School and Family Level Socioeconomic Status, School Connectedness and Health and Wellbeing Among 9–11 Year Olds: Cross Sectional Analysis of the Student Health and Wellbeing Survey in Wales

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Abstract

Schools are important social institutions which play a role in reducing and amplifying inequalities, including health inequalities. A growing evidence base indicates that school and family socioeconomic status (SES) interact to create positive and negative health outcomes, with 'benefits' of attending a higher SES school greatest for children from higher SES families. School connectedness is an increasingly studied mechanism, or set of mechanisms, for improving health and reducing health inequalities. Studies on interactions of school and family SES and on school connectedness have to date focused mainly on secondary schools. This paper presents multilevel analyses of survey data from 17,000 primary school children in Wales, aged 9–11 years. It finds that school and family SES are independently associated with health behaviours and mental health and wellbeing outcomes, and interact, with 'benefits' of attending a higher SES school greatest for children from higher SES families. Exceptions include some risk behaviours, most common among children from higher SES families in lower SES schools. School connectedness was associated with most outcomes, with some variations between components of school connectedness. Interactions were consistent with greater benefit of attending a higher SES school for children from higher SES families in relation to peer environment, but not for other aspects of school connectedness. Better understanding mechanisms via which family SES may be amplified or attenuated by school characteristics is vital in informing intervention to reduce health inequalities. This paper provides some evidence that school connectedness may be an important target mechanism for interventions to improve health and reduce inequalities.

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1 Introduction

There is overwhelming evidence, from the United Kingdom and internationally (Tawiah et al., 2022), that life expectancy, life chances and quality of life years are unequally distributed by socioeconomic status (SES) (Marmot, 2020; Marmot et al., 2010). The UK is one of the most unequal high income countries in the world, and according to a 2023 report by The Equality Trust (2023), this substantial inequality costs the UK economy an estimated £106 billion per year. Health inequalities have a broad array of causes (Phelan et al., 2010). They are in part sustained by socioeconomic differences in health behaviours, which are in turn shaped by structural 'causes of causes' (Marmot & Bell, 2016). Social and economic patterns in health behaviours and mental health outcomes emerge during childhood before persisting throughout the life-course (Hanson & Chen, 2007; Moore & Littlecott, 2015; Viner et al., 2012). While some outcomes, such as tobacco and alcohol use have improved at the population level (Hallingberg et al., 2020), others such as mental health have deteriorated rapidly in recent years (Anthony et al., 2023), with long standing inequalities widening in line with growing economic inequity (Elgar et al., 2015; Shackleton et al., 2016). The COVID-19 pandemic has further worsened these trajectories (Moore et al., 2022). Without significant action, the ongoing cost of living crisis is likely to continue this worsening of child health and deepening of inequalities (Iacobucci, 2023).

Schools are often considered an important setting for action to improve child health and reduce health inequalities, in large part due to their capacity to reach most of the child population in societies with universal provision (Moore et al., 2015). Clearly, schools cannot compensate fully for growing structural drivers of inequality; eliminating childhood poverty, and reducing economic inequality, remain arguably the most important goals for efforts to reduce health inequalities. However, schools are important social institutions in which inequalities in wider society might be mirrored, mitigated, or amplified (Anderhag et al., 2013; Herke et al., 2022). Indeed, our own research with secondary schools in Wales illustrates the independent and interacting associations of school and family level SES with health and wellbeing, with 'health benefits' of attending a school with a more affluent intake appearing to be greatest for children also from more affluent families, amplifying a tendency for already better outcomes in these young people (Moore & Littlecott, 2015; Moore et al., 2017).

One potential mechanism, or set of mechanisms, via which schools might influence health outcomes and inequalities is through school connectedness. School connectedness is a concept with various definitions, which converge around a focus on emotional and relational aspects of school experience, including relationships with teachers and peers, and involvement in school life (Raniti et al., 2022). According to Markham and Aveyard's (2003) theory of Health Promoting Schools, individuals are only in a position to *choose* healthier outcomes when their capacity for practical reasoning (i.e. critically perceiving reality and viewing problems and solutions from different perspectives) and affiliation (i.e. shared values and empathetic understanding of others' orientations to meaning) are supported. Schools can create conditions for children to realize these potentials through the instructional order (the means of developing knowledge and skills) and the regulatory order (institutional norms, val-

ues and belief system). When children are disengaged from the instructional order, detached from the regulatory order, or alienated from both, they may disengage and become apathetic to school values. This rejection of school norms may lead young people to seek community and belonging within sub-groups defined by risk taking and opposition to school norms (Fletcher & Bonell, 2013). Hence, potential mechanisms to improve school connectedness may include erosion of institutional boundaries within schools, and improving emotional and relational aspects of how young people relate to their school community (Berti et al., 2023).

The importance of school connectedness for an array of outcomes is now supported by a rapidly growing evidence base, including randomized controlled trials finding far reaching effects of school connectedness interventions (Bonell et al., 2018; Shinde et al., 2018) and a recent systematic review (Raniti et al., 2022). For example, informed by Markham and Aveyard's theory, Bonell and colleagues' found improvements in mental health and wellbeing, as well as behavioural outcomes from substance use to contact with police, following an intervention to improve school connectedness. These findings were published alongside the SEHER trial, which found similar benefits of an intervention in India to improve mental health and reduce risk taking in adolescence through improving school connectedness (Bonell et al., 2018; Shinde et al., 2018). Notably however, as the evidence base on the role of school connectedness has grown, at the population level, school connectedness has deteriorated in the UK. For example, recent data from The Children's Society (2023) show that children's happiness with school life deteriorated rapidly from 2013 to 2017 and has remained low since. Hence, there is good evidence that improving young people's sense of connection to their school community may have beneficial impacts of their health and wellbeing.

While Markham and Aveyard drew on Bernstein's (1975) work, they placed more limited emphasis than did Bernstein on socioeconomic inequalities in these processes. As theorised by Bernstein, there is evidence that students' socioeconomic backgrounds substantially influence their interactions with the instructional and regulatory order, with those from lower SES backgrounds more likely to adopt an "alienated" response, rejecting school norms due to incongruence with the values of their families and other aspects of their lives beyond school (Fletcher & Bonell, 2013; Markham et al., 2021). These difficulties may be amplified when attending schools with more affluent intakes. In such schools, norms and values are likely constructed around those of a dominant more affluent majority, with relative poverty commonly made visible through schools' processes and practices, such as expensive uniforms or extra-curricular activities (Laing et al., 2023). Our previous analyses of Welsh data (Moore et al., 2017), since replicated in England by Shackleton et al. (2018), found that children from lower SES families were less likely to report feeling that their teachers accepted them and cared about them where they attended a school with a more affluent intake. No such interaction was however found for other indicators of school connectedness, such as peer relationships and perceived child involvement in decision making.

Hence, given growing evidence both that school connectedness acts as an important mechanism in improving child health and wellbeing, and that school connectedness is often lower among children from lower SES backgrounds, it is plausible that

improving school connectedness may also play a role in reducing health inequalities. However, many gaps in this emerging evidence base remain. Most research on interactions of family and school SES have focused on secondary schools, although some evidence is emerging from the Netherlands that the tendency for greater inequality in mental health in higher SES schools emerges throughout primary (or 'elementary') school (Anderhag et al., 2013). Likewise, most research on school connectedness has focused on secondary schools, and less progress has been made in understanding these processes among primary school aged children. Interventions which have improved population outcomes via improving school connectedness have also to date not typically found evidence of reduced socioeconomic inequalities (Bonell et al., 2018). There is however currently substantial interest in adapting models which have shown good effects in secondary schools via enhancing school connectedness to primary schools, with explicit stated aims of reducing inequalities (Bonell et al., 2023).

There are good reasons to suppose that socioeconomic dynamics, and effects of school connectedness, observed in secondary schools might function in different ways in the very different primary school context than in secondary schools, and hence a need to test the transferability of the above findings to the primary school context. Primary schools in the UK are smaller than secondary schools, and serve more tightly bounded geographical communities, and are therefore more internally socioeconomically homogeneous than secondary schools. Relative to secondary schools, there is typically more between-school variation in socioeconomic status but more limited within-school variation (Moore et al., 2020). We have shown previously that children who transition from a primary school with a lower SES intake are likely to experience a detriment to their wellbeing as they converge on a secondary school with a more socioeconomically diverse hierarchy (Moore et al., 2020). One might expect socioeconomic differences at the school-level within primary schools to be driven to a larger extent by family socioeconomic status in primary schools, acting independently of it to a lesser extent than in larger and more socioeconomically heterogeneous secondary schools. Further, while indicators of school connectedness have declined over time, they typically remain higher in primary school aged children (Donaldson et al., 2023) than in secondary school aged students, perhaps indicating more limited potential variation to influence health outcomes or target through intervention relative to secondary schools.

In this paper, we partially replicate our earlier analyses of data from surveys of 11–16 year olds (Moore et al., 2017), using new data from 9 to 11 year old primary school children in Wales. We use different indicators of health behaviour and of health and wellbeing, due to differences between surveys; for example, our indicators of risk behaviour in earlier analyses focused largely on substance use outcomes which were not measured in the primary school surveys as they were considered less relevant to younger children. In this paper, we instead use measures of energy drink use, social media use and perpetration of bullying. Risk behaviours have been studied to a larger extent in adolescence than childhood, and hence, we acknowledge that the very classification of a behaviour as 'risky' in childhood is likely to be more contested. While in adolescence, the extent to which social media is beneficial, harmful or both is contested (Anthony et al., 2023), our sample for this study are below the age at which most social media use is permitted by social media company rules. We

also use an expanded range of indicators of mental health, given that these were not available in the earlier secondary school surveys we used.

Given the cross sectional nature of our data, we do not formally test the role of school connectedness as a mediator of the association between socioeconomic status and health outcomes. However, we explore commonalities and differences in the relationships of socioeconomic indicators with health and well-being and school connectedness indicators, and associations of school connectedness with health and well-being outcomes, which will inform future longitudinal analyses.

The following questions are tested in the analyses reported here:

1. Is lower SES (at the school and family level) associated with poorer mental health, subjective wellbeing, and health behaviours in primary school aged children?
2. Do associations with family SES differ according to the socioeconomic composition of the school a child attends?
3. Are school connectedness measures associated with health behaviours and mental health among primary school aged children?
4. Is lower SES (at the school and family level) associated with lower ratings of school connectedness in primary school aged children?

2 Methods

2.1 Sampling, Recruitment and Data Collection

From September 2022-March 2023, all state-maintained mainstream primary schools in Wales were invited to participate in a survey as part of work to expand the School Health Research Network into primary schools (Murphy et al., 2021). Children in Years 3–6 (ages 7–11 years old) were invited to participate. Three hundred and fifty-four schools participated (29.0% of primary schools in Wales) with 32,606 child responses (Donaldson et al., 2023). Partial responses were not retained, and therefore it is not possible to assess drop out attrition throughout the survey. However, only a small number of children ($n=628$; 1.9%) opened the survey but declined to participate. Because a shortened survey was used with younger children which excluded many items of interest to our research questions, this analysis uses a subsample of this data ($n=17,369$), focusing on children in Years 5–6 (aged 9–11) from 352 schools.

2.2 Measures

2.2.1 Socioeconomic Status (Family and School Level Indicators)

The family affluence scale (FAS) was used to assess family-level SES. It is a validated five item measure about the child's home environment, including whether they have a dishwasher, their own bedroom, the number of computers in the household, the number of cars or vans, and the number of bathrooms (Currie et al., 2023). While adolescent surveys have typically used this 6 item measure since 2013, the item on

'holidays outside of Wales' has not been used in our primary school surveys, following public involvement work in 2019 which indicated that younger children did not understand what to classify as a holiday outside of Wales (Hallingberg et al., 2021). During COVID-19, patterns of holiday taking were impacted by COVID-19 restrictions and hence the most recent adolescent surveys commonly also exclude this item (Page et al., 2023). Scores ranged from 0 to 10. For descriptive purposes, categories of low (scores of 0–6), medium (scores of 7–8) and high affluence (9–10) were created. To aid interpretability, at the school level, percentages of children who were eligible for free school meals (%FSM) were transformed to represent the percentage of children *not* eligible for free school meals. At the individual-level, FSM entitlement has been found to reliably capture the most socioeconomically disadvantaged families in England and Wales, although as a binary indicator, it does not capture social gradients, and many children living in poverty are nevertheless just above the threshold for FSM (Taylor, 2018). However, at the school-level, its aggregation creates a continuous indicator enabling analysis of gradients in school-level inequalities, and school-level FSM entitlement correlates strongly with other measures (such as aggregated FAS scores; (Moore et al., 2017). Hence in our models, higher values for both socioeconomic indicators mean higher levels of affluence. In presentation of descriptives, schools were grouped based on low (≤77.0% of children ineligible for free school meals), medium (77.1–88.0% ineligible) and high (>88.0% ineligible) levels of school affluence, but in multi-level analyses this is used as a continuous variable.

2.2.2 Health Behaviours

We include measures of three health protective behaviours (exercise and consumption of fruit and vegetables) and three health risk behaviours (energy drink consumption, social media use and bullying perpetration). Exercise was assessed with a question asking 'outside of school, how often do you usually exercise so much so that you get out of breath and sweaty'. Children who reported four or more days a week were scored '1', with children scoring below this scored 0. Two questions asked about fruit and vegetable consumption. Children who reported consuming fruit and vegetables daily were scored '1', with non daily consumption scored as 0. For energy drink consumption, children who stated that they never drink energy drinks were scored '0' and all other children who reported some level of consumption (from less than once a week to more than once per day) were scored '1'. For social media use, children who reported' using social media a few times a week or every day were scored '1', with never or less frequent users scored 0. Children were asked 'How often have you taken part in bullying another person(s) at school in the past couple of months?'. Children who reported bullying perpetration were scored '1', with those reported no perpetration scored 0. While acknowledging that our indicators of health risk and protective behaviours do not have an equally weighted impact on child health outcomes, similarly to Moore et al. (2017), each of these items was used individually, and also summed to create an index of health behaviour, with the latter three items reversed scored so that for all items higher scores were indicative of more healthy behaviours.

2.2.3 Mental Health and Subjective Wellbeing

Three measures were used to assess mental health and subjective wellbeing. The Me and My Feelings (MMF) questionnaire was used to assess emotional difficulties and behavioural difficulties (Deighton et al., 2013). Children were asked how often they feel or behave certain ways (answer options of 'never', 'sometimes' or 'always'). The scale consists of 16 questions, of which 10 relate to emotional difficulties and six to behavioural difficulties. Emotional difficulties questions include: 'I feel lonely'; 'I feel scared'; 'I worry when I am at school' and 'I cry a lot'. The scale is scored out of 20 (alpha=0.82). According to established cutpoints (Deighton et al., 2013), scores of 10 and higher indicate elevated or clinically significant emotional difficulties, children with a score of 10 or higher were scored '1'. Behavioural difficulties questions include: 'I get very angry'; 'I do things to hurt people'; 'I break things on purpose' and 'I hit out when I am angry'. The scale is scored out of 12 (alpha=0.77). Scores of six and higher indicate elevated or clinically significant behavioural difficulties, and children in this group were scored '1'. Scores were 'pro-rated' (i.e. based on the average of completed items) so long as >50% of individual items were completed for each scale. The third measure was a single item based on the Cantril subjective wellbeing scale (Cantril, 1965) asks children to rate their life from 0 ('I have the worst possible life') to 10 ('I have the best possible life').

2.2.4 School Connectedness Measures

To assess children's perceptions of the school environment, nine questions were asked, modelled on questions used in our previous analyses (Moore et al., 2017). All questions were scored on a five point Likert scale from strongly agree to strongly disagree. Items were reverse scored so that higher values equated to higher levels of connectedness. Three items were summed to create a 'teacher-student relationships' measure – 'my teachers accept me as I am'; 'my teachers care about me as a person'; 'I trust my teachers' (alpha=0.84). Three items were summed to create a 'peer environment' measure – 'children enjoy being together'; 'most children are kind and helpful'; 'other children accept me as I am' (alpha=0.72). Three items were summed to create an 'involvement in school-level decision-making' measure – 'children have a say in planning school activities'; 'children have chance to help plan school projects'; 'children's ideas are treated seriously' (alpha=0.78).

2.3 Analysis

Data were cleaned and descriptive statistics run in Stata version 17.0. Participating schools were nationally representative in terms of FSM entitlement (i.e. sample average school-level FSM entitlement of 21.5% vs. a national average of 20.1%) although participation was highest within South-East Wales (40.4% of schools) and lowest in North Wales (21.2%). Weighting by local authority however had a negligible impact on prevalence estimates for variables reported in this paper and no weighting was used in our analysis (Supplementary Table 1). For individual items included in our analysis, between 0 and 11% missingness was observed (Supplementary Table

2). Analysis of missingness indicated that some variables were modestly but consistently associated with missingness (e.g. family affluence, emotional and behavioural difficulties) across other items. The data were transferred to R version 4.3.1 and the jomo.smc package used to multiply impute the multi-level data using substantive model compatible multilevel multiple imputation. A separate imputation was carried out for each specified substantive model included within this analysis, with 'glmer' used for imputation of binary outcome variables and 'clmm' for ordinal outcome variables. Both family and school affluence measures were standardised. The school connectedness measures were standardised and treated as continuous when acting as predictor variables and ordinal when as dependent variables to allow convergence. All the variables included within the analysis were used as auxiliary variables when not included in the substantive model, plus a variable to indicate whether the survey was completed in English or Welsh. For the family affluence scale (FAS), the total FAS score was imputed and the five associated FAS items used as auxiliary variables. It was not possible to include all the items for the school connectedness measures as it increased computational time excessively, and these measures were imputed directly. Imputation resulted in a small percentage of values that exceeded the minimum and maximum bounds of the combined likert scale measures for both fas and school connectedness (when treated as continuous), however, simulations suggest that unbiased model estimates are obtained by retaining the imputations as received rather than imposing restrictions on range either during or after multiple imputation (Rodwell et al., 2014). Burn-in and between-imputation updates were set to 1000 and five imputations carried out per substantive model (Quartagno et al., 2019). Descriptive statistics of imputed outcome variables are provided in Supplementary Tables 3, and indicate that estimates of each change only to a negligible extent between imputations. Data were transferred back into Stata for multi-level analysis using the imputed datasets. Multi-level ordinal logistic regression was used for subjective wellbeing, the three school connectedness measures and the health index, and binary logistic regression for all other outcomes. Models were built by adding main effects of gender, school year, family affluence and free school meal percentage, plus an interaction between the latter two variables. FAS and FSM scores were standardised and multiplied to create an interaction term, with margin plots inspected post-estimation to aid interpretation of interactions. Models were run initially without the three school connectedness measures due to concerns regarding potential overadjustment by variables on the causal pathway between SES and our outcomes of interest. However, estimates of associations of SES with outcomes were not materially altered by inclusion of school connectedness indicators and hence we only report final models including all variables in the manuscript, and include estimates from earlier models in supplementary material.

2.4 Sensitivity Analysis

Complete case analysis was also run on the original non-imputed dataset using Stata. As analyses using complete cases or imputation were highly consistent in line with the only negligible differences in descriptive statistics estimated across imputations,

we report only the fully imputed analysis in the main body of the paper but include complete case analyses within the supplementary file.

3 Results

3.1 Sample Description

Descriptive information for the study sample is provided in Table 1. The sample included an approximately even number of Year 5 and 6 students and of boys and girls. A minority of children reported that they exercised $>=4$ times per week, or that they ate fruits or vegetables daily. A minority also reported energy drink use and bullying perpetration, although most reported regular use of social media. Overall, 29%

Table 1 Sample characteristics

		Frequency	%
School year	Year 5	8251	47.5%
	Year 6	9118	52.5%
Gender	Boy	8310	48.9%
	Girl	8347	49.1%
	Other gender identity	337	2.0%
Family affluence	Low affluence	5338	34.4%
	Medium affluence	6289	40.6%
	High affluence	3874	25.0%
Exercise	4–7 days per week	7501	47.0%
Fruit	At least daily	7763	46.8%
Vegetables	At least daily	6407	38.8%
Energy drinks	Ever	4119	24.8%
Social media	A few times per week or every day	9504	58.8%
Bullying perpetration	Have taken part	2367	14.9%
Emotional difficulties	Elevated or clinically significant	4982	29.3%
Behavioural difficulties	Elevated or clinically significant	2523	14.9%
			Mean
Subjective wellbeing		16,251	7.7 (0–10)
Health index		13,478	3.4 (0–6)
Peer environment		15,463	8.8 (0–12)
Teacher-student relationships		16,069	10.1 (0–12)
Student decision making		15,395	8.8 (0–12)

reported elevated emotional difficulties and 15% elevated behavioural difficulties respectively. Subjective wellbeing was skewed, with an average score of approximately 8 out of 10. For school connectedness indicators, while all items were skewed toward the higher end of the range, indicating a tendency toward high ratings, this was particularly evident for teacher relationships, for which an average score of 10 out of a possible 12 was reported.

3.2 Associations of Socioeconomic Status with Health and Well-Being Related Outcomes

Higher family SES was associated with better health outcomes, with a small number of exceptions. Children from higher SES families reported fewer emotional or behavioural difficulties and better subjective wellbeing, and were more likely to report health protective behaviours (e.g. eating daily fruits and vegetables and taking part in regular exercise). Odds ratios indicated in Table 2 for example indicate that a 1 standard deviation (SD) increase in family affluence was associated with 29% higher odds of reporting more than 4 days exercise, 8% lower odds of emotional difficulties and 12% increased odds of reporting high life satisfaction. Health risk behaviours however did not follow this same pattern. For bullying perpetration the odds ratio was in the direction of lower perpetration among children from higher SES families, although this association was marginal and intersected the null. However, an increase of 1 SD in family affluence score was associated with an 8% *increase* in the odds of energy drink use and a 6% *increase* in the odds of regular use of social media, indicating riskier behaviour among children from higher SES families.

School-level SES was independently associated with most outcomes, with a pattern of worse outcomes in schools with more affluent intakes, except for exercise where the odds ratio was close to 1.00 and intersected the null. For example, a 1 SD increase in school SES was associated with a 16% increase in fruit consumption, a 14% decrease in the odds of emotional difficulties and a 6% increase in the odds of high subjective wellbeing. Notably, for energy drinks and social media, associations with school level socioeconomic status ran in the opposite direction than for family socioeconomic status, with a 1 SD increase in school affluence associated with a 23% reduction in odds of social media use and an 8% reduction in odds of energy drink use.

For most outcomes, there was also evidence of interaction between school and family level SES, indicating that the association of family SES with outcomes differed according to the affluence of the school attended by the child. Interactions were consistent in most cases with an interpretation that (i) 'benefits' of attending a higher SES school, for health behaviour and for mental health and wellbeing, are greatest for children who are also from higher SES families, and that (ii) in most cases, children from the lowest SES families appear to derive no improvement in outcomes, or report worse outcomes, where attending a school with a higher SES intake. Notable exceptions were social media use and, to a smaller extent, energy drink use for which interactions ran in the opposite direction. In both cases, being from higher family SES but within a lower SES school was associated with the greatest social media and energy drink use.

Table 2 Odds ratios and 95% confidence intervals for associations of school connectedness indicators with health and wellbeing outcomes from multilevel logistic regression analyses using multiple imputation (N=17,369)

	Health protective behaviours			Health risk behaviours			Combined health index	Mental health and wellbeing		
	Exercise	Fruit	Vegetables	Energy drink	Social media	Bully perpetration		Emotional difficulties	Behavioural difficulties	Subjective wellbeing
Teacher-student relationships	0.95 (0.91, 0.99) $p=0.011$	1.05 (1.01, 1.10) $p=0.027$	1.05 (1.00, 1.10) $p=0.039$	0.80 (0.76, 0.83) $p<0.001$	0.82 (0.79, 0.86) $p<0.001$	0.76 (0.72, 0.80) $p<0.001$	1.21 (1.16, 1.26) $p<0.001$	0.81 (0.78, 0.85) $p<0.001$	0.72 (0.69, 0.76) $p<0.001$	1.31 (1.26, 1.37) $p<0.001$
Peer environment	1.04 (1.00, 1.09) $p=0.078$	1.02 (0.98, 1.07) $p=0.330$	0.96 (0.92, 1.00) $p=0.033$	0.99 (0.95, 1.04) $p=0.706$	1.02 (0.98, 1.06) $p=0.316$	0.83 (0.78, 0.88) $p<0.001$	1.04 (1.00, 1.08) $p=0.030$	0.55 (0.52, 0.57) $p<0.001$	0.65 (0.62, 0.69) $p<0.001$	1.85 (1.78, 1.91) $p<0.001$
Student involvement in school decision-making	1.11 (1.07, 1.16) $p<0.001$	1.08 (1.04, 1.12) $p<0.001$	1.07 (1.03, 1.11) $p=0.001$	1.02 (0.97, 1.06) $p=0.472$	1.05 (1.01, 1.09) $p=0.020$	1.01 (0.95, 1.07) $p=0.766$	1.06 (1.02, 1.09) $p=0.002$	0.97 (0.92, 1.02) $p=0.170$	1.07 (1.01, 1.13) $p=0.019$	1.12 (1.08, 1.16) $p<0.001$
Family affluence	1.29 (1.25, 1.34) $p<0.001$	1.23 (1.19, 1.28) $p<0.001$	1.24 (1.19, 1.28) $p<0.001$	1.08 (1.04, 1.12) $p<0.001$	1.06 (1.01, 1.10) $p=0.011$	0.96 (0.91, 1.01) $p=0.101$	1.21 (1.17, 1.25) $p<0.001$	0.91 (0.87, 0.94) $p<0.001$	0.90 (0.86, 0.95) $p<0.001$	1.14 (1.11, 1.17) $p<0.001$
School affluence	1.01 (0.97, 1.05) $p=0.751$	1.16 (1.10, 1.21) $p<0.001$	1.26 (1.20, 1.33) $p<0.001$	0.92 (0.87, 0.98) $p=0.007$	0.78 (0.73, 0.82) $p<0.001$	0.84 (0.79, 0.90) $p<0.001$	1.30 (1.24, 1.37) $p<0.001$	0.87 (0.83, 0.92) $p<0.001$	0.80 (0.76, 0.85) $p<0.001$	1.03 (0.99, 1.07) $p=0.179$
Family*School affluence	1.05 (1.01, 1.08) $p=0.013$	1.03 (0.99, 1.06) $p=0.118$	1.05 (1.02, 1.09) $p=0.005$	0.97 (0.94, 1.01) $p=0.194$	0.91 (0.87, 0.94) $p<0.001$	0.96 (0.92, 1.01) $p=0.090$	1.09 (1.05, 1.13) $p<0.001$	0.94 (0.91, 0.98) $p=0.001$	0.91 (0.87, 0.96) $p<0.001$	1.03 (1.00, 1.07) $p=0.030$

3.3 Associations of School Connectedness with Health Behaviours, Mental Health and Well-Being

As indicated in Table 2, positive teacher relationships were associated with consistently better health outcomes in all outcomes except exercise. A one point increase in score for student-teacher relationships was associated with for example, 20% lower odds of energy drink use, 18% lower odds of social media use, 24% lower odds of bullying perpetration, 19% lower odds of emotional difficulties and 28% lower odds of behavioural difficulties as well as a 31% higher odds of reporting higher subjective wellbeing. Peer environment was significantly associated with 5 of 9 outcomes, including increased exercise and reduced bullying perpetration. Associations were particularly strong for mental health and subjective wellbeing, with a one point increase in ratings of peer environment score associated with substantially lower odds of emotional and behavioural difficulties (45% and 35% lower respectively) and 85% higher odds of reporting high subjective wellbeing. A one point increase in perceived student involvement in school decision making was associated with increases of between 7 and 11% in the odds of exercise, fruit and vegetable consumption and 12% higher odds of improved subjective wellbeing, though also with 7% higher odds of behavioural difficulties.

3.4 Associations of SES with School Connectedness Indicators

As indicated in Table 3, associations of SES with school connectedness indicators were more inconsistent. Associations of family SES and all school connectedness indicators were marginal and intersected the null in all cases. However, a 1 SD increase in school SES was associated with 7% greater odds of an increased positive score for teacher-student relationships and peer environment, with a smaller estimate in the same direction for student involvement intersecting the null. There was limited evidence of interactions between school and family SES for school connectedness measures except for peer environment, where an interaction in the direction of greater socioeconomic inequality within more affluent schools was observed.

4 Discussion

Consistent with our earlier analyses of data from secondary school aged students in Wales (Moore & Littlecott, 2015; Moore et al., 2017), in this paper, family and school SES were independently associated with health and well-being outcomes among primary school aged children in Wales. Associations of school and family SES, in most cases, operated in the same direction as one another, with better outcomes reported by children from higher SES families, and by children attending schools with higher SES intakes. Higher school-level SES was associated with better outcomes in all cases, except for exercise, which showed little patterning by school-SES. Findings were hence consistent with a body of literature which identifies socioeconomic inequalities in an array of health and well-being outcomes from childhood (Hanson & Chen, 2007; Moore & Littlecott, 2015; Viner et al., 2012), at least in relation to measures

Table 3 Odds ratios and 95% confidence intervals for associations of socioeconomic status with school connectedness outcomes from multilevel logistic regression analyses using multiple imputation ($N=17,369$)

	Teacher-student relationships	Peer environment	Student involvement in school decision-making
Family affluence	0.98 (0.95, 1.01) $p=0.202$	1.00 (0.96, 1.04) $p=0.999$	0.97 (0.93, 1.00) $p=0.065$
School affluence	1.07 (1.02, 1.13) $p=0.008$	1.07 (1.02, 1.13) $p=0.009$	1.04 (0.98, 1.11) $p=0.168$
Family *School affluence	1.01 (0.98, 1.04) $p=0.383$	1.04 (1.01, 1.07) $p=0.013$	1.01 (0.98, 1.04) $p=0.607$

at the school level. However, associations of family SES with health and wellbeing outcomes were somewhat less consistent in their direction. Both energy drink consumption and social media use were more commonly reported among children from higher SES families, while simultaneously being associated with school-level SES in the opposing direction. For social media use, this conflicts with our own earlier descriptive analyses of these same data (Donaldson et al., 2023), which showed only marginal patterning by family SES in the direction of lower use among children from higher SES families. These newer analyses suggest that analysis by family SES alone masks two countervailing socioeconomic trends. One plausible explanation for higher engagement in these behaviours among children from higher SES families, consistent with evidence of associations of pocket money with alcohol use (Anderhag et al., 2013), might be that both require the child to have access to resources, such as money or technologies.

Again, consistent with our earlier analyses (Moore & Littlecott, 2015; Moore et al., 2017), in most cases, school and family-level socioeconomic status interacted. Interactions were typically in the direction of greatest 'benefit' of attending a higher SES school among children who were also from higher SES families, indicating an amplification of these inequalities by school-level SES. Again, social media and energy drink use did not follow this pattern, with interactions operating in the opposing direction, particularly for social media. Perhaps in some circumstances, a greater culture of riskier behaviour in schools with lower SES intakes combines with access to greater material resource, to increase risk taking in young people from higher SES families who attend those lower SES schools.

Consistent with Markham and Aveyard's (2003) theory of health promoting schools, and with a growing body of literature focused on secondary school aged students (Bonell et al., 2018; Raniti et al., 2022; Shinde et al., 2018), school connectedness indicators were positively associated with a broad range of outcomes. Consistent with our earlier study of secondary school aged students in Wales (Moore et al., 2017), the aspect of school connectedness most consistently associated with positive health and wellbeing outcomes was student-teacher relationships, with better ratings of relationships with teachers associated with better outcomes across all measures, except exercise. The perceived quality of the peer environment was strongly related to mental health and subjective wellbeing, though was less consistently associated with health behaviours. Children's perceptions of child involvement in decision making were by contrast consistently related to health protective behaviours but with less

clear associations with health risk behaviours and mental health outcomes. Hence, while all components of school connectedness appear to have important associations with health and wellbeing outcomes, different sub-domains of the higher-level construct of school connectedness may be important for different outcomes. Nevertheless, the transferability of evidence from our secondary school analysis to primary schools lends support to current moves to extend effective secondary school environment interventions to primary schools (Bonell et al., 2023).

While many of our earlier findings were replicated, we did not see the same socioeconomic variation in children's relationships with school staff as observed in our secondary school analysis. In our previous analysis of secondary school data, student-teacher relationships were rated more negatively by children from lower SES families, but in lower SES schools, relationships with teachers tended to be experienced more positively (Moore et al., 2017). This perhaps reflects a tendency for schools to tailor their practices to the dominant group within their intake, with young people from poorer backgrounds feeling better accepted by teachers where they were numerically dominant within the school's composition, but more marginalised where they attend schools where they are in a minority. However, in this new analysis, student-teacher relationships did not differ by family SES, but were perceived more positively in schools with higher SES intakes. Higher family SES was associated with a marginal reduction in perceptions of child involvement in decision making, but not with student-teacher relationships or peer environment. Meaningful interactions between school and family SES were only found for perceptions of peer environment. It is possible that in primary schools, where teachers typically have a consistent class across a whole school year, teachers are better able to develop relationships with individual children from diverse backgrounds and tailor their approaches to individuals rather than to the dominant group than in secondary schools, leading to a smaller interaction between family and school SES than observed in secondary school. However, the socioeconomic homogeneity of primary schools relative to secondary schools may make peer environment a greater challenge for children from poorer backgrounds where attending more affluent schools, making it more challenging to connect with others from similar backgrounds than in larger heterogeneous secondary school contexts.

This study benefits from a large sample of primary school aged children, and use of well validated measures where these were available. Nevertheless, it has a number of substantial limitations. The cross sectional design means that cause and effect relationships cannot be established. Hence, further longitudinal work is necessary to better understand the nature and direction of associations observed. For example, poor mental health may lead to more negative feelings about school rather than negative feelings about school worsening mental health, or these may act reciprocally. Due to the young age of our sample and desire to keep the survey short, we measured a limited range of demographic co-variates and hence many potential confounders are unmeasured and hence not accounted for in our analysis. The study relies on self-report measures which are prone to social desirability biases, and other biases related to variation in cognitive capabilities of this young sample. For some measures single items are used due to brevity with which some individual health and wellbeing issues are covered within a broad survey, and more multifaceted measures such as

social media use and subjective wellbeing might have resulted in different conclusions. While we comment throughout on similarities to and differences from earlier work in secondary schools, it is plausible that some differences arise not from differences between primary and secondary schools, but rather from the changed temporal context. Our 2017 paper (Moore et al., 2017) which this analysis partially replicates for example used data collected at the starting point of a rapid worsening in school connectedness (Society, 2023) and mental health outcomes (Anthony et al., 2023). Further, given our younger sample, we also used different risk behaviours, further limiting comparability to secondary school research.

Nevertheless, this study provides important new evidence both regarding the roles of school and family level SES in child health and wellbeing in primary school age children, and on the associations of various aspects of school connectedness with health behaviours and mental health and wellbeing. While schools cannot be expected to fully compensate for structural inequalities within society, that socioeconomic gradients by family SES differ according to the composition of the school a child attends suggests that primary schools are nevertheless environments in which these inequalities can be influenced. Understanding the mechanisms through which schools' everyday processes and practices mitigate or amplify differences by family socioeconomic background is vital in informing intervention. While most research on interventions to improve health and wellbeing through enhancing school connectedness focuses on adolescence, school connectedness may be an important mechanism for improving health and wellbeing outcomes earlier in children's school career. However, different aspects of school connectedness appear to matter for different outcomes. While building positive relationships with school staff was associated with almost all outcomes, associations of peer environment tended to be associated with health protective behaviours and wellbeing, while involvement in school decision making appeared more closely associated with health protective behaviours. Hence, the focus of interventions based on improving school connectedness might differ according to the outcomes they seek to influence. The peer environment, and a focus on inclusion of children of differing socioeconomic backgrounds within this, may be particularly important for interventions aiming to reduce inequalities through improving school connectedness.

Author Contributions GM conceived the paper and produced the first draft of the manuscript, integrating a first draft of the methods section and data tables prepared by CD. CD designed and undertook all statistical analyses, building on an earlier published analysis by GM. SO managed the collection of survey data and it's management and checked statistical analysis outputs against the manuscript. KM & LA oversaw survey from which the data are drawn, within a larger study led by GM and JH. All authors contributed important revisions to the content of the draft manuscript and approved the final draft.

Declarations

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