



The serial mediation effect of prospective imagery vividness and anxiety symptoms on the relationship between perceived stress and depressive symptoms among Chinese vocational college students during the COVID-19 pandemic

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Abstract

The mental health of vocational college students has been neglected during the COVID-19 pandemic. Prospective imagery may play a role in the relationships among stress, anxiety and depression. This study aimed to survey the mental health of Chinese vocational college students and explore the mediation effect of prospective imagery vividness and anxiety symptoms on the relationship between perceived stress and depressive symptoms. A total of 2,381 vocational college students ($M_{\text{age}} = 18.38$ years, range: 16–21, $SD = 0.92$) provided self-report data on perceived stress, anxiety and depressive symptoms and prospective imagery vividness. Two potential serial mediation models were postulated regarding the roles of prospective imagery vividness and anxiety symptoms in the relationship between perceived stress and depressive symptoms. The prevalence rates of stress, anxiety and depressive symptoms were 55.7%, 33.2% and 53.5%, respectively, among vocational college students. Perceived stress was associated with decreased vividness of positive prospective imagery and increased vividness of negative prospective imagery and anxiety symptoms, leading to increased depressive symptoms. Additionally, prospective imagery vividness and anxiety symptoms had a serial mediation effect on the relationship between perceived stress and depressive symptoms. The results demonstrated that impoverished vividness of positive prospective imagery is not only a central feature of depression but also associated with anxiety. Interventions targeting prospective imagery vividness may alleviate anxiety and depressive symptoms among Chinese vocational college students and should be implemented as soon as possible during the COVID-19 pandemic.

Keywords Prospective imagery · Perceived stress · Depressive symptoms · Anxiety symptoms · Vocational college students

Introduction

Stressful life events associated with the COVID-19 pandemic such as lockdowns, school closures, and unemployment, all have the potential to impact mental health among

younger groups (Guessoum et al., 2020; Jehi et al., 2022; Santomauro et al., 2021). A meta-analysis of 436,799 college students showed that the prevalence rates of anxiety and depression were 29% and 37%, respectively, during the COVID-19 pandemic (Wang et al., 2021). A study of 2,057 Chinese vocational medicine students found that the prevalence rates of anxiety and depression were 30.8% and 57.5%, respectively (Shao et al., 2020), which are higher than those in general college students. Although there are growing concerns about the mental health of general college students, few papers have focused on the mental health of students in vocational colleges. Thus, more studies are needed to understand the mental health of vocational college students.

In China, many students who do not pass the general college entrance examination elect to attend vocational colleges; some even enter vocational college after graduating

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from junior high school. Compared with general college students, most vocational college students face bleaker job prospects after three years of vocational training at a younger age. Younger age and worrisome job prospects were both risk factors for anxiety and depression during the COVID-19 pandemic (Mahmud et al., 2021; Santomauro et al., 2021), which suggests that vocational college students may be more vulnerable to these two mood disorders.

Stressful life events are important triggers of anxiety and depression, but the impact of stressful events on individuals' mental health is largely determined by *perceived stress*, which is a valuable predictor of anxiety and depression (Cohen et al., 1983). Perceived stress refers to psychological stress induced by people's perception that an external event outweighs their capacity to cope (Folkman & Lazarus, 1985; Folkman et al., 1986). Previous studies have found that college students with high levels of perceived stress exhibit high levels of anxiety and depression during the COVID-19 pandemic (Chi et al., 2021; Kohls et al., 2021). However, the underlying mechanism remains unclear, and related research in vocational college students is lacking.

The relationship between stress and the health outcomes during the COVID-19 pandemic is influenced by many factors, such as personality traits and external supports (Ye et al., 2020; Chi et al., 2021). Future thinking may be one such factor, but there is a paucity of research on the subject. Future thinking refers to the ability to simulate oneself in possible future events; people with anxiety and depression show deficits in this ability (Moustafa et al., 2018). For example, when faced with the COVID-19 pandemic, most people employed hope as a positive and adaptive coping strategy (Ogueji et al., 2021, 2022); however, people with anxiety and depression reported more avoidance of pandemic-related thoughts (Kar et al., 2021). The explanation for this difference is intuitive: most people have an optimistic bias toward the future (Lefebvre et al., 2017); however, people with anxiety are often uncertain about the future and prepare for future threats (Lang et al., 2017). Similarly, individuals with depression have negative perceptions and predictions of the future (Beck, 1967; LeMoult & Gotlib, 2019; Strunk et al., 2006). These negative thoughts or fears of the future prompt such individuals to avoid thinking about anything related to the pandemic.

MacLeod and Byrne (1996) confirmed that positive and negative future thinking follow the same pattern as positive and negative affect in anxiety and depression, outlined by the tripartite model of anxiety and depression (Clark & Watson, 1991). Specifically, depression is associated with decreased positive future thinking and increased negative future thinking, while anxiety is associated with only increased negative future thinking (MacLeod & Byrne, 1996; MacLeod et al., 1997). The prospective imagery task (PIT) is a widely used tool to measure the vividness of imagery in future thinking

(Holmes et al., 2008a; Stöber, 2000). It comprises 20 items with 10 positive future scenarios (e.g., "You will have lots of good times with friends") and 10 negative future scenarios (e.g., "You will have a serious disagreement with a good friend"). The ratings of imagery vividness in the future scenarios reflect the ability to image future events. Individuals with depression exhibit imbalance in the ability to imagine positive future and negative future events (Holmes et al., 2008a; Moustafa et al., 2018). Consistent with Clark and Watson (1991) and MacLeod and colleagues (MacLeod & Byrne, 1996; MacLeod et al., 1997), many studies have found that people with depression struggle to generate vivid positive prospective imagery (Holmes et al., 2008a; Pile & Lau, 2018) and that people with anxiety and depression have greater vividness of negative prospective imagery (Pile & Lau, 2018, 2020; Tallon et al., 2020). Impoverished vividness of positive prospective imagery is regarded as a sign of hopelessness and a central feature of depression (Moustafa et al., 2018; Stöber, 2000). In other words, vivid positive prospective imagery represents hopes for the future and can be understood as a protective factor against depression. People with more vivid positive prospective imagery experience more positive emotion (Wilson et al., 2018), are more optimistic (Blackwell et al., 2013; Ji et al., 2017), and regain optimism more quickly even when depressed (Ji et al., 2017). However, the relationship between positive prospective imagery and anxiety is unclear. Inconsistent with the tripartite model of anxiety and depression, Liu et al. (2021) and Morina et al. (2011) found that anxiety is also associated with reduced vividness of positive prospective imagery. Similarly, Stöber (2000) found that when not controlling for the overlap between anxiety and depression, anxiety is related to less vividness of positive prospective imagery. Thus, positive prospective imagery vividness may be associated with anxiety as well as depression. Overall, more studies are needed to confirm the relationship between positive prospective imagery and anxiety.

Although no previous studies have directly examined the association between perceived stress and the vividness of prospective imagery, we proposed that perceived stress could influence the vividness of prospective imagery for the following reasons. To our knowledge, the vividness of prospective imagery is determined by at least two factors: one is the participant's ability to generate vivid imagery, and the other is the participant's engagement in similar prospective imagery in everyday life (Ji et al., 2017). These two factors can both be influenced by perceived stress. In a recent study, people with perceived stress reported decreased clarity of mental imagery (Kaur et al., 2022). Although, in this study, the content of imagery is not future events but neutral objects, the result indicates that perceived stress may reduce people's clarity of generated imagery. Another study showed that people with higher daily perceived stress reported less

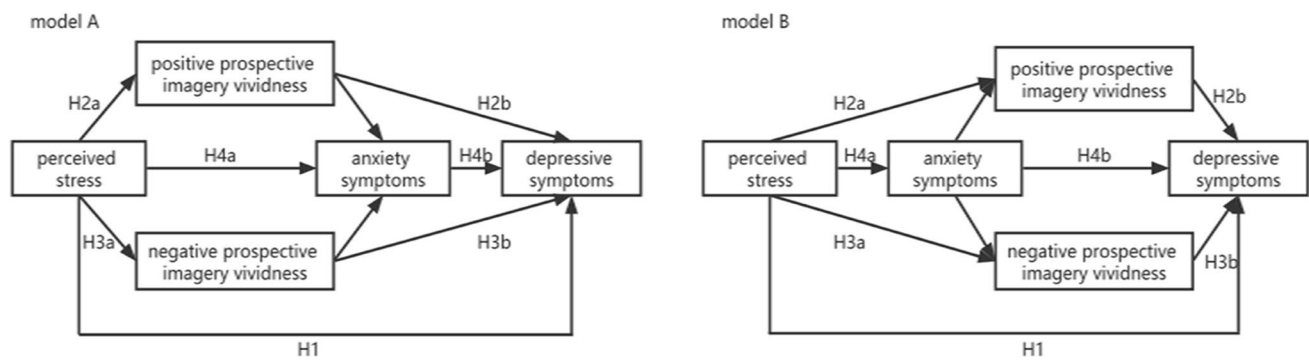


Fig. 1 Two potential serial mediating models of the relationship between perceived stress and depressive symptoms

daily positive affect and more daily negative affect during the COVID-19 pandemic (Jiang, 2020). Considering the amplification effect of imagery on both positive and negative emotions (Holmes et al., 2008b), we infer that this emotional response may partly result from people's prospective imagery about the pandemic. This means that people with higher perceived stress may engage in less positive prospective imagery and more negative prospective imagery during the COVID-19 pandemic, which may be reflected in reduced vividness of positive prospective imagery and increased vividness of negative prospective imagery. Due to the effects of perceived stress on the above two factors, we can propose that people with higher perceived stress will have less vividness of positive prospective imagery, but the vividness of negative prospective imagery cannot be clearly defined. Two potential possibilities should be taken into account. One possibility is that perceived stress decreases the vividness of negative prospective imagery through a greater influence on generating imagery. The other possibility is that perceived stress increases the vividness of negative prospective imagery through a greater influence on engagement with negative prospective imagery. Empirical research is needed to verify these two possibilities.

In addition, aside from prospective imagery, anxiety may also mediate the relationship between perceived stress and depression. Barlow and colleagues reported that when faced with threats and challenges, individuals' feelings range along a continuum from stress to anxiety to depression, depending partly on their sense of control and ability to cope (Barlow & Durand, 2012; Barlow et al., 2001). In other words, anxiety may be a middle stage between perceived stress and depression. Although many previous studies have observed a bidirectional relationship between anxiety and depression, anxiety may occur earlier than depression. A review reported that in childhood, anxiety is more prevalent than depression, whereas in adolescence, depression is more prevalent; thus the comorbidity of anxiety and depression may vary based on age (Cummings et al., 2014). This suggests that many

depressed adolescents may have experienced anxiety in childhood. Furthermore, some evidence indicates that anxiety predicts depression more strongly than depression predicts anxiety. In a longitudinal study following a community sample of adolescents over 15 years, those with depressive disorders had relatively low risks of anxiety disorders, whereas those with anxiety disorders had relatively high risks of depressive disorders (Olinio et al., 2008). Thus, anxiety can be largely regarded as a predictor of depression.

Many common risk factors of anxiety and depression during the COVID-19 pandemic have been discussed (Hettich et al., 2022; Peng et al., 2023). However, few studies have focused on the effect of prospective imagery. As mentioned above, many studies have demonstrated that people with anxiety and depression exhibit increased vividness of negative prospective imagery (Liu et al., 2021; Pile & Lau, 2018, 2020; Tallon et al., 2020). However, the causal relationship among these factors remains unclear. As people tend to initially experience anxiety when facing stress, negative prospective imagery may contribute to depression by affecting anxiety. In other words, there are two potential paths: first, perceived stress may increase the vividness of negative prospective imagery, causing anxiety and depression; or perceived stress may increase anxiety symptoms, leading to greater vividness of negative prospective imagery and depression. Given the ambiguous relationship between anxiety and positive prospective imagery, it remains unclear whether they exert a serial mediation effect on the relationship between perceived stress and depression.

Overall, to the best of our knowledge, no studies have studied the mediation effect of prospective imagery vividness and anxiety on the relationship between perceived stress and depression during the COVID-19 pandemic. After synthesizing the relevant literature, we proposed two potential serial mediating models to address this knowledge gap among Chinese vocational college students. The specific hypotheses are as follows (see Fig. 1):

H1: Perceived stress is positively related to depressive symptoms.¹

H2: Vividness of positive prospective imagery is a protective factor that mediates the relationship between perceived stress and depressive symptoms. Specifically, perceived stress is negatively related to positive prospective imagery vividness (H2a) which in turn is negatively related to depressive symptoms (H2b).

H3: Vividness of negative prospective imagery is a risk factor that mediates the relationship between perceived stress and depressive symptoms. Specifically, perceived stress is positively (or negatively) related to negative prospective imagery vividness (H3a) which in turn is positively related to depressive symptoms (H3b).

H4: Anxiety symptoms mediate the relationship between perceived stress and depressive symptoms. Specifically, perceived stress is positively related to anxiety symptoms (H4a), which in turn are positively related to depressive symptoms (H4b).

H5: Negative (or positive) prospective imagery vividness and anxiety symptoms exert a serial mediation effect on the relationship between perceived stress and depressive symptoms (not shown in Fig. 1).

Methods

Participants and procedure

This research recruited a total of 2,381 participants ($M_{\text{age}} = 18.38$, $SD = 0.92$, range = 16–21, 77.9% female) from a vocational college in Nanchang, Jiangxi Province, China. The questionnaires were distributed via SurveyStar (Changsha Ranxing Science and Technology, Shanghai, China). The data were collected from February 22 to September 12, 2022. All participants were notified about the purpose of the study and completed the survey voluntarily. Informed consent from adolescents' guardians was obtained prior to the survey. All participants received 2 mental health course credits. The survey was approved by the Morals and Ethics Committee of the School of Psychology, Jiangxi Normal University (Nanchang, China).

Measures

Perceived Stress Scale (PSS)

The scale was developed by Cohen et al. (1983), and a Chinese version was developed by Yang and Huang (2003). It

consists of 14 items that measure the degree to which situations in one's life have been viewed as stressful over the past month. Each item is rated from 0 to 4 (0 = never, 4 = always). Seven items are reverse scored. The total score has a range of 0–56 points. Scores of more than 25 points can be regarded as health risk stress (HRS) (Yang & Huang, 2003). In this study, this scale showed good reliability (Cronbach's $\alpha = 0.816$).

The 7-item Generalized Anxiety Disorder scale (GAD-7)

The GAD-7 is a 7-item self-report tool to easily screen anxiety symptoms (Löwe et al., 2008). Each item is valued from 0 (not at all) to 3 (nearly every day), and the total score ranges from 0 to 21. A higher score indicates more severe generalized anxiety symptoms. The total GAD-7 score is interpreted as follows: no (0–4), mild (5–9), or moderate or severe (≥ 10) clinically relevant anxiety symptoms (Zhang et al., 2020). In this study, this scale showed good reliability (Cronbach's $\alpha = 0.924$).

The 9-item Patient Health Questionnaire (PHQ-9)

The PHQ-9 is a 9-item self-administered scale to assess the severity of depressive symptoms (Kroenke et al., 2001). The participants are asked how often they were bothered by the depressive symptoms over the last 2 weeks. Each item is valued from 0 (not at all) to 3 (nearly every day), and the total score ranges from 0 to 27. The total PHQ-9 score is interpreted as follows: no (0–4), mild (5–9), or moderate or severe (≥ 10) clinically relevant depressive symptoms (Zhang et al., 2020). In this study, this scale showed good reliability (Cronbach's $\alpha = 0.883$).

Prospective Imagery Task (PIT)

The Chinese version of the PIT comprises 20 items divided into two subscales, with 9 positive future scenarios on the positive subscale (PIT-P) and 11 negative future scenarios on the negative subscale (PIT-N) (Liu et al., 2021). This is different from the original scale, which contains 10 positive future scenarios and 10 negative future scenarios (Holmes et al., 2008a; Stöber, 2000). Specifically, item 18 (“Your mind will be very alert and ‘on the ball’”) is transformed from a positive scenario to a negative scenario for the Chinese group (Liu et al., 2021). Participants are asked to imagine a total of 20 scenarios in turn. The rating of the vividness of each image ranges from 1 (“no image at all”) to 5 (“very vivid”). A higher score indicates greater vividness of the prospective imagery. In this study, the two subscales both showed good reliability (PIT-P: Cronbach's $\alpha = 0.923$; PIT-N: Cronbach's $\alpha = 0.923$).

¹ Because our sample was nonclinical, we used anxiety symptoms and depressive symptoms in place of anxiety and depression.

Table 1 Severity of perceived stress, anxiety and depressive symptoms ($n=2,381$)

Mental health outcomes	Participants, (<i>No</i> , %)		
	All ($n=2,381$, 100%)	Boys ($n=526$, 22.1%)	Girls ($n=1,855$, 77.9%)
<i>Perceived stress</i>			
Non-health risk stress (≤ 25)	1,054 (44.3)	248 (47.1)	806 (43.5)
Health risk stress (≥ 26)	1,327 (55.7)	278 (52.9)	1,049 (56.5)
<i>GAD-7 scores, anxiety symptoms</i>			
Normal (0–4)	1,591 (66.8)	364 (69.2)	1,227 (66.1)
Mild (5–9)	691 (29.0)	142 (27.0)	549 (29.6)
Moderate or severe (10–27)	99 (4.2)	20 (3.8)	79 (4.3)
<i>PHQ-9 scores, depressive symptoms</i>			
Normal (0–4)	1,106 (46.5)	271 (51.5)	835 (45.0)
Mild (5–9)	994 (41.7)	196 (37.3)	798 (43.0)
Moderate or severe (10–21)	281 (11.8)	59 (11.2)	222 (12.0)
<i>Type of anxiety or depressive symptoms</i>			
None	1,075 (45.1)	264 (50.2)	811 (43.7)
Pure anxiety symptoms	31 (1.3)	7 (1.3)	24 (1.3)
Pure depressive symptoms	516 (21.7)	100 (19.0)	416 (22.4)
Comorbid anxiety and depressive symptoms	759 (31.9)	155 (29.5)	604 (32.6)

Covariates

In this study, we aimed to explore the effect of prospective imagery on the relationship between perceived stress and anxiety and depression. To exclude the influence of participants' general imagery ability on PIT scores, we controlled for **Vividness of Visual Imagery Questionnaire (VVIQ)** scores (Marks, 1973). In this questionnaire, participants are asked to imagine 16 scenes and comment on the vividness of the images. The score ranges from 1 (no image at all, merely thoughts about the object) to 5 (very clear imagery, as vivid as if the object is actually seen). A higher score indicates greater vividness of generating imagery. In this study, this scale showed good reliability (Cronbach's $\alpha=0.964$).

Sex was also controlled for as a covariate.

Statistical analysis

IBM SPSS Statistics version 20.0 was used for all statistical analyses and calculations. The variables used for mediating analyses were presented as mean (M) \pm standard deviation (SD), and the relationships among them were assessed using bivariate Pearson's correlation analyses.

The PROCESS macro (ver. 3.0, Models 80 and 81) was applied to perform mediating analyses to examine the two potential serial mediating models (Hayes, 2017). All continuous variables were standardized before the mediating analyses.

The indirect effect was considered significant if the bootstrap confidence intervals (CIs) based on 5000 random

samples did not include zero. In all the inferential statistical procedures, a p value of 0.05 or less (≤ 0.05) was considered statistically significant.

Results

Mental health outcomes of vocational college students

The results showed that 55.7% of vocational college students perceived health risk stress (52.9% boys vs. 56.5% girls). The prevalence rates of anxiety and depressive symptoms were 33.2% and 53.5%, respectively. Only 45.1% of students (50.2% boys vs. 43.7% girls) had no anxiety or depressive symptoms. The comorbidity rate of anxiety and depressive symptoms was 31.9% (29.5% boys vs. 32.6% girls) (all above results are shown in Table 1).

Preliminary analysis

Table 2 shows the means and standard deviations of all variables and their Pearson correlations. PSS scores were positively correlated with GAD-7, PHQ-9 and PIT-N scores, and negatively correlated with PIT-P scores. GAD-7 scores were positively correlated with PHQ-9 and PIT-N scores but negatively correlated with PIT-P scores. PHQ-9 scores were negatively correlated with PIT-P scores but positively correlated with PIT-N scores. VVIQ scores were negatively correlated with PSS, GAD-7 and PHQ-9 scores and positively

Table 2 Descriptive Statistics and Bivariate Pearson's Correlation Analyses ($n=2,381$)

Variables	<i>M</i>	<i>SD</i>	Sex	PSS	GAD	PHQ	PIT-P	PIT-N	VVIQ
Sex	-	-	1						
PSS	25.46	6.29	0.065**	1					
GAD	3.20	3.5	0.051*	0.481***	1				
PHQ	5.25	4.14	0.057**	0.504***	0.790***	1			
PIT-P	3.07	0.91	-0.026	-0.456***	-0.192***	-0.239***	1		
PIT-N	2.53	0.84	-0.056**	0.068**	0.169***	0.153***	0.535***	1	
VVIQ	3.25	0.87	-0.004	-0.334***	-0.145***	-0.175***	0.720***	0.452***	1
α				0.816	0.924	0.883	0.923	0.923	0.964
<i>skewness</i>				-0.377	1.342	0.906	-0.170	0.384	-0.219
<i>kurtosis</i>				1.168	2.581	1.393	-0.154	0.130	0.187

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Male sex was coded as 1 and female sex was coded as 2

Abbreviations: *M*, mean; *SD*, standard deviation. PSS= Perceived Stress Scale score; GAD= the 7-item General Anxiety Disorder score; PHQ = the 9-item Patient Health Questionnaire score; PIT-P= positive subscale of prospective imagery task score; PIT-N= negative subscale of prospective imagery task score, VVIQ= vividness of visual imagery questionnaire score

correlated with PIT-P and PIT-N scores. VVIQ scores and sex were defined as covariates in the subsequent analysis.

Comparing mediation effects when controlling and not controlling for VVIQ

To illustrate the influence of VVIQ on the results, we compared the mediation effects when the VVIQ score was not controlled for with controls in Model A.

The results demonstrated that the negative association between perceived stress and positive prospective imagery vividness decreased by nearly half after controlling for VVIQ [from ($\beta = -0.456$, $p < 0.001$) to ($\beta = -0.242$, $p < 0.001$)], while the positive association between perceived stress and negative prospective imagery vividness increased considerably [from ($\beta = 0.072$, $p < 0.001$) to ($\beta = 0.252$, $p < 0.001$)]. Moreover, the indirect effects were substantially altered after controlling for VVIQ. Specifically, when VVIQ was not controlled for, the mediation effect of positive prospective imagery vividness ($\beta = 0.041$, 95% CI = [0.025, 0.057]) was much larger than that of negative prospective imagery vividness ($\beta = 0.005$, 95% CI = [0.002, 0.010]). Additionally, the serial mediation effect of positive prospective imagery vividness and anxiety symptoms ($\beta = 0.035$, 95% CI = [0.018, 0.054]) was much larger than that of negative prospective imagery vividness and anxiety symptoms ($\beta = 0.010$, 95% CI = [0.004, 0.018]). When VVIQ was controlled for, the mediation effect of positive and negative prospective imagery vividness became approximately equal ($\beta = 0.021$, 95% CI = [0.011, 0.031]) vs ($\beta = 0.019$, 95% CI = [0.011, 0.028]). Additionally, the serial mediation effect of negative prospective imagery vividness and anxiety symptoms

($\beta = 0.036$, 95% CI = [0.026, 0.047]) became larger than that of positive prospective imagery vividness and anxiety symptoms ($\beta = 0.014$, 95% CI = [0.004, 0.026]).

All of the above results are shown in Fig. 2.

The serial mediation effects between perceived stress and depressive symptoms

The results of Model A showed that perceived stress was significantly and positively associated with anxiety ($\beta = 0.413$, $p < 0.001$) and depressive ($\beta = 0.119$, $p < 0.001$) symptoms. Perceived stress was significantly negatively related to positive prospective imagery vividness ($\beta = -0.242$, $p < 0.001$) and positively related to negative prospective imagery vividness ($\beta = 0.252$, $p < 0.001$). In addition, positive prospective imagery vividness was significantly negatively related to anxiety ($\beta = -0.085$, $p < 0.001$) and depressive symptoms ($\beta = -0.086$, $p < 0.001$), while negative prospective imagery vividness was significantly positively related to anxiety ($\beta = 0.206$, $p < 0.001$) and depressive symptoms ($\beta = 0.075$, $p < 0.001$). Anxiety symptoms had a significant strong positive relationship with depressive symptoms ($\beta = 0.702$, $p < 0.001$). Moreover, the bootstrap method indicated that 3 parallel and 2 serial mediation paths were significant.

In Model B, the association of anxiety symptoms and positive prospective imagery vividness were not significant ($\beta = 0.023$, $p = 0.135$). Furthermore, the serial mediation effect of anxiety symptoms and positive prospective imagery vividness was also not significant ($\beta = -0.001$, 95% CI = [-0.003, 0.001]), and the serial mediation effect

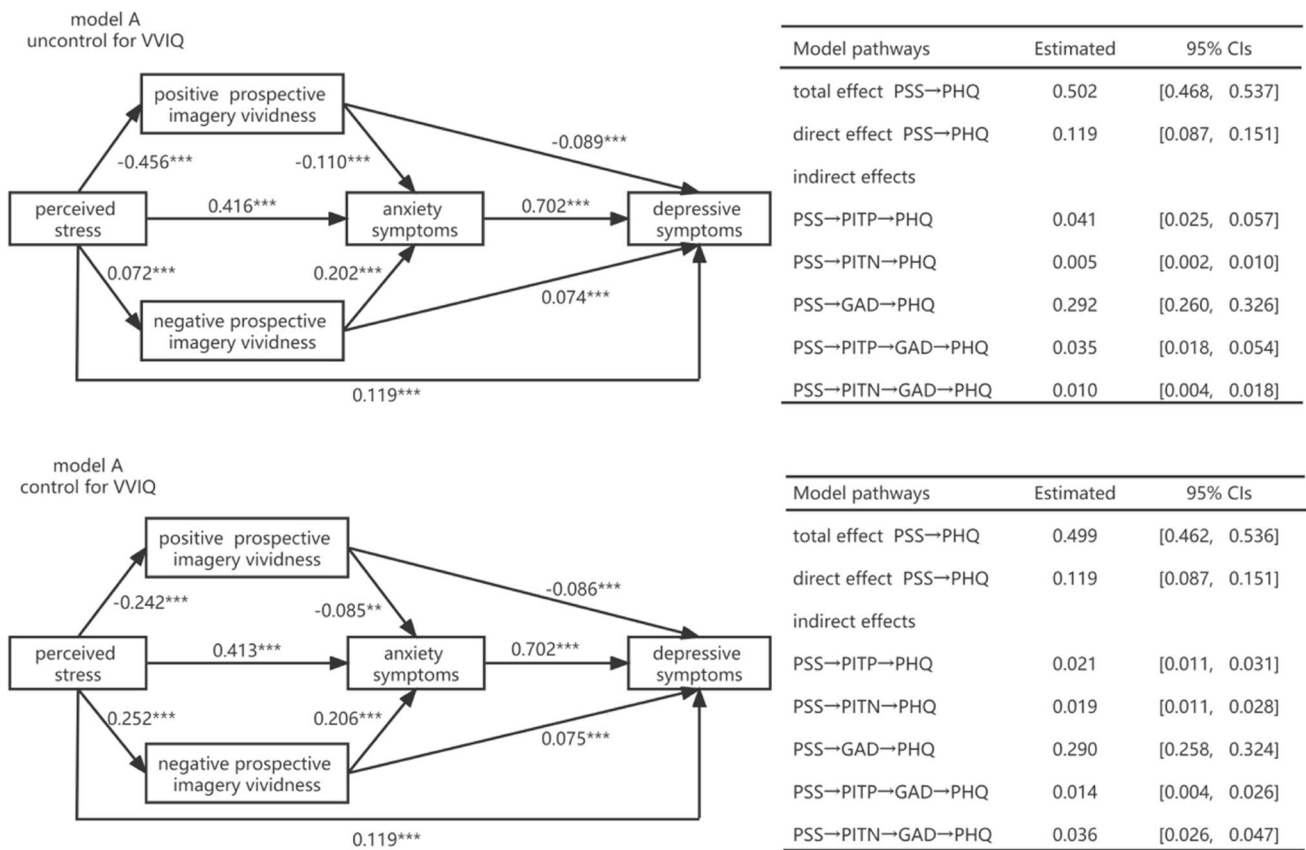


Fig. 2 Comparison of mediation effects when controlling (or not controlling) for VVIQ

of anxiety symptoms and negative prospective imagery vividness was weak ($\beta = 0.006$, 95% CI = [0.003, 0.009]).

All of the above results are shown in Fig. 3.

Discussion

This study recruited a large sample and surveyed the mental health of Chinese vocational college students during the COVID-19 pandemic. The mediation effect of prospective imagery vividness and anxiety symptoms on the relationship between perceived stress and depressive symptoms was also explored.

The prevalence rates of stress, anxiety, and depressive symptoms among vocational college students were 55.7%, 33.2%, and 53.5%, respectively, which were much higher than the rates (23%, 29% and 37%) observed in a previous meta-analysis of college students (Wang et al., 2021). The prevalence rates of anxiety and depressive symptoms were similar to that reported by Chinese vocational medicine students (30.8% and 57.5%, respectively) (Shao et al., 2020). In addition, 54.9% of the vocational college students had at least one of anxiety or depressive symptoms. The results suggest that more attention should be given to the mental

health of vocational college students during the COVID-19 pandemic.

Consistent with previous studies, perceived stress was significantly and positively associated with anxiety and depressive symptoms (Kohls et al., 2021; Wang et al., 2021). The result confirms that perceived stress is a valuable predictor of anxiety and depression, in line with the theories and findings of prior studies (Cohen et al., 1983; Yang & Huang, 2003). Furthermore, anxiety symptoms exerted a strong mediation effect on the relationship between perceived stress and depressive symptoms, which is in line with the result of Zhang et al. (2022). The indirect effect of perceived stress on depressive symptoms through anxiety symptoms was nearly three times greater than that of the direct effect of perceived stress on depressive symptoms. The results emphasize the importance of anxiety in the development of depression and potential interventions.

As expected, perceived stress decreased the vividness of positive prospective imagery and increased the vividness of negative prospective imagery. A comparison of results obtained when controlling or not controlling for VVIQ confirmed that perceived stress influenced prospective imagery vividness through two paths. First, consistent with the findings of Kaur et al. (2022), perceived stress decreased

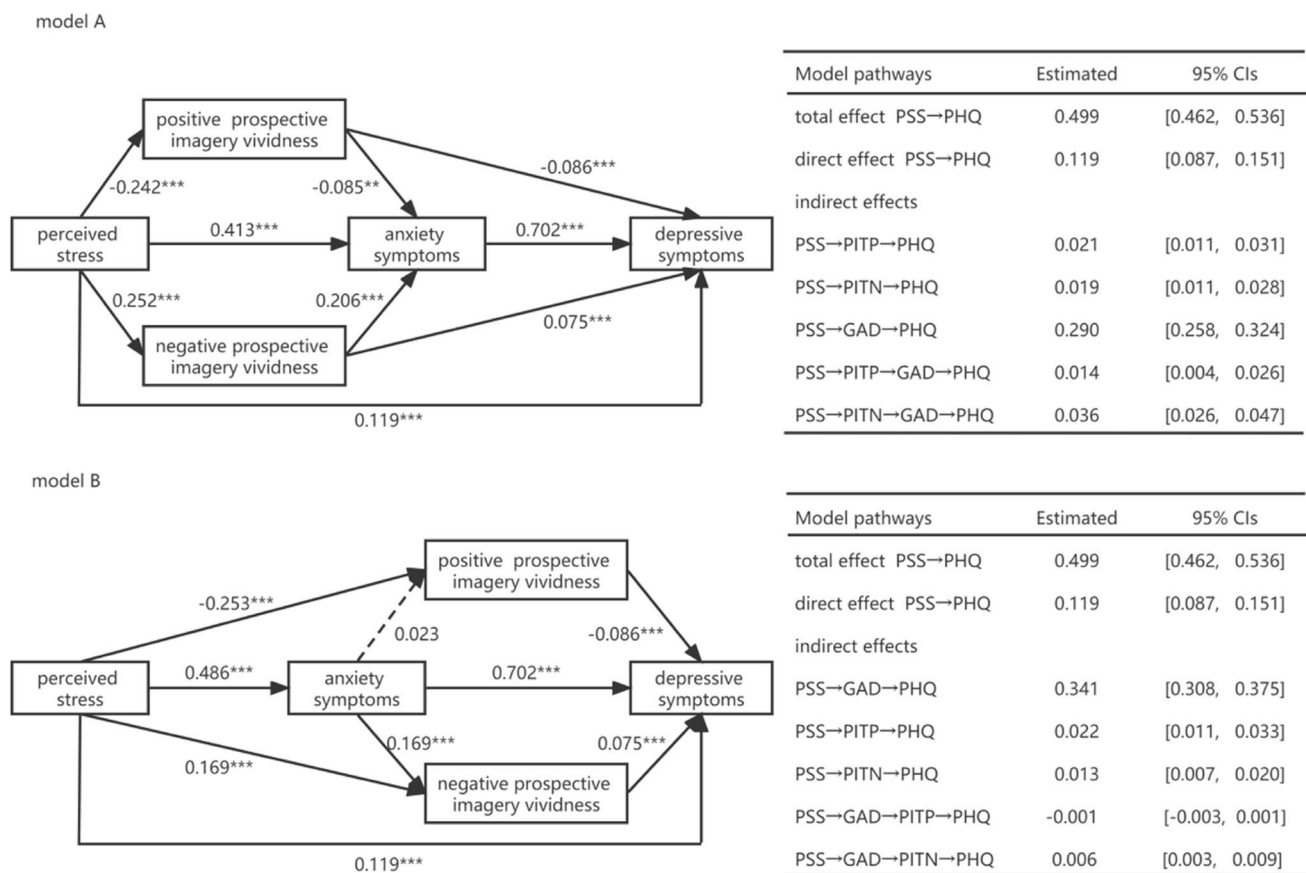


Fig. 3 Serial mediation paths between perceived stress and depressive symptoms

the clarity of generated imagery. Second, perceived stress decreased the vividness of positive prospective imagery by reducing the generation of positive prospective imagery and increase the vividness of negative prospective imagery by increasing the generation of positive prospective imagery in everyday life. Both paths involve the same directions of effects of perceived stress on positive prospective imagery vividness and the opposite direction of effects on negative prospective vividness. Thus, when VVIQ was not controlled for, the correlation coefficient between perceived stress and positive prospective imagery vividness was much higher, while the two paths had a net effect of approximately zero on the relationship between perceived stress and negative prospective imagery vividness. The results support our inference that the reduction in daily positive affect and increase in daily negative affect, accompanied by a high level of perceived stress during the COVID-19 pandemic (Jiang, 2020), may result from alterations in prospective imagery vividness in some extent. Perceived stress reduced individuals' generation of positive prospective imagery in everyday life and further led to reduced daily positive affect. Similarly, their generation of negative prospective imagery increased, leading to increased negative affect.

Furthermore, in accordance with previous studies (Liu et al., 2021; Morina et al., 2011), we found that both anxiety and depressive symptoms were associated with decreased vividness of positive prospective imagery and increased vividness of negative prospective imagery. The results confirm the relationship between anxiety and positive prospective imagery, which is consistent with that higher anxiety is related to high detail/vividness and conversely lower detail/vividness in future thinking (Du et al., 2022). Moreover, we found that the relationship between positive prospective imagery and anxiety symptoms might be unidirectional. In Model A, positive prospective imagery vividness was negatively associated with anxiety symptoms and the indirect path of perceived stress → positive prospective imagery → anxiety symptoms → depressive symptoms was significant. In contrast, in Model B, anxiety symptoms were not associated with positive prospective imagery vividness and the indirect path of perceived stress → anxiety symptom → positive prospective imagery vividness → depressive symptoms was not significant. In other words, decreased positive prospective imagery vividness may lead to anxiety symptoms, but anxiety symptoms do not lead to decreased positive prospective imagery vividness. These results are not

consistent with the tripartite model of anxiety and depression (Clark & Watson, 1991) or that of MacLeod and colleagues (MacLeod & Byrne, 1996; MacLeod et al., 1997), but are supported by the results of Stöber (2000). Stöber replicated the work of MacLeod et al. (1997) in a nonclinical sample and found that positive and negative prospective imagery may not follow the same patterns as positive and negative affect.

In addition, although anxiety symptoms were associated with both positive and negative prospective imagery in this study, their relationship with negative prospective imagery was stronger and exerted a stronger mediation effect (with negative prospective imagery) on the relationship between perceived stress and depressive symptoms. This result is consistent with the findings of Stöber (2000), who suggested that negative prospective imagery may be more closely related to anxiety than to depression and that reduced vividness of positive prospective imagery may be more closely related to depression than to anxiety. It is also in line with the finding of Zhu et al. (2022), which confirmed that daily negative affect has robust relationship with anxiety whereas daily positive affect has robust relationship with depression. Additionally, it is worth noting that the serial mediation effect in Model A was much greater than that in Model B. In other words, once anxiety symptoms appear, the serial mediation effect of anxiety symptoms and prospective imagery disappears.

Taken together, these findings can inform interventions to improve the mental health of vocational college students during the COVID-19 pandemic. First, perceived stress is an important predictor of anxiety and depressive symptoms. Thus, the self-guided stress management intervention may markedly reduce not only perceived stress but also anxiety and depressive symptoms (Amanvermez et al., 2022). Second, positive prospective imagery vividness exerts a protective role in both anxiety and depression symptoms. Therefore, positive imagery training, that can enhance positive prospective imagery vividness (Murphy et al., 2015), may be a useful intervention technique to mitigate anxiety and depressive symptoms. Finally, given that the serial mediation of the prospective imagery vividness and anxiety symptoms is unidirectional, the interventions targeting prospective imagery vividness should be adopted as soon as possible to alleviate both anxiety and depressive symptoms.

Limitations and future research directions

There are some limitations of the current study that are worthy of attention. First, prospective imagery is multidimensional and key areas include ratings of vividness, arousal and likelihood (Morina et al., 2011; Tallon et al., 2020). In this study, only the vividness of prospective imagery was assessed. Future studies should take the other characteristics

of prospective imagery into consideration. Second, although mediating analysis is a useful method to understand the mechanism of the effect of independent variables on the dependent variable (Hayes & Rockwood, 2017), it is difficult to draw causal conclusions because this study was cross-sectional. Therefore, the causal relationship among perceived stress, prospective imagery vividness, anxiety and depressive symptoms needs to be verified by future longitudinal studies. Third, the results of this study were based on the hypothesis that anxiety is a middle stage between stress and depression. However, some people develop depression first or experience both anxiety and depression simultaneously. More models are needed to elucidate the effect of prospective imagery on the relationships among stress, anxiety and depression. Finally, the participants in this study were students at vocational college, and most of them were female, which limits the generalization of these results to other populations. Consequently, further studies are needed, especially longitudinal studies with more diverse samples, to replicate the results.

Conclusion

Vocational college students have exhibited high prevalence rates of stress, anxiety and depressive symptoms during the COVID-19 pandemic. The twofold role of prospective imagery was verified: positive prospective imagery served as a protective factor against anxiety and depressive symptoms, while negative prospective imagery was a risk factor of anxiety and depressive symptoms. Impoverished vividness of positive prospective imagery is not only a central feature of depression but is also associated with anxiety. Prospective imagery and anxiety symptoms exerted a serial mediation effect on the relationship between perceived stress and depression. These findings establish a theoretical basis for interventions targeting prospective imagery vividness to mitigate anxiety and depressive symptoms among Chinese vocational students during the COVID-19 pandemic.

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Human and animal rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the Jiangxi Normal University institutional review board and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All participants were notified about the purpose of the study and completed the survey voluntarily.

Informed consent Informed consent was obtained from all individual participants included in the study.

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