



Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: [www.elsevier.com/locate/schres](http://www.elsevier.com/locate/schres)

## The association between changes in depression/anxiety and trajectories of psychotic-like experiences over a year in adolescence

Syudo Yamasaki<sup>a</sup>, Satoshi Usami<sup>b</sup>, Ryo Sasaki<sup>c</sup>, Shinsuke Koike<sup>d</sup>, Shuntaro Ando<sup>a,e</sup>, Yuko Kitagawa<sup>f</sup>, Misato Matamura<sup>f</sup>, Masako Fukushima<sup>g</sup>, Hiromi Yonehara<sup>g</sup>, Jerome Clifford Foo<sup>f,h</sup>, Atsushi Nishida<sup>a</sup>, Tsukasa Sasaki<sup>f,\*</sup>

<sup>a</sup> Department of Psychiatry and Behavioral Science, Tokyo Metropolitan Institute of Medical Science, 2-1-6 Kamikitazawa, Setagaya-ku, Tokyo 156-8506, Japan

<sup>b</sup> Department of Psychology, University of Tsukuba, Tennodai, Tsukuba, Ibaraki 305-8572, Japan

<sup>c</sup> School of Medicine, Yokohama City University, 3-9 Fukuura, Kanazawa-ku, Yokohama, Kanagawa 236-0004, Japan

<sup>d</sup> University of Tokyo Institute for Diversity & Adaptation of Human Mind (UTIDAHM), The University of Tokyo, 3-8-1 Komaba, Meguro-ku, Tokyo 153-8902, Japan

<sup>e</sup> Department of Neuropsychiatry, Graduate School of Medicine, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

<sup>f</sup> Department of Physical and Health Education, Graduate School of Education, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

<sup>g</sup> The University of Tokyo Secondary School attached to the Faculty of Education, Minamidai, Nakano-ku, Tokyo 164-8654, Japan

<sup>h</sup> Department of Genetic Epidemiology in Psychiatry, Central Institute of Mental Health, Medical Faculty Mannheim, Heidelberg University, J5, 68159 Mannheim, Germany

### ARTICLE INFO

#### Article history:

Received 19 August 2016

Received in revised form 3 August 2017

Accepted 9 October 2017

Available online xxxx

#### Keywords:

Psychotic-like experiences

Trajectories

Adolescence

Depression

Anxiety

### ABSTRACT

**Background:** Recent cross-sectional studies suggest that psychotic-like experiences (PLEs) are associated with depression and anxiety in adolescents. While longitudinal studies have observed that adolescents suffer more severe symptoms of depression/anxiety when PLEs persist, it remains unclear whether depression/anxiety worsens or improves with PLE emergence or remission, respectively. In this prospective school-based study, we investigated the association between longitudinal changes in depression/anxiety and one-year PLE trajectories in adolescence.

**Methods:** Nine hundred and twelve adolescents participated in the baseline assessment of PLEs and depression/anxiety; 887 (97.3%) adolescents completed the follow-up assessment one year later. Multilevel analysis was conducted to evaluate the change in depression/anxiety, evaluated using the General Health Questionnaire-12 (GHQ-12), during the year according to PLE trajectory, adjusting for baseline depression/anxiety, gender, age, substance use and victimization.

**Results:** Sixteen percent of adolescents reported PLEs at baseline, with 56% of them remitting at follow-up. At follow-up, PLEs were experienced by 6.6% of adolescents not experiencing PLEs at baseline (incident PLE group). After adjusting for covariates, GHQ-12 score worsened significantly during the year in students with incident trajectories (regression coefficient for time,  $\alpha_1 = 1.91$ , 95% CI: 1.04–2.77), but in those showing remission, GHQ-12 score did not significantly improve ( $\alpha_1 = -0.20$ , 95% CI:  $-0.97$ – $0.56$ ).

**Conclusions:** Greater awareness about PLEs and their trajectories in school health care settings may be a key towards the prevention and treatment of adolescent depression and anxiety.

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### 1. Introduction

Psychotic-like experiences (PLEs), hallucinatory experiences and delusional thoughts, are relatively common in the general population (around 5%) (van Os et al., 2009), and more prevalent in childhood and adolescence. According to a recent meta-analysis (Kelleher et al., 2012), the prevalence of PLEs is 7.5% in adolescents aged 13–18. Recent studies also demonstrate that PLEs may remit after one or two years in

over half of adolescents who experienced PLEs (Dominguez et al., 2011; Downs et al., 2013; Thapar et al., 2012).

It is thought that experiencing PLEs increases the risk of having depression/anxiety in adolescents (Chapman et al., 1994; Dhossche et al., 2002; Verdoux et al., 1999). Depression/anxiety are recognised as common mental disorders and are frequent in the adolescent phase (Patton et al., 2014). Cross-sectional studies have shown that adolescents who experienced PLEs were at 4 to 6-fold greater risk of having depression and anxiety symptoms than those never experiencing PLEs (Nishida et al., 2008; Scott et al., 2009; Varghese et al., 2011). Longitudinal studies have expanded these findings, revealing that depression/anxiety symptoms at 1–2 years follow-up become more severe in adolescents when

\* Corresponding author.

E-mail address: [sasaki@p.u-tokyo.ac.jp](mailto:sasaki@p.u-tokyo.ac.jp) (T. Sasaki).

PLEs persist (De Loore et al., 2011; Downs et al., 2013; Mackie et al., 2011; Wigman et al., 2011b).

However, it remains unclear whether depression/anxiety symptoms change when PLEs emerge or remit. Several longitudinal studies have thus far investigated the relationship between the level of depression/anxiety and PLE trajectories in adolescents (De Loore et al., 2011; Downs et al., 2013; Mackie et al., 2011; Wigman et al., 2011b), finding that depression/anxiety became more severe when PLEs persist than when PLEs remitted or did not emerge. However, interpretation of these results is made difficult by issues like low retention rate (Mackie et al., 2011), differing or inconsistent time courses of surveys in participants (De Loore et al., 2011; Downs et al., 2013; Wigman et al., 2011b), and the investigation of PLE remission without examining emergence (De Loore et al., 2011; Downs et al., 2013). Low retention rates may lead to biased estimates due to high amounts of missing data. In addition, considerable variation in timing of the follow-up period in each study could make the precise evaluation of symptom changes challenging; results of the analysis may be unstable, leading to insufficient generalizability. Analysis of data from a cohort with high retention rate, with fewer variations of follow-up period, and with adequate information of changes of PLE (no PLEs, remission, emergence and persistence) is expected to more accurately evaluate relationships between PLE trajectories and changes in depression/anxiety.

As such, in this study, we aimed to examine the relationships between changes in depression/anxiety symptoms and PLE trajectories in adolescence. Specifically, in school-based samples, we investigated whether depression/anxiety worsened or improved when PLEs emerged or remitted, respectively. Follow-up assessments were carried out after exactly one year in all participants, resulting in a high retention rate (97%). Four groups of PLE trajectories were determined according to the method used in a previous study (Downs et al., 2013): (i) no PLEs (adolescents who did not report PLEs at either baseline or follow-up), (ii) remission (adolescents who reported PLEs at baseline but not at follow-up), (iii) incidence (adolescents who did not report PLEs at baseline, but reported at follow-up), and (iv) persistence (adolescents who reported PLEs at both baseline and follow-up). Covariates including substance use and victimization, which are thought to be associated with PLEs and depression/anxiety (Linscott and van Os, 2013), were adjusted for in the analysis for the evaluation of changes in depression/anxiety and PLE trajectories.

## 2. Methods

### 2.1. Participants

We used data from a longitudinal survey of mental health status conducted between 2009 and 2013 in a combined junior and senior high school (grades 7–12; ages 12–18) in Tokyo, Japan. Every year, the school recruits and enrolls 120 seventh grade students who pass the entrance examinations; no students enrol in the school after grade 7. There are always approximately 720 (120 per grade) students enrolled, and the survey was conducted every year for five years. During the five-year period, out of the 943 students who were eligible to participate in two consecutive years, 912 students (96.7%) consented to participate (455 males and 457 females) in the study. After it was discussed and approved by the research committee of the high school, the study was approved by the ethics committee of the Graduate School of Education at the University of Tokyo. Written information about the aims, methods and voluntary nature of the study was sent to all parents of the participating students.

### 2.2. Procedure

Participants answered questionnaires at baseline (T0) and at a one-year follow up (T1). It was clearly written in the information given to parents that participation was voluntary and that if the students or

parents did not wish to participate (for their children to participate), they were under no obligation to do so. On the day of the survey, school teachers distributed the questionnaires with envelopes to students and explained that answers would not be seen by school teachers. Any students who did not want to participate were allowed to leave the classroom or turn in a blank questionnaire. The students who consented to participate were asked to fill in their school ID numbers, but not their names. Students were instructed to seal the questionnaires in the envelopes upon completion. Students took around 20 min to complete the questionnaire. They were not paid for their participation. The researchers did not know any students' school ID numbers, and therefore answers could be analysed anonymously but still be used for longitudinal follow-ups.

### 2.3. Questionnaires

Questionnaires assessed PLEs and symptoms of depression and anxiety. The questionnaires used were the same as in our previous studies (Matamura et al., 2014; Nishida et al., 2010; Nishida et al., 2008; Oshima et al., 2010).

#### 2.3.1. Psychotic-like experiences (PLEs)

PLEs, including auditory hallucinations and delusional ideations, were assessed by items derived from the schizophrenia section of the Diagnostic Interview Schedule for Children (DISC-C) (Costello et al., 1985). A Japanese version of the DISC-C was developed using a translation and back translation method and has already been used in several previous studies conducted in Japan (Nishida et al., 2010; Nishida et al., 2014; Nishida et al., 2008; Oshima et al., 2010; Watanabe et al., 2012). PLEs were assessed through the following four items: (i) 'Have you ever heard voices that other people cannot hear?' (heard voices); (ii) 'Some people believe that their thoughts can be read. Have other people ever read your thoughts?' (thoughts read); (iii) 'Have you ever had messages sent especially to you through the television or radio?' (special messages); and (iv) 'Have you ever thought that people are following you or spying on you?' (spied-upon). All answers were given on a four-point scale: 'no', 'maybe', 'yes, once', and 'yes, twice or more'. We defined students who answered 'yes, once' or 'yes, twice or more' to any of the four PLE items as those who had experienced PLEs. Four groups of PLE trajectories were determined using the assessment results from T0 and T1 according to the method used in a previous study (Downs et al., 2013): (i) no PLEs (adolescents who did not report PLEs at either T0 and T1), (ii) remission (adolescents who reported at least one PLE at T0, but none at T1), (iii) incidence (adolescents who did not report PLEs at T0, but reported at least one PLE at T1), and (iv) persistence (adolescents who reported at least one PLE at both T0 and T1).

#### 2.3.2. Symptoms of depression and anxiety

The 12-item version of the General Health Questionnaire (GHQ-12) is one of the most widely used self-report measures for assessing depression and anxiety symptoms (e.g. for depression, "Have you recently been feeling unhappy and depressed?"; and for anxiety, "Have you recently been lost much sleep over worry?"). The GHQ-12 has been found to be highly correlated with depression and anxiety symptoms evaluated by interview in community samples (Goldberg and Blackwell, 1970; Goldberg et al., 1976) and over half of GHQ-12 items show sufficiently high factor loadings for depression or anxiety (Kihç et al., 1997). It has been validated among young people as well as among adults, and the validity and reliability of the Japanese version of the instrument has been established (Doi and Minowa, 2003). This assessment uses a four-point Likert scale (0-1-2-3) with binary item scoring, where two responses (0: Not at all, 1: Same as usual) are given scores of 0, and two responses (2: Rather more than usual, 3: Much more than usual) are given scores of 1 [0-0-1-1]. Individual item scores are summed to form a total score ranging from 0 (best possible score) to 12 (worst possible score).

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