The role of bullying victimization in the pathway between autistic traits and psychotic experiences in adolescence: Data from the Tokyo Teen Cohort study

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ABSTRACT

Autistic traits are associated with psychotic experiences in adolescence; however, the mechanisms underlying this relationship are not well understood. Prior research indicates that bullying victimization increases the risk of psychotic experiences in general adolescent populations, and autistic youth are at higher risk of being bullied than their non-autistic peers. Using longitudinal data from general population adolescents aged 10–14 in the Tokyo Teen Cohort study, we tested the hypothesis that bullying is responsible for the association between autistic traits and psychotic experiences in adolescence. We identified an indirect effect (estimate = 0.033 [95% CIs: 0.014–0.057], p < 0.001) between autistic traits and psychotic experiences via bullying victimization, even after controlling for known confounders. Prevention of bullying victimization may be one avenue for reducing risk of psychosis among adolescents with high levels of autistic traits.

Keywords: Autistic traits, Psychotic experiences, Bullying, Autism, Adolescence

1. Introduction

Psychotic experiences (PEs) occur in 7–23% of adolescents (Kelleher et al., 2012a,b, Majer et al., 2018) and confer a three-fold increased risk of any mental health problem (Healy et al., 2019). Childhood victimization experiences are potent risk factors for PEs (Bentall et al., 2014; Croft et al., 2019; Fisher et al., 2013; Trott et al., 2015). In particular, bullying victimization increases risk for subsequent PEs at least two-fold (Cunningham et al., 2016; van Dam et al., 2012).

Prior research suggests autistic traits (ATs) in child and adolescent populations also increase risk of PEs (Sullivan et al., 2013; Taylor et al., 2015). As ATs emerge in early childhood (Georgiadis et al., 2013; Ozonoff et al., 2014) and show stability over important developmental stages even in non-clinical populations (Haraguchi et al., 2019; Robinson et al., 2011), research into the AT-PE pathway is crucial for identifying targets for early intervention. A recent meta-analysis found a weak-to-medium correlation (r = 0.34) between ATs and PEs using data from eight studies (Kiyono et al., 2020). However, the mechanisms underlying this relationship remain unclear.

We hypothesized that bullying victimization may be a mediating factor between ATs and PEs. Studies with clinical samples have consistently found that autistic youth are at a much higher risk of being bullied than their non-autistic peers, with prevalence rates ranging from 40 to 94% (Maiano et al., 2016; Schroeder et al., 2014; Sreckovic et al., 2014). Moreover, within clinical samples, higher levels of ATs further increase risk of being bullied (Forrest et al., 2020; Zablotsky et al., 2014). One
retrospective study with a university students sample reported a modest positive association ($r = 0.21$) between ATs and bullying frequency (Kunihira et al., 2006), but studies investigating ATs and bullying risk in general population samples are sparse. Yet, taken alongside prior findings that differences in communication and emotional expression common to autistic youth may directly create ‘targets’ for bullies (Cappadocia et al., 2012; Riefle et al., 2012), it follows that ATs would also increase the risk of bullying victimization within general populations - and subsequently increase risk of PEs.

The aim of the present study was therefore to investigate whether bullying victimization was a mediating factor between ATs and PEs in general population adolescents. To the best of our knowledge, no studies have investigated this relationship in this age group; therefore, our findings would represent a substantial contribution to the evidence on the ATs-PEs pathway.

2. Materials and methods

2.1. Study design and participants

This study was part of the Tokyo Teen Cohort (TTC) study (http://ttcp.umin.jp/) (Ando et al., 2019). In brief, the TTC study is a large population-based longitudinal survey assessing the health and development in a general sample of adolescents living in three municipalities in the Tokyo metropolitan area (Setagaya, Mitaka, and Chofu) born between September 2002 and August 2004. Eligible households were identified and randomly sampled via the resident register in each municipality. Data were collected at three time points, when participants were 10 (T1), 12 (T2), and 14 (T3) years of age. A total of 3171 child–parent pairs participated at baseline (T1); of these, 3007 pairs participated at T2 (follow-up rate: 94.8%) and 2667 pairs at T3 (follow-up rate: 84.1%). A trained interviewer visited the participants’ homes at each time point to administer self-report questionnaires to both child and parent, and conduct a semi-structured interview with the parent.

The TTC study protocol was approved by the Ethics Committees of the Tokyo Metropolitan Institute of Medical Science (approval number: 12-35), the University of Tokyo (100057), and SOKENDAI (the Graduate University for Advanced Studies; 2012002). Written informed consent was obtained from the parent prior to participation.

2.2. Measures

2.2.1. PEs

The Adolescent Psychotic-like Symptom Screener (APSS) (Laurens et al., 2007) is a widely-used seven-item self-report measure assessing hallucinations and delusions in adolescents, which has good positive and negative predictive validity for symptoms assessed via diagnostic interview (Kelleher et al., 2011). Each item has three possible responses: ‘yes, definitely’, ‘maybe’, and ‘no, never’, scored with 1, 0.5, and 0 points, respectively. Overall, a score between 0 and 7 is produced by totaling individual item scores, which was then treated as a continuous variable for statistical analysis. The Japanese version of the APSS has shown satisfactory internal consistency within this sample (Cronbach’s $\alpha = 0.714$) (Ando et al., 2018). We also reported number of participants scoring 1 or more item as ‘definitely’ to allow demographic comparisons with other studies.

2.2.2. ATs

The short Autism-spectrum Quotient—adolescent version (AQ-10) is a 10-item self-report measure assessing the presence of ATs in 12-15-year-old children without intellectual disability (Allison et al., 2012). The AQ-10 is adapted from the 50-item AQ (Baron-Cohen et al., 2001), with the shortened version exhibiting equivalent predictive validity (Booth et al., 2013). Responses are given on a 4-point Likert scale (“definitely disagree”, “slightly disagree”, “slightly agree”, or “definitely agree”). Five items require “agree” answers to endorse the AT, with the remaining five requiring “disagree” answers. Each item is scored as 1 or 0, with a total of $\geq 6$ points considered ‘high autistic traits’, in line with previous studies (Allison et al., 2012; Booth et al., 2013; Heys et al., 2018). Comparisons of AQ-50 scores between adult and child samples from Japan and United Kingdom support cross-cultural construct validity (Carruthers et al., 2018; Wakabayashi et al., 2006, 2007). The Japanese AQ-10 has been used in subsequent studies in Japan (Hirakawa et al., 2019; Michikawa et al., 2015).

2.2.3. Bullying

Bullying victimization data were collected from both child and parent. First, the following definition of bullying was shown: “a child is being bullied when another child, or a group of children, say or do nasty and unpleasant things to him or her. It is also bullying when a child is teased repeatedly in a way he or she does not like. But it is not bullying when two children of about the same strength quarrel or fight” (Solberg and Olweus, 2003). Children were then asked, “How often have you been bullied in the past 2 months?”, while parents were asked, “How often has your child been bullied in the past 2 months?”. Answers were scored on a 5-point Likert scale, as follows: “never” = 0, “only once or twice” = 1, “two or three times a month” = 2, “about once a week” = 3, or “several times a week” = 4. Parent-child agreement was low (weighted $k = 0.24$), although this is consistent with the low-to-moderate agreement reported across studies in several countries (Larrañaga et al., 2018; Lohre et al., 2011; Ronning et al., 2009; Wolke et al., 2014). Youth may be unwilling to report painful or traumatic experiences, and parents may be unaware of bullying depending on when and where it occurs; it has been suggested that using multiple informants is therefore the best approach to capture as many instances of bullying as possible when using self-report questionnaires (Arseneault et al., 2010). Accordingly, we classified scores above 0 from either respondent as the child having experienced bullying victimization.

2.2.4. Confounding variables

Low household income (Agerbo et al., 2015), parental history of psychotic disorder (Rasic et al., 2014), child’s intelligence quotient (IQ) (Horwood et al., 2008), and child’s attention deficit hyperactivity disorder (ADHD) symptoms (Hennig et al., 2017) were all considered confounding variables, having been shown to be related to PEs in previous studies. Data collected at age 10 was used for these variables. ADHD symptoms were measured via the ‘hyperactivity/inattention’ subscale of the parent-rated Strengths and Difficulties Questionnaire (Goodman, 1997). Each of the five items is scored on a 3-point Likert scale: ‘Not true’ = 0, ‘Sometimes true’ = 1 and ‘Definitely true’ = 2. Overall scores ranged from 0 to 10. IQ was measured using two subscales (information and picture completion) of the Wechsler Intelligence Scale for Children-Third Edition (WISC-III) (Wechsler, 1991). TTC gathered annual household income and maternal history of antipsychotic medicine usage among broader demographic information.

2.3. Statistical analyses

Associations between each of the three main variables—ATs at age 12, bullying at age 12, and PEs at age 14—were tested using cross-tabulation and chi-square tests. Next, structural equation modeling was used to calculate unstandardized and standardized path coefficients in a saturated mediation model of ATs predicting PEs mediated by bullying. The indirect effect of ATs on PEs via bullying was calculated by multiplying the direct path coefficients between a) ATs and bullying, and b) bullying and PEs, and the Monte Carlo method for assessing mediation (MacKinnon et al., 2004) was used to estimate confidence intervals. Finally, the Sobel test (Sobel, 1982) was used to confirm the presence of an indirect effect. Significance values were set to $0.05$ for all statistical analyses. We adopted a full information maximum likelihood estimation procedure to handle missing data (Cham et al., 2017) under the assumption of missing at random. All analyses were performed using
3. Results

Participants’ demographic information and descriptive statistics are shown in Table 1. Approximately one-sixth (15.7%) of participants reported “definitely” having experienced at least one psychotic experience at T3. A total of 8.1% of participants had scores indicating high levels of ATs at T2, with boys almost twice as likely to score high compared to girls (10.1% vs. 5.5%; $\chi^2 = 21.5, p < 0.001$). Among all, 16.2% of participants had experienced bullying within the previous 2 months at T2 (as reported by either the parent or child, or both). Children scoring high on ATs were almost twice as likely to have experienced bullying compared with those scoring below threshold (29.4% vs. 15.1%; $\chi^2 = 27.6, p < 0.001$). Children who were bullied were more likely to rate at least one item as “maybe” or “definitely” present on the APSS at T3 compared with those who had not experienced bullying (43.2% vs. 31.1%; $\chi^2 = 13.7, p < 0.001$); when considering only those who reported at least one item as “definitely” present, the difference was even greater (24.5% vs. 14.6%; $\chi^2 = 17.5, p < 0.001$). No difference was found in the frequency of at least one APSS item being rated positively between children with high levels of ATs and those without ($\chi^2 = 0.514, p = 0.473$).

Fig. 1 shows the tested path model and the direct effect coefficients between the variables. All analyses were controlled for the confounding variables of sex, IQ, ADHD symptoms, low household income, and history of maternal antipsychotic medicine usage. We found associations between ATs and bullying ($\beta = 0.126, p < 0.001$) and between bullying and PEs ($\beta = 0.263, p < 0.001$), indicating an indirect effect of ATs on PEs. Using the Monte Carlo method with 20,000 repetitions to estimate confidence intervals suggested the presence of a modest indirect effect of ATs on PEs via bullying (estimated indirect effect $= 0.033$ (95% CIs: 0.014–0.057), $p < 0.001$). The Sobel test was conducted (Sobel test statistic $= 3.40, p < 0.001$), which further supported the presence of this indirect effect. There was no evidence of a direct or total effect of ATs on PEs (estimated direct effect $= -0.038, p = 0.589$; estimated total effect $= -0.006, p = 0.928$).

4. Discussion

We observed an indirect effect between autistic traits and psychotic experiences via bullying victimization, consistent with our hypothesis.

While there is no shortage of literature documenting the deleterious effects of bullying victimization on the mental health of general population adolescents (Evens-Lacko et al., 2017; Moore et al., 2017; Ttofi et al., 2011), as well as specifically within autistic youth (Hoover and Kaufman, 2018), this study is the first to identify bullying as an indirect pathway for increased PE likelihood in general population adolescents with high ATs.

Multiple individual, social, and environmental factors explain why autistic youth are more likely to be victims of bullying, including lack of social support (Bauminger et al., 2003; Cappadocia et al., 2012; Humphrey and Symes, 2010), difficulties in understanding and communicating in social situations (Cappadocia et al., 2012; Sterzing et al., 2012), heightened anger responses provoking bullies to repeatedly perpetrate (Novin et al., 2019; Rieffe et al., 2012), and inadequate inclusion policies and practices in many mainstream school environments (Symes and Humphrey, 2012; Zablotsky et al., 2014) (see Humphrey & Hebron's extensive work (Humphrey and Hebron, 2015) for thorough discussion of the etiology of bullying victimization within autism). Subsequently, bullying victimization increases the risk of PEs through mechanisms such as a) development of negative beliefs about oneself and the world; b) heightened suspicion of, and vigilance against, hostility from others; and c) social isolation, leaving bullying victims with unusual experiences “unchecked” by peers (Catone et al., 2017; van Dam et al., 2012; Wolke et al., 2014). These mechanisms may be amplified in autistic youth, who may already have greater difficulties maintaining close friendships (Mendelson et al., 2016). Future research on specific elements in this pathway is necessary to understand how the effects of such mechanisms may differ within this vulnerable group.

We echo the calls of other researchers to routinely screen for bullying early in the clinical assessment of children and adolescents with high ATs. Further, we recommend that schools give particular consideration to autistic youth when implementing anti-bullying strategies, and to regularly update and revise their wider inclusion policies and practices (Bond and Hebron, 2016), learning from schools which have noted successes in creating inclusive environments (Morewood et al., 2012), to ensure that autistic youth in mainstream education are adequately supported.

The present study has a strong advantage in that it used a large longitudinal dataset, which provided good statistical power and allowed us to make inferences about causal direction. However, we should note several limitations of our findings. First, due to the AQ-10’s child age requirements (12–15), ATs were measured only during wave 2 of TTC, and the APSS was administered only during wave 3. This precluded us from controlling or testing for reverse associations between ATs, bullying and PEs. ATs tend to emerge in early childhood (Georgiades et al., 2012; Ozonoff et al., 2014) and show stability across important developmental periods (Haraguchi et al., 2019; Robinson et al., 2011), which may substantially offset this limitation. Nonetheless, reverse-causality was not precluded by our study design. Datasets with data from all measures at multiple time points could be analyzed using cross-lagged or latent growth curve models, providing a clearer picture of any reverse causation and controlling for auto-regressive effects. Second, using conventional indirect effect size thresholds (Preacher and Kelley,
2011) our model's indirect effect size confidence interval (95% CI: 0.014–0.057) was just above the threshold for 'small' (0.01). Moreover, our finding of a positive indirect effect via bullying simultaneously with no total effect between ATs and PEs suggests the existence of counter-weighting negative indirect effects ('suppression') in our sample (MacKinnon et al., 2000). While bullying victimization is one factor increasing risk in the AT-PEs pathway, it is likely one of many such factors. Further research incorporating multiple mediating variables is recommended to better understand factors predicting mental ill-health in general population youth across the autism spectrum.

In conclusion, autistic traits increase risk of being bullied in adolescence, which subsequently increases risk of psychotic experiences. As such, effective bullying prevention strategies may be one avenue by which risk of later mental ill-health can be reduced for this vulnerable group. Yet, contrary to previous research we found no overall effect of ATs on PE likelihood. Further studies investigating other possible pathways between autistic traits and psychotic experiences are recommended to better understand this complex association.

CRediT authorship contribution statement

Daniel Stanyon: Conceptualization, Data curation, Formal analysis, Writing – original draft. Syudo Yamasaki: Conceptualization, Data curation, Formal analysis, Writing – original draft. Shuntaro Ando: Data curation, Writing – review & editing. Kaori Endo: Data curation, Writing – review & editing. Miharu Nakashishi: Writing – review & editing. Tomoki Kiyono: Writing – review & editing. Mariko Hosoza: Writing – review & editing. Sho Kanata: Data curation, Writing – review & editing. Shinya Fujikawa: Data curation, Writing – review & editing. Yuko Morimoto: Data curation, Writing – review & editing. Mariko Hiriwa-Hasegawa: Writing – review & editing. Kiyoto Kasai: Writing – review & editing. Atsushi Nishida: Conceptualization, Data curation, Formal analysis, Writing – original draft.

Declaration of competing interest

None.

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