Psychotic experiences predict subsequent loneliness among adolescents: A population-based birth cohort study

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Abstract

Background: Cross-sectional studies have suggested that the occurrence of psychotic experiences is associated with loneliness in the general adolescent population. However, there has been a scarcity of prospective longitudinal studies on this topic.

Methods: We investigated the longitudinal association between the presence of psychotic experiences and loneliness among adolescents using data from a population-based birth cohort study (Tokyo Teen Cohort; N = 3171). Psychotic experiences and loneliness were assessed at three timepoints with two-year intervals through early adolescence (age 10, 12, and 14).

Results: After adjusting for demographic characteristics and potential confounding factors, linear regression analyses showed a significant longitudinal association between psychotic experiences and subsequent loneliness (for age 10 to 12: B = 0.041, 95% CI: 0.009–0.074, p = .013; for age 12 to 14: B = 0.061, 95% CI: 0.026–0.096, p = .001). The reverse association, between preceding loneliness and later psychotic experiences, was not significant (for age 10 to 12: B = 0.003, 95% CI: −0.052–0.057, p = .926; for age 12 to 14: B = −0.028, 95% CI: −0.088–0.032, p = .355).

Discussion: Loneliness could be a sign of underlying psychotic experiences among adolescents but does not appear to be antecedent to these symptoms. Clinicians and teachers should assess for the presence of psychotic experiences in young adolescents who report loneliness. Future studies capturing PEIs and loneliness at narrower time intervals, and including other potential mediators and confounders, may be insightful.

1. Introduction

Psychotic experiences are subtle sub-clinical hallucinations and delusions that are common in the general adolescent population (Yung et al., 2009; Armando et al., 2010; Nishida et al., 2010; Mackie et al., 2011), but can be a risk factor for the onset of psychotic disorders (Yung et al., 2006; Mackie et al., 2011) as well as suicidal behavior (Nishida et al., 2010; Kelleher et al., 2013; Yates et al., 2019) and poor functional outcomes (Koyanagi et al., 2016; Healy et al., 2018). Psychotic disorders, including schizophrenia, are among the top 20 leading contributors to years lived with disability globally (GBD, 2018), largely due to the young age at onset, severe burden of disability, and typically chronic
course of illness. Identification of demographic and clinical correlates of individuals who report psychotic experiences may provide insights into pathways that lead to clinical psychotic disorders.

There is an emerging interest in loneliness as a potential risk factor or functional consequence of psychosis (Narita et al., 2020). Loneliness is a subjective painful feeling of perceived isolation, independent of objective social isolation (Cacioppo et al., 2014). Recent meta-analyses revealed that loneliness was significantly associated with the presence of psychotic experiences in the general population (Chau et al., 2019) as well as psychotic symptoms in people diagnosed with a psychotic disorder (Michalska da Rocha et al., 2018). However, these associations were based on cross-sectional observations, which could not be used to determine whether adolescents were more likely to first report loneliness or psychotic experiences. Understanding these longitudinal associations can help clarify whether loneliness is more likely to be an etiological mechanism or psychosocial consequence of psychotic experiences among adolescents.

In this study, we aimed to investigate the longitudinal association between psychotic experiences and loneliness among adolescents using data from three waves of the Tokyo Teen Cohort study, a population-based birth cohort study in Japan.

2. Material and methods

2.1. Study design, sample, and survey procedure

This study used data from a population-based birth cohort study (Tokyo Teen Cohort: TTC), which is currently ongoing (URL: http://ttcp.umin.jp/index.html). The TTC is a multidisciplinary survey of adolescents when they were 10, 12, and 14 years old, aimed at investigating adolescent health and development (Ando et al., 2019). We randomly sampled 3171 households with 10-year-old early adolescents by using the basic resident register in three municipalities: Setagaya, Mitaka, and Chofu in Tokyo, Japan. Eligible residents were those born between September 2002 and August 2004. A survey of youth at age 10 was carried out between October 2012 and January 2015. When these children were 12 and 14 years old, respectively, 3007 households participated in the second wave of the study (follow-up rate: 94.8%), and 2667 households participated in the third wave of the study (follow-up rate: 84.1%), respectively. We sent letters of invitation to participants around their birthday of the target age at each wave. A trained interviewer then visited their homes and the survey was completed over two visits at each wave. The TTC is based at three research institutes: the Tokyo Metropolitan Institute of Medical Science, The University of Tokyo, and SOKENDAI (The Graduate University for Advanced Studies). This survey was approved by the ethics committees of the above three institutes.

2.2. Measurements

2.2.1. Psychotic experiences

Adolescents’ current self-reported psychotic experiences were assessed by items derived from the schizophrenia section of the Diagnostic Interview Schedule for Children (Costello et al., 1985), with an added question on visual hallucinations. Psychotic experiences were assessed by the following five items: (i) auditory hallucinations (Have you ever heard voices that other people cannot hear?), (ii) persecutory thoughts (Have you ever thought that other people are following you or spying on you?), (iii) visual hallucinations (Have you ever seen things that other people could not see?), (iv) thought broadcasting (Have other people ever read your thoughts?), and (v) special messages (Have you ever had messages sent especially to you through television or radio?). The three possible responses were “Yes, definitely,” “Maybe,” and “No, never.” The response of “Yes, definitely” was regarded as the presence of psychotic experiences (scored as 1), and “Maybe” and “No, never” were regarded as the absence of psychotic experiences (scored as 0). A Japanese version of the scale was developed using the translation and back-translation method, and has been applied in previous studies conducted in Japan (Nishida et al., 2014; Yamasaki et al., 2019). Responses from the five experiences were summed as the composite score of psychotic experiences. This score ranged from 0 to 5 and was categorized into four groups: none (0), one (1), two (2), and three or more (3). Higher scores reflected more psychotic experiences.

2.2.2. Loneliness

Adolescent’s self-reported loneliness in the past two weeks was assessed by the question, “I felt lonely” which was from the Short Mood and Feelings Questionnaire (Kuo et al., 2005). The three possible responses were “not true” (0), “sometimes” (1), and “true” (2). Higher scores reflected more loneliness.

2.2.3. Covariates

Adolescent ages in months were calculated at all time points by birth date and survey date. Adolescent sex was confirmed at the baseline survey. Annual household income was reported by a primary caregiver when adolescents were aged 10 and 12 years. Adolescent’s self-reported bullying-victims experience was assessed at ages 10 and 12 by a question, “How often have you been bullied at school in the past couple of months?” The definition of bullying provided in the questionnaires was as follows: “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 that 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). The five possible responses were “never,” “once or twice in two months,” “two or three times a month,” “once a week,” and “several times a week.” All answers other than “never” (scored as 0) were interpreted as being bullied (scored as 1). The primary caregiver’s self-reported harsh parenting was assessed at ages 10 and 12 by a question, “Do you slap your child as a means of discipline?” Four possible responses were “rarely” (0), “sometimes” (1), “often” (2), and “always” (3). Higher scores reflected more harsh parenting. Adolescent’s common difficulties were rated at ages 10 and 12 by the primary caregiver with the Japanese version of the Strength and Difficulties Questionnaire (SDQ) (Matsuishi et al., 2008), a widely used parent-reported questionnaire developed to evaluate behavioral conditions of children and adolescents (Goodman, 1997). The SDQ has four difficulty subscales (hyperactivity-inattention, emotional symptoms, conduct problems, and peer relationship problems), and each of the subscales has five questions answered on a 3-point Likert scale (0: not true, 1: somewhat true, 2: absolutely true). The scores are summed for each subscale, so that each has a possible score from 0 to 10. The total difficulty score is calculated by summing the four difficulty subscales, with higher scores reflecting more difficulties.

2.3. Analyses

Multiple linear regression analyses were conducted to evaluate the longitudinal associations between loneliness and later psychotic experiences. We conducted a regression analysis with preceding loneliness at age 10 as a predictor and psychotic experiences at age 12 as an outcome, adjusting for sociodemographic factors and other confounders (bullying-victim experience, harsh parenting, and total difficulties score from Strength and Difficulties Questionnaire). We also conducted a regression analysis with preceding psychotic experiences at age 10 and later loneliness at age 12. These two analyses were replicated with a longitudinal dataset of ages 12 and 14. 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 Mplus 8.3.
3. Results

As stated above, 164 and 504 baseline participants did not participate at age 12 and 14 respectively, thus drop-out rate were 5.2% at age 12 and 15.9% at age 14. Among participants those who did participate at age 10, 35 cases were missing for loneliness, and 114 cases were missing for psychotic experiences. At age 12, the missing cases were 487 for loneliness and 526 for psychotic experiences, while at age 14, these numbers were 606 and 619 respectively. The prevalence of loneliness and psychotic experiences at each time point (ages 10, 12, and 14) are shown in Table 1. Among the 3171 adolescents, 1684 (53.1%) were boys. The mean and standard deviation (SD) for age in months at age 10 was 122.1 (SD = 3.30; N = 3167). For annual household income, most participants were in the category of 6–9.99 million yen (age 10: 40.2% [1224 / 3046]; age 12: 38.0% [1032 / 2718]). The percentage of bullied participants were in the category of 6

Table 1. Repeated-measures analyses of variance (ANOVAS) excluding participants with any missing data were conducted to confirm the decreasing trends of loneliness and psychotic experiences with age and significant for both variables (Loneliness: F (1, 1854) = 47.92, p < 0.001; Psychotic experiences: F (1, 1777) = 700.74, p < 0.001); Friedman’s nonparametric tests showed similar results (Loneliness: $\chi^2$ = 56.170, p < 0.001, Psychotic experiences: $\chi^2$ = 103.983, p < 0.001). The prevalence of loneliness at baseline (age 10) among excluded participants due to drop out and missing values at follow-up (age 12 and 14) did not significantly differ from that among the analyzed group ($\chi^2$ = 1.641, p = 0.650). Similarly, no difference was found for prevalence of psychotic experiences ($\chi^2$ = 4.066, p = 0.131).

The results of the linear regression analysis for loneliness and psychotic experiences are shown in Table 2. The model that adjusted for demographic variables and potential confounders (Model 1) showed that loneliness at age 10 was significantly associated with later psychotic experiences at age 12, although this was no longer significant in the model with further adjustment for antecedent psychotic experiences (Model 2). From age 12 to 14, preceding loneliness was not significantly associated with later psychotic experiences in either model. On the other hand, psychotic experiences were significantly associated with later loneliness in both models 1 and 2, both from age 10 to 12, and from age 12 to 14, preceding (Table 2). We confirmed similar results in the logistic regression analyses (Supple Table 2).

4. Discussion

This is the first study, to the best of our knowledge, to investigate the bi-directional longitudinal associations between presence of psychotic experiences and loneliness among a general adolescent population. Our results revealed that adolescents who had reported psychotic experiences were more likely to self-report loneliness two years later, both from age 10 to 12 and again from age 12 to 14. In contrast, the longitudinal associations between loneliness and subsequent psychotic experiences were not significant. These findings expand on previous cross-sectional data by showing that the temporal order of psychotic experiences and loneliness is consistent with psychotic experiences as potential contributing causes (or, at least, risk indicators) of subsequent loneliness, but are not consistent with loneliness being a causal risk factor for subsequent psychosis.

Feelings of shame among adolescents who are confronted with psychotic experiences may bridge the path from psychotic experiences to loneliness. One survey indicated that symptom-related shame (“About my symptoms and experiences, I have felt ashamed”) was common among clinical adolescent populations at high risk for psychosis (Vanulait et al., 2012; Yang et al., 2015). Such feelings of shame may involve the self-perception of being different from other adolescents who do not appear to have psychotic experiences, which in turn evolves into peer-related loneliness. While we adjusted for exposure to bullying and harsh parenting, we also cannot rule out the possibility that the association between psychotic experiences and loneliness is driven by other shared socioeconomic or biological risk factors.

The prevalence of psychotic experiences in participating adolescents was 15–27% and declined over time. These rates are similar to those found in other community studies (Yung et al., 2009; Nishida et al., 2010; Mackie et al., 2011), confirming that psychotic experiences are common in the general adolescent population. However, school teachers may be less likely to be aware of psychotic experiences in students, compared to other psychological distress such as anxiety and depression (Nugent et al., 2013). Although adolescent loneliness has received attention as a target of interventions (Cacioppo and Cacioppo, 2018), there may be a risk of underestimation of background pathology, including psychotic experiences, of perceived loneliness in school settings. The possible presence of psychotic experiences should be assessed by clinicians and school teachers working with adolescents who report loneliness, particularly given well-established associations between psychotic experiences and suicidal behavior (Nishida et al., 2010; Keller et al., 2013; Yates et al., 2019) and functional outcomes (Koyanagi et al., 2016; Healy et al., 2018).

The main strength of this study lies in its prospective longitudinal design with three assessments during adolescence. That we could adjust for confounding factors, including sociodemographic characteristics, adverse experiences, and common difficulties, was also a strength. On the other hand, there were some potential limitations. We asked about the presence of psychotic experiences that included hallucinations and delusions, but not negative symptoms, which could potentially mediate the association between positive psychotic experiences and subsequent loneliness. Further, loneliness was assessed using a single item, although single item measures are typical of large cohort studies. More detailed assessment, including both positive and negative symptoms, would
elucidate the mechanisms of how and when psychotic experiences and loneliness develop in adolescence. This study does not necessarily deny the possibility of the other temporal direction, that is, from loneliness to psychotic experiences. If the cause and effect can happen within a period shorter than two years, this study may have missed it. Future research with narrower time intervals may discover the significant paths for both directions. Finally, to uncover underlying mechanisms, future studies controlling variables such as depression, anxiety, academic performance, personality traits, substance use, family history, childhood trauma measured at several timepoints may be insightful.

5. Conclusions

In conclusion, our study revealed that psychotic experiences may lead adolescents to feel lonely. The reverse association between loneliness and later psychotic experiences was non-significant, suggesting that subjective loneliness may not contribute directly to psychosis etiology. Clinicians and school teachers should assess for, and pay careful attention to, the presence of any psychotic experiences in early adolescents who report loneliness.

CRediT authorship contribution statement

Endo: Conceptualization, Data curation, Formal analysis, Writing - original draft. Syudo Yamasaki: Conceptualization, Data curation, Formal analysis, Writing - original draft. Miharu Nakahara: Conceptualization, Formal analysis, Writing - original draft. Jordan DeVylder: Writing - review & editing. Satoshi Usami: Formal analysis. Yuko Morimoto: Data curation. Daniel Stanyon: Writing - review & editing. Kazuhiro Suzuki: Writing - review & editing. Mitsuhiro Miyashita: Writing - review & editing. Makoto Arai: Writing - review & editing. Shinya Fujikawa: Data curation. Sho Kanata: Data curation. Shuntaro Ando: Data curation, Writing - review & editing. Mariko Hiraisha-Hasegawa: Writing - review & editing. Kiyoto Kasai: Writing - review & editing. Atsushi Nishida: Conceptualization, Data curation, Formal analysis, Writing - original draft.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2021.11.031.

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Table 2

The longitudinal association between loneliness and psychotic experiences by multiple linear regression analysis.

| From loneliness to psychotic experiences | B | 95% CI | p   |
|-----------------------------------------|---|--------|-----|
| From age 10 to 12                       |   |        |     |
| Model 1                                 | 0.073 | 0.015 | 0.131 | 0.013 | * |
| Model 2                                 | 0.003 | –0.052 | 0.057 | 0.926 |   |
| From age 12 to 14                       |   |        |     |
| Model 1                                 | 0.011 | –0.052 | 0.073 | 0.740 |   |
| Model 2                                 | –0.028 | –0.088 | 0.032 | 0.355 |   |

| From psychotic experiences to loneliness | B | 95% CI | p   |
|-----------------------------------------|---|--------|-----|
| From age 10 to 12                       |   |        |     |
| Model 1                                 | 0.064 | 0.033 | 0.096 | 0.001 | *** |
| Model 2                                 | 0.041 | 0.009 | 0.074 | 0.013 | * |
| From age 12 to 14                       |   |        |     |
| Model 1                                 | 0.072 | 0.035 | 0.109 | 0.001 | *** |
| Model 2                                 | 0.061 | 0.026 | 0.096 | 0.001 | ** |

Model 1: Adjusted for demographic variables (sex, age in month, and household income) and potential confounding factors (bullying-victim experience, harsh parenting, and total difficulties score from Strengths and Difficulties Questionnaire).

Model 2: Adjusted for all the above and outcome (psychotic experiences or loneliness) at previous time points (age 10 or age 12).

CI: confidence interval.

p < .05.

p < .01.

p < .001.
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