

Academic Anxiety and Self-handicapping Among Medical Students During the COVID-19 Pandemic: A Moderated Mediation Model

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Abstract

Background: The outbreak of 2019 coronavirus disease (COVID-19) could increase the risk of academic anxiety among medical students. Research has revealed that academic anxiety was a risk factor for self-handicapping, however, little is known about the underlying mechanisms that may mediate or moderate this association. This study examined the mediating role of procrastination and moderating role of hardiness in the association between academic anxiety and self-handicapping during the COVID-19 pandemic.

Methods: This study measured academic anxiety, self-handicapping, procrastination and hardiness in a sample of 320 Chinese medical students, and explored the relationship between variables.

Results: Results showed that academic anxiety was positively correlated with procrastination and self-handicapping, and negatively correlated with hardiness; procrastination was positively correlated with self-handicapping, and negatively correlated with hardiness; hardiness was negatively correlated with self-handicapping. Furthermore, procrastination partially mediated the relationship between academic anxiety and self-handicapping, and both the effects of academic anxiety on self-handicapping and the mediating effect of procrastination were moderated by hardiness. The direct effect was stronger for medical students with lower hardiness, and the indirect effect was potent for medical students with both levels of hardiness.

Conclusion: During the COVID-19 outbreak, the effect of academic anxiety on self-handicapping of medical students was affected by procrastination and hardiness. These findings suggest that we need to pay attention to the academic anxiety and procrastination of medical students during the COVID-19 pandemic, and we can intervene in self-handicapping by cultivating hardiness in the future.

1. Introduction

On January 30, 2020, the World Health Organization declared that the COVID-19 epidemic constitutes a public health emergency of international concern (WHO,2019). Its infectious and fast transmission characteristics have seriously threatened the physical and mental health of the people. In the face of the increasingly severe epidemic, the Chinese government has promptly adopted policies such as home isolation and delayed school opening to control population movements and prevent the spread of the epidemic (Wang J.,2020). According to Lazarus and Folkman's (1984) theory of psychological stress, emotional, behavioral and physical stress responses based on their own cognitive assessment. Faced with long-term isolation at home, reduced interpersonal communication and changes in learning styles, college students may have adverse reactions such as anxiety and depression. Academic anxiety is a kind of negative emotional state that students experience more frequently in academic situation(Collie, Ginns, Martin & Papworth,2017). During the COVID-19 pandemic, studies have shown that graduates have higher anxiety scores than non-graduates(Wang J.,2020), clinical medical students are more likely to experience anxiety and depression(WANG K.et al., 2020;WANG H.et al.,2020), and emergency medicine

report that the pandemic has induced moderate to severe levels of anxiety at work and at home (Rodriguez et al, 2020). The longer enforced isolation continues, the greater the possibility of an increase in anxiety and depression symptoms (Knopf, 2020). Indeed, researchers have shown that academic anxiety is associated with lower academic engagement (Martin, 2008) and greater academic disengagement (Martin, Anderson, Bobis, Way & Vellar, 2012). To study the academic anxiety of medical students during the COVID-19 pandemic can provide reference for the later psychological intervention.

Self-handicapping is creating or claiming obstacles to successful performance in order to protect the sense of self-competence (Jones & Berglas, 1978). A qualitative study conducted by Martin, Marsh, Williamson, and Debus (2003) shows that high self-handicappers are more likely to make excuses for failure (such as giving up efforts or procrastination) and lack of learning persistence. This research also shows that self-handicapping is positively associated with test anxiety. Before the test, high self-handicappers will reduce their effort and show higher pressure, and the final test scores are worse than low self-handicappers (McCrea & Hirt, 2009). Self-handicappers will adopt a series of behaviors to impede or provide obstacles to one's academic achievement (Martin, 2011). These behaviors can include procrastination, deliberately creating circumstances that will negatively impact on one's performance (e.g., losing one's study materials), strategic withdrawal of effort, and avoiding practicing one's skills or engaging in examination preparations (Putwain, 2019). Self-handicapping, emerging as a big obstacle to realize one's potential and to succeed, has many negative associations with academic life, health, and psychological well-being (Barutçu, 2020). During the COVID-19 pandemic, using self-handicapping strategies is one of the important and effective factors in students' psychological health that has important consequences, such as weak academic performance and lack of efforts (Zarshenas et al., 2019). In order to make students better get through this special period, it is worth studying their self-handicapping.

During this special period of the epidemic, the level of academic anxiety and self-handicapping of medical students may increase. Previous research has centered primarily on the direct association between academic anxiety and self-handicapping, and the underlying mediating mechanism (i.e., how academic anxiety affects self-handicapping) and moderating mechanism (i.e., when academic anxiety affects self-handicapping) involved in this association are largely unknown. To fill these gaps, the present study constructed a moderated mediation model to test the mediating role of procrastination and the moderating role of hardiness personality in the relation between academic anxiety and self-handicapping among Chinese medical students. The findings would advance our understanding of how and when academic anxiety could affect self-handicapping, and how to protect Chinese medical students from the unfavorable impacts of academic anxiety during the COVID-19 pandemic.

1.1. Procrastination as a mediator

Steel (2007) defined procrastination as a voluntary delay of an intended course of action despite the expected negative consequences. Procrastination is a common problem among university students when approaching academic tasks (Klassen et al., 2009; Kim & Seo, 2015). Schraw et al. (2007)'s theoretical

model indicates that one maladaptive aspect of academic procrastination is fear of failure. Procrastination is significantly related to anxiety (Zhang et al.2020; Akpur,2017), depression (Flett et al.,2016; Aftab et al.,2017; Shi et al.,2019), life satisfaction (Balkis & Duru,2016; Kandemir,2014) and self-efficacy (Zhang et al.,2018; Ziegler & Opdenakker,2018). A meta-analysis by Van Eerde (2003) showed that there was a positive association between test anxiety and procrastination. The higher the test anxiety level, the higher the procrastination level reported by students. The study by Yerdelen (2016) et al. investigated the longitudinal association between students' anxiety and procrastination. Their results showed that procrastination significantly increased throughout the semester, while academic anxiety decreased. At the beginning of an academic term, students' procrastination was positively correlated with anxiety. Procrastination may help students to emotionally cope with their academic anxiety in the short term. However, as the deadlines and the final exams approach, students' procrastination will decrease in the last stage of the semester in order to avoid failure due to insufficient preparation (Krispenz et al.,2019).

Researchers and practitioners have long regarded procrastination as a self-handicapping and dysfunctional behavior (Chun Chu & Choi,2005). In a meta-analysis, Van Eerde (2003) examined the related factors of procrastination and found that the largest positive relation was between procrastination and self-handicapping. When exploring the relative contributions of self-efficacy, self-regulation and self-handicapping on the procrastination behavior of university students, the results suggested that self-handicapping predict procrastination independently (Strunk & Steele, 2011). Meyer (2000) studied the use of academic procrastination as a self-handicapping strategy under experimental conditions and pointed out that there was a positive correlation between them. Procrastination was considered as a predictor of self-handicapping (Akin, A, 2012). According to Beck et al. (2000), the study assessed self-consciousness and self-handicapping predictors of academic procrastination, and the results showed that academic procrastination and self-handicapping were highly correlated. High self-handicappers and procrastinators studied less, delayed more in test preparation, and scored lower on course exams. Self-handicapping and procrastination are overlapping construct, and high scores on one scale predict high scores on another. Self-handicapping is a more complex and broader concept than procrastination (Beck et al.,2000; Barutçu & Demir,2020). Overall, academic anxiety can predict procrastination, and the relationship between procrastination and self-handicapping is highly correlated and can be mutually predictable. It is reasonable to propose the following hypothesis:

Hypothesis 1

Procrastination would mediate the relation between academic anxiety and self-handicapping among medical students during the COVID-19 pandemic.

1.2. Hardiness as a moderator

Although academic anxiety may lead to procrastination and self-handicapping, it is possible that not all medical students are equally influenced. Therefore, it is important to examine moderators that may buffer

the relation between academic anxiety and its unfavorable outcomes. The present study examined whether the direct effect of academic anxiety on self-handicapping and the indirect effect of procrastination would be moderated by hardiness.

Hardiness is a hypothetical construct originally proposed by Kobasa (1979). It is considered as a stable personality resource consisting of three cognitive components: commitment, challenge and control. Commitment (as contrasted with alienation) refers to an ability to feel deeply involved in the activities of their lives. Control (as opposed to powerlessness) summarizes the belief that they can influence the course of events. Challenge (as contrasted with threat) epitomizes the expectation that it is normal for life to change, and to promote further development (Kobasa,1979; Waysman, Schwarzwald & Solomon,2001). Hardiness is considered as an attribute of psychological resilience, which is related to physical health and psychological well-being (Crowley, Hayslip & Hobdy,2003), and has value in enhancing performance, meaningful, behavior and health under stress (Maddi,2014; Maddi & Salvatore,2006). A meta-analysis showed that hardiness can buffer and moderate the effects stressors on strains, while hardiness and hardiness components generally led to higher ratings of school and work performance (Eschleman, Bowling & Alarcon,2010). Hardiness might change the perceptions of events to make them less stressful, and might promote optimism and positive coping (Chan,2000). According to Waysman et al. (2001), the study indicated that hardiness had a moderating effect on both long-term positive and negative changes after traumatic events, which was helpful for individuals to seek practical help from others during stressful times and build larger support networks.

When coping with the traumatic events of the epidemic, medical students may have different behavioral responses due to their hardiness. Students with high hardiness cope with stresses by problem solving, rather than procrastination to denying or avoiding so as to preserve the status quo (Maddi & Salvatore,2006). Therefore, hardiness, as a positive personality trait, may buffer the detrimental outcomes of academic anxiety (e.g., procrastination and self-handicapping). Namely, both the association between academic anxiety and self-handicapping and the association between procrastination and self-handicapping may be moderated by hardiness. Furthermore, according to prior research on the combination of mediation and moderation models (Edwards & Lambert,2007; Hayes,2018), if hardiness mediated the relation between academic anxiety and self-handicapping, and hardiness moderated the association between procrastination and self-handicapping simultaneously, the mediating effect of procrastination would be moderated by hardiness. There will be a moderated mediation model involving procrastination and hardiness in the relation between academic anxiety and self-handicapping. Thus, we put forward the following hypotheses:

Hypothesis 2

Hardiness would moderate the relation between academic anxiety and self-handicapping, with the relation being stronger for medical students with lower hardiness.

Hypothesis 3

Hardiness would moderate the mediating effect of procrastination in the relation between academic anxiety and self-handicapping, with the mediating effect of procrastination being stronger for medical students with lower hardiness.

1.3. The present study

This study tested the mechanisms underlying the relation between academic anxiety and self-handicapping in medical students. Specifically, we examined a moderated mediation model to answer three questions: (a) whether procrastination mediated the relation between academic anxiety and self-handicapping, (b) whether hardiness moderated the relation between academic anxiety and self-handicapping, and (c) whether hardiness moderated the mediating effect of procrastination in the relation between academic anxiety and self-handicapping. Testing mediator and moderator variables in a single model could generate more comprehensive information than assessing two separate models (Fairchild & MacKinnon, 2009). The moderated mediation model in the present study (see Fig. 1) would not only tell how and when academic anxiety influences self-handicapping, but would also tell when of the how academic anxiety influences self-handicapping.

2. Methods

2.1. Participants

A total of 320 medical students completed our survey that was designed to collect information including demographic variables, academic anxiety, self-handicapping, procrastination and hardiness. 33.4 percent of the participants were males. Twenty-two (6.9%) of them were first grade, 41(12.8%) of them were second grade, 229(71.6%) of them were third grade, 25(7.8%) of them from fourth grade and 3(0.9%) of them were other grades students.

2.2. Procedure

This study was conducted online via a Chinese survey website (www.wjx.cn) to reduce contact during the epidemic. Students can complete the questionnaire voluntarily and anonymously online. The questionnaire contained polygraph questions to ensure the authenticity of all the answers. A total of 320 valid questionnaires were selected based on the polygraph questions, the integral nature of all answers as well as the reasonable completion times across all measures. Participants completed the survey after informed consent was obtained from the schools, teachers and participants. The research content and data collection procedures were approved by the Biomedical Research Ethics Committee of Fujian Medical University (NO.79).

2.3. Measurements

2.3.1. Academic anxiety

The two-item Academic Anxiety Questionnaire was used to measure the level of academic anxiety of medical students. Participants were asked to answer two items including “I’m always nervous near the final exam” and “I’m anxious about the final exam.”. Participants responded on a 7-point scale, ranging from 1 (do not apply to me at all) to 7 (apply to me very much). The total academic anxiety score was calculated by averaging the score on the two items, with higher scores indicating more academic anxiety. Cronbach's α coefficient was 0.90 in the current study.

2.3.2. Self-handicapping

The Self-Handicapping Scale (SHS, Rhodewalt,1990) was used to measure medical students’ self-handicapping. This measure is a single-factor measure including 14 items (e.g., “When I do something wrong, my first impulse is to blame the circumstance.”). Participants responded on a 6-point scale, ranging from 0 (disagree very much) to 5 (agree very much). The total self-handicapping score was calculated by averaging the score on the fourteen items, with higher scores indicating higher self-handicapping. Cronbach's α coefficient was 0.67 in the current study.

2.3.3. Procrastination

The General Procrastination Scale (GP, Lay,1986) was used to measure medical students’ procrastination during the COVID-19 pandemic. This measure is a single-factor measure including 20 items (e.g., When preparing for deadlines, I often waste time doing other things). Each item is answered on a five-point scale, ranging from 1 (do not apply to me at all) to 5 (apply to me very much). The average score of 18 items generated a total GP score, with higher scores representing higher procrastination. Cronbach's α coefficient was 0.82 in the current study.

2.3.4. Hardiness

Hardiness was assessed by the Chinese version (LU G.H. & LIANG B.Y.,2008) of the Hardiness Scale for Chinese college (Maddi, Harvey, Khoshaba, Lu, Persico, & Brow,2006). Participants answered 27 items assessing four aspects of hardiness, including commitment, control, challenge and perseverance. Sample items included ‘When someone gets mad at me, I try to calm him down’. Participants responded on a four-point scale, ranging from 1 (do not apply to me at all) to 4 (apply to me very much). Mean scores were calculated, with higher scores indicating higher hardiness. Cronbach's α coefficient was 0.94 in the current study.

2.4. Data analysis

This study collected data through questionnaires, and there was a risk of common method biases. Harman’s single factor testing was used to test the common method biases. The results showed that there were 16 factors with eigen value greater than 1. And the cumulative variance explained by the first factor was 20.69%, which was less than the critical value of 40%. This indicated that there were no serious common method biases in this study.

We first conducted gender and grade difference analyses in the current sample. Then, descriptive statistics and correlation of study variables were calculated with SPSS 24.0. To test the moderated mediation model, we used Model 15 of the SPSS macro PROCESS version 3.0(www.afhayes.com) developed by Hayes (2018). This module is specifically developed for testing complex models including both mediator and moderator variables (see Fig. 1 as a sample model). It has been used by lots of scholars to test moderated mediation models (e.g., Jiang, Ren, Liu, & You,2020; Bartone & Homish,2020).

3. Results

3.1. Preliminary analyses

The Independent sample t-test indicated that procrastination and self-handicapping showed no grade differences, whereas academic anxiety ($t=-4.82, p < 0.001$) and hardiness ($t = 4.124, p < 0.001$) showed significant grade differences. Specifically, male scored significantly lower than female in academic anxiety and scored significantly higher than women in hardiness. The one-way analysis of variance indicated that academic anxiety, procrastination, and self-handicapping showed no grade differences, whereas hardiness showed significant grade differences ($F = 2.42, p < 0.05$). Specifically, no significant differences in hardiness were found between participants from first to third grade, while participants from fourth grade significantly scored higher than those from other grades. The descriptive statistics and correlation matrix were presented in Table 1. Academic anxiety was positively correlated with procrastination and self-handicapping, and negatively correctly with hardiness. Procrastination was positively correlated with self-handicapping, and negatively correctly with hardiness. Hardiness was negatively correctly with self-handicapping.

Table 1
Descriptive statistics and intercorrelations between variables.

	M	SD	1	2	3	4
1.academic anxiety	4.56	1.36	-			
2.procrastination	2.84	0.48	.161**	-		
3.hardiness	2.44	0.51	-.195**	-.356**	-	
4.self-handicapping	3.31	0.49	.242**	.428**	-.133*	-

Note. N = 320. * $p < 0.05$. ** $p < 0.001$. *** $p < 0.001$.

3.2 Testing for the moderated mediation models

The main results generated by Hayes' (2018) SPSS macro PROCESS were presented in Table 2 consisting of three parts: mediator and dependent variable model, conditional direct effect analysis and conditional indirect effect analysis. The mediator variable model was to test the effects of academic anxiety on procrastination, while the dependent variable model was to test the effects of academic anxiety,

procrastination and hardiness on self-handicapping. The conditional direct effect analysis was to test the effects of academic anxiety on self-handicapping at the mean of hardiness as well as plus and minus one standard deviation from mean of hardiness. Similarly, the conditional indirect effect analysis was to test the effects of academic anxiety on self-handicapping through the mediation of procrastination at the mean of hardiness as well as plus and minus one standard deviation from mean of hardiness. As can be seen from the mediator variable model ($F = 2.87, R^2 = 0.03, p < 0.05$) and dependent variable model ($F = 15.82, R^2 = 0.26, p < 0.001$), after controlling for gender and grade, academic anxiety positively predicted procrastination ($\beta = 0.06, p < 0.01$), procrastination positively predicted self-handicapping ($\beta = 0.41, p < 0.001$), and academic anxiety positively predicted self-handicapping ($\beta = 0.07, p < 0.001$). These results indicated procrastination partially mediated the relationship between academic anxiety and self-handicapping. Therefore, H1 was supported. Besides, the interaction of academic anxiety and hardiness showed significant effects on self-handicapping ($\beta = -0.09, p < 0.01$) and the interaction of procrastination and hardiness showed significant effects on self-handicapping ($\beta = 0.27, p < 0.001$). These findings indicated both the association between academic anxiety and self-handicapping and the association between procrastination and self-handicapping were moderated by hardiness (see Fig. 2 and Fig. 3). Furthermore, as can be seen from the conditional direct effect analysis and conditional indirect effect analysis, two of three conditional direct effects (based on the moderator values at the mean and at -1 standard deviation) and three conditional indirect effects were positively and significantly different from zero. Namely, the effect of academic anxiety on self-handicapping were observed when hardiness was moderated to low, but not when hardiness was high. The indirect effect of academic anxiety on self-handicapping through procrastination was observed when hardiness was moderated to low and high. Therefore, both H2 and H3 were supported.

Table 2
Conditional process analysis

	R ²	b	SE	t	p
Mediator variable model	0.03				0.04
constant		0.06	0.15	0.41	0.68
sex		-0.01	0.06	-0.25	0.81
grade		-0.01	0.04	-0.35	0.72
academic anxiety		0.06	0.02	2.84	< 0.01
Dependent variable model	0.26				
constant		3.21	0.14	23.23	0
sex		0.04	0.05	0.73	0.46
grade		0.02	0.03	0.49	0.62
academic anxiety		0.07	0.02	3.55	< 0.001
procrastination		0.41	0.05	7.61	< 0.001
hardiness		0.05	0.05	0.91	0.36
academic anxiety × hardiness		-0.09	0.03	-3.19	< 0.01
Procrastination × hardiness		0.27	0.08	3.48	< 0.001
Conditional direct effect analysis at IA = M ± SD		b	Boot SE	Boot LLCI	Boot ULCI
M-1SD (1.93)		0.11	0.02	0.06	0.16
M (2.44)		0.07	0.02	0.03	0.10
M + 1SD (2.95)		0.02	0.02	-0.03	0.06
Conditional indirect effect analysis at IA = M ± SD		b	Boot SE	Boot LLCI	Boot ULCI
M-1SD (1.93)		0.02	0.01	0.00	0.03
M (2.44)		0.02	0.01	0.01	0.04
M + 1SD (2.95)		0.03	0.01	0.01	0.06
Note. N = 320. Bootstrap sample size = 5000. LL = Low limit, CI = 95% confidence interval, UL = upper limit.					

4. Discussion

This study constructed a moderated mediation model to analyze the mechanisms underlying the association between academic anxiety and self-handicapping among medical students during the COVID-19 pandemic. The results indicated that procrastination played a mediating role and hardiness played a moderating role in the relation between academic anxiety and self-handicapping. Besides, the mediating effect of procrastination was also moderated by hardiness.

Firstly, our study found that academic anxiety could significantly predict self-handicapping among medical students. This result is consistent with previous study that academic anxiety is positively associated with self-handicapping (Thomas & Gadbois,2007; Firoozi, Zadebagheri, Kazemi, & Karami, 2016). Affected by isolation during the COVID-19 pandemic, medical students could not attend classes normally in the classroom and can only learn online through the Internet. Teachers also could not give feedback on students' learning. Facing the approaching of final exams, students will suffer academic anxiety because of fear of failure. According to the self-worth theory (Covington,1992), failure has an impact on students' self-worth, because failure is interpreted as a symbol of low ability, and low ability is then equivalent to low self-worth (Martin, Marsh, & Debus, 2001). In the current educational settings, people attach great importance to individual achievement and performance, as well as their perceptions of self-worth (Leondari & Gonida,2007; Gadbois & Sturgeon,2011). Students with high academic anxiety tend to adopt self-handicapping and defensive pessimism strategies, which can protect their sense of self-worth from anticipated failure by reflecting attributions away from a lack of ability (Covington,2009; Putwain,2019). Although some studies have shown that self-handicapping yields positive outcomes such as enhancing performance and enjoyment, minimizing the impact of failure and making people ready for others' evaluation in case of failure (Rhodewat & Hill,1995; Deppe & Harackiewicz,1996; Brown & Kimble,2009), the study of Martin, Marsh and Debus (2001) showed that self-handicapping was more negatively associated with educational outcomes than defensive pessimism strategies (Thomas & Gadbois, 2007). Students with high academic anxiety not only resulted in self-handicapping, but also lead to poor academic performance.

Secondly, our study indicated that procrastination partially mediated the relation between academic anxiety and self-handicapping. Previous studies have revealed that procrastination was significantly associated with academic anxiety and self-handicapping (Yerdelen,2016; Akin, A, 2012), but to our knowledge, no research to date has demonstrated the indirect relationship of academic anxiety to self-handicapping through procrastination. Consistent with our assumption, our study found that academic anxiety had an impact on procrastination, and procrastination partially mediated the impact of academic anxiety on self-handicapping. Long-term online learning will increase students' time of using the Internet, while high internet dependency can have negative consequences for university students, such as anxiety (Watanabe,2014), social isolation (Shaw & Black, 2008), decrease of self-confidence (Steel,2007) and even Internet addiction (Hayat, Kojuri & Mitra amini,2020). Previous studies have identified barriers to online learning environments, including issues of self-regulation, self-pacing, speed of learning, and differences in effort (Hooshyar, Kori, Pedaste & Bardone,2019; Azevedo et al.,2005). During the epidemic isolation period, students could not compare with others in time to confirm their learning progress, and fear and anxiety of COVID-19 would lead to academic procrastination.

Moreover, our study found that both the effect that academic anxiety itself exerted on self-handicapping and the effect that academic anxiety exerted on self-handicapping through procrastination were moderated by hardiness. The direct effect was more potent for medical students with low hardiness, and the indirect effect was potent for medical students with both levels of hardiness. Namely, hardiness not only alleviates the direct impact of academic anxiety on self-handicapping, but also buffers the indirect impacts of academic anxiety on self-handicapping via the mediation of procrastination. These results coincide with previous studies revealing the protective role of hardiness in academic anxiety and self-efficacy (Cheng, Tsai & Liang, 2019; Abdollahi et al.,2018; Abdollahi & Noltemeyer, 2018).

Specifically, according to the academic hardiness theory (Benishek et al.,2005), medical students with high levels of academic hardiness showed less procrastination. Because they thought online learning was an opportunity for growth and development rather than a stressful event during the COVID-19 pandemic. They had confidence and skills to carry on study hard and pursue academic goals (Abdollahi et al.,2018). Medical students with high academic hardiness had internal locus of control, effective learning strategies, time management skills, achievement oriented, and low levels of academic stress (Abdollahi, Panahipour, Akhavan Tafti, & Allen, 2020; Abdollahi, Maleki Farab, Panahipour, & Allen, 2020). Such students were less likely to adopt procrastination or self-handicapping strategies to avoid academic tasks. Faced with demanding academic environment during the COVID-19 pandemic, students with high levels of academic hardiness were likely to assess the stress state as more challenging, controllable and less threatening, and they were more likely to adapt and participate in the situation in order to learn more ,even prosper and thrive under the pressure (Kamtsios & Karagiannopoulou,2015). Students with high levels of academic hardiness also had emotional self-regulation skills that can assist them stay optimistic and actively participate in academic tasks, and challenge their difficult course work so that can gain experience under pressure (Abdollahi et al. 2015). Thus medical students with high hardiness may better cope with academic anxiety and the consequent adverse impacts.

5. Limitations And Implications

The results of this study have some limitations, which need to be improved in future research. First, this research adopts a cross-sectional research design, so that causal interpretations cannot be drawn. Future researches should adopt longitudinal design or experimental study to explore the causal relationship between academic anxiety and self-handicapping through crossover design, multi-layer linear model, or manipulating independent and mediate variables. Second, the data of this study were obtained through self-report questionnaires, which may have a risk of social desirability or other biases. Therefore, future researches could collect data from multiple aspects (e.g., hospital, school and family) to solve this limitation. Third, the participants in this study were mostly concentrated in Fujian, which is a low-risk area of the COVID-19, and the data collection time was not before the final exam. Therefore, the time and place of data collection may affect the response of medical students. Lastly, this study only evaluated procrastination as a mediating factor and hardiness as a moderating factor, therefore, it is recommended that future researches explore other potential factors to increase its soundness.

Despite these limitations, this study is the first attempt to test the mediating role of procrastination and the moderating role of hardiness in the association between academic anxiety and self-handicapping among medical students during the COVID-19 pandemic. It reinforces the existing literature by exploring the mechanism of this relationship. Specifically, it explains how, when, and where of how academic anxiety influences self-handicapping. In addition, this research has important practical implications. First, it is necessary for parents and educators to know medical students' academic anxiety and its adverse impacts during the COVID-19 pandemic, and help them to alleviate their academic anxiety in time. Secondly, considering that procrastination is an important mechanism linking academic anxiety and self-handicapping, it will be effective for educators and psychological teachers to help medical students reduce procrastination behavior by developing good study habits. Multiple meta-analysis showed that using combinations of psychoeducational, behavioral, and cognitive interventions had a large positive effect (Van Eerde & Klingsieck, 2018; Malouff & Schutte, 2019). For example, studies have found that it is effective and acceptable to intervene medical students' procrastination via internet-based acceptance and commitment therapy and cognitive behavioral therapy (Küchler, Albus, Ebert & Baumeister, 2019; Gagnon et al., 2019). In addition, it is necessary to formulate specific support plans for the procrastination behavior of medical students, including improving academic skills, increasing self-regulated learning strategies, and reducing emotional state problems (Hen, 2018). Third, hardiness not only alleviates the direct effect of academic anxiety on self-handicapping, but also alleviates the indirect effect of academic anxiety on self-handicapping through the mediation of hardiness. A study has shown that parental education styles has a certain impact on children's tough personality (Higinio & Antonia, 2020). Besides, studies have shown that hardiness among nurses, as positive personal resource, can reduce stress and burnout and affect the way in which nurses interact with their working environment and to increase engagement (Bemana et al., 2014; Garrosa et al., 2014). Therefore, improving medical students' hardiness may also be an effective way to buffer the negative impacts of academic anxiety.

6. Conclusion

During the COVID-19 pandemic, procrastination partially mediated the relationship between academic anxiety and self-handicapping among medical students. Besides, both the effects academic anxiety on self-handicapping and the mediating effect of procrastination were moderated by hardiness. Considering the negative impact of academic anxiety and self-handicapping, we need to pay attention to the psychological status of medical students during the COVID-19 outbreak, and we can appropriately intervene in self-handicapping by cultivating hardiness.

7. Declarations

Ethical Approval and Consent to participate

The research content and data collection procedures were approved by the Biomedical Research Ethics Committee of Fujian Medical University (NO.79).

Consent for publication

Not applicable

Availability of supporting data

Datasets are available through the corresponding author upon reasonable request.

Competing interests

All authors declare no conflict of interest.

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Authors' contributions

Qin Jiang and Jun Jia conceived the idea. Qin Jiang and Xianhao Lin provided help and guidance in data collection and processing. Jun Jia analyzed and interpreted the data and wrote the manuscript. All authors read and approved the final manuscript.

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Figures

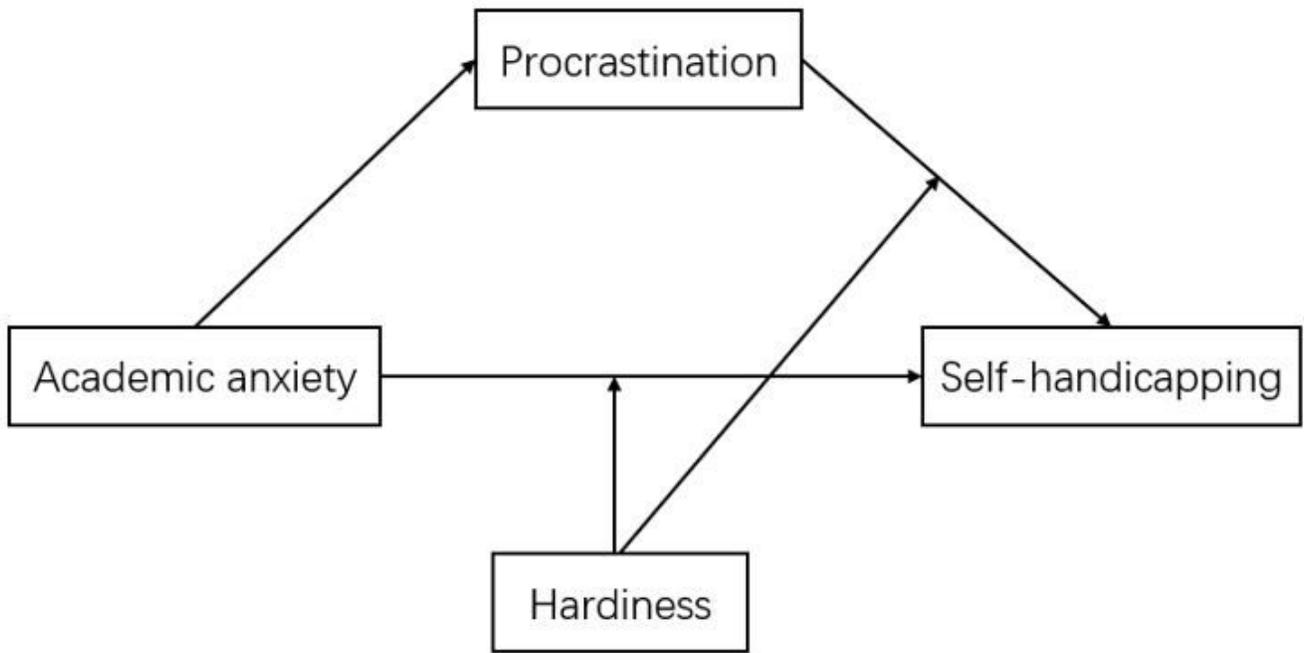


Figure 1

Conceptual model

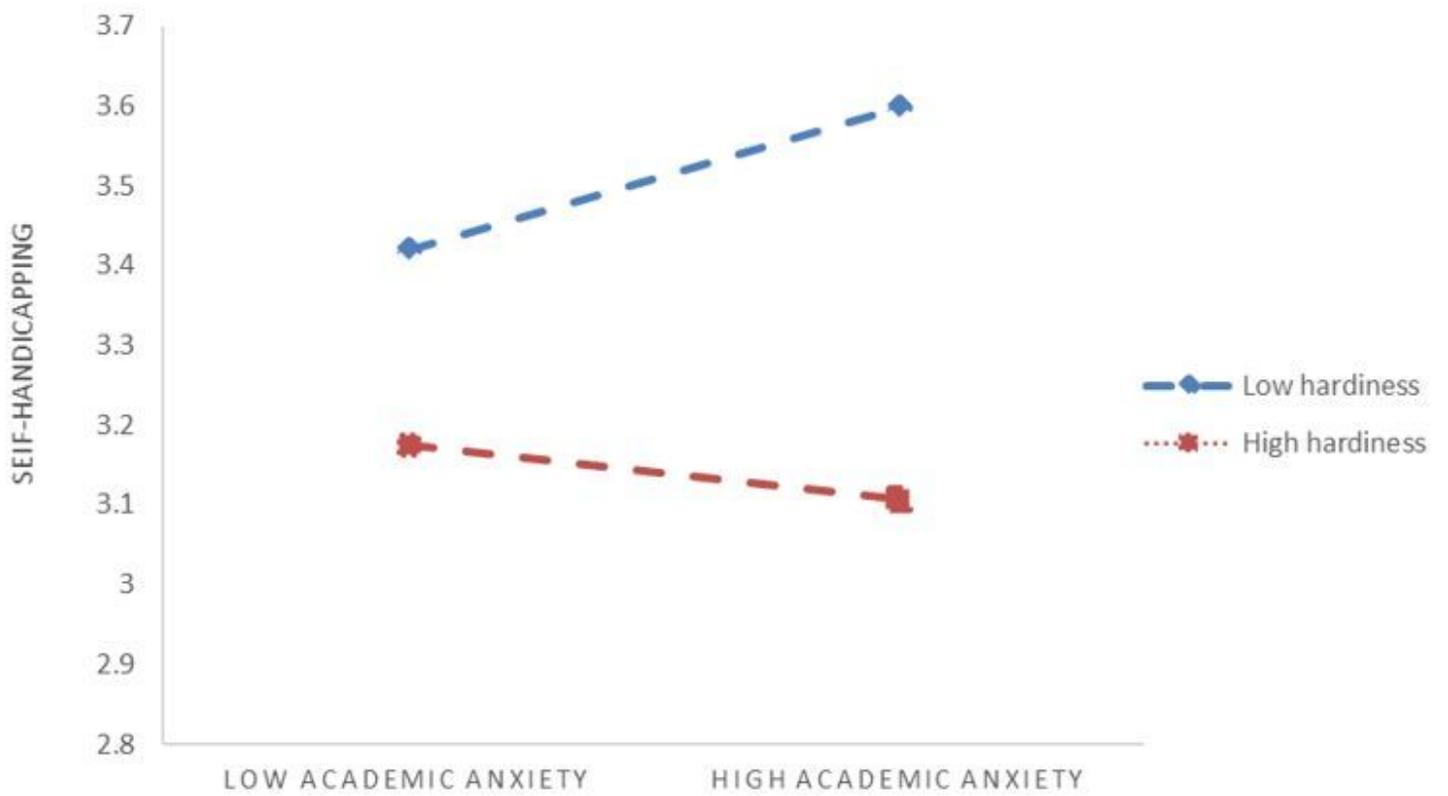


Figure 2

Hardiness moderates the relation between academic anxiety and self-handicapping

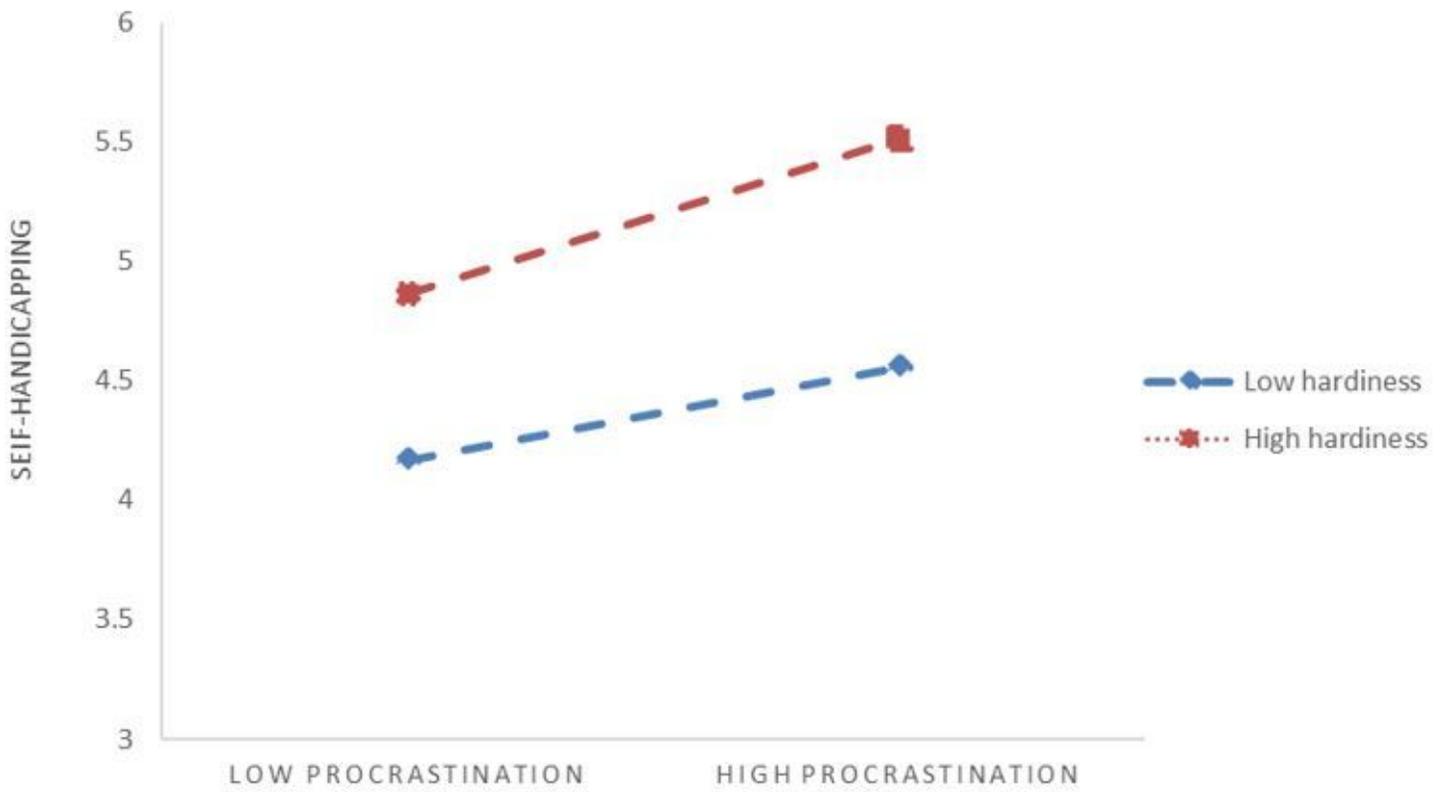


Figure 3

Hardiness moderates the relation between procrastination and self-handicapping