# Changes in psychotic-like experiences and related influential factors in technical secondary school and college students during COVID- 19

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ABSTRACT

*Objective:* Although students have been found to be at high risk of distress during the COVID-19 pandemic, little is known about the pandemic's impact on psychotic-like experiences (PLEs). We conducted a study in technical secondary school and college students before and during the pandemic to explore changes in PLEs and relevant influential factors.
*Methods:* A total of 938 students completed both waves of the survey through electronic questionnaires. PLEs were assessed using the 15-item Positive Subscale of the Community Assessment of Psychic Experiences (CAPE-P15). Childhood trauma, perceived stress, resilience, and demographic factors were evaluated at baseline, and psychological status was measured during the pandemic.
*Results:* The overall CAPE-P15 scores significantly decreased during the pandemic. Students with persistent PLEs showed the most severe COVID-19 related psychological symptoms, followed by new-onset and remitted individuals; those without PLEs exhibited the mildest symptoms (all $p < .001$). A single parent family (OR = 4.707), more childhood trauma (OR = 1.056), and a higher family income (OR = 1.658) were predictive of new-onset PLEs during the pandemic, while better resilience was a protective factor, associated with remission of previous PLEs (OR = 0.932).
*Conclusions:* Despite a downward trend in the prevalence of PLEs during the pandemic, PLEs predict greater serious psychological impact due to COVID-19, especially for students with persistent PLEs. Interventions that cultivate students' resilience are urgently needed to reduce PLEs and improve mental health, especially for students from single parent households or those who have experienced childhood trauma.

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## 1. Introduction

At the end of December 2019, a novel coronavirus disease 2019 (COVID-19) broke out in the Chinese city of Wuhan and was later declared a public health emergency of international concern by the World Health Organization on January 30, 2020 (WHO, 2020). As of January 6, 2021 the virus had spread to 222 countries and infected >84,474,195 patients, resulting in 1,848,704 deaths (WHO, 2021). In addition to its direct impact on the physical health of millions of people, the pandemic also poses an indirect threat to billions of people. Negative psychological implications of COVID-19 have been reported in patients infected with COVID-19, frontline health care workers, and the general public (Centers For Disease Control Prevention, 2020; Chen et al., 2020; Liu et al., 2020). Psychological interventions, especially those targeting groups at high risk of distress, are urgently needed (Talevi et al., 2020).

Previous studies have suggested that students are a demographic that has experienced a greater psychological impact from the pandemic (Wang et al., 2020). Due to rising concerns about the COVID-19 pandemic, many countries, including China, have taken confinement measures, including contact restrictions, self-isolation, and closure of schools, colleges, universities and other educational institutions (Bedford et al., 2020). These measures can greatly affect the psychological status of students (Sahu, 2020), but only a few studies have focused on this population (Cao et al., 2020; Li et al., 2020; Torales et al., 2020; Zhou et al., 2020). All of these studies have found a heightened level of depression, anxiety, and stress in students, leaving other changes in mental health unknown.

Psychotic-like experiences (PLEs) refer to experiences that resemble the positive symptoms of psychosis (Kelleher and Cannon, 2011), which are relatively common in adolescents (Kelleher et al., 2012). These experiences can not only cause individuals distress, but also predict the

later onset of full-blown mental disorders (Healy et al., 2019). As suggested by previous research, the risks of occurrence and conversion to clinical outcomes of PLEs are associated with numerous psychosocial factors, such as ethnic minority status, urbanization, childhood trauma, and perceived stress (Croft et al., 2018; Leaune et al., 2019; Lecic-Tosevski, 2019; Turley et al., 2019). Additionally, resilience, the ability to cope with adversities (Southwick and Charney, 2012), has been found to play a protective role in the occurrence of PLEs (Barahmand and Heydari, 2016). Recently, Brown et al. reported a increased incidence of psychosis during pandemic-like experiences, such as SARS (severe acute respiratory syndrome) and MERS (Middle East respiratory syndrome): an incidence of 0.9% to 4% in people infected with a virus, and a 25% increase in people not infected with a virus (Brown et al., 2020), suggesting that a pandemic-like experience may have an impact on psychosis. However, most of the studies included in this review focused on psychiatric patients or patients infected with a virus, and little is known about a pandemic's impact on college students.

From October 2019 to November 2019 (just before the COVID-19 pandemic), we conducted a cross-sectional survey on PLEs in high school and college students. From April 2020 to May 2020, the second wave of the survey was conducted in the same population. A follow-up study was an opportunity to explore how PLEs changed in response to the pandemic and to better understand of factors that affected the occurrence of PLEs.

In this study, we aimed to explore the changes in the prevalence and severity of PLEs in technical secondary school and college students during the COVID-19 pandemic. We also examined the relationship between the changes in PLEs and psychological problems related to COVID-19 and investigated predictors of these changes during the COVID-19 pandemic.

## 2. Materials and methods

### 2.1. Study design and participants

At baseline, a convenience sample of students was recruited from five technical secondary schools and six colleges in four provinces (Guangdong, Henan, Hunan, Zhejiang) in China. Technical secondary schools in China resemble universities in structure with a younger student population. All students were enrolled full-time in the technical schools or colleges. Students completed the baseline survey (the first wave of the survey) by scanning the Quick Response (QR) code of the questionnaire with mobile phones during their psychological health course. Participants were asked to register their contact information if they were willing to participate in the subsequent survey. The second wave of the survey was conducted by sending the QR to those who had registered their contact information. The baseline survey was conducted from October 2019 to November 2019 before the outbreak of COVID-19, and the second wave of the survey was from April 2020 to May 2020 during the COVID-19 pandemic and the students' home confinement. To control the quality of the survey responses, the inclusion criterion was that "the response time for each wave of the survey ≥ five minutes." All participants (or their guardians, if necessary) gave electronic informed consent before starting the online survey. The investigation was carried out in accordance with the Helsinki Declaration as revised 1989 and approved by the Ethics Committees of Guangzhou Huiai Hospital of Guangzhou Medical University.

### 2.2. Measures

#### 2.2.1. Demographic characteristics

Demographic information collected for the baseline survey included: sex, age, ethnicity, birth place, family income, parental marital status, "left-behind" child status (referring to those left behind in their hometown by one or both of their migrant worker parents) (Sun et al., 2017a), single child status, history of mental disorders, chronic

physical conditions (having at least one of the following: arthritis, angina, asthma, diabetes, visual impairment or hearing problems) (Koyanagi et al., 2018), and family history of mental disorders. Demographic information collected for the second wave of the survey included: place of residency during the COVID-19 pandemic and whether or not they had relatives or acquaintances (e.g. friends, neighbors, classmates, or family members) infected with COVID-19.

#### 2.2.2. The 15-item positive subscale of the community assessment of psychic experiences (CAPE-P15)

The CAPE-P15 is a self-report scale for measuring PLEs, derived from the 42-item Community Assessment of Psychic Experiences (Capra et al., 2013). The scale contains two subscales: the frequency subscale and associated distress subscale. As PLEs are defined by the experiences themselves (Laurens et al., 2012; Sun et al., 2017a, 2017b; Zhang et al., 2019), we used the frequency subscale to assess PLEs in this study. Response to each item ranges from 1-never, 2-sometimes, 3-often, to 4-nearly always. The total score was divided by the number of valid answers to provide the weighted score. The psychometric properties of the Chinese version of the CAPE-P15 for measuring current PLEs were certified in a previous study (Sun et al., 2020). However, as a self-report scale, its validity for detecting genuine PLEs has been doubtful because of differences between patients' and experts' understanding (Schultze-Lutter et al., 2011). Hence, we validated the self-report PLEs to interview-verified PLEs using a sample of college students in a prior study. The relevant article is currently being prepared for publication. Using interview-verified PLEs as golden criteria, a frequency score of 1.57 on the self-report CAPE-P15 was identified as the optimal cut-off value for detecting genuine PLEs. In this sample, Cronbach's α for the total score was 0.896.

#### 2.2.3. The childhood trauma questionnaire (CTQ)

The CTQ (Bernstein and Fink, 1998) was used to measure self-reported experiences of childhood trauma before age 16 during the first wave of the survey. Higher CTQ scores indicate a greater number of childhood traumas experienced. The CTQ has been found to have good reliability and validity in the Chinese population (Fu et al., 2005). In this sample, Cronbach's α for the total score was 0.808.

#### 2.2.4. The multidimensional scale of perceived social support (MSPSS)

The MSPSS was developed to measure subjective social support (Zimet et al., 1990). The scale consists of 12 items covering three domains: perceived support from family, friends, and significant others (for this study, teachers were used for the third domain). Response to each item ranges from 1 (highly disagree) to 7 (highly agree), with higher scores indicating stronger perceived support. The scale has shown good reliability and validity in the Chinese population (Wang et al., 1999). In this study, the scale was used in the first wave of the survey, and the Cronbach's α for the total score was 0.941.

#### 2.2.5. The 10-item Connor-Davidson resilience scale (CD-RISC-10)

The CD-RISC-10, derived from the 25-item Connor-Davidson Resilience Scale (CD-RISC), is used to measure the ability to cope with adversity (Campbell-Sills and Stein, 2007). The scale is composed of 10 items, with each item scored from 0 (never) to 4 (nearly always). Higher total scores indicate better resilience. The Chinese version has shown adequate psychometric properties (Ye et al., 2016). In this study, the scale was used in the first wave of the survey, and the Cronbach's α for the total score was 0.918.

#### 2.2.6. The psychological questionnaire for public health emergency (PQPHE)

The PQPHE was developed to measure a person's psychological status during the SARS epidemic (Gao et al., 2004). The questionnaire contains 25 items covering five domains: depression, neurasthenia, fear, anxiety and obsession-compulsion, and hypochondriasis. Response to

each item ranges from 0 (no symptom/seldom) to 3 (severe/nearly always), with higher scores indicating more severe symptoms. The scale has shown good psychometric properties in the Chinese population (Gao et al., 2004). In the second wave of survey, it was used to assess students' psychological status during the COVID-19 pandemic, with the word "SARS" in the original questionnaire changed to "COVID-19". The Cronbach's α for the total score was 0.931 in this sample.

### 2.3. Statistical analysis

Participants with response times of less than 5 min and those who did not finish both surveys were excluded from the analyses. For the final sample, demographic variables were first analyzed descriptively. The CAPE-P15 total scores of both waves of the survey were compared through a paired *t*-test for all included participants. Previous research has showed that adolescents living in Hubei Province (Zhou et al., 2020) and those having relatives or acquaintances infected with COVID-19 (Cao et al., 2020) were significantly more affected by the pandemic. However, they do not represent the majority of adolescents in China during the pandemic. Considering the limited size of this sample, their data could have skewed the overall data to overestimate the effect of the pandemic. Hence, a paired t-test was conducted for the remaining participants after excluding those living in Hubei Province and those who had relatives or acquaintances infected with COVID-19. We also compared the CAPE-P15 total scores of both waves of the survey between these two subgroups.

Second, we divided the participants into four groups based on the cut-off value we previously found: non-PLEs group (both CAPE-P15 total scores <1.57), persistent group (both CAPE-P15 total scores >1.57), new-onset group (baseline CAPE-P15 total score < 1.57, the second CAPE-P15 total score > 1.57), and remission group (baseline CAPE-P15 total score > 1.57, the second CAPE-P15 total score < 1.57). Demographic variables, CAPE-P15 total scores, and the change in total scores were compared through ANOVA, Chi-square tests, and Kruskal-Wallis H tests. The scores in all five domains on the PQPHE were also compared among these four groups.

Finally, we investigated predictors of changes in PLEs using logistic regression. An intercept model was established initially to evaluate the school/college-level heterogeneity. We then conducted two binary logistic regressions to calculate odds ratios (ORs) and 95% confidence intervals (95% CI) and compare them between the new-onset group and non-PLEs group, as well as between the persistent group and remission group, with all demographic variables, THQ, MSPSS, and CD-RISC-10 total scores included in the model. The variance inflation factor (VIF) was used to evaluate multicollinearity. A two-sided *p*-value < .05 was considered statistically significant. All analyses were conducted using SPSS 19.0 (Corp, 2010).

## 3. Results

### 3.1. Description of the sample

A total of 2350 students were invited to participate in the first wave of the survey, with 85 refusing to participate, leaving 2265 individuals. Nine hundred and thirty-eight of these students participated in the second wave of the survey. All response times for each wave of the survey were above 5 min for these participants. Hence, all responses were included in the subsequent analyses (See Fig. A1 for details).

Compared to those lost to follow-up, these students scored slightly lower on CAPE-P15 (1.31 ± 0.01 vs. 1.28 ± 0.01, *p* = .033). They were slightly younger (*p* = .011), and a lower proportion were female or of Han ethnicity (both *p* < .001), the majority ethnicity in China. More of them were born in rural areas (*p* < .001), were from families with a low economic status (*p* < .001), or had a chronic physical illness (*p* = .021). No significant differences were found in other demographic characteristics (all *p* > .05, see Table A1).

**Table 1**
Demographic characteristics of the participants (*N* = 935).

| Characteristics | N | % |
|---|---|---|
| Sex | | |
| Female | 653 | 69.4 |
| Male | 285 | 30.4 |
| Ethnicity | | |
| Han[a] | 843 | 89.9 |
| Other ethnic groups | 95 | 10.1 |
| Birth place | | |
| Urban | 117 | 12.5 |
| Town | 182 | 19.4 |
| Rural | 639 | 68.1 |
| Family income (RMB per month) | | |
| Below 1000 | 36 | 3.8 |
| 1000–3000 | 300 | 32.0 |
| 3000–5000 | 317 | 33.8 |
| 5000–10,000 | 228 | 24.3 |
| Above 10,000 | 57 | 6.1 |
| Parental marital status | | |
| Married | 829 | 88.1 |
| Not current married[b] | 112 | 11.9 |
| "Left-behind" child status(yes) | 453 | 48.3 |
| Single child status (yes) | 182 | 19.4 |
| History of mental disorders (yes) | 11 | 1.2 |
| Chronic physical illness[c] (yes) | 107 | 11.4 |
| Family history of mental disorders (yes) | 49 | 5.2 |

[a] Han is the major ethnic group in China.
[b] Not current married included separated, divorced and widowed.
[c] Chronic physical conditions referred to having at least one of arthritis, angina, asthma, diabetes, visual impairment or hearing problems.

The age of the 938 students ranged from 14 to 25 years old, with a mean age of 17.65 (SE = 0.052). Other demographic characteristics are listed in Table 1. Of these individuals, 20 students lived in Hubei Provence, and 8 students had relatives or acquaintances infected with COVID-19.

### 3.2. The impact of the COVID-19 pandemic on PLEs

The CAPE-P15 total scores before the COVID-19 pandemic were significantly higher than scores during the COVID-19 pandemic (1.28 ± 0.01 vs. 1.11 ± 0.01, *t* = 16.180, *df* = 937, *p* < .001).

Because data from students living in Hubei Provence or with relatives or acquaintances infected with COVID-19 could have impacted the results, we reanalyzed the data after excluding these individuals and found that the CAPE-P15 total scores remained higher before the pandemic (1.28 ± 0.01 vs. 1.11 ± 0.01, *t* = 16.384, *df* = 909, *p* < .001).

Students with relatives or acquaintances infected with COVID-19 had numerically but not statistically lower CAPE-P15 total scores compared to scores during the pandemic (1.24 ± 0.12 vs. 1.33 ± 0.31, *t* = −0.486, *df* = 7, *p* = .642). Those living in Hubei Province also did not demonstrate significant changes in the CAPE-P15 total scores (1.30 ± 0.08 vs. 1.20 ± 0.07, *t* = 1.770, *df* = 19, *p* = .093). However, as further analysis was limited by the small number of these individuals, and their data could have skewed the overall data, we excluded them for the subsequent analyses.

### 3.3. Four different PLEs trajectories and their relationship with the COVID-19 related psychological symptoms

We further divided the sample into four groups according to the preset cut-off value. Fig. 1 shows the changes in CAPE-P15 scores before and during the COVID-19 pandemic among the four groups. The persistent group had the highest scores both before (non-PLEs group: *p* < .001; new-onset group: *p* < .001; remission group: *p* = .005) and during the COVID-19 pandemic (non-PLEs group: *p* < .001; new-onset group: *p* < .001; remission group: *p* < .001), while the non-PLEs group exhibited the lowest scores both before (new-onset group: *p* = .001; remission group: *p* < .001) and during the COVID-19 pandemic
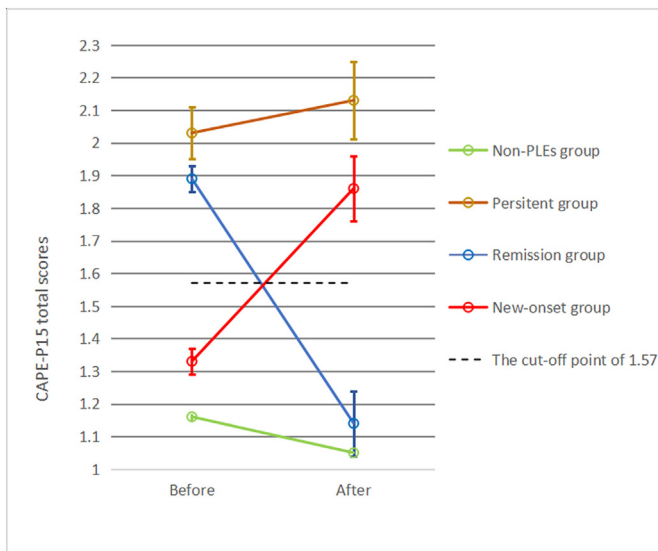
**Fig. 1.** The change of CAPE-P15 scores before and during the COVID-19 pandemic among non-PLEs group, persistent group, remission group, and new-onset group. Note:CAPE-P15, the 15-item Positive Subscale of the Community Assessment of Psychic Experiences; PLEs, psychotic-like experiences.

(new-onset group: $p < .001$; remission group: $p < .001$). The remission group had the second-highest scores before the COVID-19 pandemic (new-onset group: $p < .001$) and the second-lowest scores during the COVID-19 pandemic (new-onset group: $p < .001$). Table 2 compares demographic characteristics and CAPE-P15 score changes among the four groups. The new-onset group had higher proportions of students of single parenthood and "left-behind" children than the other three groups, while the non-PLEs group had the lowest proportion of participants with histories of mental disorders or chronic physical illness. No significant differences were found in sex, ethnicity, age, birth place, family income, single child status, or family history of mental disorder among the four groups. However, significant differences were found in CAPE-P15 score changes, and all post-hoc multiple comparisons also showed significant differences (all $p < .01$).

These four groups also had significant differences in all COVID-19 related psychological symptoms (all $p < .001$, see Fig. 2). The persistent group ($N = 24$) had the highest scores in all five domains (Depression: $1.68 \pm 0.14$; Neurasthenia: $1.68 \pm 0.16$; Fear: $1.46 \pm 0.12$; Anxiety and obsession-compulsion: $1.17 \pm 0.17$; Hypochondriasis: $0.65 \pm 0.17$), followed by the new-onset group ($N = 19$) (Depression: $1.33 \pm 0.19$; Neurasthenia: $1.52 \pm 0.20$; Fear: $1.16 \pm 0.17$; Anxiety and obsession-compulsion: $0.91 \pm 0.15$; Hypochondriasis: $0.37 \pm 0.13$) and then the remission group ($N = 120$) (Depression: $0.62 \pm 0.05$; Neurasthenia: $0.66 \pm 0.06$; Fear: $0.71 \pm 0.05$; Anxiety and obsession-compulsion: $0.29 \pm 0.03$; Hypochondriasis: $0.23 \pm 0.04$). The non-PLEs group ($N = 747$) exhibited the lowest scores in the five domains (Depression: $0.33 \pm 0.02$; Neurasthenia: $0.32 \pm 0.02$; Fear: $0.52 \pm 0.02$; Anxiety and obsession-compulsion: $0.12 \pm 0.01$; Hypochondriasis: $0.11 \pm 0.01$).
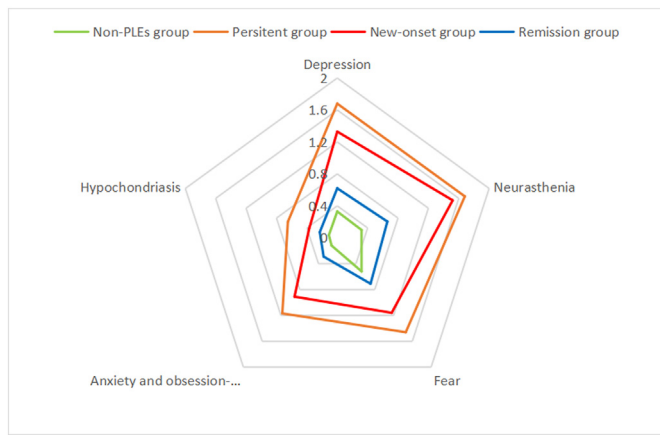
### 3.4. Factors associated with changes in PLEs

The test of intercept variance was not statistically significant ($p = .967$). No reason for the potential multicollinearity of all variables was found, with variance inflation factor (VIF) values of 1.462 and below (O'Brien, 2007). Both regression models were found to be statistically significant (new-onset group vs. non-PLEs group: $p = .016$; persistent group as vs. remission group: $p = .039$). As shown in Table 3, students of single parenthood, who tended to have higher CTQ scores and higher family incomes, were more likely to experience new-onset PLEs, while those with higher CD-RISC-10 scores tended to achieve remission of previous PLEs. Single child status also had a marginally significant enhancing impact on the persistence of PLEs ($p = .054$).

### 4. Discussion

To our knowledge, this is the first study on the impact of the COVID-19 pandemic on PLEs. In this study, we explored trends in PLEs during the pandemic and identified four different trajectories for PLEs. We also found relationships between the trajectories of PLEs and pandemic-related symptoms, as well as predictors of changes in PLEs.

Although the overall CAPE-P15 scores significantly decreased during the COVID-19 pandemic, students with relatives or acquaintances infected with COVID-19 had numerically elevated CAPE-P15 scores, supporting the theory that having relatives or acquaintances infected

**Table 2**
Comparisons of demographic characteristics and CAPE-P15 score changes among non-PLEs group, persistent group, new-onset group, remission group ($N = 910$).

| | Non-PLEs ($N = 747$) | Persistent ($N = 24$) | New-onset ($N = 19$) | Remission ($N = 120$) | F/$\chi2$ | $p$-Value |
|---|---|---|---|---|---|---|
| Demographic characteristics | | | | | | |
| Sex (female), N (%) | 526 (70.4) | 16 (66.7) | 11 (57.9) | 80 (66.7) | 2.048 | 0.562 |
| Ethnicity (Han[a]), N (%) | 669 (89.6) | 21 (87.5) | 17 (89.5) | 110 (91.7) | 0.643 | 0.886 |
| Age, mean (SE) | 17.67 (0.06) | 17.63 (0.41) | 17.21 (0.41) | 17.64 (0.15) | 0.548 | 0.650 |
| Birth place, N (%) | | | | | 4.607 | 0.595 |
| Urban | 92 (12.3) | 3 (12.5) | 3 (15.8) | 15 (12.5) | | |
| Town | 139 (18.6) | 3 (12.5) | 6 (31.6) | 29 (24.2) | | |
| Rural | 516 (69.1) | 18 (75.0) | 10 (52.6) | 76 (63.3) | | |
| Family income (RMB per month), N (%) | | | | | 5.639 | 0.131 |
| Below 1000 | 26 (3.5) | 2 (8.3) | 1 (5.3) | 7 (5.8) | | |
| 1000–3000 | 240 (32.1) | 9 (37.5) | 2 (10.5) | 37 (30.8) | | |
| 3000–5000 | 260 (34.8) | 8 (33.3) | 6 (31.6) | 37 (30.8) | | |
| 5000–10,000 | 175 (23.4) | 4 (16.7) | 9 (47.4) | 31 (25.8) | | |
| Above 10,000 | 46 (6.2) | 1 (4.2) | 1 (5.3) | 8 (6.7) | | |
| Parental marital status (not current married[b]), N (%) | 84 (11.2) | 2 (8.3) | 7 (36.8) | 17 (14.2) | 12.262 | 0.007 |
| "Left-behind" child status(yes), N (%) | 345 (46.2) | 10 (41.7) | 13 (68.4) | 70 (58.3) | 9.672 | 0.022 |
| Single child status (yes), N (%) | 144 (19.3) | 1 (4.2) | 4 (21.1) | 28 (23.3) | 4.779 | 0.189 |
| History of mental disorders (yes), N (%) | 5 (0.7) | 1 (4.2) | 1 (5.3) | 3 (2.5) | 8.546 | 0.036 |
| Chronic physical illness[c] (yes), N (%) | 70 (9.4) | 6 (25.0) | 4 (21.1) | 21 (17.5) | 13.852 | 0.003 |
| Family history of mental disorders (Yes), N (%) | 37 (5) | 2 (8.3) | 3 (15.8) | 5 (4.2) | 5.183 | 0.159 |
| CAPE-P15 score changes, Mean (SE) | −0.11 (0.01) | 0.09 (0.09) | 0.52 (0.10) | −0.75 (0.03) | 431.366 | < 0.001 |

Note:CAPE-P15, the 15-item Positive Subscale of the Community Assessment of Psychic Experiences; PLEs, psychotic-like experiences.
[a] Han is the major ethnic group in China.
[b] Not current married included separated, divorced and widowed.
[c] Chronic physical conditions referred to having at least one of arthritis, angina, asthma, diabetes, visual impairment or hearing problems.

**Fig. 2.** All pandemic related symptoms among among non-PLEs group, persistent group, remission group, and new-onset group. Significant differences were found in all COVID-19 related psychological symptoms among the four groups (all $p < .001$). Note:PLEs, psychotic-like experiences.

with COVID-19 was a risk factor for increased psychological problems in college students (Cao et al., 2020). However, the elevation needs to be interpreted with caution due to the small sample size of students who endorsed having relatives or acquaintances with COVID-19 ($N = 8$). Further analysis found that most participants with PLEs at baseline remitted ($N = 120$), with only a small portion exhibiting persistent PLEs ($N = 24$). This result is congruent with previous research, suggesting that PLEs are mostly transient (75–90%) and that only a small population experiences the persistence of PLEs and their development into clinical outcomes (van Os et al., 2009). Additionally, a few individuals ($N = 19$) had new-onset PLEs during the COVID-19 pandemic. Both cross-sectional and longitudinal studies have suggested that the peak incidence of PLEs is during late adolescence and early adulthood (Sullivan et al., 2020), the period that is also the age of onset for half of all lifetime mental disorders (Kessler et al., 2007). However, the annual incidence of PLEs has been reported to be 0.015–0.020 around ages 17–19 (Sullivan et al., 2020), while the incidence within a 6-month period was 0.021 (19/910) during the pandemic. Thus, the COVID-19 pandemic and subsequent confinement measures may accelerate the onset and development of PLEs, which coincides with the impact of pandemic on psychosis (Brown et al., 2020). However, the overall decrease in CAPE-P15 scores during the pandemic also suggests protective factors associated with COVID-19, such as more time spent with family and reduced school stress, which were further explored in the regression analysis.

Through comparisons among the four groups, we found that all COVID-19 related psychological symptoms (including depression, neurasthenia, fear, anxiety and obsession-compulsion, and hypochondriasis) were most serious in the persistent group. These results support the

**Table 3**
Stepwise logistic regression of predictors for change of PLEs.

|  | OR | 95%CI | Wald | p-Value |
|---|---|---|---|---|
| New-onset group vs. non-PLEs group |  |  |  |  |
| Family income | 1.658 | 1.037, 2.650 | 4.466 | 0.035 |
| Parental marital status (Not current married[a]) | 4.707 | 1.760, 12.590 | 9.520 | 0.002 |
| CTQ | 1.056 | 1.021, 1.092 | 9.980 | 0.002 |
| Persistent group vs. remission group |  |  |  |  |
| Single child status (yes) | 7.657 | 0.967, 60.644 | 3.717 | 0.054 |
| CD-RISC-10 | 0.932 | 0.870, 0.998 | 4.053 | 0.044 |

Note:PLEs, psychotic-like experiences; MSPSS, the Multidimensional Scale of Perceived Social Support; CTQ, the Childhood Trauma Questionnaire; CD-RISC-10, the 10-item Connor-davidson Resilience Scale.
[a] Not current married included separated, divorced and widowed.

relationship between PLEs and non-psychotic psychopathology proposed by previous studies (Healy et al., 2019; Iorfino et al., 2019), and further suggest that persistent PLEs are of the greatest predictive value clinically among the four types of PLEs. Additionally, compared to the non-PLEs group, the new-onset and remission groups also displayed more severe psychological symptoms related to the pandemic, thereby illustrating the clinical relevance of even transient PLEs.

In the final logistic model, single parenthood seemed to be the most strongly predictive factor for new-onset PLEs. As reported in a previous study, the pandemic and subsequent confinement measures could serve as opportunities for family cohesion, but the increased risk of domestic violence and child maltreatment may outweigh these benefits (Fegert et al., 2020). To make matters worse, children of single parenthood are at higher risk of child maltreatment (Kratky and Schroder-Abe, 2018; van Berkel et al., 2020). During the pandemic, single parent families are also likely to perceive more economic burden and less social support, which may aggravate family conflicts. For these students, school is more than an educational hub, playing an important role by offering a window of freedom, interaction with peers, and psychological solace (Ghosh et al., 2020). The closure of schools, together with home confinement and fear of infection, may further reinforce the negative effect of single parenthood. Students with more childhood trauma were also at higher risk of new-onset PLEs, a finding that is consistent with previous studies (Pan et al., 2019; Sun et al., 2017a, 2017b). Negative beliefs induced by early trauma may be activated through stress-regulation systems as a result of the pandemic (Cristobal-Narvaez et al., 2017), leading to the onset of PLEs. Higher family income was surprisingly found to be another risk factor, as previous research has suggested that low socioeconomic status increases the risk of PLEs (Croft et al., 2018; DeVylder and Koyanagi, 2018). Recent research has also identified that low income can have adverse impacts on mental health during the pandemic (Ghosh et al., 2020). However, as most of our participants were from middle-income families, they may have not perceived substantial economic burden due to the pandemic. Instead, students from higher socioeconomic classes may have endured more academic pressure from their parents, a conjecture that is supported by a previous survey conducted in China (Tong, 2016).

Resilience, thought to be a protective factor in dealing with stress, played the most important role in remission of previous PLEs. Attention to resilience has increased during the pandemic, as good resilience implies the capacity for positive adaptation in face of environmental stressors (Stark et al., 2020). As the fight against the COVID-19 pandemic is gradually transitioning to what will likely be a new normal, now is the time to foster long-term resilience to cultivate the mental health equivalent of "herd immunity" (PeConga et al., 2020). Resilience has been found to be associated with a series of psychosocial factors, such as positive emotion and cognition, shared family beliefs and close relationships, strong social support, altruism, good sleep, attention to health and good cardiovascular fitness (Killgore et al., 2020; Prime et al., 2020; Southwick and Charney, 2012). For students, promoting resilience in the context of the pandemic requires long-term intervention across multiple systems (e.g. families and schools). Our results also suggest the possible impact of single child status on the persistence of PLEs. These individuals suffer more from lack of peer contact due to school closure. This phenomenon does not seem to have received adequate attention and needs further research in a large sample for confirmation.

One strength of our study is that we compared data from the same groups before and during the COVID-19 pandemic, a strategy that was able to illustrate the influence of the pandemic on PLEs. To our knowledge, this is also the first study on the relationship between PLEs and COVID-19 related psychological symptoms, suggesting the predictive value of PLEs for measuring the psychological impact of a public health emergency.

Several limitations of this study need to be acknowledged. First, a relatively small sample was used for analyses, especially for each PLEs group. By the second wave of the survey, the start of the 2020 spring

semester had been delayed by 2 to 3 months, which made it difficult to conduct a school-based survey. We had to contact the students by sending text messages or emails, resulting in a high attrition rate. Meanwhile, because of the small sample of students with relatives or acquaintances infected with COVID-19, we could not further analyze the differences in PLEs changes under different levels of distress. However, our results may still reflect the psychological status of the majority of students under the pandemic. Those lost to follow-up did show higher PLEs at baseline, which may have led to an underestimation of the impact of the pandemic on PLEs. Finally, surveys through QR codes can lead to poor data quality. To address this issue, we recorded the survey response times in each wave and excluded responses less than 5 min to ensure a certain extent of data reliability.

In conclusion, there was a downward trend in PLEs in these students, even during the COVID-19 pandemic. However, PLEs predicted more serious psychological impact from COVID-19, especially in students with persistent PLEs. During the pandemic, new-onset PLEs were more likely to emerge in students from single parent or higher-income families, as well as in those with more childhood trauma, while better resilience was conducive to remission of previous PLEs.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.schres.2021.02.015.

## CRediT authorship contribution statement

Authors Meng Sun, *Dongfang Wang* and Liang Zhou designed the study and wrote the protocol. All authors participated in the data collecting and provided advice o*n interpretation of the data*. Author Meng Sun undertook the statistical analysis *and* wrote the first draft of the manuscript. Authors *Dongfang Wang,* Ling Jing and Liang Zhou modified the manuscript. All authors contributed to and have approved the final manuscript.

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