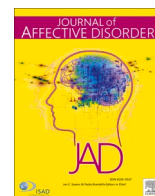




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Self-compassion predicted joint trajectories of depression and anxiety symptoms during the COVID-19 pandemic: A five-wave longitudinal study on Chinese college students

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ABSTRACT

Objective: The long-term protective effect of self-compassion on mental health remained unclear in the pandemic context. This study aimed to investigate the trajectories of depression and anxiety symptoms and the role of self-compassion during the pandemic.

Methods: In this one-year five-wave longitudinal study (retested every three months from February 2020 to February 2021), 494 Chinese college students completed the study through online questionnaires and provided information on depression and anxiety symptoms, self-compassion, and sociodemographic variables. Independent and joint trajectories of depression and anxiety symptoms were explored by growth mixture models. Predictive effects of self-compassion on trajectories were examined by logistic regression models.

Results: Four and three heterogeneous latent trajectories were identified for depression and anxiety symptoms, respectively. Three distinct joint trajectories of depression and anxiety were determined: low symptoms group (54.0 %), mild symptoms group (34.4 %), and risk group (11.5 %). Participants with higher levels of self-compassion were more likely to follow the low symptoms trajectory of depression and anxiety symptoms (all $p < 0.001$).

Conclusions: Group heterogeneity existed in the trajectories of depression and anxiety symptoms. Improving the levels of self-compassion would help to prevent and alleviate depression and anxiety symptoms. Programs based on self-compassion are encouraged to cope with the mental health challenges in the pandemic context.

1. Introduction

Growing evidence suggests that the coronavirus disease 2019 (COVID-19) pandemic has a pervasive impact on public mental health and increases the risk of psychopathologies such as depression and anxiety (Bueno-Notivol et al., 2021; Duan et al., 2020). According to a recent meta-analysis, the pooled prevalence of depression and anxiety were 31.4 % and 31.9 % in the global population, respectively (Wu et al., 2021a). Of note, studies have reported that college students were experiencing a higher level of mental health problems than general populations during the pandemic (Gutiérrez-Hernández et al., 2021; Romeo et al., 2021). College students, undergoing a critical time with several stressors, including uncertainty towards future development and

social relations, present vulnerability to mental health problems during the pandemic (Browning et al., 2021; Fu et al., 2021). As the pandemic continues, mental health status may vary at different stages of the pandemic. Considering the well-documented undesirable outcomes of depression and anxiety (e.g., impaired social functioning and even suicide-related outcomes) (Gijzen et al., 2021; Saade et al., 2019), investigating the longitudinal course of depression and anxiety and modifiable protective factors among college students in the context of COVID-19 is important.

A couple of longitudinal studies have emerged to track the temporal changes in mental health status at a population level with the continuation of the pandemic (Duan et al., 2020; Fancourt et al., 2021; Li et al., 2021c), but results were mixed. Some reported that participants' mental

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health status worsened, including elevated levels of depression and anxiety symptoms (Duan et al., 2020; Hawes et al., 2021; Li et al., 2021c). In contrast, other studies revealed patterns of stable or generally recovered depression and anxiety symptoms (Fancourt et al., 2021; Fluharty et al., 2021; O'Connor et al., 2021). Such inconsistency in these results may be partly attributed to different pandemic stages, follow-up periods, regions, and populations. For example, residents' perception of the pandemic is different across regions and pandemic stages (Fujii et al., 2021; Mækela et al., 2020), and accordingly, overall changes in psychological status at the population level vary (Hummel et al., 2021; Lee et al., 2021). In addition to external macro factors, individuals may present unique changes in developmental trends of mental health owing to personal and family characteristics (Fancourt et al., 2021). For example, compared to individuals experiencing economic difficulties, members of a family possessing affluent economic and social resources can more easily adapt to the negative impacts of the unprecedented pandemic (Kimhi et al., 2021). Additionally, while undergoing a stressful event, individuals with diverse psychological resources may adopt different coping styles and further present unique characteristics in the changes of their mental health status (Chen et al., 2022). Therefore, possible group heterogeneity may exist in the developmental trajectories of mental health problems in response to the pandemic. Indeed, several studies have argued that the mean population estimate of depression and anxiety symptoms may not adequately reflect individual variability (Batterham et al., 2021; Carr et al., 2022; Hyland et al., 2021; Kimhi et al., 2021; McPherson et al., 2021; Saunders et al., 2021; Shevlin et al., 2021). According to the existing research on the level of depression and anxiety during the pandemic, most results identified three to five groups with distinct trajectories, reflecting the stability, improvement, and deterioration in mental health, respectively. Generally, the majority of people were resilient, while about 30 % experienced trajectories with reducing, worsening, or sustaining depression or anxiety symptoms.

Given the presence of distinct trajectories of mental health problems, a subsequent issue to be addressed was to find the predictors of these trajectories for future prevention and intervention work. Compared to relatively fixed factors such as demographic characteristics (e.g., age and gender) and family factors (e.g., socioeconomic status [SES]), focusing on modifiable psychological resources (e.g., self-compassion) may be more helpful for intervention programs. Self-compassion, a healthy attitude towards oneself, may help to cope with the development of mental health problems during the ongoing pandemic. Neff (2003a, 2003b) conceptualized that self-compassion entails three main components: (i) being kind and understanding towards oneself when faced with sufferings (self-kindness vs. self-criticism), (ii) perceiving one's suffering is not personal but universal (common humanity vs. isolation), and (iii) treating one's suffering from a balanced perspective (mindfulness vs. over-identification). With the non-evaluative and interconnected nature, self-compassion cultivates a healthy and adaptive style of thinking. This cognitive pattern forested in self-compassion may be the mechanism through which self-compassion treats multiple psychopathologies, including depression and anxiety. A meta-analysis of randomized controlled trials (including both clinical and non-clinical populations of all ages) concluded that self-compassion interventions could significantly improve depression symptoms, and the improvement continues to increase at follow-up (Ferrari et al., 2019). Additionally, a recent review concluded that self-compassion could be an active ingredient in the prevention and treatment of anxiety in young people (Egan et al., 2021). Although there is little longitudinal research on the role of self-compassion in mental health under the pandemic context, initial evidence from cross-sectional studies is promising: a higher level of self-compassion was associated with overall mental well-being, including lower levels of depression and anxiety (Deniz, 2021; Gutiérrez-Hernández et al., 2021; Li et al., 2021a). Nevertheless, whether self-compassion may predict trajectories of depression and anxiety symptoms during the pandemic in college students remains unclear.

Although some studies have examined the heterogeneous trajectories of depression and anxiety and the role of self-compassion in the context of COVID-19, there are still several research gaps to be addressed. First of all, few or none have considered the fact that depression and anxiety symptoms tend to co-exist (Cummings et al., 2014). A 15-year longitudinal study even found that the stable comorbid states of depression and anxiety were more common than non-comorbid states (i.e., depression alone or anxiety alone) (Merikangas et al., 2003). Therefore, further research is warranted to focus on the co-occurrence, extending prior evidence about the trajectories of merely depression or anxiety. In addition, most studies either collected data for a short period (one to six months) or in the early phases of the pandemic, and only one study followed for one year (Carr et al., 2022). Considering that COVID-19 is still ongoing and is anticipated to exist for a long time, adopting an intensive longitudinal design to capture fluctuations or changes in mental health over a long period can provide more insightful information for the future public crisis. Moreover, longitudinal studies on the role of self-compassion in preventing or alleviating psychological distress during the pandemic are scarce. Considering self-compassion has been regarded as an important factor to target in psychological well-being interventions (Marsh et al., 2018), conducting related research under the pandemic background is needed to provide insights into further interventions. Therefore, using a sample derived from a one-year, five-wave longitudinal study during the COVID-19 pandemic, this study aimed to examine (1) the independent and joint trajectories of depression and anxiety symptoms among Chinese college students; (2) the role of self-compassion in predicting the trajectories. We postulated that (1) there would be group heterogeneity (i.e., different patterns) in the independent and joint trajectories of depression and anxiety symptoms, and (2) the baseline level of self-compassion would predict the trajectories.

2. Methods

2.1. Participants and procedure

We used snowballing sampling to recruit college students from various colleges or universities in China as participants through social media platforms (e.g., Wechat and Tencent QQ). Participants were invited to complete an online questionnaire that included sociodemographic variables (i.e., age, gender, family structure, having sibling[s] or not, SES, current location, and college location), self-compassion, depression, and anxiety on a Chinese online survey platform (<https://www.wjx.cn>). Repeated measurements were scheduled at five-time points at three-month intervals: T1 (February 2020), T2 (May 2020), T3 (August 2020), T4 (November 2020), and T5 (February 2021).

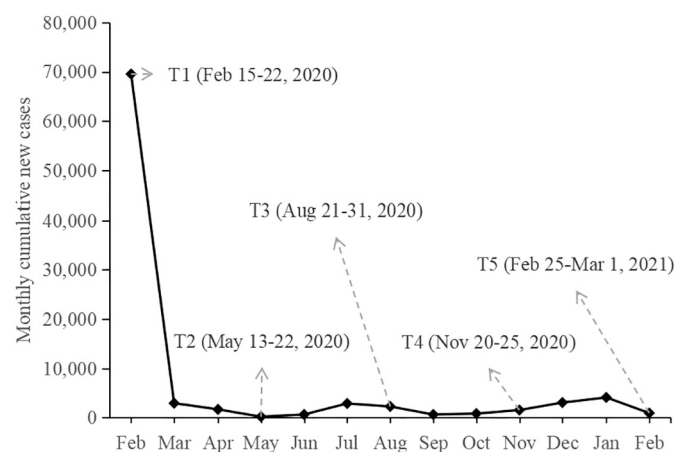


Fig. 1. The COVID-19 pandemic situation in China corresponding to each time point of data collection.

Note: Data retrieved from <https://ourworldindata.org/coronavirus>

2020), T3 (August 2020), T4 (November 2020), and T5 (February 2021). Fig. 1 displays the pandemic situation (indicated by monthly cumulative new cases) in China corresponding to each time point. Data collection spanned from the outbreak period to the remission period. The time period of the baseline survey was at the peak of the number of COVID-19 new confirmed cases in China. In the subsequent second, third, fourth, and fifth surveys, the development of the pandemic was gradually controlled with occasional sporadic cases. The information and data were retrieved from [OurWorldInData.org](https://www.ourworldindata.org) (Roser et al., 2020).

All participants provided consent before filling out the questionnaires. As fair compensation for time spent in this study, those who completed the questionnaires would receive approximately 10–15 RMB (approximately 1.5–2 USD) via online payment. There were no missing values due to the setup of the online questionnaire that required participants to answer all items before submission. Of the 1164 students who provided valid information in the baseline survey, 1108 (95.2%), 992 (85.2%), 717 (61.6%), and 494 (42.4%) participants remained in the second, third, fourth, and fifth wave, respectively. Participants were recognized by their phone numbers during the longitudinal data collection. An a-priori power analysis was conducted by G*Power 3.1 using the following parameters: F-test, ANOVA repeated measures, effect size $f = 0.1$ (small effect size), $\alpha = 0.05$, statistical power = 0.95, number of groups = 5 (up to five latent trajectories), number of measurements = 5 (five waves), correlation among repeated measures = 0.5, and non-sphericity correction $\epsilon = 0.99$. A total sample size of $n = 190$ was deemed necessary based on these parameters. Thus, our final sample size ($n = 494$) was enough for analyzing the latent trajectories. The project obtained ethical clearance from the Human Research Ethics Committee of the Shenzhen University.

2.2. Measures

2.2.1. Sociodemographic factors

Participants reported their age (years) and gender (male/female), family structure (intact/non-intact), whether being the single child in their family (single/non-single). SES was also measured by the MacArthur Scale (Cundiff et al., 2013). Additionally, participants reported their current location and college location. According to the average number of confirmed cases of the current location and school location in seven days during T1, we classified participants into two categories: < 1000 cases and ≥ 1000 cases to distinguish the pandemic degree of their locations. For this, we referred to the province-wise updates from <https://lab.isaacclin.cn/nCoV>.

2.2.2. Self-compassion

Self-compassion was assessed by the 26-item self-compassion scale (SCS) (Neff, 2003a). SCS includes six subscales, with three subscales representing compassionate aspects and three representing uncompassionate aspects. After reverse coding the uncompassionate aspects, the grand mean of the six subscales was computed. Responses are identified on a 5-point scale from “almost never” to “almost always”. A higher grand mean indicates a higher level of self-compassion. The Chinese version has demonstrated good psychometric properties (Chen et al., 2011). The Cronbach's α coefficient of SCS in this study was 0.87.

2.2.3. Depression symptoms

The Chinese version of the 9-item Patient Health Questionnaire (PHQ-9) was used to measure the severity of depression symptoms (Hu et al., 2014; Kroenke et al., 2001). A Likert scoring of 0–3 points was adopted (0 = “not at all” to 3 = “nearly every day”). Summing up the 9 items yields a total score ranging from 0 to 27 (higher points indicating more severe symptoms). The cutoff scores of PHQ-9 are 5, 10, 15, and 20, indicating mild, moderate, moderately severe, and severe depression symptoms, respectively (Kroenke et al., 2001). PHQ-9 has demonstrated good psychometric properties in previous studies (Li et al., 2021c; Wang et al., 2014). The Cronbach's α coefficients at 5 time points in the study

were 0.85, 0.88, 0.89, 0.89, and 0.87, respectively.

2.2.4. Anxiety symptoms

The Chinese version of the Zung Self-rated Anxiety Scale (Z-SAS) was utilized to assess participants' anxiety symptoms (Wang and Chi, 1984; Zung, 1971). There are 20 items on a 4-point Likert scale (1 = “none or a little of the time” to 4 = “most or all of the time”), among which five items (item 5, 9, 13, 17, and 19) were reverse scored. The scores of all items are added up to obtain the raw score. Then, the raw score is multiplied by 1.25 to create the standard score. The total score ranges from 25 to 100. Classification of severity is based on the below cutoffs: mild (score 50–60), moderate (score 61–70), and severe (score > 70). Z-SAS has been used to measure the anxiety severity of Chinese college students in previous literature (Li et al., 2021b; Zhang et al., 2020a). The Cronbach's α coefficients at 5 time points in the study were 0.83, 0.85, 0.88, 0.85, and 0.87, respectively.

2.2.5. Data analysis

First, we compare the characteristics at baseline between analytical samples and excluded samples using χ^2 (categorical variables) and t -tests (continuous variables). Maximum likelihood estimates (ML) were used for analysis. Second, we established latent growth mixture models (GMM) for depression and anxiety symptoms separately. Third, joint trajectories of depression and anxiety symptoms were examined. Since there were five-time points, the possibility of curvilinear patterns in trajectories was also considered. Linear and linear + quadratic unconditional GMM (i.e., no covariates) were performed to identify the linear and curvilinear trajectories of depression and anxiety symptoms over time. We first ran parallel process growth mixture models (PPGMM), but the models could not converge successfully. After we fixed the variance in the intercept and slope to zero, the models were finally established (Wu et al., 2022; Lauterbach and Armour, 2016). The optimal number of latent classes was determined by model fit indices, interpretability, and theoretical appraisals (Vermunt, 2017). A better model fit was indicated by lower Bayesian information (BIC), lower Akaike information criteria (AIC), lower sample size-adjusted Bayesian information criterion (aBIC), higher entropy, a significant adjusted Lo–Mendell–Rubin likelihood ratio test (LMR) result, and a significant bootstrap likelihood ratio test (BLRT) (Nylund et al., 2007).

Finally, posterior class assignments were exported from Mplus to SPSS to run the multinomial logistic regression analyses. Three models were established separately for the independent and joint trajectories of depression and anxiety symptoms (the dependent variables), and self-compassion was the independent variable. Age, gender, family structure, whether being the single child, SES, and confirmed cases in the current location and college location were included as covariates. Results of logistic regression were presented as odds ratios with a 95% confidence interval (CI). SPSS 23.0 and Mplus 8.3 were used to conduct the above analyses.

3. Results

3.1. Characteristics of participants

As shown in Table 1, the baseline average age of the final sample was 20.41 years (SD = 1.74), with 34.4% males and 65.6% females. There was not significant statistical difference between variables of the analytical samples and excluded samples. The mean score (SD) of self-compassion at T1 was 3.25 (0.46). The mean scores (SD) of depression scores at T1, T2, T3, T4, and T5 were 6.42 (4.75), 6.88 (4.60), 6.98 (4.87), 6.11 (4.51), and 6.40 (4.41), respectively. The mean scores (SD) of anxiety scores at T1, T2, T3, T4, and T5 were 40.72 (8.51), 40.68 (8.29), 41.19 (9.83), 41.32 (9.24), and 40.38 (9.55), respectively. More details are shown in Table 2.

Table 1
Comparison of baseline variables between the analytical sample and the excluded sample.

| Variables | Analytical samples | | Excluded samples | | p |
|-------------------------------------|--------------------|-------|------------------|-------|-------|
| | N/ Mean | %/SD | N/ Mean | %/SD | |
| Gender | | | | | 0.850 |
| Male | 170 | 34.4% | 227 | 33.9% | |
| Female | 324 | 65.6% | 443 | 66.1% | |
| Siblings | | | | | 0.760 |
| Single | 159 | 32.2% | 210 | 31.3% | |
| Non-single | 335 | 67.8% | 460 | 68.7% | |
| Family structure | | | | | 0.668 |
| Intact | 454 | 91.9% | 611 | 91.2% | |
| Non-intact | 40 | 8.1% | 59 | 8.8% | |
| Confirmed cases in current location | | | | | 0.188 |
| < 1000 | | | | | |
| < 1000 | 181 | 36.6% | 271 | 40.4% | |
| ≥ 1000 | 313 | 63.4% | 399 | 59.6% | |
| Confirmed cases in college location | | | | | 0.953 |
| < 1000 | 133 | 26.9% | 180 | 26.9% | |
| ≥ 1000 | 315 | 63.8% | 424 | 63.3% | |
| Missing ^a | 46 | 9.3% | 66 | 9.9% | |
| Age | 20.41 | 1.74 | 20.58 | 1.90 | 0.104 |
| Subjective socioeconomic status | 4.90 | 1.32 | 4.86 | 1.40 | 0.564 |
| Depression | 6.42 | 4.75 | 6.70 | 4.88 | 0.318 |
| Anxiety | 40.72 | 8.51 | 40.92 | 8.09 | 0.688 |
| Self-compassion | 3.25 | 0.46 | 3.25 | 0.48 | 0.886 |

^a Unable to determine the number of confirmed cases in the location.

Table 2
Levels of depression and anxiety symptoms of the analytical sample.

| Variable | Mean (SD) | Range | Skewness | Kurtosis |
|---------------------|------------|-----------|----------|----------|
| Depression symptoms | | | | |
| T1 | 6.4 (4.8) | 0–23 | 0.88 | 0.45 |
| T2 | 6.9 (4.6) | 0–27 | 0.84 | 0.83 |
| T3 | 7.0 (4.9) | 0–25 | 0.90 | 0.76 |
| T4 | 6.1 (4.5) | 0–27 | 1.02 | 1.58 |
| T5 | 6.4 (4.4) | 0–23 | 0.95 | 0.81 |
| Anxiety symptoms | | | | |
| T1 | 40.7 (8.5) | 25.0–80.0 | 0.94 | 1.27 |
| T2 | 40.7 (8.3) | 25.0–75.0 | 0.84 | 0.54 |
| T3 | 41.2 (9.8) | 25.0–81.3 | 0.87 | 0.51 |
| T4 | 41.3 (9.2) | 25.0–77.5 | 0.89 | 0.66 |
| T5 | 40.4 (9.6) | 25.0–80.0 | 0.89 | 0.79 |

3.2. Independent trajectories of depression and anxiety symptoms

The final model classes were decided by the fit indices and substantial meaning (Nylund et al., 2007). The performance of the BLRT test may be better than that of the LMR-LRT test (Nylund et al., 2007). When the two test results are contradictory, the BLRT test results shall gain

Table 3
Fit indices for independent trajectories of depression symptoms.

| Model | AIC | BIC | aBIC | Entropy | LMR (p) | BLRT (p) | Class count and proportions/N (%) |
|----------------------------|------------------|------------------|------------------|-------------|--------------|-------------------|--|
| Linear weights only | | | | | | | |
| 2C | 13,422.46 | 13,477.10 | 13,435.83 | 0.83 | < 0.001 | < 0.001 | 408 (82.6)/86 (17.4) |
| 3C | 13,389.22 | 13,456.46 | 13,405.68 | 0.84 | 0.041 | < 0.001 | 78 (15.8)/24 (4.9)/392 (79.3) |
| 4C | 13,366.08 | 13,445.92 | 13,385.62 | 0.83 | 0.066 | < 0.001 | 374 (75.7)/47 (9.5)/43 (8.7)/30 (6.1) |
| 5C | 13,347.53 | 13,439.99 | 13,370.16 | 0.83 | 0.079 | < 0.001 | 344 (69.6)/49 (9.9)/8 (1.6)/30 (6.1)/63 (12.8) |
| Linear + Quadratic weights | | | | | | | |
| 2C | 13,415.48 | 13,491.13 | 13,434.00 | 0.86 | < 0.001 | < 0.001 | 69 (14.0)/425 (86.0) |
| 3C | 13,366.06 | 13,458.51 | 13,388.69 | 0.86 | 0.410 | < 0.001 | 62 (12.5)/398 (80.6)/34 (6.9) |
| 4C | 13,347.78 | 13,457.05 | 13,374.53 | 0.88 | 0.096 | < 0.001 | 16 (3.2)/392 (79.4)/24 (4.9)/62 (12.5) |
| 5C | 13,333.71 | 13,459.78 | 13,364.56 | 0.85 | 0.300 | < 0.001 | 43 (8.7)/28 (5.7)/371 (75.1)/37 (7.5)/15 (3.0) |

Note. The final extracted model is bold.

ascendancy. Regarding depression trajectories, one class in the 3- and 5-class model accounted for <5 % of the total sample, which was considered a spurious class (Nylund et al., 2007). In comparison, the 4-class linear model showed better fit indices. In addition, when the fit indices of the linear and the curve were similar, a concise model could be chosen to improve model parsimony (Ram and Grimm, 2009). This study finally determined the 4-class linear model as the best fitting model for depression (Table 3). The selection of independent anxiety trajectories was similar to the above process. While comparing the 2-class and 3-class linear models for anxiety in Chinese college students, the 3-class linear model provided more nuanced and valuable information regarding the classification of subgroups than the 2-class linear model. Therefore, 3-class linear model was selected as the most optimal solution for anxiety trajectories (Table 4).

As Fig. 2 shown, four distinct trajectories were identified for depression symptoms. Based on initial levels and development trends of these trajectories, they were named low symptoms group (n = 374, 75.7 %), risk group (n = 47, 9.5 %), decreasing symptoms group (n = 43, 8.7 %), and deterioration group (n = 30, 6.1 %). The intercept (I) and slope (S) for these groups were: low symptoms group (I = 5.02, S = -0.04), risk group (I = 13.40, S = 0.07), remission group (I = 13.61, S = -1.96), and deterioration group (I = 6.26, S = 1.62). The low symptoms group was characterized by stable and low levels of symptoms throughout the study. The risk group remained at moderate levels of symptoms (PHQ-9 scored between 10 and 15) across five measurements. The remission group showed moderate symptoms initially and decreased to a mild level (PHQ-9 scored between 5 and 10). The deterioration group showed mild symptoms at baseline but increased to a moderate level subsequently.

Fig. 3 demonstrates the three distinct trajectories of anxiety symptoms, named low symptoms group (n = 407, 82.4 %), remission group (n = 37, 7.5 %), and deterioration group (n = 50, 10.1 %). The I and S were: low symptoms group (I = 21.38, S = 0.73), remission group (I = 55.86, S = -2.10), deterioration group (I = 47.94, S = 2.45). The low symptoms group remained normal anxiety levels (SAS < 50) during the survey period. The other two groups presented the opposite trend: the remission group initially presented a mild level of anxiety symptoms (SAS scored between 50 and 60) and then recovered to normal levels, whereas the deterioration group initially presented a normal level of symptoms but then increased to mild levels.

3.3. Joint trajectories of depression and anxiety symptoms

One to five latent categories were extracted to identify the optimal number of joint development trajectories of depression and anxiety symptoms. The fit indices of the models are shown in Table 5. Joint trajectories are determined in a similar way to independent trajectories considering both fit indices and substantial meaning. From 3-class to 4-class, the values of AIC, BIC, and aBIC decline slower, which indicated 3-class to be an inflection point. In addition, there was redundancy in 4-class due to 2 groups of moderate depression symptoms with similar

Table 4
Fit indices for independent trajectories of anxiety symptoms.

| Model | AIC | BIC | aBIC | Entropy | LMR (p) | BLRT (p) | Class count and proportions/ N (%) |
|----------------------------|------------------|------------------|------------------|-------------|--------------|-------------------|--|
| Linear weights only | | | | | | | |
| 2C | 16,383.11 | 16,437.75 | 16,396.48 | 0.81 | 0.015 | < 0.001 | 431 (87.2)/63 (12.8) |
| 3C | 16,349.07 | 16,416.31 | 16,365.53 | 0.82 | 0.285 | < 0.001 | 37 (7.5)/407 (82.4)/50 (10.1) |
| 4C | 16,328.06 | 16,407.91 | 16,347.60 | 0.87 | 0.225 | < 0.001 | 401 (81.2)/69 (14.0)/6 (1.2)/18 (3.6) |
| 5C | 16,319.61 | 16,412.06 | 16,342.24 | 0.86 | 0.096 | < 0.001 | 49(9.9)/5(1.0)/42(8.5)/396(80.2)/2(0.4) |
| Linear + Quadratic weights | | | | | | | |
| 2C | 16,358.33 | 16,433.97 | 16,376.84 | 0.82 | 0.006 | < 0.001 | 418 (84.6)/76 (15.4) |
| 3C | 16,323.89 | 16,416.35 | 16,346.52 | 0.83 | 0.617 | < 0.001 | 69 (14.0)/37 (7.5)/388 (78.5) |
| 4C | 16,299.24 | 16,408.51 | 16,325.98 | 0.87 | 0.017 | < 0.001 | 67 (13.6)/37 (7.5)/2 (0.4)/388 (78.5) |
| 5C | 16,280.96 | 16,407.04 | 16,311.82 | 0.87 | 0.578 | < 0.001 | 31 (6.3)/8 (1.6)/61 (12.3)/384 (77.7)/10 (2.1) |

Note. The final extracted model is bold.

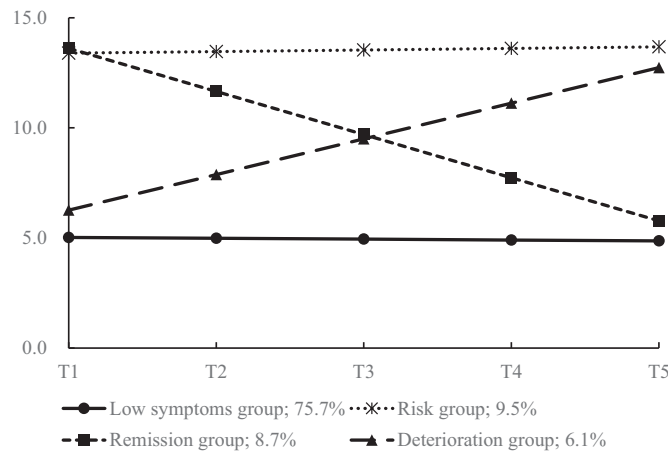


Fig. 2. The estimated latent trajectories of depression symptoms.

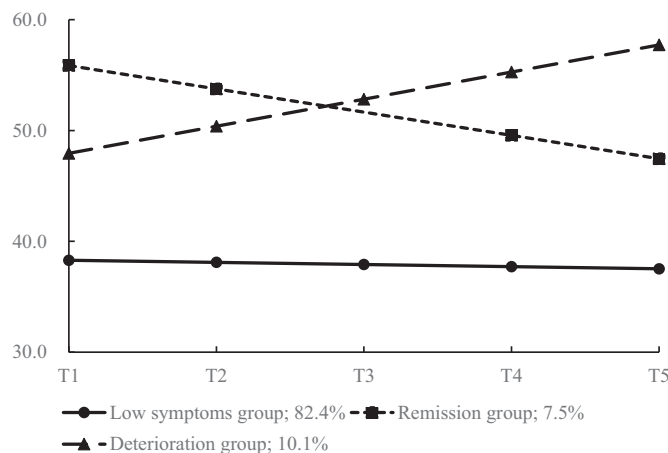


Fig. 3. The estimated latent trajectories of anxiety symptoms.

Table 5
Fit indices for joint trajectories of depression and anxiety symptoms.

| Model | AIC | BIC | aBIC | Entropy | LMR (p) | BLRT (p) | Class count and proportions/ N (%) |
|-----------|------------------|------------------|------------------|-------------|--------------|-------------------|--|
| 2C | 29,636.64 | 29,737.51 | 29,661.33 | 0.91 | < 0.001 | < 0.001 | 375(75.9)/119(24.1) |
| 3C | 29,271.63 | 29,393.50 | 29,301.46 | 0.88 | 0.009 | < 0.001 | 267(54.0)/170(34.4)/57(11.5) |
| 4C | 29,076.40 | 29,219.29 | 29,111.37 | 0.87 | 0.003 | < 0.001 | 118(23.9)/58(11.7)/253(51.2)/65(13.2) |
| 5C | 28,985.90 | 29,149.80 | 29,026.02 | 0.87 | 0.071 | < 0.001 | 64(13.0)/243(49.2)/118(23.9)/25(5.1)/44(8.9) |

Note. The final extracted model is bold.

trends. Therefore, this study finally determined the 3-class linear model as the best fitting model for the joint developmental trajectory of depression and anxiety in Chinese college students.

Therefore, the joint development trend of depression and anxiety in early adolescents is divided into three sub-categories: the first category of adolescents accounts for the largest proportion, about 54.5 %, and their depression and anxiety levels have always been at a low and minimal level during the 5-time measurement, which is named as “low symptoms” group (Intercept $I_{dep} = 4.50, p < 0.001, I_{anx} = 35.86, p < 0.001$; slope $S_{dep} = -0.16, p = 0.003, S_{anx} = -0.34, p = 0.001$; dep represents depression, anx stands for anxiety, the same below). The second category of participants accounted for 34.4 %, and their depression and anxiety reached a mild level in the initial period, and stay stable. They were named as “mild symptoms group” (Intercept $I_{dep} = 8.05, p < 0.001, I_{anx} = 44.05, p < 0.001$; slope $S_{dep} = -0.07, p = 0.526, S_{anx} = 0.25, p = 0.207$). The third category accounted for 11.5 %, and their initial levels of depression and anxiety were above the cutoff, and depression symptoms presented stable while anxiety symptoms showed an increasing trend, which was named “risk group” (Intercept $I_{dep} = 13.08, p < 0.001, I_{anx} = 54.10, p = 0.039$; slope $S_{dep} = 0.15, p = 0.416, S_{anx} = 0.82, p = 0.039$). The levels of depression and anxiety of each trajectory group at the five measurement time points are shown in Table 6.

3.4. Predictive role of self-compassion on trajectories of depression and anxiety symptoms

Tables 7–9 presents the longitudinal associations between baseline self-compassion and the trajectories of depression and anxiety symptoms after adjusting for socio-demographic variables. Low symptoms groups were set as the reference. For depression symptoms, participants with a higher level of self-compassion were less likely to belong to the risk group (OR = 0.08 [0.03, 0.18], $p < 0.001$), the remission group (OR = 0.14 [0.06, 0.33], $p < 0.001$), and the deterioration group (OR = 0.20 [0.07, 0.52], $p < 0.001$). Regarding anxiety symptoms, participants with a higher level of self-compassion were less likely to appear in the remission group (OR = 0.07 [0.03, 0.17], $p < 0.001$) and the deterioration group (OR = 0.24 [0.11, 0.52], $p < 0.001$). In terms of the joint trajectories, compared with the low symptoms group, students with higher levels of self-compassion showed lower likelihood belonging to the risk group (OR = 0.03 [0.01, 0.08], $p < 0.001$) and the mild symptoms group (OR = 0.07 [0.04, 0.14], $p < 0.001$).

Table 6
Mean and standard deviation of depression and anxiety symptoms for each latent joint trajectory.^b

| Groups | Depression symptoms | | | | | Anxiety symptoms | | | | |
|------------------------------|---------------------|--------------|--------------|--------------|--------------|------------------|--------------|--------------|--------------|--------------|
| | T1 | T2 | T3 | T4 | T5 | T1 | T2 | T3 | T4 | T5 |
| Low symptoms group (54.0 %) | 4.22 (3.31) | 4.60 (3.16) | 4.28 (3.05) | 3.67 (2.67) | 3.91 (2.53) | 35.86 (4.94) | 35.45 (5.23) | 34.78 (4.94) | 35.49 (4.75) | 34.04 (4.70) |
| Mild symptoms group (34.4 %) | 7.79 (4.43) | 8.15 (3.73) | 8.86 (4.03) | 7.48 (3.66) | 7.82 (3.33) | 44.18 (6.67) | 44.04 (6.44) | 45.74 (6.56) | 44.90 (6.04) | 45.09 (6.38) |
| Risk group (11.5 %) | 12.58 (4.52) | 13.82 (4.24) | 14.00 (4.46) | 13.44 (4.04) | 13.84 (3.94) | 53.18 (8.96) | 55.15 (6.90) | 57.61 (8.40) | 57.92 (7.30) | 56.03 (8.15) |

^b Note. Data are shown in Mean (SD).

Table 7
The predictive role of self-compassion on independent trajectories of depression symptoms.

| | Risk group | | Remission group | | Deterioration group | |
|---|------------|-------------|-----------------|-------------|---------------------|--------------|
| | OR | 95 % CI | OR | 95 % CI | OR | 95 % CI |
| Male (female as reference) | 0.88 | 0.40 – 1.93 | 0.90 | 0.41 – 1.95 | 0.59 | 0.22 – 1.56 |
| Intact family structure (non-intact as reference) | 0.93 | 0.28 – 3.13 | .88 | 0.27 – 2.80 | 2.56 | 0.33 – 20.09 |
| Single child (non-single as reference) | 1.29 | 0.62 – 2.68 | 1.00 | 0.47 – 2.13 | 1.21 | 0.51 – 2.90 |
| Confirmed cases in current location <1000 (≥ 1000 as reference) | 1.14 | 0.40 – 3.31 | 0.67 | 0.19 – 2.31 | 0.35 | 0.07 – 1.76 |
| Confirmed cases in college location <1000 (≥ 1000 as reference) | 0.43 | 0.13 – 1.40 | 1.66 | 0.46 – 5.94 | 1.70 | 0.33 – 8.78 |
| Age | 1.16 | 0.95 – 1.41 | 0.99 | 0.80 – 1.22 | 1.19 | 0.95 – 1.49 |
| Subjective socioeconomic status | 0.80 | 0.61 – 1.03 | 1.03 | 0.78 – 1.36 | 1.02 | 0.74 – 1.40 |
| Self-compassion | 0.08*** | 0.03 – 0.18 | 0.14*** | 0.06 – 0.33 | 0.20** | 0.07 – 0.52 |

Note. Low symptoms group as reference.

** $p < 0.01$.

*** $p < 0.001$.

4. Discussion

In this one-year five-wave longitudinal study on Chinese college students, we described the independent and joint trajectories of depression and anxiety symptoms and the protective role of self-compassion on these trajectories. The majority of Chinese college students could make adaptive psychological responses without depression and anxiety symptoms, but others experienced more severe and fluctuating symptoms. Better self-compassion could predict more mentally healthy trajectories. The specific discussion of these findings is as follows.

4.1. Independent trajectories of depression and anxiety symptoms

Our findings are in line with several studies investigating trajectories of mental health during the pandemic (Saunders et al., 2021; Batterham et al., 2021; Carr et al., 2022; Hyland et al., 2021; Kimhi et al., 2021; McPherson et al., 2021; Shevlin et al., 2021). Most people followed a relatively healthy trajectory with no or few symptoms of both depression and anxiety. But notably, though most young people followed the

Table 8
The predictive role of self-compassion on independent trajectories of anxiety symptoms.

| | Remission group | | Deterioration group | |
|---|-----------------|-------------|---------------------|-------------|
| | OR | 95 % CI | OR | 95 % CI |
| Male (female as reference) | 1.18 | 0.50 – 2.78 | 1.28 | 0.64 – 2.58 |
| Intact family structure (non-intact as reference) | 0.29* | 0.11 – 0.81 | 0.67 | 0.21 – 2.08 |
| Single child (Non-single as reference) | 0.98 | 0.43 – 2.25 | 1.03 | 0.51 – 2.08 |
| Confirmed cases in current location <1000 (≥ 1000 as reference) | 0.53 | 0.14 – 2.07 | 0.63 | 0.20 – 1.94 |
| Confirmed cases in college location <1000 (≥ 1000 as reference) | 1.88 | 0.47 – 7.55 | 0.84 | 0.26 – 2.74 |
| Age | 1.35** | 1.10 – 1.65 | 1.17 | 0.97 – 1.42 |
| Subjective socioeconomic status | 0.92 | 0.69 – 1.22 | 0.76* | 0.59 – 0.98 |
| Self-compassion | 0.07*** | 0.03 – 0.17 | 0.24*** | 0.11 – 0.52 |

Note. Low symptoms group as reference.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table 9
The predictive role of self-compassion on joint trajectories of depression and anxiety symptoms.^d

| | Risk group | | Mild symptoms group | |
|--|------------|-------------|---------------------|-------------|
| | OR | 95 % CI | OR | 95 % CI |
| Male (female as reference) | 1.07 | 0.51 – 2.24 | 0.93 | 0.57 – 1.52 |
| Intact family structure (non-intact as reference) | 0.48 | 0.15 – 1.55 | 0.49 | 0.21 – 1.10 |
| Single child (Non-single as reference) | 1.27 | 0.62 – 2.60 | 1.02 | 0.62 – 1.67 |
| Confirmed COVID-19 cases in current location <1000 (≥ 1000 as reference) | 0.74 | 0.24 – 2.31 | 1.08 | 0.49 – 2.35 |
| Confirmed COVID-19 cases in college location <1000 (≥ 1000 as reference) | 0.70 | 0.21 – 2.33 | .99 | 0.44 – 2.24 |
| Age | 1.25* | 1.03 – 1.52 | 1.05 | 0.92 – 1.21 |
| Subjective socioeconomic status | 0.69** | 0.53 – 0.89 | 0.93 | 0.77 – 1.13 |
| Self-compassion | 0.03*** | 0.01 – 0.08 | 0.07*** | 0.04 – 0.14 |

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

^d Note. Low symptoms group as reference.

healthy trajectory of depression symptoms, about 25 % of participants belonged to the additional distinct subgroups (risk group, remission group, and deterioration group) in which members have experienced or continued to experience moderate levels of depression symptoms during the study period. Regarding anxiety symptoms, the symptoms of all three trajectories were normal or mild across the five waves generally. However, while some respondents (7.5 %) reported reductions in symptom severity, others (10.1 %) experienced increasing anxiety at the same time. These findings support the conclusion of a review examining trajectories of resilience and dysfunction following potential trauma (Galatzer-Levy et al., 2018): individuals' responses to adversity are heterogeneous, and the majority can be psychologically resilient and successfully adapt to adversity. Collectively, relative to anxiety symptoms, Chinese college students seemed more likely to experience depression symptoms in the pandemic context. This conclusion requires cautious interpretation because the difference between the prevalence or level of depression and anxiety symptoms may be caused by the difference of scales measuring depression and anxiety symptoms. However, some studies using large samples did report that the prevalence of depression symptoms was higher than that of anxiety symptoms (Li et al., 2021c; Wang et al., 2021; Wu et al., 2021b). These findings highlight the importance of assessing different indicators of mental health to fully grasp the mental status of specific populations.

4.2. Joint trajectories of depression and anxiety symptoms

To our knowledge, the current study was the first to investigate the joint trajectories of depression and anxiety under the COVID-19 pandemic context by considering the co-existence of depression and anxiety. We found three distinct joint patterns of depression and anxiety symptoms. It is evident that the trajectories of depression and anxiety symptoms are correlated, displaying consistent developmental trends. By virtue of the PPLCGM, this study adds to previous knowledge about the joint occurrence of the symptoms, highlighting the stability of their co-morbidity also in the long run during the pandemic. In all, the results suggest that when someone being on a trajectory of high levels of depressive or anxiety symptoms, it is most likely that the person is also on a high level or increasing trajectories of the other symptoms. Hence, mental health interventions should focus on the symptoms of depression and anxiety simultaneously, rather than assuming that they are occurring and developing independently.

4.3. The predictive role of self-compassion on the trajectories of depression and anxiety symptoms

More importantly, this study found that self-compassion could be a significant factor in differentiating the development trajectories of depression and anxiety symptoms during the COVID-19 pandemic. Taking the healthy group as the reference, participants with higher levels of self-compassion were less likely to be in the persistence group, remission group, or deterioration group of depression symptoms, as well as the remission or deterioration group of anxiety symptoms. These results are consistent with cross-sectional studies reporting an inverse correlation between self-compassion with depression and anxiety during the COVID-19 pandemic (Gutiérrez-Hernández et al., 2021; Lau et al., 2020). Before the presence of the pandemic, there has been solid empirical evidence asserting that self-compassion was closely related to mental well-being and reduced the propensity of psychological problems, including depression and anxiety (Baker et al., 2019; Ford et al., 2017; Sheerin et al., 2018). A meta-analysis of randomized controlled trials found that self-compassion interventions could exert significant effects on improving depression and anxiety (Ferrari et al., 2019). From an evolutionary perspective, self-compassion stimulates caregiving hormones (i.e., oxytocin) and physiological reactions (e.g., increased heart rate variability) (Gilbert, 2014; Kirby et al., 2017), resulting in a sense of security, connection, and compassionate motivation. Thus, by

balancing the automatic nervous system, self-compassion practice can bring psychological health benefits and reduce the risk of psychopathology problems (Gilbert, 2014). A review has suggested that psychological constructs related emotional functioning (e.g., coping strategies, personality) underline individual differences in trajectories of response to aversive events (Galatzer-Levy et al., 2018). Besides, individual characteristics and environmental stressors before or after an event may impact the response to the event more than the object nature of the event itself (Galatzer-Levy et al., 2018). Therefore, even though individuals are all facing the same stressful event (e.g., the COVID-19 pandemic), the change of mental state after the occurrence of the event differs across individuals owing to the variability of psychological capitals. Our findings further confirmed that self-compassion, as an attitude towards oneself in sufferings that get emerging attention from practitioners and researchers, is an important factor affecting the variability of psychological status and can provide enormous psychological benefits to individuals affected by the pandemic.

4.4. Strengths and implications

Despite these limitations, the present study has some strengths and practical implications. First, we used an intensive longitudinal design to assess college students' mental health across one year, covering the peak and remission period of the COVID-19 pandemic. This provides valuable insights into the timely prevention and intervention of mental health problems during a pandemic. Second, we used a person-centered approach (i.e., GMM, assuming heterogeneous development), which allowed us to identify distinct subgroups in the trajectories of depression and anxiety symptoms with varying initial levels and development trends. Third, self-compassion was found to be a protective factor against the development and deterioration of depression and anxiety symptoms longitudinally, which might shed light on future intervention programs considering that self-compassion has been proved to be a malleable construct that can be cultivated (Ferrari et al., 2019). In the context of the pandemic, the current intensive longitudinal study provides supporting evidence for the protective roles of self-compassion on mental health, and thus emphasizes the importance of developing and implementing programs targeting self-compassion. We encourage mental health practitioners to adapt self-compassion-based interventions by taking the situation of the COVID-19 situation (e.g., social distancing) into account. For example, the efficacy of internet- and mobile-based interventions for improving depression and anxiety symptoms has been well summarized (Domhardt et al., 2019; Firth et al., 2017; Josephine et al., 2017). Hence, interventions based on self-compassion can be adapted to be online resources to be more accessible for a wider audience. Besides, when setting goals or evaluating the effect of self-compassion interventions in college students, depression symptoms should be given priority as this study found that depression symptoms were relatively common among college students.

4.5. Limitations and future research

There are several limitations worth noting in this study. First, measures were self-reported and, consequently, subject to social desirability bias and shared method variance. Future studies can combine subjective indicators and objective ones to have more accurately measure mental health status. Second, it is not possible to infer causal relationships between variables of the study given the descriptive (non-experimental) nature of our research design. Third, as we adopted a convenient sampling method in this study, findings may not be extended to the broader populations. Future studies can enlarge the sample size and validate in other populations. Fourth, this study did not account for other variables, such as physical activity and sleep, that could also be modified and influence the variations of depression and anxiety under the pandemic (Creese et al., 2021; Zhang et al., 2020b). Fifth, we only included participants with full completion (completing all four follow-up studies) in

the final analysis sample. This led to the failure of fully utilizing the information provided by participants who missed one, two, three, or four follow-up studies and may reduce the statistical power.

5. Conclusions

Under the background of the pandemic situation, there was significant heterogeneity in the independent and joint trajectories of depression and anxiety symptoms among Chinese college students. When students had a higher level of self-compassion at baseline, they were more likely to follow more desirable patterns of mental health subsequently, showing stable and low levels of depression and anxiety symptoms. Therefore, we encourage mental health service workers to design and implement more self-compassion-based programs for college students.

CRedit authorship contribution statement

KL and LH designed the study, conducted the statistical analysis and wrote the manuscript. LH conducted data collection work and KL double checked statistical analysis. DQ, HB and XC critically reviewed and revised the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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