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RESEARCH ARTICLE

A longitudinal study of sibling bullying and mental health in autistic adolescents: The role of self-esteem

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Abstract

Sibling bullying is associated with poor mental health in autistic adolescents. The reasons for this remain unknown. In the current study, we attempted to replicate the existing findings on the direct associations between sibling bullying and mental health in autistic adolescents and expand knowledge by focusing on the indirect associations through self-esteem. We made use of existing data from the Millennium Cohort Study, a nationally representative UK-based birth cohort study. We fitted a mediation model to longitudinal data from a sample of 416 autistic adolescents aged 11, 14, and 17 years old who had at least one sibling. We found that sibling bullying was prevalent in the lives of autistic adolescents, especially in those who were late-diagnosed, had a shared bedroom, and lived in a low-income household. Additionally, increased sibling bullying in early adolescence was a significant predictor of reduced self-esteem in mid-adolescence; in turn, reduced self-esteem predicted poorer mental health and wellbeing in late adolescence. Our findings indicate that sibling bullying in early adolescence may indirectly lead to poorer mental health and wellbeing in late adolescence through a reduction in self-esteem in mid-adolescence in autistic adolescents. We discuss the implications of these findings further.

Lay Summary

Sibling bullying is prevalent in the lives of autistic adolescents and is shown to be associated with poor mental health. However, no previous research has investigated whether sibling bullying directly or indirectly predicts mental health difficulties. Our findings suggested that about 40% of autistic adolescents experienced sibling bullying at least once a week. In addition, we found that being involved in sibling bullying indirectly increases the mental health difficulties of autistic adolescents by reducing their self-esteem.

KEYWORDS

autism, mental health, self-esteem, sibling bullying, wellbeing

INTRODUCTION

Sibling relationships of autistic children are characterized by both positive and negative interactions. On the positive side, such siblings are reported to have less conflict and longer stability in their closeness as they age compared to non-autistic child families (Kaminsky & Dewey, 2001; Orsmond et al., 2009). On the negative side, however,

higher aggressive and disruptive behaviors have been observed among siblings in families of autistic children compared to other families (Mascha & Boucher, 2006). Such negative sibling relationships are likely to also include rivalry, jealousy, conflict, aggression, and bullying (Caspi, 2011; Edwards et al., 2006). Although rivalry, jealousy, and conflict are seen as normative parts of daily sibling interactions, consistent and frequent sibling

conflict may lead to bullying which is a psychologically harmful form of violence (Olweus, 1984).

Sibling bullying is a form of intra-family violence. It is defined as frequent and repeated aggressive behaviors that intend to harm the weaker sibling physically, verbally, socially, or psychologically (Wolke et al., 2015). Sibling bullying is potentially the most prevalent form of violence in children's and adolescents' lives as nearly 50% reported having been involved in sibling bullying, either as a bully, victim, or both (Deniz, Derinalp, et al., 2023; Duncan, 1999; Toseeb et al., 2018; Wolke et al., 2015). Although sibling bullying has been found to be highly prevalent in both western and non-western cultures, interestingly, reports from some countries, such as China, indicated lower rates of sibling bullying (10%–20%) than the high prevalence in other countries (Liu et al., 2021; Peng et al., 2022; Qing et al., 2022). This indicates that there may be culture-level risk and protective factors of sibling bullying.

Some individual and family-level risk factors have been shown to be associated with sibling bullying. For example, individuals who are White, female, first born, have a male sibling, have two or more siblings, and live in poverty are more likely to be victims of sibling bullying than those who are non-White, male, with no male sibling, have one only sibling, and live in high-income families (Bowes et al., 2014; Dantchev et al., 2018; Dantchev & Wolke, 2019a; Eriksen & Jensen, 2009; Liu et al., 2021; Menesini et al., 2010; Tippet & Wolke, 2015; Toseeb et al., 2018). Although having an older male sibling is suggested as a risk factor for sibling bullying (Bowes et al., 2014; Menesini et al., 2010), contradicting evidence also exists as Duncan (1999) report that females are either equally or more likely to be perpetrators of sibling bullying compared to males. Hence, more research is needed to shed light on the interaction between sex and sibling bullying. Additionally, most of the evidence, in regard to individual and family-level precursors of sibling bullying, comes from the general population, therefore, more research is needed to test whether they apply to the autistic population.

Until recently, mental illness and wellbeing were considered two psychological constructs representing opposite ends of a linear spectrum. Recently, however, researchers have begun to draw a dividing line between mental illness and wellbeing, arguing that while they may be highly related, one does not mean the absence of the other (Keyes, 2005). Supporting this, the United Kingdom Department of Health (2014) published a report suggesting that mental illness and wellbeing are two distinct phenomena, and that mental wellbeing is not simply the absence of mental illness. Additionally, using UK-based representative population cohort data, researchers have shown weak correlations between mental health difficulties and wellbeing (Patalay & Fitzsimons, 2016). They have also noted that mental illness and well-being have drastically different correlates, suggesting that these two terms should not be considered as ends of the same continuum, but as two

separate, though related continua. Consistent with the recent trend, in this study, on the one hand, the term mental health is used to refer to individuals' internalizing (i.e., emotional difficulties and peer problems) and externalizing problems (i.e., conduct problems and hyperactivity/inattention) while on the other hand, well-being covers two main concepts: *hedonic* (e.g., feeling good, subjective well-being) and *eudaimonic* (e.g., positive functioning) wellbeing (Clarke et al., 2010).

Self-esteem is briefly defined as a person's summary judgment of their own worth (Bailey 2nd, 2003) and seems to be highly related to life satisfaction (Diener & Diener, 1995) and meaning in life (Steger et al., 2006). Previous studies, in the general and autistic populations, have shown that high levels of self-esteem are significantly correlated with low levels of mental health difficulties (McCauley et al., 2019; Moksnes & Reidunsdatter, 2019; van der Crujisen & Boyer, 2021) and high levels of wellbeing (Corden et al., 2021; Mazurek, 2014; Moksnes & Reidunsdatter, 2019). However, the strong correlations between self-esteem and mental health and wellbeing do not indicate a causal relation. For instance, correlations between self-esteem and mental health and wellbeing appeared to be non-significant upon controlling for individual and family characteristics (Boden et al., 2008). On this, some researchers suggest that self-esteem is not part of mental health or wellbeing, but it is rather a potential correlate of both psychological constructs (Orth et al., 2012). As such, self-esteem has repeatedly been tested as a mediator factor in the associations between various predictor factors and mental health and wellbeing outcomes (Kurtović et al., 2018; Lee et al., 2013; Urzúa et al., 2018). Hence, in the present study, self-esteem is considered a distinct construct that potentially relates to both mental health and wellbeing, but it is not necessarily an indicator of either psychological phenomenon.

There is a link between sibling bullying and mental health and wellbeing in the general population. Sibling bullying is associated with high levels of anxiety and depression (Bowes et al., 2014; Duncan, 1999; Liu et al., 2020), psychological distress and self-harm (Wolke et al., 2015), internalizing and externalizing problems (Buist & Vermande, 2014; Coyle et al., 2017; Tucker et al., 2013), and poor wellbeing (Toseeb & Wolke, 2021). These associations between sibling bullying and mental health and wellbeing appear to be comparable irrespective of the sibling bullying role (i.e., the victim or the bully) (Toseeb & Wolke, 2021). Therefore, there is an abundance of evidence demonstrating a link between sibling bullying and mental health and wellbeing in the general population.

Although autistic children are more likely to be involved in sibling bullying than non-autistic children (Toseeb et al., 2018), only a handful of research has focused on the associations between sibling bullying and mental health and wellbeing in autistic individuals. Autistic adolescents who are involved in sibling bullying in early adolescence show more internalizing and

externalizing problems in early- and mid-adolescence, compared to those who are not involved in sibling bullying (Toseeb et al., 2018; Toseeb, McChesney, Oldfield, & Wolke, 2020). Irrespective of bullying roles (i.e., victim-only, bully-only, bully-victim), autistic adolescents who are involved in sibling bullying show greater internalizing problems than non-involved ones. However, autistic adolescents who are perpetrators of bullying (bully-only) show significantly higher externalizing problems than victims and bully-victims (Toseeb, McChesney, Oldfield, & Wolke, 2020). No study to date has investigated the associations between sibling bullying in early adolescence and mental health and wellbeing in late adolescence in autistic adolescents. Therefore, the long-term implications of sibling bullying on the mental health and wellbeing of autistic adolescents remain unclear.

Studies on sibling bullying and self-esteem in the general population are scarce. In one study, sibling violence was associated with lower levels of self-esteem in Singaporean youths (Gan & Tang, 2020). Nevertheless, the study findings relied on retrospective reporting of sibling violence from samples of youths aged 18–25 years old. This does not tell us much about the associations during early- and mid-adolescence. Additionally, a UK-based longitudinal study found that consistently high sibling bullying victimization at age 11 years predicted lower levels of self-esteem at age 14 years (Sharpe et al., 2021). In the same sample, adolescents who were either victims or bully-victims of sibling bullying at age 11 years had lower self-esteem at age 17 years compared to non-involved adolescents (Toseeb & Wolke, 2021). These findings suggest that sibling bullying in early adolescence, irrespective of the bullying role, is associated with lower levels of self-esteem in mid- and late-adolescence. However, there has been no systematic investigation of the longitudinal association between sibling bullying and self-esteem in autistic adolescents.

THE CURRENT STUDY

The previous studies suggest direct links between sibling bullying and self-esteem; sibling bullying and mental health and wellbeing; and self-esteem and mental health and wellbeing (e.g., Sharpe et al., 2021; Toseeb, McChesney, Oldfield, & Wolke, 2020; van der Cruisen & Boyer, 2021). Although no evidence exists in the sibling bullying literature, two recent studies have suggested that self-esteem is a significant mediator in the associations between peer victimization and mental health in Chinese children and adolescents (Yang et al., 2022; Zhong et al., 2021). The strong correlation between sibling and peer bullying (Wolke et al., 2015) points out that self-esteem may as well be a significant mediator between sibling bullying and mental health and wellbeing. Despite this, no study to date has tested whether self-esteem is a

significant mediator in the associations between sibling bullying and mental health in either the general or autistic population. Thus, the question of whether sibling bullying is an indirect correlate, through self-esteem, of poor mental health and wellbeing has remained unanswered.

The existing literature suggests that different types of sibling bullying (i.e., victimization and perpetration) are differently correlated with self-esteem and mental health and wellbeing in adolescents, though the existing evidence is inconsistent. For instance, a recent study in autistic adolescents suggests that bullies of sibling bullying show greater externalizing problems than victims or bully-victims of sibling bullying (Toseeb, McChesney, Oldfield, & Wolke, 2020). A recent study in the general population, however, indicates that victims or bully-victims of sibling bullying show poorer mental health and wellbeing than bullies of sibling bullying (Toseeb & Wolke, 2021). Further evidence, from the general as well as the autistic population, demonstrates that different types of sibling bullying involvement (i.e., victimization and perpetration) exert different effects on the mental health of those involved (Bowes et al., 2014; Dantchev & Wolke, 2019b; Toseeb et al., 2018; Toseeb, McChesney, Oldfield, & Wolke, 2020). No studies to date have tested the associations between different types of sibling bullying and wellbeing in autistic adolescents.

Although there has been growing interest in researching sibling bullying and its correlates, the existing evidence comes primarily from the general population, while little knowledge exists in the autistic population. Additionally, the nature of the associations between sibling bullying and mental health and wellbeing (i.e., direct or indirect) has remained unknown. Finally, it is not yet clear how differing types of sibling bullying involvement (i.e., victimization and perpetration) correlate with mental health and wellbeing in autistic adolescents. To address this knowledge gap, the current study aimed to (1) report the prevalence and individual – and family – level correlates of sibling bullying, (2) test the potential mediator role of self-esteem in mid-adolescence in the longitudinal associations between sibling bullying in early adolescence and mental health and wellbeing in late adolescence, and (3) report whether the associations between sibling bullying and mental health and wellbeing differ based on the type of sibling bullying involvement (i.e., sibling bullying victimization and sibling bullying perpetration) in autistic adolescents. In doing so, we sought to answer the following research questions and test the following hypotheses:

RESEARCH QUESTIONS

RQ1: What is the prevalence of sibling bullying in autistic adolescents?

RQ2: What are the individual – and family – level correlates of sibling bullying in autistic adolescents?

RQ3: Does sibling bullying in early adolescence directly predict mental health and wellbeing in late adolescence?

RQ4: Does sibling bullying in early adolescence directly predict self-esteem in mid-adolescence?

RQ5: Does self-esteem in mid-adolescence directly predict mental health and wellbeing in late adolescence?

RQ6: Does self-esteem mediate the associations, if any, between sibling bullying in early adolescence and mental health and wellbeing in late adolescence?

RQ7: Do different types of sibling bullying experiences, victimization and perpetration, correlate differently with mental health and wellbeing in late adolescence in autistic adolescents?

HYPOTHESES

H1. Autistic adolescents with higher rates of sibling bullying in early adolescence would show poorer mental health and wellbeing in late adolescence compared to those with lower rates of sibling bullying in early adolescence.

H2. Autistic adolescents with higher rates of sibling bullying in early adolescence would show lower levels of self-esteem in mid-adolescence compared to those with lower rates of sibling bullying in early adolescence.

H3. Higher rates of self-esteem in mid-adolescence would be associated with better mental health and wellbeing in late adolescence in autistic adolescents.

H4. Self-esteem in mid-adolescence would significantly mediate the longitudinal associations between sibling bullying in early adolescence and mental health and wellbeing in late adolescence in autistic adolescents.

METHODS

Ethics statement

In this study, we made use of existing data from the Millennium Cohort Study (MCS), which we accessed through the UK Data Service (2020). The MCS is a nationally representative UK-based cohort study. In the MCS, children born between 2000 and 2002, and their families, were recruited to the study when the children were 9 months old and subsequently followed at ages 3, 5, 7, 11, 14, and 17 years. Local ethical approval for data collection was granted by relevant ethics committees (Full details are available [here](#)).

Sampling autistic adolescents

For the analyses reported here, primarily, data collected during adolescence (11, 14, and 17 years of age) were used. However, demographic information from the earlier waves was also used to determine sample demographics. Data from ages 11, 14, and 17 years were merged yielding 13,234 unique observations. The three-wave data sets were then labeled as follows: early adolescence (T1) when adolescents were aged 11 years old, mid-adolescence (T2) when aged 14 years old, and late adolescence (T3) when they were at 17 years of age.

When the child was 5, 7, 11, and 14 years old, parents were asked: "Has a doctor or other health professional ever told you that your child had autism, Asperger's syndrome, or other autistic spectrum disorder?". Those individuals whose parents responded yes at any one of the time points were identified as autistic. This yielded a sample of 450 autistic adolescents. Those without any siblings at ages 11 and 14 were removed ($n = 34$) which yielded an overall sample of 416 eligible autistic adolescents.

Measures

Sibling bullying

At age 11 (T1) and 14 years (T2), adolescents self-reported their sibling bullying experiences by responding to a two-item sibling bullying questionnaire (SBQ): (1) "how often do you hurt or pick on your brothers or sisters on purpose?", and (2) "how often do your brothers or sisters hurt you or pick on you on purpose?". The SBQ is a six-point Likert-type scale scored as follows: 0 = *never*, 1 = *less often*, 2 = *every few months*, 3 = *about once a month*, 4 = *about once a week*, 5 = *most days*. In the SBQ, these two items were combined to generate a sibling bullying variable in which higher scores mean increased rates of sibling bullying. Additionally, a well-accepted cut-off value, *about once a week* (Dantchev et al., 2019; Deniz, Derinalp, et al., 2023), was specified to report the prevalence of sibling bullying. That is, participants who were victimized by a sibling or those who bullied a sibling at least once a week were categorized as *involved* in sibling bullying. The Cronbach's alpha values for the sibling bullying measure were good at two-time points (T1 $\alpha = 0.77$; T2 $\alpha = 0.80$).

Self-esteem

In the MCS, participants' self-esteem was measured using the five-item (positively worded) version of the Rosenberg Self-Esteem scale (RSE; Rosenberg, 1965). The adolescents self-reported their self-esteem on a four-point scale (0 = *strongly disagree*, 1 = *disagree*, 2 = *agree*,

3 = *strongly agree*). The items were: (1) “I feel that I am a person of worth, at least on an equal plane with others”, (2) “I feel that I have a number of good qualities”, (3) “I am able to do things as well as most other people”, (4) “I take a positive attitude toward myself”, (5) “On the whole, I am satisfied with myself”. Overall self-esteem scores were generated by summing the responses to all items ranging from zero to 15 with higher scores indicating higher levels of self-esteem. The RSE had good to high internal consistency at both time points (T1 $\alpha = 0.75$; T2 $\alpha = 0.89$)

Mental health

When the adolescents were 17 years old (late adolescence), internalizing and externalizing problems were measured using the self-report Strength and Difficulties Questionnaire (SDQ; Goodman, 1997). The SDQ is a widely used mental health screen. Responses to 20 items are answered on a three-point scale (0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*); higher scores indicated increased mental health difficulties. The items are divided into four subscales; emotional problems, peer problems, conduct problems, and hyperactivity. In line with the scoring guidelines (sdqinfo.org), emotional problems and peer problems subscales were combined to create an internalizing problems scale. Similarly, conduct problems and hyperactivity subscales were summed to create an externalizing problems scale. The SDQ showed excellent internal reliability ($\alpha = 0.82$)

Wellbeing

The Short Warwick-Edinburgh Mental Wellbeing Scale (S-WEMWBS; Tennant et al., 2007) was used to measure the wellbeing of adolescents when they were 17 years old (T3). The S-WEMWBS is a well-validated, reliable, and self-report instrument to assess the mental wellbeing of adolescents. The S-WEMWBS is a five-point Likert-type scale (1 = *none of the time*, 2 = *rarely*, 3 = *some of the time*, 4 = *often*, 5 = *all of the time*) that consists of the following items: (1) “I have been feeling optimistic about the future”, (2) “I have been feeling useful”, (3) “I have been feeling relaxed”, (4) “I have been dealing with problems well”, (5) “I have been thinking clearly”, (6) “I have been feeling close to other people”, (7) “I have been able to make up my own mind about things”. Responses to the items were summed to generate a total wellbeing score with higher scores indicating greater wellbeing. In addition, the total test scale of the 7-item S-WEMWBS was re-coded and adjusted to the 14-item test score to better reflect participants’ wellbeing according to metrics provided in the scale’s user guide (Stewart-Brown & Janmohamed, 2008). Detailed

information regarding S-WEMWBS raw-score transformation can be found in Table S1. In the present study, the S-WEMWBS had excellent internal consistency reliability ($\alpha = 0.80$). Given that the score transformation is made at the scale level, not the item level, the internal consistency of the S-WEMWBS is reported on the original scale

Covariates

Potential covariates of sibling bullying were defined based on the existing empirical evidence and the availability of such variables in the MCS. More specifically, ethnicity, sex, number of siblings, birth order, and family income, which have previously been found to be significant correlates of sibling bullying (Bowes et al., 2014; Dantchev et al., 2018; Dantchev & Wolke, 2019a; Eriksen & Jensen, 2009; Liu et al., 2021; Menesini et al., 2010; Tippet & Wolke, 2015; Toseeb et al., 2018), were added as potential covariates of sibling bullying. Although no previous study has tested this, we have also looked to see whether having a shared bedroom is a risk factor for sibling bullying, given that researchers have suggested that increased time spent together with limited personal space increases sibling conflict (Toseeb, 2022). These variables were also tested as potential covariates of other model variables (i.e., self-esteem, internalizing and externalizing problems, and wellbeing) if significant bivariate correlations are found.

At various time points, primary caregivers were asked to report a range of demographic information, such as the cohort member’s ethnicity (0 = Non-White, 1 = White), sex (0 = Female, 1 = Male), number of siblings (0 = One-only sibling, 1 = Two or more siblings), and whether they had their own bedroom (0 = No, 1 = Yes). They also reported the family income (0 = Above average OECD, 1 = Below average OECD). Although not measured directly, we derived birth-order and late autism diagnosis variables based on the other reported information in the dataset:

Birth order

When the child was 9 months old, parents were asked to report the number of siblings their child had. Based on this, children were labeled as “first-born” if they had no siblings at 9 months of age and “second or later born” if they had at least one.

Late diagnosis

When the child was 5, 7, 11, and 14 years old, parents were asked whether their child was diagnosed with autism by a doctor or other health professional. Adolescents were categorized as *late diagnosed* if their parent responded “No” when they were aged 5 years old, and “Yes” at any later time point (7, 11, or 14)

Statistical analyses

The main aims of the analyses presented in this study were to: (a) report the prevalence and demographic correlates of sibling bullying, (b) explore the correlations between sibling bullying and mental health and well-being, and (c) test the mediator role of self-esteem in the associations between sibling bullying and negative and positive mental health. All statistical analyses were conducted on STATA/ MP 17 (StataCorp., 2021).

First, descriptive statistics were produced to report the characteristics of the sample and the prevalence of sibling bullying. All descriptive statistics were performed on the multiply imputed data set using the *mi estimate* command. Second, Point Biserial (PBIS) correlation was used to determine the bivariate correlations among dummy coded demographic characteristics and discrete model variables (e.g., sibling bullying). Based on the PBIS matrix, the significant correlates of interest variables were identified as control covariates of interest variables in the proposed mediation model. Third, due to the non-normal distribution in some interest variables, Spearman's correlation coefficient was used to report the zero-order correlations between sibling bullying and other model variables (i.e., self-esteem, internalizing and externalizing problems, and wellbeing). Fourth, a structural equation model (SEM) was fitted to test the direct and indirect effects of sibling bullying on mental health and wellbeing. Indirect effects were reported using the MEDSEM package in STATA (Mehmetoglu, 2018). A Monte Carlo simulation was fitted to replicate the MEDSEM findings on randomly generated samples ($N = 5000$) to correct potential biases in parameter estimations.

Sensitivity analyses

In the current study, the main analyses tested the mediating role of self-esteem in the associations between sibling bullying and mental health and wellbeing. However, we also aimed to test whether different types of sibling bullying involvement, sibling victimization, sibling perpetration, and overall sibling bullying, correlate differently with self-esteem, mental health, and wellbeing in autistic adolescents. For this, we conducted sensitivity analyses by replacing the overall sibling bullying (i.e., victimization and perpetration combined) predictor variable with victimization and perpetration. Any differences in the direct and indirect correlations, as well as in the mediation results are reported alongside the main model.

Missing data

Prior to handling missing data, the missingness pattern in the dataset was evaluated to test whether the prerequisites

for handling missing data were met. According to Rubin (2004), missing data can be handled if the missingness pattern in the dataset is missing at random (MAR), meaning that the missingness is not predicted by observed values in interest variables. For this, a binary variable *missingness pattern* ($0 = \text{No missing values}$, $1 = \text{At least 1 missing value in any observation}$) was constructed. Furthermore, a multiple logistic regression analysis was conducted to test whether this variable – missingness pattern – was predicted by observed values in demographics (i.e., gender, ethnicity) or model variables (i.e., sibling bullying, self-esteem, mental health, well-being). The logistic regression indicated that the missingness pattern in the dataset was not predicted by any observed values in the demographic or interest variables. Detailed information regarding the missing at-random test can be seen in Table S2.

Upon exploration of the missingness pattern in the dataset (MAR), missing values were handled using two advanced statistical techniques: multiple imputations by chained equations (MICE) and maximum likelihood with missing values (MLMV). In fitting MICE, predictive mean matching (PMM) was used to generate 50 multiply imputed datasets following a pre-made suggestion of “the number of imputed datasets (m) should be greater than the highest proportion of missingness” in interest variables (Van Buuren, 2018). The PMM was chosen over the regress method, as the regress option produced imputations outside scale ranges (e.g., negative values). Followed by, the multiply imputed datasets were used to report descriptive statistics. Finally, the full information maximum likelihood (FIML) algorithm was used in the SEM analyses to handle missing values and maximize the sample power. More information regarding the number of missing and imputed values in interest variables is outlined in Table S3.

RESULTS

Sample characteristics

At time 1, the mean age of the participants was 11.20 years, 88% were White, 78% were males, 59% were second or laterborn (had at least one older sibling), 53% had two or more siblings, 69% had their own bedroom, 80% had a late autism diagnosis, and 34% were from low-income households. Overall, 62% of autistic adolescents self-reported being involved in sibling bullying at least once a week in early adolescence. Of these, 40% bullied their siblings, while 58% were victimized by their siblings. In addition, most of autistic adolescents, who were involved in sibling bullying, were bully-victims (59%), while far fewer were victim-only (35%) or bully-only (6%). More information regarding sibling bullying roles by demographic characteristics can be seen in Table S4.

Demographic correlates of interest variables

Point biserial correlations (see Table 1) indicated that participants who were late-diagnosed, had a shared bedroom, and lived in a low-income household were more likely to be involved in sibling bullying than those who were early diagnosed, owned a bedroom, and lived in a high-income household. Although no other demographics were associated with sibling bullying, some demographics were correlated with other interest variables. For example, autistic adolescents who were White, female, early-diagnosed, and had an older sibling had lower self-esteem than others. Additionally, those who were White, female, early-diagnosed, and lived in low-income households had poorer mental health and wellbeing than those who were non-White, male, late-diagnosed, and lived in high-income households. More details can be found in Table 1.

Prior to the test of the mediation, we looked to see whether our pre-hypothesized model meets the pre-existing mediation conditions (i.e., significant path a and path b) by testing zero-order correlations between the

interest variables (see Table 2). Spearman's correlation matrix showed significant associations between sibling bullying in early adolescence and self-esteem in mid-adolescence (path a), and between self-esteem in mid-adolescence and mental health and wellbeing in late adolescence (path b). There were, however, no concurrent associations between sibling bullying and self-esteem in early adolescence, while they were significantly and negatively correlated in mid-adolescence. Additionally, lower levels of self-esteem in early adolescence increased the risk for sibling bullying involvement in mid-adolescence. These findings confirmed that our pre-hypothesized model met the pre-determined mediation conditions.

Path analyses

Upon meeting the pre-determined mediation conditions, the hypothesized mediation model was tested with the significant demographic covariates of interest variables (see Table 1). The model was also controlled for

TABLE 1 Point biserial correlations between the potential covariates and interest variables ($N = 416$).

| | Mean | Std. dev. | Sibling bullying (T1) | Self-esteem (T2) | Internalizing problems (T3) | Externalizing problems (T3) | Wellbeing (T3) |
|--------------------|------|-----------|-----------------------|------------------|-----------------------------|-----------------------------|----------------|
| Ethnicity | 0.88 | 0.32 | 0.09 | -0.15** | 0.07 | 0.11* | -0.07 |
| Sex | 0.78 | 0.41 | -0.03 | 0.30*** | -0.31*** | -0.05 | 0.01 |
| Late diagnosis | 0.81 | 0.38 | -0.14** | 0.13** | -0.05 | -0.15** | 0.10* |
| Birth order | 0.59 | 0.49 | -0.01 | -0.14** | 0.08 | -0.04 | -0.08 |
| Number of siblings | 0.53 | 0.49 | 0.07 | 0.04 | 0.01 | 0.01 | -0.02 |
| Own bedroom | 0.68 | 0.46 | 0.11* | -0.01 | 0.07 | 0.04 | 0.06 |
| Family income | 0.33 | 0.47 | 0.11* | -0.02 | 0.18*** | 0.11* | -0.13** |

Note: Ethnicity: 0 = Non-White, 1 = White; Sex: 0 = Female, 1 = Male; Late diagnosis: 0 = No, 1 = Yes; Birth order: 0 = First-born, 1 = Second-or later-born; Number of siblings: 0 = One-only sibling, 1 = Two or more siblings; Own bedroom: 0 = No, 1 = Yes; Family income: 0 = Above average OECD, 1 = Below average OECD. Positive values indicate higher rates of sibling bullying, increased internalizing and externalizing problems, and better self-esteem and wellbeing. Bold values indicate statistical significance at the $p < .05$ level.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

TABLE 2 Zero-order correlations between the interest variables (Spearman's R_s , $N = 416$).

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|
| 1. Sibling bullying (T1) | — | | | | | | |
| 2. Sibling bullying (T2) | 0.42*** | — | | | | | |
| 3. Self-esteem (T1) | 0.01 | -0.11* | — | | | | |
| 4. Self-esteem (T2) | -0.22*** | -0.21*** | 0.44*** | — | | | |
| 5. Internalizing problems (T3) | -0.01 | 0.25*** | -0.14** | -0.29*** | — | | |
| 6. Externalizing problems (T3) | 0.24*** | 0.41*** | -0.20*** | -0.35*** | 0.42*** | — | |
| 7. Wellbeing (T3) | -0.08 | -0.27*** | 0.20*** | 0.38*** | -0.47*** | -0.50*** | — |
| Mean | 5.18 | 3.81 | 16.27 | 15.49 | 7.61 | 7.37 | 21.17 |
| Standard deviation | 3.29 | 2.94 | 2.39 | 2.56 | 3.01 | 3.07 | 3.32 |

Note: Higher scores indicate higher rates of sibling bullying, increased internalizing and externalizing problems, and better self-esteem and wellbeing. Bold values indicate statistical significance at the $p < .05$ level.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

individuals' pre-existing self-esteem levels (early adolescence). The aim of the latter was to test whether individuals' self-esteem in mid-adolescence is predicted by their pre-existing self-esteem levels or their sibling bullying experiences. We attempted to control the model for sibling bullying in mid-adolescence, however, this created a suppression effect and an inconsistent mediation due to sibling bullying in mid-adolescence acting as a reversed signed second mediator alongside self-esteem in mid-adolescence. To overcome this suppression effect, sibling bullying in mid-adolescence was later removed from the model, as it was not a variable of interest in the originally proposed mediation model. The pre-hypothesized SEM, which controlled for significant covariates, as well as self-esteem in early adolescence, provided a good model fit and explained a significantly large proportion of variance in the dependent variables: $\chi^2(38) = 40.38$, $\chi^2(p) = 0.365$, RMSEA = 0.012, CFI = 0.99, TLI = 0.99, CD = 0.63.

Direct associations

The SEM path analysis (see Table 3) showed that increased sibling bullying in early adolescence was significantly and directly associated with reduced self-esteem in mid-adolescence. Additionally, reduced levels of self-esteem in mid-adolescence were significantly and directly correlated with increased internalizing and externalizing problems and decreased wellbeing in late adolescence. Finally, internalizing and externalizing problems were concurrently and positively associated, both of which, in turn, were negatively correlated with wellbeing in late adolescence. That is, autistic adolescents with high levels of internalizing problems in late adolescence showed high externalizing problems and poor wellbeing in late adolescence, and vice versa. Sibling bullying in early adolescence was not a direct correlate of internalizing and externalizing problems or wellbeing in late adolescence in autistic adolescents. Additionally, lower levels of self-esteem in early adolescence were not directly associated with higher internalizing and externalizing problems or poorer wellbeing in late adolescence. That is, sibling bullying and self-esteem may not have prolonged direct effects on the mental health and wellbeing of autistic adolescents.

Indirect associations

The Sobel test (see Table 4) suggested that, instead of a direct link, there may be an indirect link between sibling bullying and internalizing and externalizing problems and wellbeing in autistic adolescents. More specifically, our mediation analysis indicated that sibling bullying in early adolescence was indirectly linked to increased internalizing and externalizing problems and wellbeing in late

adolescence through a reduction in self-esteem in mid-adolescence in autistic adolescence. All mediations were complete, that is, self-esteem fully-mediated the associations between sibling bullying in early adolescence, mental health and wellbeing in late adolescence in autistic adolescents. The mediation model is illustrated in Figure 1.

Covariates (mediation)

The mediation model also controlled for potential covariates. For this, we tested all potential demographic correlates of sibling bullying (i.e., ethnicity, sex, birth order, number of siblings, own bedroom, and family income) as its precursors in the proposed model, regardless of whether they showed a significant bivariate correlation with sibling bullying in PBIS matrix (Table 1). Additional paths were added between demographic variables and other model variables (i.e., self-esteem, internalizing and externalizing problems, and wellbeing) where significant correlations were found in PBIS matrix (see Table 1).

The path analysis showed that being diagnosed late with autism was the only significant covariate of sibling bullying in early adolescence when tested with all other demographic variables. That is, ethnicity, sex, birth-order, number of siblings, having own bedroom, and family income were not significant correlates of sibling bullying in early adolescence. Additionally, despite their bivariate correlations, being White, late diagnosed, and living in a low-income household were no longer significant correlates of externalizing problems in late adolescence upon testing with other model variables. Similarly, being late-diagnosed with autism was no longer a direct correlate of wellbeing in late adolescence upon tested in the mediation model, though, low family income was still a significant correlate of poorer wellbeing in late adolescence. Finally, no changes were observed in the significant correlates of internalizing problems between the PBIS matrix (Table 1) and SEM paths (Table 3). That is, females and those who lived in low-income households showed higher internalizing problems than males and those living in high-income households.

Sensitivity findings

Two separate SEMs were fitted for sensitivity purposes to replicate the findings of the hypothesized mediation model by replacing sibling bullying in early adolescence (predictor) with victimization and perpetration. Both sensitivity models provided good model fits: Sensitivity SEM-1 = Model Fit = $\chi^2(35) = 39.28$, $\chi^2(p) = 0.284$, RMSEA = 0.017, CFI = 0.99, TLI = 0.98, CD = 0.61; Sensitivity SEM-2 = $\chi^2(35) = 38.09$, $\chi^2(p) = 0.330$, RMSEA = 0.01, CFI = 0.99, TLI = 0.98, CD = 0.63.

TABLE 3 SEM paths ($N = 416$).

| Standardized | β | SE | z | p | 95% CI |
|--|--------------|------|--------|------------------|--------------|
| Direct pathways | | | | | |
| Sibling bullying (T1) \rightarrow Self-esteem (T2) | -0.16 | 0.05 | -2.88 | <0.01 | -0.26, -0.05 |
| Sibling bullying (T1) \rightarrow Internalizing problems (T3) | -0.12 | 0.08 | -1.44 | 0.149 | -0.30, 0.04 |
| Sibling bullying (T1) \rightarrow Externalizing problems (T3) | 0.12 | 0.08 | 1.58 | 0.114 | -0.03, 0.28 |
| Sibling bullying (T1) \rightarrow Wellbeing (T3) | -0.01 | 0.06 | -0.10 | 0.917 | -0.13, 0.12 |
| Self-esteem (T1) \rightarrow Self-esteem (T2) | 0.38 | 0.05 | 7.56 | <0.001 | 0.28, 0.48 |
| Self-esteem (T1) \rightarrow Internalizing problems (T3) | -0.02 | 0.10 | -0.16 | 0.869 | -0.22, 0.19 |
| Self-esteem (T1) \rightarrow Externalizing problems (T3) | -0.06 | 0.09 | -0.62 | 0.536 | -0.24, 0.12 |
| Self-esteem (T1) \rightarrow Wellbeing (T3) | 0.01 | 0.07 | 0.17 | 0.866 | -0.14, 0.16 |
| Self-esteem (T2) \rightarrow Internalizing problems (T3) | -0.32 | 0.09 | -3.23 | <0.001 | -0.51, -0.12 |
| Self-esteem (T2) \rightarrow Externalizing problems (T3) | -0.31 | 0.08 | -3.66 | <0.001 | -0.47, -0.14 |
| Self-esteem (T2) \rightarrow Wellbeing (T3) | 0.32 | 0.06 | 4.71 | <0.001 | 0.19, 0.45 |
| Concurrent associations | | | | | |
| Externalizing problems (T3) $\leftarrow \rightarrow$ Wellbeing (T3) | -0.48 | 0.06 | -7.07 | <0.001 | -0.61, -0.35 |
| Internalizing problems (T3) $\leftarrow \rightarrow$ Wellbeing (T3) | -0.58 | 0.10 | -5.59 | <0.001 | -0.78, -0.37 |
| Externalizing problems (T3) $\leftarrow \rightarrow$ Internalizing problems (T3) | 0.81 | 0.13 | 5.92 | <0.001 | 0.54, 1.08 |
| Covariates | | | | | |
| Ethnicity \rightarrow Sibling bullying (T1) | 0.08 | 0.05 | 1.41 | 0.157 | -0.03, 0.19 |
| Sex \rightarrow Sibling bullying (T1) | -0.01 | 0.05 | -0.33 | 0.744 | -0.12, 0.08 |
| Late diagnosis \rightarrow Sibling bullying (T1) | 0.13 | 0.06 | 2.22 | 0.026 | 0.02, 0.25 |
| Birth order \rightarrow Sibling bullying (T1) | -0.02 | 0.05 | -0.042 | 0.671 | -0.13, 0.08 |
| Own bedroom \rightarrow Sibling bullying (T1) | -0.11 | 0.05 | -1.99 | 0.047 | -0.22, -0.01 |
| Family income \rightarrow Sibling bullying (T1) | 0.09 | 0.05 | 1.82 | 0.068 | -0.01, 0.20 |
| Ethnicity \rightarrow Self-esteem (T2) | -0.09 | 0.05 | -1.59 | 0.111 | -0.20, 0.02 |
| Sex \rightarrow Self-esteem (T2) | 0.24 | 0.04 | 5.09 | <0.001 | 0.15, 0.33 |
| Late diagnosis \rightarrow Self-esteem (T2) | -0.05 | 0.05 | -0.98 | 0.325 | -0.17, 0.05 |
| Birth order \rightarrow Self-esteem (T2) | -0.14 | 0.05 | -2.67 | <0.01 | -0.24, -0.03 |
| Sex \rightarrow Internalizing problems (T3) | -0.37 | 0.07 | -5.13 | <0.001 | -0.51, -0.23 |
| Family income \rightarrow Internalizing problems (T3) | 0.25 | 0.08 | 2.99 | <0.01 | 0.08, 0.42 |
| Family income \rightarrow Externalizing problems (T3) | 0.12 | 0.07 | 1.65 | 0.098 | -0.02, 0.27 |
| Ethnicity \rightarrow Externalizing problems (T3) | 0.05 | 0.06 | 0.66 | 0.509 | -0.08, 0.18 |
| Late diagnosis \rightarrow Externalizing problems (T3) | 0.07 | 0.07 | 1.04 | 0.300 | -0.06, 0.21 |
| Late diagnosis \rightarrow Wellbeing (T3) | -0.03 | 0.05 | -0.57 | 0.569 | -0.14, 0.08 |
| Family income \rightarrow Wellbeing (T3) | -0.14 | 0.05 | -2.38 | 0.017 | -0.25, -0.02 |
| Factor loadings | | | | | |
| Internalizing problems (T3) \rightarrow Emotional problems (T3) | 0.67 | 0.06 | 9.70 | <0.001 | 0.53, 0.81 |
| Internalizing problems (T3) \rightarrow Peer problems (T3) | 0.43 | 0.06 | 6.71 | <0.001 | 0.30, 0.56 |
| Externalizing problems (T3) \rightarrow Conduct problems (T3) | 0.62 | 0.05 | 11.32 | <0.001 | 0.51, 0.73 |
| Externalizing problems (T3) \rightarrow Hyperactivity (T3) | 0.76 | 0.05 | 13.87 | <0.001 | 0.65, 0.87 |

Note: Model Fit = $\chi^2(35) = 38.17$, $\chi^2(p) = 0.327$, RMSEA = 0.015, CFI = 0.99, TLI = 0.98, CD = 0.63. Bold values indicate statistical significance at the $p < .05$ level.

Sensitivity analysis path coefficients can be seen in Tables S5 and S6.

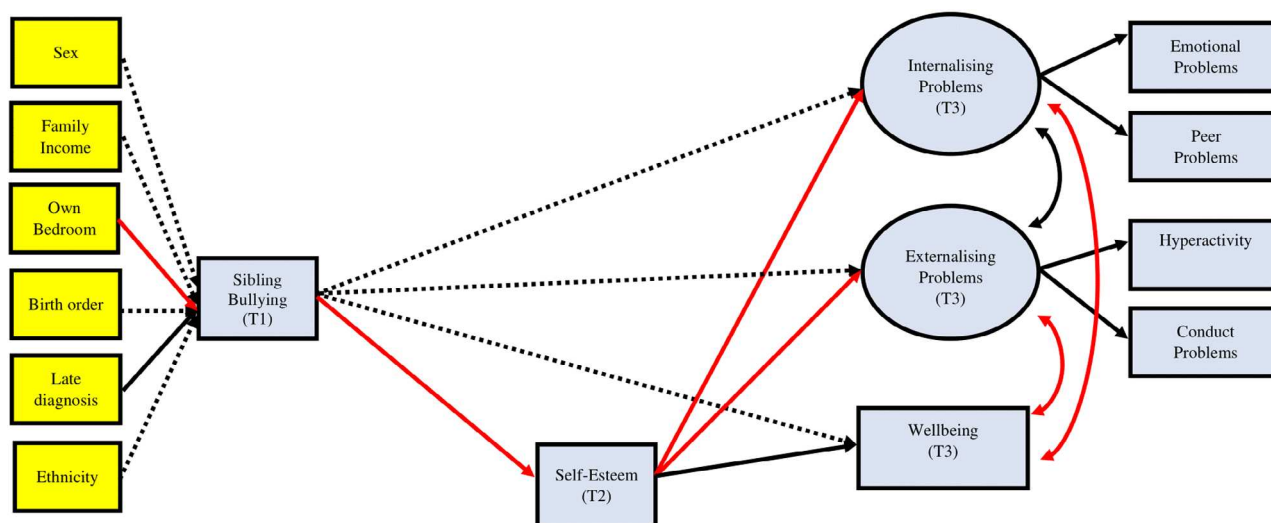
Our sensitivity findings were almost identical to the original mediation findings. In summary, sensitivity models suggested that, regardless of the sibling bullying role (i.e., being a victim or perpetrator), being involved in

sibling bullying in early adolescence reduced self-esteem in mid-adolescence and, in turn, reduced self-esteem, increased internalizing and externalizing problems, and reduced wellbeing in late adolescence. Similar to the original model, there were no direct correlations between the predictor (i.e., sibling bullying victimization or sibling

TABLE 4 Mediation results ($n = 416$).

| Mediation pathways | Standardized coefficients | | | Sobel test | | | | |
|--|-------------------------------|--------------------------------|--------------------------|----------------|-----------|-------|-----------------|--------------|
| | X → M β (p) | M → Y β (p) | X → Y β (p) | Ind. Eff. | Std. err. | z | p | 95% CI |
| Sibling bullying (T1) → Self-esteem (T2) → Internalizing problems (T3) | −0.155 (<0.01) | −0.320 (<001) | −0.129 (0.149) | 0.050 | 0.023 | 2.15 | 0.032 | 0.01, 0.10 |
| Sibling bullying (T1) → Self-esteem (T2) → Externalizing problems (T3) | −0.155 (<0.01) | −0.307 (<0.001) | 0.127 (0.114) | 0.048 | 0.021 | 2.26 | 0.024 | 0.01, 0.09 |
| Sibling bullying (T1) → Self-esteem (T2) → Wellbeing (T3) | −0.155 (<0.01) | 0.320 (<0.001) | −0.007 (0.917) | − 0.050 | 0.020 | −2.45 | <0.01 | −0.09, −0.01 |

Note: Bold values indicate statistical significance at the $p < .05$ level.



Note. The solid black arrows represent significant positive interactions, the solid red arrows represent significant negative interactions, and the dotted arrows represent non-significant paths. The model controls for self-esteem (T1), however, it is not illustrated in the graph for clarity purposes. Additionally, paths between demographic covariates and interest variables (i.e., self-esteem, internalising and externalising problems, and wellbeing) are not shown for clarity purposes. However, their path coefficients are outlined in Table 3. Blue Highlighted: Main interest variables. Yellow highlighted: Control (covariate) variables. Ethnicity: 0=Non-White, 1=White; Sex: 0=Female, 1=Male; Late Diagnosis: 0=No, 1=Yes; Birth Order: 0= First-born, 1= Second-or later-born; Own Bedroom: 0= No, 1= Yes; Family Income: 0= Above Average OECD, 1= Below Average OECD. Positive values indicate higher rates of sibling bullying, increased internalising and externalising problems, and better self-esteem and wellbeing.

FIGURE 1 The mediating role of self-esteem between sibling bullying and mental health and wellbeing.

bullying perpetration in early adolescence) and outcome variables (i.e., internalizing and externalizing problems and wellbeing in late adolescence). This indicates that self-esteem in mid-adolescence fully mediated the longitudinal associations between sibling bullying victimization or perpetration in early adolescence and mental health and wellbeing in late adolescence in autistic adolescents. Detailed information regarding sensitivity mediation findings can be seen in Table S7.

Although there were no differences in path analysis between the sensitivity and original models, some differences were observed in the demographic correlates of sibling bullying. For example, the original model indicated

that being late diagnosed with autism was the only significant correlate of sibling bullying in early adolescence. Based on the sensitivity findings, we observed that autistic adolescents who were late diagnosed with autism were more likely to bully their siblings, but were not more prone to be victimized by their siblings. Additionally, although the original model suggested no other covariates of sibling bullying in early adolescence, the sensitivity models showed that autistic adolescents who were White and had a shared bedroom were more likely to be victimized by their siblings than those who were non-White or had their own bedroom. That is, regardless of sibling bullying role — victimization or perpetration—

individuals who were involved in any type of sibling bullying in early adolescence, victimization or perpetration, showed similar trajectories of self-esteem and mental health and wellbeing in middle and late adolescence. Despite this, the precursors of sibling bullying seemed to vary depending on the bullying role.

DISCUSSION

To the best of our knowledge, our study has been the first in examining the longitudinal associations between sibling bullying, self-esteem, mental health, and wellbeing from early to late adolescence in autistic adolescents. Consistent with past reports, from the general and autistic populations, we found that sibling bullying was highly prevalent in the lives of autistic adolescents as about 40% reported bullying a sibling and 58% reported being victimized by a sibling at least *about once a week* (Deniz, Derinalp, et al., 2023; Duncan, 1999; Menesini et al., 2010; Toseeb et al., 2018; Toseeb, McChesney, Oldfield, & Wolke, 2020; Wolke & Samara, 2004; Wolke & Skew, 2012). This finding also supports an earlier argument suggesting that sibling bullying may be the most prevalent form of violence in adolescents' lives. (Hoetger et al., 2015; Krienert & Walsh, 2011; Wolke & Skew, 2012). Additionally, for the first time, we found that self-esteem in mid-adolescence is a significant mediator between sibling bullying in early adolescence and mental health and wellbeing in late adolescence in autistic adolescents.

Demographic correlates

Many researchers have suggested that having a male sibling is a risk factor for sibling bullying (Bowes et al., 2014; Dantchev et al., 2018; Tippet & Wolke, 2015; Toseeb et al., 2018; Toseeb, McChesney, Dantchev, & Wolke, 2020; Toseeb, McChesney, Oldfield, & Wolke, 2020; Tucker et al., 2013, 2014). However, we found no significant correlations between sibling bullying and sex in the present study. Although our findings contradict some previous reports, there is also inconsistency in the existing literature in terms of the relations between sex and sibling bullying. For instance, while some researchers suggested that males are more likely to be perpetrators of sibling bullying (Bowes et al., 2014; Menesini et al., 2010) others disagreed suggesting that females are either equally or more likely to be perpetrators of sibling bullying than males (Duncan, 1999). Additionally, Tippet and Wolke (2015) suggested that males are more likely to be victims as well as perpetrators of bullying compared to females. Moreover, while Tucker et al. (2013) found higher rates of sibling bullying between male–male sibling pairs than otherwise formed sibling pairs such as male–female, Wolke and Skew

(2011) found higher rates of bully-victims in families formed with mixed siblings (males-females) than otherwise formed families (i.e., brothers-only or sisters-only). That is, although previous studies draw an association between sex and sibling bullying, the existing evidence, including the current study findings, is inconsistent regarding the role of sex in sibling bullying. Hence, more research is needed to clarify the relations between siblings' sex composition and sibling bullying.

Less controversial, but still inconsistent, most of the existing evidence suggests that being the first-born and having two or more siblings increase the likelihood of being involved in sibling bullying (Bowes et al., 2014; Dantchev et al., 2018; Toseeb et al., 2018; Toseeb, McChesney, Dantchev, & Wolke, 2020; Toseeb, McChesney, Oldfield, & Wolke, 2020; Tucker et al., 2013, 2014). However, there are also opposing arguments in the literature. For instance, some researchers have found that first-born children are more likely to be both victims and bullies of sibling bullying than second or laterborns (Tippet & Wolke, 2015). Additionally, a recent report has shown that adolescents with one-only sibling had higher rates of sibling bullying than those with two or three or more siblings (Deniz, Derinalp, et al., 2023). Adding to this inconsistency in the literature, we found no correlations between sibling bullying, victimization and perpetration, and birth order or number of siblings. Hence, given that most of the existing evidence comes from the general population, more studies are needed to shed light on the role of birth order and number of siblings in families of autistic adolescents.

Previous research has reported that coming from a White ethnic background is a risk factor for increased sibling bullying (Bowes et al., 2014; Dantchev et al., 2018; Tippet & Wolke, 2015; Toseeb et al., 2018; Toseeb, McChesney, Oldfield, & Wolke, 2020; Tucker et al., 2013, 2014). In the present study, we found no correlations between ethnicity, number of siblings, birth order and sibling bullying in autistic adolescents. However, we found that White autistic adolescents were more likely to be victimized by their siblings but not to bully their siblings than non-Whites. That is, autistic children who live in families from White ethnic backgrounds may be at increased risk for being bullied by their siblings, but may not be more likely to be perpetrators of bullying. This well aligns with a recent report, as Toseeb, McChesney, Dantchev, and Wolke (2020) have also found that White adolescents are at increased risk of being a victim (i.e., victim-only) but not a perpetrator (i.e., bully-only) of sibling bullying. Perhaps, this may be because non-White families are more inclined to protect their autistic child during sibling conflict and bullying situations than White families (Deniz, Asbury, & Toseeb, 2023).

For the first time, we found that autistic adolescents who were late diagnosed with autism were at an increased risk for involving in sibling bullying compared to those

with an early autism diagnosis. Our sensitivity models showed that this correlation was related to bullying a sibling but not being victimized by a sibling. That is, autistic adolescents who were late diagnosed with autism were more likely to bully their siblings but were not more likely to be victimized by them, compared to those who were early diagnosed. Given that females are more likely to be late diagnosed with autism than males (Milner et al., 2023), this may potentially place autistic females at a relatively higher risk of involvement in sibling bullying than autistic males.

Similarly, for the first time, we explored that autistic adolescents who shared a bedroom with their siblings were more likely to be involved in sibling bullying than those who had their own bedrooms. Again, our sensitivity models showed that this was linked to bullying a sibling but not being victimized by a sibling. That is, autistic adolescents who shared a bedroom with their siblings were more likely to bully their siblings than those who had their own bedrooms. They were not, however, more likely to be victimized by their siblings than those who had their own bedrooms. One could argue that sharing a bedroom potentially prepares the best possible ground for sibling bullying as it increases the time spent together with no or low parental supervision, which increased the risk for sibling conflict and bullying (Monks et al., 2009; Toseeb, 2022; Wolke et al., 2015). It could also be argued that sharing a bedroom may potentially increase the risk of being involved in sibling bullying due to a lack of personal space and privacy (Stadheim et al., 2022). Given that sharing a bedroom increased the risk of bullying a sibling, but not being victimized by a sibling, we argue that autistic adolescents may tolerate their siblings less than being tolerated by their siblings. Future researchers would benefit from replicating our literature-leading findings suggesting that sharing a bedroom may be a risk factor for sibling bullying perpetration in autistic adolescents. Researchers would also benefit from replicating our findings in non-autistic populations.

The existing literature on the relations between low family income and sibling bullying has largely remained inconsistent in the past years. While some researchers found no correlations between sibling bullying and low family income (Dirks et al., 2019; Toseeb, McChesney, Dantchev, & Wolke, 2020), a study reported negative correlations (Toseeb et al., 2018). In the present study, however, we first found significant correlations between sibling bullying and low family income which is consistent with previous reports (Eriksen & Jensen, 2009; Liu et al., 2021; Tippet & Wolke, 2015). This finding is also backed up by the resource control theory which suggests that coercive behavior, in this context of bullying, takes place to gain or maintain control over limited resources (Salmon & Hehman, 2014). However, upon controlling for all other individual risk factors, family income was no longer correlated with increased sibling bullying. Our sensitivity findings also showed no significant

correlations between subtypes of sibling bullying (victimization and perpetration) and family income. This demonstrates that the inconsistency in the literature regarding the link between family income and sibling bullying may be due to the confounding effects of other risk factors. Thus, more research is needed to understand whether sibling bullying is more common in low-income families compared to high-income families upon controlling for other individual – and family-level risk factors.

In regard to the covariates of other interest variables, our findings were somewhat congruent and somewhat inconsistent with the available literature. Consistent with the existing literature (Toseeb et al., 2018; Tucker et al., 2013), we found that autistic adolescents who were female and lived in low-income households had poorer mental health compared to males and those living in high-income households. We also found that autistic adolescents who lived in low-income households had poorer wellbeing compared to others, which also well aligns with a previous report (Toseeb & Asbury, 2022). Additionally, aligning with the previous reports, we found that female autistic adolescents and those who had older siblings were at increased risk for lower self-esteem than those without any older siblings (Corden et al., 2021; Fukuya et al., 2021). Although there is some evidence that somewhat contradicts our latter findings, as some researchers have found no correlations between sex and self-esteem (Adkins, 2003; Arwert & Sizoo, 2020; Cooper et al., 2021), this evidence primarily comes from either autistic adults or the general population, while little is known about the demographic correlates of self-esteem in autistic adolescents. Thus, more research is needed to support or disprove our findings, as the existing literature on which to base our findings is weak.

Sibling bullying and mental health and wellbeing

Our findings rejected H_1 suggesting that sibling bullying involvement in early adolescence does not directly predict increased internalizing and externalizing problems and poorer wellbeing in late adolescence in autistic adolescence. Our findings do not align with an abundance of previous reports which indicated significant direct associations between sibling bullying and mental health and wellbeing (Bowes et al., 2014; Buist & Vermande, 2014; Coyle et al., 2017; Duncan, 1999; Liu et al., 2020; Mathis & Mueller, 2015; Plamondon et al., 2021; Toseeb et al., 2018; Toseeb, McChesney, Oldfield, & Wolke, 2020; Toseeb & Wolke, 2021; Tucker et al., 2013; Wolke et al., 2015). We suspect that the main reasons for this inconsistency were that we reported causal associations (i.e., mediation model), whereas the contradicting previous evidence indicated correlations between sibling bullying and mental health and wellbeing without any causal inferences. Additionally, we reported the long-term longitudinal associations between sibling bullying

and mental health, while some previous reports only focused on concurrent or proximal associations between sibling bullying and mental health and wellbeing. Supporting this argument, a recent report which tested the causal links (i.e., mediation) also found no direct links between sibling victimization and internalizing problems in adolescents (Fite et al., 2022). That is, although most of the evidence in the literature indicates that sibling bullying is correlated with poorer mental health and wellbeing, the nature of this association may be indirect.

Sibling bullying and self-esteem

In favor of H₂, aligning with the existing literature, our findings suggested that autistic adolescents who had higher sibling bullying rates in early adolescence had lower levels of self-esteem in mid-adolescence (Plamondon et al., 2021; Sapouna & Wolke, 2013; Sharpe et al., 2021; Sherman et al., 2006; Skinner & Kowalski, 2013; Toseeb & Wolke, 2021), compared to those with lower rates of sibling bullying in early adolescence. Again, aligning with previous findings (Dantchev & Wolke, 2019b) based on zero-order correlations, i.e., not causal, high levels of self-esteem in early adolescence may serve as protective factors against subsequent sibling bullying involvement in mid-adolescence in autistic adolescents. Hence, we argue that increased rates of sibling bullying appear to be direct risk factors for reduced levels of self-esteem later in life and high levels of self-esteem seem to prevent experiencing sibling bullying later in life in autistic adolescents. Hence, promoting the self-esteem of autistic adolescents may reduce the risk of sibling bullying involvement for such individuals.

Self-esteem, mental health, and wellbeing

Backing H₃, we found that autistic adolescents who had lower self-esteem in mid-adolescence showed higher internalizing and externalizing problems and poorer wellbeing in late adolescence compared to those with higher levels of self-esteem. The former finding well aligns with the previous reports, from the general population, as self-esteem has often been found as a negative correlate of internalizing and externalizing problems (Boyes et al., 2020; Cooper et al., 2017; Fernandes et al., 2021), and a positive correlate of wellbeing (Cooper et al., 2017; Corden et al., 2021; Padhy et al., 2011; Poudel et al., 2020). Although not hypothesized, we found no direct prolonged effects of self-esteem in early adolescence on internalizing and externalizing problems in late adolescence in autistic adolescents. This, perhaps, could be related to the development course of self-esteem as researchers have reported that self-esteem drops significantly when transitioning from childhood to adolescence (Harter, 2015). That is, high levels of self-esteem in middle adolescence, but not in early adolescence, may protect

the mental health and wellbeing of autistic adolescents in late adolescence.

Confirming H₄, we found that higher rates of sibling bullying in early adolescence predicted reduced self-esteem in mid-adolescence. In turn, reduced self-esteem in mid-adolescence predicted poorer mental health wellbeing in autistic adolescents in late adolescence. Our findings extended the previous knowledge beyond past studies (Sharpe et al., 2021; Toseeb & Wolke, 2021) and, for the first time in the literature, suggested that self-esteem significantly mediate the associations between early sibling bullying involvement and later mental health difficulties and poorer wellbeing in autistic adolescents. Based on our findings, we also suggest that both being victimized by a sibling and bullying a sibling have similar deteriorating impacts on the mental health and wellbeing of autistic adolescents.

Strengths and limitations

A major strength of this study is the use of a sample of autistic adolescents that is drawn from a UK-based representative cohort study. The longitudinal and representative nature of the data increased the chance of generalisability of the results to the western populations. Furthermore, the use of the well-known and widely used psychometric scales increased the validity and reliability of the reported results. Moreover, we believe that the use of advanced statistical techniques to handle missing data further minimized the bias estimates of the parameters and increased the sample power.

There were also limitations. For instance, although the current study used a nationally representative sample of adolescents in the UK, the sample consisted of predominantly male participants (78%). Although recent figures still show that males are three to four times more likely to be diagnosed with autism, the ongoing debates indicate that females may be under-represented in both autism research and diagnosis. Future researchers would benefit from a better representation of females. Moreover, the low power in the female sample further prevented us from conducting a multi-group SEM to test the potential effects of sex~late autism diagnosis (i.e., late diagnosed females) interaction in the associations between sibling bullying, self-esteem, and internalizing problems. Furthermore, whilst the use of well-validated psychometric scales is the one strengths of the study, the measure of sibling bullying is based on single-item sibling victimization and sibling perpetration questions. Future researchers should make use of multi-item sibling bullying scales to increase the sensitivity of the measure. Another limitation of the study is the type of self-report scales that were used to report sibling bullying, mental health, and wellbeing of the autistic participants. Since the sample was drawn from a nationally representative cohort study, none of the scales that were used was specifically developed for autistic individuals which raises

concerns over the sensitivity of the findings. Additionally, the lack of information regarding siblings' age, gender, and autistic characteristics, which could serve as potential covariates, was another limitation. Finally, it is important to note that our models did not control for other types of bullying and victimization, especially peer bullying, which hold the potential to confound the associations reported in this study.

CONCLUSIONS AND IMPLICATIONS

In conclusion, our main findings show that sibling bullying is highly prevalent in the lives of autistic adolescents as nearly one in two autistic adolescents experience sibling bullying about once a week. Additionally, instead of a direct link, sibling bullying involvement in early adolescence is indirectly correlated with poor mental health and wellbeing in late adolescence through a reduction in self-esteem in a mid-time-point (i.e., mid-adolescence) in autistic adolescents.

Regarding implications, we suggest that sibling bullying is not a routine, part of daily sibling interaction and hence it should be considered a serious form of violence that deteriorates the mental health and wellbeing of autistic adolescents. Hence, we emphasize the immediate need for sibling bullying prevention programmes in families of autistic adolescents as early prevention of sibling bullying is likely to protect the self-esteem, and therefore, the mental health and wellbeing of autistic adolescents. Finally, where delivering sibling bullying interventions is not feasible, due to them taking place behind closed doors and most children not disclosing such experiences to their parents or others, interventions targeting the self-esteem of such individuals are likely to further protect their subsequent mental health and wellbeing from the detrimental effects of sibling bullying.

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CONFLICT OF INTEREST STATEMENT

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from UK Data Service. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from <https://ukdataservice.ac.uk/2020/10/14/millennium-cohort-stu> with the permission of UK Data Service.

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SUPPORTING INFORMATION

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