in models where exclusion and truancy are predictors of subsequent change in mental health between age 11 and 14 and between age 11 and 17.

Covariates

A range of other factors have been associated with truancy and exclusion, namely child, family and school related factors (Paget et al., 2018), many of which have also been associated with child mental health, so it was important to adjust for these potential confounders. Covariates in the prediction of exclusion and truancy included gender (main model only), ethnicity, SEN at age 11, pubertal development at age 11, age in months at age 14 interview, household income (9 months to age 11 average), parental education, socioeconomic status, accommodation type at age 11, single parent household ever (9 months to age 11), maternal psychological distress (9 months to age 11 average), school connectedness (age 7 and age 11 average), and school bullying victimisation (age 7). In the fixed effects analyses of exclusion and truancy as predictors of mental health, only time variant covariates were included: age in months at assessment of outcome, main parent mental health distress, and change in family structure (i.e. parental break up or new partner joining household). See supplemental material (Box S1) for further information on measurement of the covariates.

Analyses

All analyses were carried out using Stata version 16 (StataCorp, 2019)

Examining associations between mental health and exclusion/truancy

The substantial analyses were in two parts. First, conduct problems and emotional symptoms during childhood (age 3 to 11 average) were examined as predictors of exclusion and truancy between age 11 and 14. These binary outcomes were examined in logistic regressions with the inclusion of several covariates to control for potential confounding.

In the second part of the analyses, exclusion and truancy between age 11 and 14 were examined as predictors of change in conduct problems and emotional symptoms between age 11 and 14 and between age 11 and 17. An individual fixed effects approach was taken in these analyses, which provides a stronger causal design when examining associations in observational longitudinal data (Wooldridge, 2010). The advantage of this analytical approach is that estimates of effects of school exclusion and truancy on mental health are based on within-individual comparisons across time. Essentially, participants become their own controls and stable characteristic that do not change over time (e.g. ethnicity, genetics, parental child rearing practices or educational level) whether observed in the data or not, are controlled for by design. None of the participants had been excluded or truanted by age 11 (these were dropped from the respective analyses), but by 14 some have experienced school exclusion or truancy, and this change is examined in relation to their change in mental health from before to after exclusion or truancy. The causal interpretation of fixed effects estimates is based on some key assumptions. The first is that there are no other unobserved changes between time points time (time-varying factors) that influence both exclusion/truancy and conduct problems/emotional symptoms. In our fixed effects analyses we therefore control for potential influential time-varying factors as outlined above. A second assumption in our fixed effects analyses is that the associations are not reverse. Reverse causation is here mitigated by exclusion or truancy occurring after age 11 but prior to age 14, and mental health being assessed at age 11 (baseline) and then after exclusion or truancy at age 14 and 17.

Multiple imputations

To minimise bias due to attrition over time, which affects all longitudinal studies (Calderwood, 2013), multiple imputations were used to partially 'restore' the original sample. Of the 19,519 children recruited initially, 10,757 participated at age 17. Multiple imputations is an efficient method for obtaining more precise estimates when data is missing such as through attrition (Mostafa et al., 2021). Because outcomes are also imputed in the current study, a range of auxiliary variables were utilised in imputation models, which improves accuracy of imputations and of subsequent estimates (Von Hippel & Lynch, 2013). Missing data was imputed back to the age 5 survey, creating 30 imputed datasets through multiple chained equations. We did not impute back to earlier sweeps because this would have meant imputing over 50% of missing values for some individuals, which is not recommended (Mishra & Khare, 2014). To adjust for attrition between the initial sweep and the imputation sample at age 5, weights developed for the cohort study were used, and weights also adjusted for the complex sampling design of the initial survey (Mostafa, 2015). The final imputed sample consisted of 15,236 children.

Research Ethics

Ethical approval was obtained for all waves of the Millennium Cohort Study through the National Health Service (NHS) Research Ethics Committee (REC). Ethical procedures included informed written parental consent and assent from participants.

RESULTS

Sample characteristics

In terms of characteristics of the MCS sample, 51% were males, 87% were of White ethnic background, and 82% lived in England in the initial survey. Around 44% of children had

parents with a degree (NVQ4) or postgraduate degree (NVQ5), whilst 8.3% had parents with no education. Conduct problems were highest in early childhood at age 3 followed by a steady decline during childhood through to age 17. The reverse pattern was seen for emotional symptoms, which were lowest in early childhood before increasing during childhood into adolescence, especially so for females. At all assessment points (age 3 to 17) males were reported by their parents to exhibit a higher level of conduct problems than females, whilst emotional symptoms were higher in females at all assessments except at age 3 where there was no difference. The prevalence of exclusion between age 11 and 14 was 5.6%, with males (7.3%) being more likely to have been excluded than females (3.8%). The prevalence of truancy between age 11 and 14 was 9.0% with no significant gender difference. Table S1 (Supplemental Material) shows sample characteristics overall and by school exclusion and truancy.

Conduct problems and emotional symptoms as predictors of school exclusion and truancy

Table 1 show results of multivariate logistic regressions examining conduct problems and emotional symptoms during childhood (age 3 to 11) as predictors of exclusion and truancy between age 11 and 14. Coefficients are reported as odds ratios (OR) and conduct problems and emotional symptoms are standardised (z-scores). Overall, we see that higher levels of conduct problems during childhood were associated with a higher likelihood of school exclusion (OR=1.74, 95% CI=1.58-1.92) and truancy (OR=1.25, 95% CI=1.15-1.36), but emotional symptoms during childhood were not associated with these outcomes. Estimates for males were similar to those for females.

Table 1: Examination of conduct problems and emotional symptoms as predictors of school exclusion and truancy: results of logistic regression models

	All (adjusted)		**Males (adjusted**		**Females (adjusted)**	
	OR	95% CI	OR	95% CI	OR	95% CI
	School Exclusion					
Panel A Conduct problems (age 3-11)	**1.74*****	1.58-1.92	**1.77*****	1.57-1.99	**1.69*****	1.43-2.01
Panel B Emotional symptoms (age 3-11)	0.99	0.89-1.09	0.97	0.86-1.09	1.02	0.86-1.21
Individuals	15,044		7,620		7,424	
	Truancy					
Panel C Conduct problems (age 3-11)	**1.25*****	1.15-1.36	**1.29*****	1.14-1.46	**1.20****	1.06-1.37
Panel D Emotional symptoms (age 3-11)	0.93	0.86-1.02	0.94	0.83-1.07	0.92	0.82-1.04
Individuals	14,848		7,543		7,305	

Notes:
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10
Conduct problems and emotional symptoms are standardised measures (z-scores).
Adjusted models include gender (main model only), ethnicity, special educational needs age 11, pubertal development at age 11, age in months at age 14 survey, household income (9 months to age 11), parental education, socioeconomic status, accommodation type age 11, single parent household ever (9 months to age 11), maternal psychological distress (9 months to age 11), school connectedness (age 7 and 11), school bullying victimisation (age 7).

Exclusion and truancy as predictors of conduct problems and emotional symptoms

Table 2 presents results of fixed effect analyses examining exclusion and truancy as predictors of conduct problems and emotional symptoms at age 14 and at age 17.

School exclusion

Panel A (Table 2) shows that being excluded from school between age 11 and 14 was related to an increase in conduct problems at age 14 (0.31 *SD*, 95% CI=0.19-0.43), with a similar association seen for both genders. For males, school exclusion continued to have a borderline significant association with increased conduct problems at age 17.

In term of emotional symptoms (Table 2, Panel B), school exclusion was associated with an increase in these symptoms in males, both at age 14 (0.18 *SD*, 95% CI=0.05-0.31) and at age 17 (0.20 *SD*, 95% CI=0.06-0.34), but for females the association was weak and not statistically significant.

Truancy

In Panel C (Table 2), we see that truancy from school between age 11 and 14 was associated with an increase in conduct problems at age 14 (0.26 *SD*, 95% CI=0.17-0.35), and this estimate was similar for males and females. Truancy was also associated with an increase in conduct problems at age 17, but only in females (0.15 *SD*, 95% CI=0.03-0.27).

Estimates in Panel D (Table 2) show that truancy was associated with an increase in emotional symptoms both at age 14 (0.21 *SD*, 95% CI=0.12-0.30), and of a similar magnitude at age 17 (0.20 *SD*, 95% CI=0.09-0.31). There was no discernible difference between these estimates for males and females at either age.

Table 2: Examination of exclusion and truancy as predictors of conduct problems and emotional symptoms: results of fixed effects analyses

	AGE 14 OUTCOMES							**AGE 17 OUTCOMES**					
	All		**Males**		**Females**			**All**		**Males**		**Females**	
	Std Coeff	95% CI	Std Coeff	95% CI	Std Coeff	95% CI		Std Coeff	95% CI	Std Coeff	95% CI	Std Coeff	95% CI
Panel A	Conduct problems at age 14							Conduct problems at age 17					
Exclusion age 11-14	**0.31*****	0.19-0.43	**0.32*****	0.18-0.46	**0.36*****	0.15-0.56		-0.13+	-0.27-0.01	-0.16+	-0.33-0.01	-0.02	-0.24-0.21
Panel B	Emotional symptoms at age 14							Emotional symptoms at age 17					
Exclusion age 11-14	0.09	-0.02-0.20	**0.18****	0.05-0.31	0.02	-0.17-0.21		0.11	-0.02-0.24	**0.20****	0.06-0.34	0.11	-0.11-0.33
Individuals	15,044		7,620		7,424			15,044		7,620		7,424	
Panel C	Conduct problems at age 14							Conduct problems at age 17					
Truancy age 11-14	**0.26*****	0.17 0.35	**0.22*****	0.10-0.34	**0.30*****	0.18-0.41		0.07	-0.03-0.17	-0.01	-0.15-0.13	**0.15***	0.03-0.27
Panel D	Emotional symptoms at age 14							Emotional symptoms at age 17					
Truancy age 11-14	**0.21*****	0.12-0.30	**0.18****	0.06-0.30	**0.23*****	0.11-0.35		**0.20*****	0.09-0.31	**0.19****	0.05-0.34	**0.21****	0.08-0.33
Individuals	14,848		7,543		7,305			14,848		7,543		7,305	

Notes:

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Conduct problems and emotional symptoms are standardised measures (z-scores).

All models adjust for time-varying covariates: age in months at assessment of outcome, main parent mental health distress, change in family structure (i.e.parental break up or new partner joining household)

DISCUSSION

Summary of main findings

This study examined school exclusion and truancy and their association with mental health both as outcomes and as predictors. Findings showed that conduct problems during childhood were associated with school exclusion and truancy in early adolescence, but childhood emotional symptoms were not predictive of either of these school outcomes. Despite emotional symptoms not leading to exclusion and truancy, results showed an increase in these types of problems into late adolescence in both males and females following truancy, and in males following school exclusion. Conduct problems were found to increase in males and females in early adolescence after both exclusion and truancy, and for males conduct problems increased into late adolescence after truancy. Overall, these findings suggest that there are bidirectional associations between conduct problems and school exclusion and truancy, whereas for emotional symptoms the association was unidirectional with evidence of these problems increasing after school exclusion and truancy, but emotional problems were not a driver of these school outcomes. In terms of gender, results indicated that conduct problems were equally predictive of exclusion and truancy in males and females, whereas exclusion and truancy appeared to have different consequences for male and females in terms of later conduct problems and emotional symptoms. For example, exclusion was found to be associated with subsequent increases in emotional symptoms in males both in early and late adolescence, but not in females, despite these symptoms generally increasing more in females during this developmental period (Bongers, Koot, van der Ende, & Verhulst, 2003).

Comparison to previous research

By providing evidence of an association between mental health and school exclusion and truancy, findings in the current study are highly consistent with previous examinations

(Finning et al., 2019; Ford et al., 2018; Gubbels et al., 2019; Mandalia et al., 2018; Parker et al., 2015; Tejerina-Arreal et al., 2020; Whear et al., 2014). Furthermore, the current study makes novel contributions to the field by providing evidence as to the direction of associations for conduct and emotional problems as distinct symptoms. The finding that conduct problems were predictive of exclusion is especially coherent with school statistics which document that disruptive behaviour and physical assault are primary reasons for exclusion (National Statistics, 2020a). The finding that emotional symptoms were not predictive of exclusion is perhaps unsurprising as these symptoms do not tend to manifest in behaviours that would lead to exclusion, except perhaps in students with comorbid conduct and emotional problems. On the other hand, one might expect emotional problems to be predictive of truancy as symptoms of depression and anxiety may lead to no-attendance; although this type of absence may be likely to be authorised on medical grounds therefore not reported by participants as truancy. Previous US longitudinal studies have found depression to precede absenteeism (Kingery, Erdley, & Marshall, 2011; Wood et al., 2012), although absenteeism included illness in both these examinations which may explain this finding.

Strengths and limitations

Strengths of this study include the use of a large longitudinal sample representative of adolescents born in the UK around the Millennium. The longitudinal aspect allows the examination of predictors measured prior to the outcomes of interest, thereby offering some mitigation against reverse causation. The fixed effects approach used in the examination of the effect of exclusion and truancy on mental health functioning is an especially strong design in terms of causality, although care should still be taken in the interpretation of these results as there may be time varying confounding factors driving this effect. Additionally, because both exclusion and truancy are driven to a large extent by individual behaviours rather than being an external event or shock, it is possible that adolescents were already heading towards

upward trajectories of mental health problems prior to exclusion or truancy (Tejerina-Arreal et al., 2020). Care must therefore be taken when interpreting the increase in mental health problems we see following exclusion and truancy, as this increase may not be fully attributable to these events.

Further limitations of this study pertain to the relatively brief measures of mental health, with both conduct and emotional each being assessed using just five items. This may limit results and comparability to studies that use larger batteries of items, including studies that use clinical assessments, or where much more specific dimension or diagnosis of mental health have been assessed. This study does not distinguish between temporary and permanent exclusions as the latter was a rare outcome in the current sample – reflecting a low prevalence at a national level - and lack of statistical power prevented its examination. Other limitations include potential misclassification of truancy because at age 11 this was measured as 'ever' and at age 14 it was measured 'in the past year' and therefore anyone who had truanted between age 11 and 13, but not between age 13 and 14, would therefore have been classified as never having truanted. Such misclassification is likely to bias result in the direction of underestimating the effect of truancy. Additionally, in order to specify the time period for truancy and exclusion, which was important for the temporal ordering of these both as outcomes and as predictors, those who had been excluded or had truanted by age 11 were dropped from their respective analyses, and by doing so this study is likely to have omitted children with the highest level of mental health problem, which is likely to bias results by underestimating the effect of these problems on exclusion and truancy.

Implications

The results of the current study suggest that prevention of exclusion and truancy should focus on addressing children's conduct problems. Early identification of these problems followed

by effective intervention and prevention would be needed. Targeting child behavioural problems may start in the home and include evidence-based parenting programmes (Barlow & Coren, 2018), as well as training teachers to manage behaviour in the classroom (Nye, Melendez-Torres, & Gardner, 2019). Another approach which has shown promise to reduce mental problems (both conduct and emotional problems) as well as exclusion, is school-based counselling (Toth, Cross, Golden, & Ford, 2022). Better access for children to mental health services would also be needed, as currently the majority of children with clinical levels of mental health problems have no contact with to mental health services (Mandalia et al., 2018), and a large proportion those who are referred are turned away (Frith, 2016).

It is important to emphasise that child behavioural problems are amongst one of many other risk factors for exclusion and truancy. School management and overarching school culture and ethos have been highlighted as important contributors to both exclusion and truancy (Graham, White, Edwards, Potter, & Street, 2019; Reid, 2005), with evidence from randomised controlled trials of school-wide interventions demonstrating a reduction in exclusion (Valdebenito, Eisner, Farrington, Ttofi, & Sutherland, 2019) and in truancy (Bonell et al., 2020). Students' relationship or bond to the school has been highlighted as a key element to reducing both exclusion and truancy (Graham et al., 2019; Keppens & Spruyt, 2020). Aside from enhancing the educational opportunities of at-risk students, preventing exclusion and truancy may also be an avenue for reducing mental health problems in adolescence, as indicated in the present study. It is notable that despite emotional symptoms not appearing to lead to school exclusion or truancy, these types of problems may arise as a consequence of these school events.

Conclusion

In conclusion, results of this study indicate that childhood conduct problems, but not emotional symptoms, are a risk factor for school exclusion and truancy in adolescence, and

that young people who are excluded or who truant may experience an increase in both conduct problems and emotional symptoms. These findings suggest that interventions that prevent school exclusion and truancy might prevent mental health problems in adolescents.

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Data availability

Data for the Millennium Cohort Study used in this paper is available from the UK Data Service. https://www.ukdataservice.ac.uk/

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SUPPLEMENTAL MATERIAL

Box S1: Control variables and their measurement

Covariates drawing on several survey sweeps were used in analyses all measured prior to exclusion and truancy in the models predicting these events. Most were reported by the main parent and some also by children themselves. Demographic information included gender and ethnicity, and age in months of the child when outcomes were measured. Special educational needs status was obtained at age 11 through parent reports. Pubertal development was assessed through self-report of the progress of body hair growth at age 11. Socioeconomic covariates included the highest educational level achieved by a parent in the household using National Vocational Qualifications (NVQ) levels, and the highest occupational status in the household was classified according to the NS-SEC (Rose & Pevalin, 2003). Accommodation type was reported at age 11, distinguishing between homeowners and those renting. Household income was an average of equivalised household income (adjusting for composition and size of household) from age 9 months to age 11 years. Single parent status covered the same cross-childhood period from age 9 months to age 11 years. Maternal psychological distress was measured using the Kessler 6-item scale (Kessler et al., 2003) using an average from age 9 months to age 11. School related variables included a measure of school connectedness administered to children at age 7 (seven items) and at age 11 (five items) (e.g. 'how much do you like school', 'how often do you feel school is a waste of time'), and the combined into an overall measure. Bullying victimisation was reported both by parents and children at age 7, from which a composite was created. In the fixed effects analyses estimating the effect of exclusion and truancy on mental health, only time-variant controls were included as this analytical design is robust to time-invariant factors. These included age in months at assessment of outcome, main parent mental health distress, change in family structure (i.e. parental break up or new partner joining household).

Notes

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Table S1: Sample characteristics overall and by school exclusion and truancy

	Total sample (prop or mean)	Excluded age 11-14 (5.6%)	p-value	Truancy age 11-14 (9.0%)	p-value			
Gender								
Male	51.10%	66.3%	ref	49.9%	ref			
Female	48.90%	33.7%	p<.001	50.1%	ns			
Ethnicity of child								
White	86.70%	83.1%	ref	88.5%	ref			
Mixed	3.20%	4.5%	ns	3.3%	ns			
Indian	1.80%	1.1%	ns	1.7%	ns			
Pakistani & Bangladeshi	4.20%	4.6%	ns	3.3%	p<.10			
Black	2.80%	5.4%	p<.01	2.3%	ns			
Other	1.20%	1.3%	ns	0.9%	ns			
Maternal psychological distress (Kessler)	13.9	19.3	p<.001	18	p<.001			
Highest education in household								
No qualifications	8.30%	20.3%	ref	11.4%	ref			
NVQ1	5.60%	11.0%	ns	6.9%	ns			
NVQ2	25.60%	35.3%	p<.001	34.0%	ns			
NVQ3	16.20%	13.9%	p<.001	16.5%	p<.10			
NVQ4	36.90%	18.0%	p<.001	26.1%	p<.001			
NVQ5	7.50%	1.5%	p<.001	5.2%	p<.001			
Lives in rented accommodation age 11	35.90%	69.9%		52.8%				
Single parent ever between 9 months and age 11	35.30%	64.0%		51.9%				
Household weekly income average 9 months to age 11	£372	£239	p<.001	£308	p<.001			
Country								
England	82.30%	85.6%	ref	77.3%	ref			
Wales	4.80%	4.4%	ns	5.4%	p<.10			
Scotland	9.00%	7.0%	p<.05	14.0%	p<.001			
Northern Ireland	3.80%	3.0%	p<.10	3.3%	ns			
Special educational needs statement	4.90%	7.5%	p<.05	5.1%	ns			

Bullied at school age 7								
Never	38.8%	29.6%	ref	34.0%	ref			
Sometimes	46.8%	45.8%	p<.05	46.7%	ns			
Often	14.4%	24.6%	p<.001	19.2%	p<.001			
School connectedness age 7 and 11 (mean)	19.0	17.1	p<.001	17.8	p<.001			
						Female	**Male**	Sex diff p-value
SDQ conduct problems age 3	2.84	4.13	p<.001	3.40	p<.001	2.72	2.96	p<.001
SDQ conduct problems age 5	1.51	2.57	p<.001	1.94	p<.001	1.37	1.66	p<.001
SDQ conduct problems age 7	1.41	2.49	p<.001	1.95	p<.001	1.24	1.57	p<.001
SDQ conduct problems age 11	1.42	2.89	p<.001	2.07	p<.001	1.28	1.56	p<.001
SDQ conduct problems age 14	1.44	3.38	p<.001	2.47	p<.001	1.37	1.51	p<.001
SDQ conduct problems age 17	1.23	2.56	p<.001	2.00	p<.001	1.16	1.3	p<.001
SDQ emotional symptoms age 3	1.38	1.71	p<.001	1.51	p<.05	1.38	1.38	ns
SDQ emotional symptoms age 5	1.39	1.61	p<.01	1.43	ns	1.43	1.35	p<.01
SDQ emotional symptoms age 7	1.55	1.90	p<.001	1.76	p<.01	1.58	1.51	p<.05
SDQ emotional symptoms age 11	1.87	2.36	p<.001	2.15	p<.001	1.96	1.79	p<.001
SDQ emotional symptoms age 14	2.03	2.67	p<.001	2.70	p<.001	2.33	1.73	p<.001
SDQ emotional symptoms age 17	2.09	2.85	p<.001	2.77	p<.001	2.54	1.66	p<.001

Notes:
Frequencies are weighted to adjust for survey design and attrition
ref=reference category used in significance testing
ns=non-significant