

**Unpacking the associations between heterogeneous externalising symptom
development and academic attainment in middle childhood**

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Abstract

This study explores children's externalising symptom development pathways between 8 and 11 years of age (three time points across 2 years) and examines their sociodemographic correlates and associations with change in academic attainment. Externalising symptoms were assessed for 5485 children across three consecutive years ($M_{\text{age}} = 8.7$ years, $SD = 0.30$ at time 1). National standardised test scores served as an index of academic attainment. Using latent class growth analysis, six distinct trajectories of externalising symptom development were identified. Children who showed increasing externalising symptomatology across the three time points were more likely to be male or have special educational needs. These derived trajectories differentially predicted children's subsequent academic attainment (controlling for earlier attainment). Children with increasing externalising symptomatology were significantly more likely to demonstrate negative change in academic achievement compared with children with consistently low externalising problems. The study helps to clarify the longitudinal association between externalising symptom development and academic attainment, and highlights the importance of early intervention for children with increasing externalising symptoms across middle childhood.

Keywords: behaviour, conduct, children, externalising, attainment, education

Introduction

Externalising problems constitute a key domain of child and adolescent psychopathology and are characterised by dysregulated behaviour, including symptoms of conduct disorder, oppositional defiant disorder and antisocial behaviour [1, 2]. Due to the disruptive nature of externalising behaviours both within the family and in the school environment [3], these problems are thought to be particularly detrimental to children's academic attainment [4]. This is of particular concern, as academic attainment has been shown to be an important predictor of adult outcomes, including occupation, earnings and health [5, 6].

The association between externalising symptoms and academic attainment has been demonstrated cross-sectionally in several studies [4, 7, 8], and these two domains have been shown to be linked from a very early age [9]. Longitudinal studies examining this relationship have largely found that externalising symptoms predict later low academic attainment [4, 10]. For example, van Lier et al. [11] explored the impact of externalising behaviours on attainment between 6 and 8 years of age and found that early externalising behaviours predicted poor attainment. Moilanen et al. [10] found a similar pattern of association in boys from middle childhood to early adolescence [see also 4, 12]. In contrast, Duncan et al. [13] analysed six datasets from different countries and found that after controlling for prior attainment, the impact of externalising symptoms was not significantly associated with later academic attainment in four of the studies. Although most current research suggests that externalising difficulties do have a longitudinal negative impact on attainment, little is understood about the impact of symptom development on learning, and the possible differential effects of heterogeneous symptom development pathways on attainment remain unclear.

The extant literature exploring the longitudinal impact of externalising problems on academic attainment has, for the most part, examined aggregated scores across the whole

sample rather than taking a person-centred trajectory approach. Aggregating scores across individuals entails the assumption that the relationship between externalising symptoms and attainment over time is the same for all individuals. Numerous studies have mapped externalising symptom trajectories over childhood and adolescence [14-18]; however, the utility of individual trajectories in predicting academic attainment within the context of childhood is yet to be explored. It may be possible, for example, that children who develop externalising symptoms in middle childhood are at particular risk for negative impacts on their academic attainment compared with those who maintain consistently low levels of externalising symptoms. As childhood is a key period for externalising symptom development [19], understanding the specific impact of different trajectories of symptom development over this period may be of particular relevance for understanding the direction of the link between behaviour and attainment and for informing effective intervention.

The current study

In light of the disruptive nature of childhood externalising problems, and the importance of academic attainment for later adult outcomes, the current study identifies externalising symptom development trajectories between 8 and 11 years of age, and explores the association between these trajectories and subsequent academic attainment (controlling for earlier attainment). We initially summarise externalising symptom development pathways over the three time points and identify their sociodemographic correlates. Next, we examine patterns of association between these trajectories and changes in children's academic attainment, having adjusted for the influence of demographic factors.

It is hypothesised that heterogeneous externalising symptom development across the three time points will have a differential impact on change in educational attainment over the same period. Given the known negative association between levels of symptoms and attainment [4, 12], it is expected that children who develop externalising symptoms will

experience the highest impact on attainment. We expect that the children who develop externalising symptomatology across the three time points will have poorer academic attainment compared with their peers who do not develop externalising symptoms, and by contrast decreasing disruptive behavior should predict relative improvement in attainment. To our knowledge, the current study is the first to examine the impact of symptom development pathways on educational attainment in middle childhood. Understanding the demographic profile of children with different symptom development, and the impact of symptom development on attainment, will provide further insight into where intervention might be most necessary and effective.

Method

Design

Externalising symptoms were assessed in the first term of schooling (autumn) every year for three consecutive years. Educational attainment scores were taken from national standardised tests in England, which correspond to ages 7 and 11 years. The attainment scores were collected *prior to* the assessment of externalising symptoms at time 1, and *following* the assessment of externalising symptoms at time 3. This allowed an examination of the impact of symptom development during the three time points on relative change (gains or losses) in national standardised tests of attainment.

Participants

Data from a naturalistic 3- year longitudinal study of mental health in English state-funded primary schools were employed in this study (for more details see Wolpert et al. [20]). Data were collected at yearly intervals from the 138 primary schools that participated in all three time points of the study. Data were available for 5485 children at any time point, representing

a 94.5% response rate. A total of 3346 participants had data for all three time points, 1311 for any two time points, and 828 for only one time point.

At time 1, mean age was 8.70 years ($SD = 0.30$ years). Almost half the sample was female (49.1%, $n = 2691$), and deprivation, as indicated by eligibility for free school meals (22.3%), was higher than national levels (18.5% [21]). The majority of participating children were classified as White (73%), followed by Asian (14.9%), Black (5.3%), Mixed (3.9%) and other (3%). Almost 11% of participants were classified as having special educational needs. Academic attainment scores on national standardised tests at time 1 ($M = 14.68$, $SD = 3.67$) were lower than the national average of 15.3.

Measures

Externalising symptoms

Externalising symptoms were measured using the behavioural difficulties subscale of the Me and My School questionnaire [22, 23], a 6-item self-report scale (e.g., ‘I hit out when I’m angry’) with three response options: *never*, *sometimes*, *always*. Responses were summed to create a total behavioural difficulties score, with higher scores indicating greater difficulties. The scale has an at-risk cut-off score of 6 [22], with 18.1% , 15.1% and 13.7% of the sample scoring above cut-off scores at each time point, respectively.

Academic attainment

National standardised test results, referred to as Key Stages (KS) in England, were used as a measure of attainment [24]. The KS1 score ($M = 14.68$, $SD = 3.67$) was used as a measure of attainment prior to the three time points of data collection, and the KS2 score ($M = 27.17$, $SD = 4.59$) was used as a measure of attainment following the study’s final time point.

Government-advised standards of KS2 attainment for this age group [25] correspond to a score of at least 25 points, which 70.6 % of the analysed sample had achieved.

Child characteristics

Sociodemographic information was derived from the National Pupil Database (NPD), which holds all school-related data pertaining to every student in England. Information included child gender (male, female), age, ethnicity (White, Asian, Black, Mixed and Other) and socioeconomic status (indicated by eligibility for free school meals) and special educational needs status (school provision for support, in referred to in the NPD as Statemented and School Action Plus).

Procedure

Ethics permission for the study and data collection was granted by the research ethics committee of University College London. Class teachers facilitated online, whole-class survey completion sessions for children. Each teacher was given a standardised instruction sheet to read aloud that outlined the content of the questionnaire, the confidentiality of the children's answers and their right to decline participation. The online survey system was designed to be easy to read and child-friendly, presenting items one after the other with the option to skip items if necessary.

Analytic strategy

The current study explores changes in externalising behaviour across three time points as a predictor of change in academic attainment from time 1 to time 3. Given the heterogeneous nature of the development of externalising problems over time, empirically derived trajectories were employed to summarise different developmental pathways over time, followed by an investigation of their association with academic attainment.

Developmental trajectories were identified using latent class growth analysis (LCGA) in Mplus [26], with full information maximum likelihood to account for missing data at any time point. LCGA is a semi-parametric technique that identifies subgroups of individuals following a similar pattern over time [27] to estimate empirically derived trajectory models

and identify a k -trajectory model that has good fit criteria, parsimony and theoretical interpretability. Criteria used to assess and select a k -trajectory model for further analysis included model fit, neatness of classification and interpretability [28]. Model selection was based on comparing log likelihood estimates of a k -trajectory model with $k-1$ trajectory model using the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT), examining drop in adjusted Bayes Information Criterion (A-BIC) estimates, and neatness of classification was assessed using entropy and posterior probabilities. Interpretability was assessed on the basis of known theoretical models, clinical usefulness and proportions in identified groups [28]. The sociodemographic correlates of the derived symptom trajectory groupings were then examined using multinomial logistic regression, comparing predictors of membership of each trajectory group with a reference trajectory group.

Following the identification of different trajectories of externalising behaviours and their correlates, the predictive capacity of these derived trajectories in explaining subsequent academic attainment was examined. The association between externalising symptom trajectory groups and attainment (KS2 scores), controlling for earlier attainment (KS1 scores), was examined using multilevel regression models in STATA12 [29]. Multilevel models were estimated to account for nesting of children within schools, as schools accounted for almost one-fifth of the variation in attainment. Sociodemographic characteristics of participants were included in this model to control for their impact on attainment scores.

Results

Based on LCGA analyses, a 6-trajectory model was selected, as it had the best neatness of classification (entropy = 0.72). Log-likelihood differences indicated that the 6-trajectory model was significantly better than the 5-trajectory model (LMR-LRT = 135.67, $p < .001$),

with the 7-trajectory model failing to improve model fit significantly (LMR-LRT = 77.32, $p = .310$). A-BIC showed a clear ‘elbow’ in reduction at the 6-trajectory model, as well as indicating that a greater number of classes did not result in sufficient improvement. The 6-trajectory model also showed sufficient heterogeneity, with the largest class consisting of less than 50% of the population and no identified classes comprising very small proportions (i.e., $< 1\%$).

The 6-trajectory model is presented in Figure 1, and Table 1 presents sample descriptive information, trajectory intercepts and slope coefficients for the different trajectories and the overall sample. As can be seen from Table 1, the proportions of children in each trajectory group varied greatly. Overall, and considering the clinical cut-off of the scale to identify high symptoms, there were two increasing externalising problem trajectories (low-moderate; low-high), two decreasing trajectories (high-moderate; high-low) and two stable trajectories (low-low; high-high). The largest proportions of children were classified as having low-low externalising problems (48.39%), followed by low-moderate increasing externalising problems (33.49%). The two smallest trajectory groups were the low-high increasing externalising problems group (2.73%, $n = 150$), and high-high externalising problem group (2.26%, $n = 124$).

Table 2 presents the results of the multinomial logistic regression examining sociodemographic predictors of trajectory group membership, with the low-low trajectory group as the reference category. Girls were significantly less likely to belong to the high-high, high-moderate, high-low, low-high, and low-moderate trajectory groups, compared to the low-low group. Ethnicity, by and large, did not significantly predict trajectory group membership, with the exception of Black ethnicity predicting a higher likelihood of membership of the high-low trajectory compared to the low-low group. Deprivation (i.e., eligibility for free school meals) significantly predicted a higher likelihood of membership of

the low-moderate, high-moderate and high-high trajectory groups compared to the low-low group. For instance, deprived children were 2.8 times as likely to have stable high symptoms as non-deprived children.

With regard to attaining the expected minimum score for KS2, 76.9% of children in the stable low-low symptom trajectory attained at least the expected score, followed by 68.9% of children with an increasing low-moderate symptom trajectory, 67% of those with a decreasing high-low symptom trajectory, 59.2% of the high-high, 56.9% of the high-moderate decreasing trajectory group and 51.4% of the low-high increasing trajectory group. Table 3 presents the results of the multilevel model predicting attainment controlling for both prior attainment and sociodemographic characteristics. Of the original sample, 806 children were missing either demographic information ($n = 90$) or academic attainment at either time point ($n = 716$), and hence these children were excluded from the following analysis. These missing children were equally represented across all six trajectory groups.

As can be seen from Table 3, when earlier attainment was controlled for, girls, deprived children, those who were younger in their class (year group), and those with special educational needs were found to have significantly lower attainment scores, and children classified as being of Asian or Other ethnicity had significantly higher attainment. The results pertaining to the trajectory groupings indicate that membership of the increasing low-moderate, low-high and high-moderate trajectory groups had a significant negative impact on subsequent academic attainment scores when compared with the low-low trajectory group. The extent to which the different trajectories negatively affected later attainment varied when compared with the reference group. The low-high increasing trajectory was associated with the most negative impact on attainment ($B = -0.95$), closely followed by the high-moderate decreasing trajectory ($B = -0.72$). The low-moderate, high-low and high-high groups all had a similar negative impact on attainment.

Discussion

The current study is the first to identify heterogeneous person-centred trajectories of externalising symptom development between 8 and 11 years of age and to explore their differential impact on academic attainment. This research contributes to the literature by highlighting the effect of different patterns of externalising symptom development for children's academic attainment in primary school. Unpacking the impact of these externalising symptom developments on academic learning has important implications for understanding child psychopathology, as well as direct implications for policy and practice in education [4], which are discussed below.

Six externalising symptom development trajectories were identified. The largest proportion of children maintained low levels of externalising symptoms across all time points. However, almost 35% of the sample experienced increasing externalising symptoms, and the smallest proportion of children demonstrated a significant decrease in symptoms. These findings are consistent with existing studies of externalising symptom trajectories over longer periods of childhood and adolescence [14, 15] and suggest that analysis of short-term developmental trajectories of symptoms can be theoretically placed within the existing literature.

The specific characteristics of identified trajectories demonstrated that gender and special educational needs were significant predictors of all higher symptom trajectories, with boys and children with special educational needs being significantly more likely to belong to a higher externalising symptom trajectory group than girls or children without special educational needs. The finding that boys are more likely to have increasing externalising problems is consistent with the extant literature [e.g. 30]. Given that special educational needs can include behavioural symptoms and these children are more likely to be involved in

bullying, this finding is also not surprising [31]. Deprivation also significantly predicted membership of the higher symptom trajectory groups, with deprived children being almost 2.5 times as likely to have stable high symptoms as non-deprived children, supporting other findings regarding deprivation and externalising symptom development [e.g. 30]. There was no clear picture concerning the association between trajectory group membership and ethnicity; this finding is not unexpected for an English sample, where associations between specific ethnic groups and externalising behaviours in children do not consistently emerge [32, 33].

The key analyses examining the association between externalising symptom development and academic attainment showed that both increasing and high-moderate trajectory groups predicted negative change in attainment compared with the group that maintained low-symptoms. The former finding is consistent with the hypothesis that children with increasing behavioural problems are likely to have corresponding poor academic attainment, possibly due to the disruptive nature of externalising problems for learning [3]. However, children in the high-high trajectory group did not show a deterioration in attainment; this may reflect a floor effect, that is, this group may already have had relatively poor attainment at the first time point. The finding may also partly be attributable to the small size of this group relative to the other trajectory groups. It is disappointing to observe that the high-low symptom trajectory was associated with a non-significant comparative deterioration in attainment. This suggests that early disruptive behaviour has a lasting impact on academic performance, which remains even though the child's behaviour has improved. The size of this effect was similar to that for children with consistently high externalising symptomology.

When comparing attainment at follow-up, stark differences between trajectory groups emerge. Based on current Government standards for attainment for this age group [25], 71% of the overall sample met the expected standard. However, the proportion of children meeting

this level varied considerably by trajectory group: just over half (51%) of the children with increasing low to high externalising symptomology, and only 59% of children with stable high symptoms, met this level. In contrast, 77% of children in the low-low trajectory group were achieving at the expected standard. The current findings make clear the impact that even short-term increases in externalising behaviours will have on the academic attainment of primary school children. Evidently, the emergence of disruptive behaviour is associated not only with deterioration in attainment, but also ultimately with performance not dissimilar to that of children whose externalising problems have always been marked (i.e., the high-high group). This suggests a strong, and probably causal, relationship between disruptive behaviour and the capacity to benefit from normal schooling. The more limited impact of behavioural improvement observed in this study strongly argues for the importance of early intervention.

Strengths and limitations

The large sample size, and its relative representativeness, are key strengths of the current study, and help provide an accurate representation of developmental trajectories of externalising problems that are broadly generalisable to the general population of primary school-aged children across England. Furthermore, employing a community sample rather than a clinical population allows an examination of children who start with low levels of problems or those with subclinical problems. Exploring the development of externalising problem symptomology in a large community sample of children contributes to understanding of the general development of externalising behaviour over time and provides important benchmarks for population-based estimates and risk factors associated with the disorder.

An important limitation of the current study was its reliance on a child-reported index of externalising problems. The recommended approach in mental health research is to use

multiple informants of children's mental health status and then triangulate across a number of different sources [34]. Given the size of the current study, however, it was not feasible to have multiple informants. While relying solely on child-report for externalising problems is a limitation of the current study, the importance of assessing children's own perspective on their mental health has been increasingly highlighted [e.g. 35], and research shows that, when asked appropriately, children are reliable reporters of their own difficulties, including externalising behaviours [36]. Nevertheless, future research would benefit from considering the association between academic attainment and externalising symptom development as measured by multiple sources to confirm and extend the current findings.

Finally, it is important to note that there were differences in mean attainment scores across the six trajectory groups prior to time 1. In particular, the three trajectory groups that started with lower symptoms, while similar with respect to externalising problems, were already divergent with respect to academic attainment. This may be due to a number of factors. First, the measures of externalising problems may not have been sensitive enough to detect changes in symptoms at this lower end of the scale. Limited variability at the lower end in measures of mental health symptoms are not uncommon, given that they are created and validated with the aim of measuring symptomatology. Second, it is possible, and indeed likely, that additional and varied risk factors at earlier time points were already having an impact on the children's academic attainment. This is highlighted by the fact that children with low-moderate and low-high trajectories had *lower* academic attainment prior to time 1 compared with those that remained on a low trajectory. This explanation is supported by theoretical models that argue that shared-risk factors predict negative development in a host of domains across development [10]. Further research would benefit from exploring the impact of externalising symptom development on academic attainment even earlier in

childhood, in addition to employing measures that better capture variation at lower levels of externalising problems.

Despite these limitations, the current study, by employing a person-centred approach and mapping trajectories of externalising symptom change over time, goes some way to providing clarity regarding the risk of externalising problems on academic outcomes in middle childhood. A trajectory approach allowed the comparison of groups of children with different patterns of symptom development, clearly highlighting groups of children at particular risk of poor academic achievement, who may then be targeted for additional support to help achieve academic parity with their peers. By unpacking the unique association between different developmental symptom trajectories and academic attainment, the current study highlights the importance of early intervention to support children with externalising problems during the final years of primary school – not only for attainment but, critically, for children’s wellbeing.

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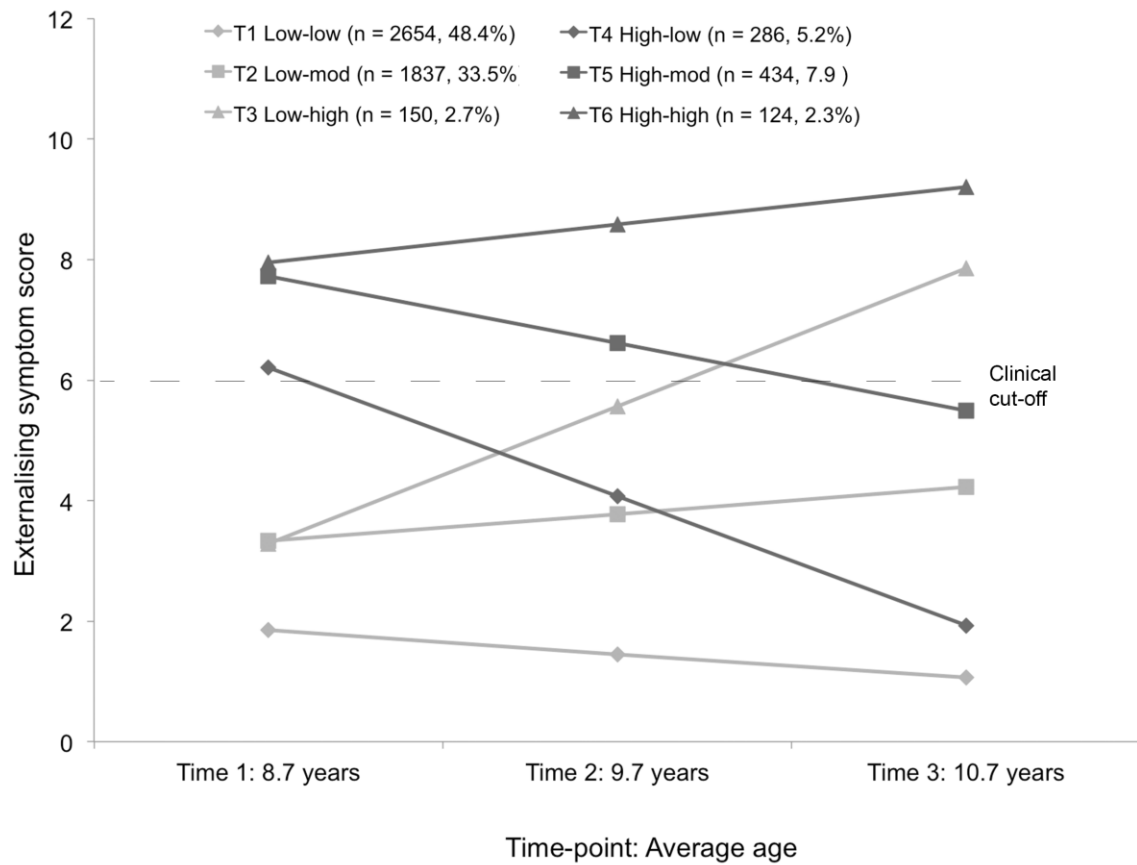


Figure 1. Heterogeneous developmental trajectories of externalising symptoms in children aged 8–11 years.

Table 1

Sample breakdown, descriptive statistics and intercept and slope coefficients for each trajectory group (T1–T6)

	T1	T2	T3	T4	T5	T6	Total sample
	Low-low	Low-moderate	Low-high	High-low	High-moderate	High-high	
<i>N</i> (%)	2654 (48.39)	1837 (33.49)	150 (2.73)	286 (5.21)	434 (7.91)	124 (2.26)	5485
Gender (% Female)	61.12%	42.68%	28.67%	38.81%	24.42%	20.16%	49.06
FSM (% Yes)	18.23%	24.16%	25.33%	23.40%	31.15%	39.52%	22.20%
Age at Time 1 <i>M</i> (<i>SD</i>)	8.70 (0.30)	8.70 (0.30)	8.68 (0.29)	8.69 (0.39)	8.71 (0.29)	8.70 (0.30)	8.70 (0.31)
SEN (% Yes)	6.53%	11.50%	25.33%	14.18%	20.14%	21.77%	10.54%
Trajectory intercept <i>M</i> (<i>SE</i>)	1.87 (0.09)	3.28 (0.11)	3.26 (0.42)	6.18 (0.41)	7.67 (0.33)	7.89 (0.48)	2.93 (0.04)
Trajectory slope <i>M</i> (<i>SE</i>)	-0.39 (0.05)	0.45 (0.05)	2.29 (0.23)	-2.14 (0.17)	-1.12 (0.20)	0.63 (0.27)	-0.20 (0.02)
Prior attainment (KS1) <i>M</i> (<i>SD</i>)	15.27 (3.47)	14.54 (3.66)	13.52 (3.81)	14.13 (3.81)	13.27 (3.72)	13.37 (3.38)	14.68 (3.68)
Subsequent attainment (KS2) <i>M</i> (<i>SD</i>)	27.90 (4.35)	26.99 (4.54)	25.27 (5.01)	26.58 (4.68)	25.44 (4.92)	25.78 (4.40)	27.17 (4.60)

Note: FSM = free school meals, SEN = Special Educational Needs; KS = Key Stage

Table 2

Relative risk ratios for the multinomial logistic regression predicting membership to the six derived externalising symptom trajectories (T1–T6)

	T1 Low-low	T2 Low-moderate	T3 Low-high	T4 High-low	T5 High-moderate	T6 High-high
		RR (SE)	RR (SE)	RR (SE)	RR (SE)	RR (SE)
Gender (Female)		0.48*** (.03)	0.28*** (.05)	0.42*** (.05)	0.22*** (.03)	0.17*** (.04)
Ethnicity (Asian)	<i>Reference group</i>	1.10 (.10)	1.39 (.31)	1.17 (.20)	1.03 (.16)	0.72 (.22)
Ethnicity (Black)		1.27 (.18)	0.94 (.41)	1.66* (.41)	1.07 (.27)	0.97 (.42)
Ethnicity (Mixed)		1.07 (.17)	1.24 (.51)	0.93 (.32)	0.91 (.26)	0.90 (.43)
Ethnicity (Other)		0.68 (.18)	0.00 (.00)	0.19 (.20)	0.47 (.25)	0.37 (.38)
Age		0.99 (.10)	0.82 (.22)	0.91 (.19)	1.10 (.19)	0.93 (.28)
FSM (Yes)		1.42*** (.11)	1.41 (.28)	1.34 (.20)	1.97*** (.24)	2.84*** (.56)
SEN (Yes)		1.55*** (.17)	3.69*** (.78)	1.93*** (.37)	2.51*** (.38)	2.47*** (.59)

Note: RR = Relative risk ratio; FSM = free school meals, SEN = Special Educational Needs

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3

Results of the multilevel regression analysis predicting subsequent academic attainment (Key Stage 2 scores)

	Estimate (SE)
Intercept	20.42*** (1.16)
Prior attainment: KS 1	0.90*** (.01)
Gender (Female)	-.41*** (.08)
FSM (Yes)	-.40*** (.11)
SEN (Yes)	-1.00*** (.15)
Ethnicity ^a (Asian)	0.67*** (.13)
Ethnicity ^a (Black)	0.29 (.22)
Ethnicity ^a (Mixed)	-0.11 (.21)
Ethnicity ^a (Other)	0.76* (.37)
Age	-0.68*** (.13)
Trajectory:	
T2 Low-moderate ^b	-0.33*** (.09)
T3 Low-high ^b	-0.95*** (.24)
T4 High-low ^b	-0.27 (.18)
T5 High-moderate ^b	-0.72*** (.16)
T6 High-high ^b	-0.30 (.27)

Note: FSM = Free School Meals, SEN = Special Educational Needs, KS = Key Stage

* $p < .05$, ** $p < .01$, *** $p < .001$

Reference group in analysis: ^a White ethnicity, ^b T1 low-low trajectory