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Longitudinal Trajectories of Psychotic-Like Experiences and Their Relationship to Emergent Mental Disorders Among Adolescents: A 3-Year Cohort Study

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ABSTRACT

Background: Psychotic-like experiences (PLEs) may be important antecedents of psychosis and other mental disorders.

Objective: To investigate distinct longitudinal trajectories of the frequency of PLEs and their relationship to subsequent development of mental disorders.

Methods: A longitudinal study of self-reported PLEs and concurrent traumatic experiences was conducted among 6,198 adolescents through annual classroom assessments over 3 years (2014–2016) using the Community Assessment of Psychotic Experiences and the Trauma History Questionnaire. Diagnoses of mental disorders were based on the Mini-International Neuropsychiatric Interview in the final year. Growth mixture modeling was used to identify distinct growth trajectories in the frequency of PLEs. Logistic regression was then used to explore relationships between different PLE trajectories and emergence of psychiatric disorders, taking account of sociodemographic characteristics and childhood antecedents.

Results: Two different PLE trajectories were identified, one characterized by stable low levels of PLE frequency and the other by progressively increasing PLE frequency. Transition to mental disorder occurred in 3.39% of the increasing-frequency group and 1.28% of the stable low-level group. The increasing-frequency group had a significantly higher risk of transition to any psychiatric disorder (OR = 2.7; 95% CI, 1.56–4.66), to a psychotic disorder (OR = 22.14; 95% CI, 2.30–213.25), and to a nonpsychotic psychiatric disorder (OR = 2.28; 95% CI, 1.27–4.10). Besides increasing PLEs (OR = 3.33; 95% CI, 1.55–7.19), other risk factors for any psychiatric disorder included childhood trauma (OR = 1.17; 95% CI, 1.01–1.36), family divorce (OR = 2.86; 95% CI, 1.24–6.61), and minority ethnicity (OR = 2.91; 95% CI, 1.18–7.20).

Conclusions: The pattern of increasing PLEs predominates in predicting emergent mental disorder, particularly psychosis, along with minority status, trauma, and family divorce, suggesting potential targets for preventive intervention.

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Psychotic-like experiences (PLEs) are positive symptoms of psychosis occurring in the absence of a full-blown psychiatric disorder.¹ PLEs are not uncommon in childhood and adolescence, with a prevalence of 17% among 9- to 12-year-olds and 7.5% among 13- to 18-year-olds.² Many studies have demonstrated that PLEs in adolescence represent an increased risk for developing subsequent psychosis,³ most often in the next 2 to 5 years.^{3,4} Risk factors for transition from PLEs to clinical psychosis include trauma, urbanicity, cannabis use, and high genetic risk (by family history) as well as characteristics of PLEs themselves, eg, their presence, severity, persistence, and associated distress.^{3,5} Although it has been suggested that differences in the longitudinal trajectory of PLEs may be associated with different levels of risk,⁶ previous longitudinal studies have been limited in sampling frequency and duration and thus have not successfully identified distinct developmental processes. Variability has also been identified in the types of psychiatric disorders that follow the appearance of PLEs, including both psychotic disorders⁷ and nonpsychotic disorders.⁸ While most studies have focused on the relationship of PLEs to psychotic disorders,⁵ further information is needed on their association with nonpsychotic disorders. Adolescence appears to be the critical developmental stage for the appearance of PLEs,⁸ accompanied, as it is, by the onset of puberty, many other neuromaturational changes, and, occasionally, psychosis itself.⁹ Additionally, it appears that psychotic disorders that emerge during late adolescence or early adulthood seem to have their first manifestation earlier in adolescence.¹⁰

To further clarify the process of transition from PLEs to diverse psychiatric disorders in adolescence, we conducted a 3-year

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Clinical Points

- Psychotic-like experiences (PLEs) are not rare phenomena, but the study of how PLEs develop has been limited.
- A trajectory with increasing PLEs among adolescents was significantly associated with the onset of psychiatric disorders, especially psychosis.
- Childhood traumatic experiences, divorced parents, and ethnic minority status also contributed to the risk for developing a psychiatric disorder.

longitudinal study of 6,198 Chinese adolescents to assess the longer-term trajectory of PLEs, the accompanying occurrence of traumatic experiences, and the eventual emergence of psychiatric disorders at the end of the 3-year period. While most of these phenomena are likely to be similar across national contexts, we also sought to examine several factors that are specific to China, including the prevalence of 1-child families and of “left-behind” children whose parents have migrated to other cities in search of work and who were unable to bring their children with them because they were ineligible for educational or health services. We thus sought to identify distinctive temporal patterns of PLEs and to explore the specific dynamic developmental process through which PLE trajectories are associated with subsequent psychotic and nonpsychotic disorders as well as additional risk factors for the transition.

METHODS

Participants

Students from 11 junior high schools in Hunan province were recruited using a random cluster method applied to schools in both the largely rural Xiangxi Region and the province’s largest city, the capital Changsha. Children with a history of psychiatric disorder were excluded on the basis of data available from questionnaires completed by school administrators and teachers.

Procedure

This longitudinal observational study assessed PLEs and traumatic experiences through questionnaires completed in the classroom setting annually over 3 years (2014–2016). Survey questionnaires were distributed to each student in their classrooms by research staff, with 1 investigator remaining to answer procedural questions. The questionnaires were sealed in an envelope immediately after completion and were kept entirely confidential. Students were assured that their responses would have no effect on their school evaluation. The survey took about 45 minutes and was repeated annually in school classrooms from September to October.

Sociodemographic information was also collected every year to identify changes in status. Confidential guidance was offered to families seeking assistance in accessing mental health care for students identified with mental problems.

In the third year, endpoint diagnoses were made by psychiatrists through clinical examinations using the Chinese version of the Mini-International Neuropsychiatric Interview (MINI).¹¹ These examinations were conducted on all high-risk participants after the last survey was completed. High-risk participants were identified through documented survey data (eg, history of any recent psychiatric condition), scores on standardized questionnaires (eg, score ≥ 3 for any specific item on the Community Assessment of Psychic Experiences [CAPE] in any of the 3 surveys), or problematic performance at school in the past 3 years through consulting with teachers in charge of classes; psychiatrists who conducted the final diagnostic interview were blinded to this information.

The study was approved by the Ethics Committees of The Second Xiangya Hospital of Central South University following the Declaration of Helsinki. All the participants and at least 1 parent or guardian gave written informed consent to participate in the study.

Measures

Sociodemographic data documented each participant’s age, sex, ethnicity, housing situation (at school or at home), residential status (urban or rural), sources of family income, single-child status, “left-behind” child status, parental marital status, parental death, family history of psychiatric disorders, and past history of recent psychiatric conditions among participants.

PLEs were assessed with the positive subscale of the CAPE (see Konings et al¹² and <http://cape42.homestead.com/index.html>). The self-report instrument measures PLEs on both a frequency scale (1 = never, 2 = sometimes, 3 = often, 4 = nearly always) and a distress scale (1 = not distressed, 2 = a bit distressed, 3 = quite distressed, 4 = very distressed). It includes 20 items derived from the Delusions Inventory (PDI-21).¹³ As some items are quite common, especially among children, or are redundant, representing similar symptoms, we selected 2 items reflecting hallucinatory experiences (HEs) and 6 items reflecting delusional experiences (DEs) for further analyses. The PLE score represents the total frequency score for 2 items reflecting hallucinatory experiences and 6 items reflecting delusional experiences (range, 8–32). Item selection was guided by previous research.¹⁴ Subjects were denoted as having frequent PLEs if they reported a frequency of “often” or “nearly always” on 1 or more of the 8 selected CAPE items.

In addition, the Trauma History Questionnaire (THQ)¹⁵ was administered, which is derived from the Traumatic Events Screening Inventory Child and Parent Report and includes 15 items. Each item is designed to assess a child’s lifetime history of traumatic events as well as the level of emotional impact of the trauma, both at the time of the event and currently. Respondents were thus asked to choose whether they have experienced a specific traumatic event (0 = no, 1 = yes) and to rate the strength of its impact using a number (from 0 = “not at all” to 4 = “extremely”), both at the time of the trauma and at the time of the current assessment.

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Table 1. Prevalence of PLEs Among All Participants Through 3 Years^a

PLE	First Year		Second Year		Third Year	
	≥1	Frequent	≥1	Frequent	≥1	Frequent
Delusion						
Delusion of reference	58.5	4.7	66.2	6.5	70.6	8.9
Delusion of persecution	29.7	2.2	34.0	3.3	35.8	4.4
Thought withdrawal	20.7	2.8	24.8	4.5	27.1	4.6
Thought insertion	25.6	3.6	29.8	5.0	33.4	5.8
Thought broadcasting	30.1	5.0	32.8	5.9	31.7	5.6
Feeling of being controlled	22.9	4.0	24.7	4.7	24.4	4.5
Any delusion	75.6	14.7	78.3	18.2	82.2	19.8
Hallucination						
Verbal auditory hallucinations	37.1	5.7	39.2	5.9	36.6	4.3
Visual hallucinations	18.9	2.2	21.7	3.1	23.5	3.3
Any hallucination	43.6	6.9	45.9	7.5	49.5	8.5
Any PLE	80.7	17.8	83.8	20.8	85.4	23.1

^aValues are shown as percentages.

Abbreviation: PLEs = psychotic-like experience.

Both the CAPE and THQ have been translated into Chinese and were validated specifically for this study. A pilot study¹⁶ prior to the formal research demonstrated good reliability and validity.

The Chinese version of the MINI¹¹ was used for the final diagnosis at the time of the third year assessment. It is a shorter version of the Schedules for Clinical Assessment in Neuropsychiatry based on *DSM-5*, which has shown excellent psychometric properties in a Chinese sample.¹¹

Statistical Analysis

Besides participants with psychiatric disorder at baseline, those who did not complete the 8 specific CAPE items or who were lost to follow-up during the 3 years were also excluded from analysis. The prevalence of PLEs, DEs, and HEs was calculated, as well as the reported frequency of each item. Growth mixture modeling (GMM) was then used to identify distinct growth trajectories for PLEs based on the total score of the 8 selected items measured by the CAPE frequency scale (range, 8–32). Fit indices used to identify the appropriate number of trajectory classes included the Akaike information criterion (AIC), the Bayesian information criterion (BIC), the adjusted Bayesian information criterion (aBIC), entropy, the *P* value of Lo-Mendell-Rubin likelihood ratio test (LMR), and a bootstrapped likelihood ratio test (BLRT).

Once the trajectory patterns were identified, bivariate comparisons of the subjects following each of the identified trajectories were conducted using *t* tests and χ^2 tests. PLE frequency scores, sociodemographic characteristics, and antecedent trauma experiences were compared. Multivariable logistic regression was then used to investigate the association of specific trajectory patterns with the presence of any endpoint 3-year psychiatric diagnoses from the MINI (as well as of both psychotic and nonpsychotic disorders), along with sociodemographic variables and antecedent trauma experiences as reflected by THQ scores. The final THQ score and sociodemographic characteristics used in the analysis were determined on the basis of survey results across all 3 years. Items were defined as positive if they were positive in any of the 3 annual surveys, an

acceptable procedure because of the consistency of PLE patterns.¹⁷

Odds ratios (ORs) and 95% CIs were calculated. A *P* value < .05 was used to identify statistically significant independent variables. GMM was conducted by Mplus 7.0 (Muthén and Muthén; Los Angeles, California). All of the other analyses were conducted using IBM SPSS Statistics version 19.0 (IBM; Armonk, New York).

Sample Size Estimation

Based on the prevalence of PLEs (7.5%) reported in a previous study,² and assuming a 25% attrition rate, a 2-sided type I error, and an α of .05, a sample of 5,000 subjects was determined to offer 80% power to detect a mean relative risk effect size of 1.42, assuming the incidence rate of mental disorders to be 4 per 100 person-years among those having psychotic experiences at the baseline.¹⁰

RESULTS

Description of the Sample

A total of 6,198 students agreed to participate in the survey. Participants at baseline were between 10.0 and 17.6 years old with a mean (SD) age of 12.9 (1.2) years. A total of 4,429 (71%) completed all 3 annual assessments and were included in further data analyses. The most common reason for loss to follow-up was transfer to another school. Supplementary Figure 1 describes the flow of data collection.

Prevalence of PLEs Among the Participants During 3 Years

Although most of the participants reported experiencing at least 1 PLE across the 3 years ($n = 3,573$ – $3,782$ per year, 80.7%–85.4%), only about one-fifth reported frequent PLEs (a frequency of “often” or “nearly always” was defined as frequent). More DEs were experienced than HEs. Delusions of reference were the most commonly reported type of delusional experience, and verbal auditory hallucinations were the most common type of hallucinatory experience. Ascending incidence rates were observed for both at least 1 PLE and frequent PLEs over the 3 years (Table 1).

Table 2. Fitting Information of Growth Mixture Modeling^a

No. of Classes in Model	k	AIC	BIC	aBIC	Entropy	LMR	P	BLRT	Proportion of Individuals in Each Class
1	5	94,501.62	94,533.84	94,517.95					
2	8	92,640.84	92,692.40	92,666.98	0.815	1,795.892	.0000	-47,245.808	0.880/0.120
3	11	91,882.03	91,952.92	91,917.97	0.799	735.766	.0001	-46,312.418	0.757/0.027/0.216
4	14	91,646.16	91,736.38	91,691.90	0.773	232.688	.0352	-45,930.01	0.027/0.026/0.205/0.741
5	17	91,467.72	91,577.28	91,523.26	0.793	177.43	.0621	-45,809.078	0.231/0.026/0.035/0.698/0.010

^aBoldface indicates the best solution of the growth mixture modeling model that the authors chose.

Abbreviations: aBIC = adjusted Bayesian information criterion, AIC = Akaike information criterion, BIC = Bayesian information criterion, BLRT = bootstrapped likelihood ratio test, k = degrees of freedom, LMR = Lo-Mendell-Rubin likelihood ratio test.

Table 3. Final Full Logistic Regression Risk Factors for Clinical Diagnosis in the 2-Class Model

Variable	All Psychiatric Disorders, OR (95% CI)	Psychotic Disorders, OR (95% CI)	Nonpsychotic Disorders, OR (95% CI)
Age	0.78 (0.54–1.11)	1.81 (0.33–9.82)	0.74 (0.51–1.09)
THQ score ^a	1.17* (1.01–1.36)	1.14 (0.59–2.18)	1.19* (1.02–1.38)
No. of times transferring to another school	1.08 (0.61–1.91)	1.81 (0.28–11.71)	1.05 (0.57–1.91)
Sex (female)	0.71 (0.35–1.46)	3.07 (0.19–49.50)	0.65 (0.31–1.38)
Ethnicity (minority)	2.91* (1.18–7.20)	0.12 (0.00–5.50)	3.96** (1.42–11.04)
Residency status ^b (urban)	1.26 (0.56–2.84)	12,770,798.65	0.86 (0.35–2.15)
Boarding option (at home)	0.71 (0.33–1.50)	0.51 (0.03–8.69)	0.74 (0.34–1.62)
“Left-behind” child status (yes)	1.19 (0.57–2.50)	1.16 (0.08–17.50)	1.21 (0.56–2.62)
Single child status (yes)	0.60 (0.23–1.56)	0.85 (0.06–13.02)	0.61 (0.22–1.71)
Stable family income ^c (no)	1.36 (0.62–2.96)	2.04 (0.13–32.93)	1.33 (0.59–3.02)
Divorced family (yes)	2.86* (1.24–6.61)	8.35 (0.40–175.02)	2.72* (1.12–6.60)
Parental death (yes)	1.80 (0.39–8.26)	0.00	2.01 (0.44–9.27)
Family history of psychiatric disorders (yes)	1.42 (0.47–4.30)	10.45 (0.63–173.73)	1.09 (0.31–3.84)
PLEs (2-class model)	3.33** (1.55–7.19)	19.68* (1.14–339.10)	2.89* (1.27–6.55)

^aTHQ represents the history of trauma events.

^bResidency status represents urban or rural household registration. There is a strict household registration system in China that divides residents into urban and rural. Rural residents are born and usually brought up in rural areas. They are not able to enjoy the equal social benefits of urban residents, no matter how long they have lived or worked in the cities.

^cStable income means that the family has a stable source of income and can support family members without others' help. On the contrary, not having a stable income means that the family needs help from other people or government aid.

* $P < .05$. ** $P < .01$.

Abbreviations: OR = odds ratio, PLE = psychotic-like experience, THQ = Trauma History Questionnaire.

Determination of PLE Trajectories

For selecting the number of trajectories using GMM, it is more appropriate to look at all of the information-based indices (AIC, BIC, aBIC), entropy, and the nested model tests (LMR and BLRT) simultaneously. Our data showed that the 2-class, 3-class, and 4-class models could all provide a feasible solution (Table 2). When the AIC, BIC, and aBIC were compared among the 3 models, the best solution appeared to be either the 4-class or the 3-class model. However, it has been recommended that an optimal model should include no class with fewer than 5% of the sample.¹⁸ Our data showed that 2 classes contained only 2.6% and 2.7%, respectively, of the sample in the 4-class model and that 1 contained only 2.7% of the sample in the 3-class model.

By using the PLE trajectory type, sociodemographic factors, and traumatic experiences as the predictive variables, further logistic regression analyses using the 2-class, 3-class, and 4-class models separately showed that only the 2-class model had a significant predictive effect on the subsequent clinical diagnosis of all psychiatric disorders ($P = .002$), psychotic disorders ($P = .040$), and nonpsychotic disorders ($P = .011$) (Table 3). This finding further supported the

clinical value of the 2-class PLE trajectory. Thus, the 2-class solution was determined to best represent PLE trajectories.

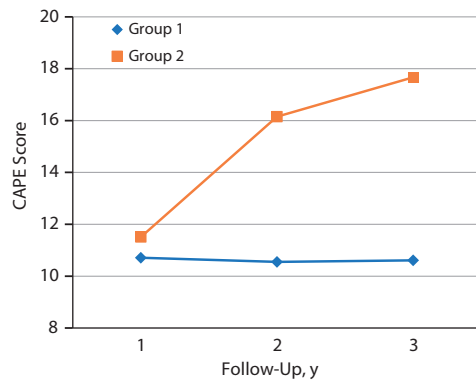
Moreover, the logistic regression also showed that minority ethnicity, divorced parents, and childhood trauma experiences were all significantly associated with any psychiatric diagnosis ($P = .021$, $.014$, and $.032$, respectively) and nonpsychotic disorders ($P = .008$, $.027$ and $.028$, respectively).

Demographics and Clinical Outcomes of the PLE 2-Class Trajectories

For the 2-class model, our data showed that the first group had a flat PLE trajectory with relatively low scores over the entire 3-year period (Figure 1). The second group, in contrast, showed a sharp rise in PLE frequency during the second year and maintained this high level in the third year. PLE frequency scores among these 2 groups over the 3 years are presented in Table 4. Comparison of the trajectory groups on sociodemographic characteristics and antecedent trauma showed that group 2 had a higher proportion of left-behind children, children who transferred schools 3 or more times, and children with a positive family history of

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Figure 1. Trends of 2 Different PLE Trajectories^{a,b}



^aThe 2 groups were identified via growth mixture modeling. This 2-class model was determined to best represent PLE trajectories and showed that the first group had a flat PLE trajectory with relatively low scores over the entire 3-year period; the second group, by contrast, showed a sharp rise in PLE frequency during the second year and maintained this high level in the third year.

^bPLEs were assessed with the positive subscale of the Community Assessment of Psychic Experiences (CAPE), a self-report instrument that measures PLEs on both a frequency scale (1 = never, 2 = sometimes, 3 = often, 4 = nearly always) and a distress scale (1 = not distressed, 2 = a bit distressed, 3 = quite distressed, 4 = very distressed). The PLE score represents the total frequency score for 2 items reflecting hallucinatory experiences and 6 items reflecting delusional experiences (range, 8–32). Abbreviation: PLE = psychotic-like experience.

psychiatric disorders and more trauma experiences and a lower proportion of subjects with a stable family income. No significant differences were found in age, sex, ethnicity, residency status, boarding option, single-child status, and the experience of having divorced parents or parental death between 2 groups (Table 4).

In group 1, only 1 participant (0.026%) was diagnosed as having a psychotic disorder, and 49 (1.26%) had diagnoses of nonpsychotic disorders at the end of 3 years. In the much smaller group 2, 3 participants (0.56%) were diagnosed with a psychotic disorder—a 22-fold greater risk compared to group 1—while 15 (2.82%) had nonpsychotic disorders—a 2.3-fold greater risk than in group 1. The transition to mental disorder thus occurred in 3.39% of group 2 and 1.28% of group 1.

DISCUSSION

We conducted a prospective longitudinal school-based survey of the relationship of PLEs and other factors to the development of psychiatric diagnoses in a large sample of Chinese adolescents. More than 80% experienced at least 1 PLE, although PLEs were infrequent for most of those who experienced them, consistent with previous research.¹⁴

Different PLE Trajectories

Two different longitudinal trajectories were identified with GMM in our study. The trajectory characterized by increasing numbers of PLEs was over 20 times more likely to be associated with a diagnosis of psychotic disorder after 3 years than the trajectory characterized by stably infrequent

PLEs. Although the transition rate of both groups was relatively low, the transition rate of the high risk group was considerably higher than in previous studies.⁵ This difference is most likely explained by the fact that we present the transition rate of a subgroup with progressively increasing PLEs rather than a group defined by having any PLEs at all. The 22-fold increase in risk of developing a psychotic disorder was also much higher than that reported in previous studies in adolescence^{7,19} although here, too, others have compared adolescents with any PLEs to those without PLEs. A 2.3-fold greater risk for nonpsychotic disorders was also found in the high-risk group. Although Kaymaz et al⁵ found more frequent transition to nonpsychotic disorders in individuals with PLEs, this difference failed to reach statistical significance in their study. These findings demonstrated validity of our GMM and of the distinctive high-risk characteristics of our “increasing PLE” subtype.

What should be noted is that while the 4-class or 3-class model might appear to be the best solution from the perspective of the information-based indices (AIC, BIC, aBIC), entropy, and the nested model tests (LMR and BLRT) there were 2 reasons for using the 2-class model. When the sample size of each class in the 4-class and 3-class model is examined, there are 2 classes containing only 2.6% and 2.7% of the sample in the 4-class model, and 1 class containing only 2.7% of the sample in the 3-class model. It has been suggested that the optimal model should include no class with less than 5% of the sample. In addition, further logistic regression analysis showed that the 2-class model, but not 4-class or 3-class model, had a significant predictive effect on clinical diagnoses, suggesting the greater clinical value of the 2-class trajectory in understanding our data.

Continuum of Psychosis

The observed trajectory of PLEs in the high-risk group is consistent with the persistent-proneness model of psychosis,²⁰ which suggests that youth with specific high-risk patterns of PLEs should be the focus of attention for preventive intervention. The high risk of transition in the high-risk group is also consistent with the “continuum of psychosis” hypothesis. Several common single nucleotide polymorphisms, similar abnormal levels of N1 suppression to self-generated speech, and similar widespread brain disconnectivity have been reported for individuals with PLEs.^{21,22} Furthermore, psychotic disorders have provided evidence for the continuum model the genetic, neurophysiologic, and brain functional levels. However, Mollon et al.²³ recently found different profiles of cognitive impairment between adults with PLEs and those with psychotic disorders. This finding could also be well explained with our model. Transition to psychotic disorders occurs more often in adolescents with high-risk-type PLEs, whereas most PLEs that persist to adulthood belong to the low-risk type, suggesting that the persistent-increasing pattern of PLEs may be a much more important risk indicator than the mere presence of PLEs. While a good deal of evidence is available linking PLEs and psychotic

Table 4. Comparisons of Sociodemographic Characteristics and Childhood Antecedents Between the 2 Trajectory Groups^a

Variable	Group 1 (n = 3,898)	Group 2 (n = 531)	χ^2/t	P
Age, mean (SD), y	12.87 (1.20)	12.91 (1.24)	0.692	.489
Sex (female)	2,042 (52.41)	296 (55.85)	2.739	.137
Ethnicity (Han)	1,565 (40.28)	194 (36.53)	15.856	.098
Residency status ^b (urban)	1,242 (32.70)	164 (31.30)	0.413	.520
"Left-behind" child status (yes)	1,203 (35.91)	184 (41.35)	5.009	.025
No. of times transferring to another school			15.856	<.001
Never	1,782 (55.31)	230 (51.69)		
1–2 times	1,267 (39.32)	170 (38.20)		
3 or more times	173 (5.37)	45 (10.11)		
Boarding option (at school)	1,729 (53.90)	245 (53.61)	0.013	.909
Single child status (yes)	1,059 (27.77)	133 (25.48)	1.212	.271
Stable family income ^c (yes)	2,900 (79.17)	359 (71.37)	15.792	<.001
Divorced family (yes)	291 (8.69)	45 (10.11)	0.990	.320
Parental death (yes)	96 (2.87)	8 (1.80)	1.681	.195
Family history of psychiatric disorders (positive)	255 (6.54)	50 (9.42)	6.022	.014
THQ score, mean (SD) ^d	7.05 (2.30)	8.89 (2.43)	16.530	<.001
PLE score, mean (SD) ^e				
First year	10.71 (2.66)	11.51 (3.34)	5.31	<.0001
Second year	10.55 (2.24)	16.15 (3.92)	32.21	<.0001
Third year	10.61 (2.09)	17.67 (3.44)	46.11	<.0001

^aValues are shown as n (%) unless otherwise noted. Some data are missing for some individuals. The adjusted proportions were calculated based on available data.

^bResidency status represents urban or rural household registration. There is a strict household registration system in China that divides residents into urban and rural. Rural residents are born and usually brought up in rural areas. They are not able to enjoy the equal social benefits of urban residents, no matter how long they have lived or worked in the cities.

^cStable income means that the family has a stable source of income and can support family members without others' help. On the contrary, not having a stable income means that the family needs help from other people or government aid.

^dTHQ represents the history of trauma events.

^ePLEs were assessed with the positive subscale of the Community Assessment of Psychic Experiences, a self-report instrument that measures PLEs on both a frequency scale (1 = never, 2 = sometimes, 3 = often, 4 = nearly always) and a distress scale (1 = not distressed, 2 = a bit distressed, 3 = quite distressed, 4 = very distressed). The PLE score represents the total frequency score for 2 items reflecting hallucinatory experiences and 6 items reflecting delusional experiences (range, 8–32).

Abbreviations: PLE = psychotic-like experience, THQ = Trauma History Questionnaire.

disorders, far less is known about the relationship between PLEs and nonpsychotic disorders. Our results clearly demonstrate such a relationship exists, which should receive more attention in the future.

Correlates of the Transition to Clinical Diagnosis

In final full models of any psychiatric disorders, including both psychotic disorders and nonpsychotic disorders, increasing PLE frequency remained the most strongly predictive risk factor for any endpoint diagnoses and the only risk factor for psychotic disorders, demonstrating the important predictive role of PLEs in the development of psychiatric disorders, especially psychosis. Adolescents with more childhood trauma were also found to be at higher risk of having increasing numbers of PLEs over time as well of having a final diagnosis of nonpsychotic disorders. In a previous study,²⁴ childhood trauma was found to be associated with the onset and expression of PLEs. This study further demonstrates that childhood trauma is associated with more persistent PLEs and, eventually, with the onset of mental disorders. Besides the widely studied relationship between childhood trauma and the onset of nonpsychotic disorders, several theories have also been proposed for the relationship of childhood trauma to PLEs. Cognitive models

suggest that negative beliefs about self-worth, body image, and other things caused by early trauma may mediate the association with PLEs.^{17,25} Stress reactivity associated with the hypothalamic-pituitary-adrenal axis could also be an underlying mechanism and merits further exploration at the genetic level.²⁴ Our result also implies that a persistent-proneness model may exist in nonpsychotic disorders, with childhood trauma as an important risk factor. Surprisingly, trauma experiences failed to be significant in our model of psychosis. However, the extremely low prevalence of final psychosis (n = 4) may also contribute to failure to observe a significant effect for trauma. As a type of trauma experience, family divorce was also found to be associated with a final diagnosis, which has been found in previous studies together with physical violence or sexual or psychological abuses.²⁶

Minority ethnicity has been found to increase the risk of psychosis²⁷ and nonpsychotic disorders.²⁸ This increased risk may also reflect a greater exposure to trauma in ethnic minorities, as well as lower rates of availability of psychiatric services.²⁹

"Left-behind" child status, frequent school transfers, and unstable family income failed to be identified as risk factors for final diagnosis, although more adolescents with these characteristics were found in the high-risk group. This

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finding may be explained by high correlation between those 3 variables and childhood trauma.

Limitations

Several limitations of this study need to be acknowledged. First, our data were based on self-report data from adolescents, which may lead to an overestimate of PLE prevalence, as the respondents were young and some items may not have been well understood. Second, there was considerable attrition (27.8%) over the 3-year study period. According to previous research,³⁰ attrition of the participants may lead to an underestimation of psychiatric disorders. We compared the baseline prevalence of PLEs among the subjects lost to follow-up and those who completed and found there was no significant difference between them ($P = .478$). However, given there was considerable attrition over the 3-year study period, we could not exclude that there could be some at-risk subjects who were lost to follow-up. Also, according to previous study, attrition of the participants may lead to an underestimation

of psychiatric disorders.³⁰ Third, no data were obtained from neurobiological or neuroimaging studies, which would be needed to provide information on possible underlying mechanisms. Finally, the follow-up period was limited to 3 years, and PLEs may persist for as many as 10 years.⁷ Longer-term research may also be informative.

CONCLUSION

In conclusion, this study explored the longitudinal trajectory of the frequency of PLEs over a 3-year period and found a distinctive pattern of increasing PLE frequency to be strongly associated with the onset of psychotic and also nonpsychotic psychiatric disorders. The trajectory of increasing PLEs, as well as childhood traumatic experiences, family divorce, and ethnic minority status, was found to incur a substantial risk of emergent psychiatric disorders, especially psychosis. Further study of the neurobiology of PLEs may shed additional light on the development of psychiatric and especially psychotic disorders in adolescence.

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Supplementary Material

Article Title: Longitudinal Trajectories of Psychotic-Like Experiences and Their Relationship to Emergent Mental Disorders Among Adolescents: A 3-Year Cohort Study

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List of Supplementary Material for the article

1. [Figure 1](#) Data Collection Flow

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Supplementary Figure 1. Data Collection Flow

