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Insomnia mediates the relation between empathy and anxiety among nursing students: a latent moderated mediation model of self-compassion

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Abstract

Background Nursing students are faced with multiple challenges and have a higher probability of suffering from anxiety. The current study aims to explore the relation between empathy and anxiety, examining the mediation and moderation effects of insomnia and self-compassion, respectively.

Methods This study employed a convenient sampling method, recruiting 1,161 nursing students (female = 923, male = 238, $Mean_{age}$ = 18.37, SD_{age} = 2.38) from three universities in China. These students completed the questionnaires online, including General Anxiety Disorder -7 (GAD-7), Jefferson Scale of Physician Empathy-Nursing student (JSPE-NS), Youth Self-rating Insomnia Scale -8 (YSIS-8), and Self-Compassion Scale (SCS). The study employed latent variable structural equation models to analyze the relation and mechanisms between empathy and anxiety. Then, the mediated role of insomnia and the moderated role of self-compassion were examined.

Results The prevalence rates of anxiety and insomnia in the current sample are 18.24% and 26.76%, respectively. The results showed that empathy could negatively predict anxiety, with a significant mediating effect of insomnia between them (B = -0.081, $p < 0.05$, 95% CI [-0.197, -0.063]). Additionally, it was proven that self-compassion moderated the positive relation between insomnia and anxiety. With a higher level of self-compassion, the indirect effect of empathy on anxiety through insomnia was weaker (B = -0.053, $p < 0.01$, 95% CI [-0.095, -0.019]). When individuals showed a lower level of self-compassion, the indirect effect of empathy on anxiety through insomnia was stronger (B = -0.144, $p < 0.01$, 95% CI [-0.255, -0.059]).

Conclusion The analysis of this research proved that empathy was negatively related to anxiety, and insomnia served as a mediator between empathy and anxiety. Besides, the protective role of self-compassion on individuals' mental health was identified. The findings of the study suggest that the education of nursing students should highlight the significance of fostering empathy and self-compassion. The intervention on insomnia may be helpful in reducing the levels of anxiety since insomnia is a risky factor for anxiety.

Keywords Empathy, Anxiety, Nursing students, Insomnia, Self-compassion, Moderation, Mediation

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Introduction

Nursing is a widely acknowledged challenging job [1]. Nursing students, even though not formally starting their careers, still face a wealth of challenges such as heavy professional training burden, difficulties in balancing study and internship, and problems of career decision-making [1, 2]. These challenges make nursing students develop greater anxiety compared to other students [3]. To develop a more professional and competent nursing workforce, it is significant to not only foster professional capability (i.e., empathy) but also protect the mental health of nursing students, especially from anxiety. The current study aims to provide constructive suggestions for the improvement of professional education and the prevention of mental health problems in nursing students. Specifically, this study focuses on the relation between empathy and anxiety, trying to examine the mediating role of insomnia and the moderating role of self-compassion in the direct relation between empathy and anxiety.

The relation between empathy and anxiety

Empathy is defined as a capacity to understand and share others' emotions, thoughts, and attitudes, involving cognitive and affective components [4, 5]. A wealth of studies have identified the significance of nurses' empathy in the clinical area. Research found that medical students with higher levels of empathy scored higher in clinical competence [6] and had higher academic scores [7]. Moreover, studies to date have documented the positive effects of empathy on therapeutic relationship [8, 9], patients' adherence to treatment regimens [10], and patients' treatment outcomes [11]. Considering these positive effects of empathy, empathy is widely recognized as an educational objective in medical training [12].

Anxiety is a common mental health problem among nursing students [1], which may cause several negative outcomes including decreasing life quality and academic attainment [13]. One previous study found that the prevalence rate of anxiety among these students was 41.7%, which highlights the significance of high concern and timely intervention on the anxiety level of nursing students [14]. Empathy has a close relation with anxiety [5, 15]. Even though empathy is an important component of nursing competency [15] and its positive effect on patients' treatment [10, 11] has been documented by previous literature, uncertainty also remained about the relation between empathy and anxiety among nursing students. On one hand, empathy may share negative associations with anxiety [15, 16]. It is supposed that a higher level of empathy among nurses would improve the nursing quality, thus mitigating the anxious emotions of both patients and nurses [5]. On the other hand, empathy is a kind of emotional labour and it is a core of guilt feelings [17]. Nurses may feel negative emotions (i.e., fatigue, stress, and anxiety) if they have excessive or misdirected empathy or face challenging clinical situations [5, 17, 18]. There is empirical evidence suggesting that empathy has a positive relation with anxiety as well [19]. Given the discrepancies in previous results, the relation between empathy and anxiety warrants further exploration.

Considering that nursing students are not yet working formally, the likelihood of encountering clinical situations out of control is low. Additionally, the relation between empathy and professional skills may be related to the higher academic performance of nursing students [6]. Therefore, this study proposes the following hypothesis:

> Hypothesis 1: Empathy is negatively related to anxiety among nursing students.

The mediation role of insomnia

Insomnia, a subjective complaint of difficulties in initiating and maintaining sleep, or waking up too early, has important effects on the mental health of individuals [20, 21]. Insomnia is a risk factor for developing anxiety, which has been supported by several research [22, 23]. Numerous studies with nurses or nursing students as subjects have also found a positive relationship between insomnia and anxiety [20, 24]. Additionally, insomnia may be a mediator between empathy and anxiety. Nurses not only need to provide professional care to patients but also need to care for the needs and mental states of patients [25]. Empathy is an important professional ability among nurses to build a harmonious nurse-patient relationship [26], which has positive impacts on the career of nurses. Thus, nursing students with higher empathy, may perform better in academic areas and have higher perceptions of professional identity [6, 26], which can mitigate their anxiety [27, 28]. Insomnia may have an impact on the association between empathy and anxiety. A wealth of studies has found that a lower level of empathy is associated with lower sleep quality or more insomnia [29, 30]. Poor sleep impairs the emotional regulatory abilities of individuals [31], which increases the risk of developing anxiety [32]. Considering the aforementioned evidence, the current research proposes the following hypothesis:

> Hypothesis 2: Insomnia mediates the relation between empathy and anxiety.

The moderation role of self-compassion

Self-compassion means treating oneself with warmth and care when facing stressful or tough situations, including

three features: self-kindness, common humanity, and mindfulness [33, 34]. Self-compassion is considered a positive psychological strength and it has been proven that self-compassion can buffer the detrimental impacts of stressful situations on individuals' mental health [35, 36]. For individuals who work in clinical or nursing work, the positive function of self-compassion is still outstanding [37, 38]. For example, a cross-sectional study recruiting 150 nurses as participants found that self-compassion could diminish the effect of perceived stress on job burnout [37]. Hanci and Randmann found that self-compassion could moderate the negative relation between burnout and work engagement among healthcare workers [39]. What's more, studies have documented that self-compassion is a protective factor against poor sleep, sharing a negative association with insomnia [40, 41]. Therefore, given the large number of studies that have found positive protective effects of self-compassion, we can speculate that self-compassion may moderate the relation between empathy, insomnia and anxiety in nursing students.

> Hypothesis 3: Self-compassion can moderate the relation between empathy and insomnia.
> Hypothesis 4: Self-compassion can moderate the relation between insomnia and anxiety.

The current study

After reviewing the previous literature, two main gaps need to be addressed. First, the relation between empathy and anxiety is still being debated. Second, the mechanism linking empathy and anxiety is still unknown, with limited studies providing evidence about this topic. To address these limitations, the current study recruited nursing students, aiming to figure out the relation and mechanism between empathy and anxiety. In terms of the mechanism between empathy and anxiety, the present study examined the mediation role of insomnia and the moderating effect of self-compassion. The results of the current study can provide deeper insight into the relation between empathy and anxiety among nursing students. Additionally, examining the role of insomnia and self-compassion can guide the protection of mental health among nursing students and the improvement of nursing professional education.

Method

Participants

The current study is based on the data collected in three universities between October 2022 and January 2023 in Jiangsu, China, using a convenient sampling method. Only nursing students were invited to participate in the survey, which was based on an online platform named Wenjuanxing (https://www.wjx.cn/). The survey consisted of four questionnaires: General Anxiety Disorder-7, Self-Compassion Scale, the Jefferson Scale of Physician Empathy-Nursing student, and Youth Self-rating Insomnia Scale as well as basic demographic items. A total of 1,567 answers were collected and 144 participants answered this survey repeatedly. Indeed, the first answer was kept and used in the current study and 79 answers were removed. Meanwhile, 327 answers appeared to come from careless responders according to the responding time (failing to meet the criterion: 2 s per item) [42]. Therefore, to ensure the availability and credibility of the data, answers from the careless participants were screened out from the dataset. Finally, only 1,161 answers (female = 923(79.50%), male = 238(20.50%), $Mean_{age} = 18.37$, $SD_{age} = 2.38$) were used in the current study.

The purpose of the study was clearly explained to all the participants through an electronic informed consent process before presenting the questionnaires. Meanwhile, the study was thoroughly reviewed and approved by the ethics committee of the university where the first author belongs (reference number: 202209230104).

Measurements

Anxiety

Anxiety was measured by the scores of General Anxiety Disorder -7 (GAD-7), which was originally developed by Spitzer et al. [43] and its validation of the Chinese version has been verified by Tong et al. [44]. GAD-7 consists of 7 items describing the specific symptoms of the general anxiety disorder, such as "feeling anxious, nervous, or on edge". Each item is rated on a four-point scale ("not at all", "several days", "more than half the days", "nearly every day"). The scores of our sample range from 0 to 21 and a higher score indicates a higher severity of anxiety. The Cronbach α score of the GAD-7 in the current study is 0.932, showing its great consistency and reliability.

Empathy

Empathy was measured using the Jefferson Scale of Physician Empathy-Nursing student version-R (JSPE-NS) [45], which was designed to measure the empathy ability toward the patient among undergraduate nursing students. The JSPE-NS contains 20 items and 3 dimensions, namely "viewpoint taking", "emotion care", and "transposition thinking". A 7-point Likert scale was used, ranging from 1 ("strongly disagree") to 7 ("strongly agree"). The Chinese version of JSPE-NS showed good psychometric properties [46]. Scores of JSPE-NS in our sample cover the range from 59 to 140 with a higher score indicating better empathy ability. The Cronbach α score of JSPE-NS

in the current study reaches 0.864, indicating good consistency and reliability.

Insomnia

Insomnia was assessed using the Youth Self-rating Insomnia Scale -8 (YSIS-8). YSIS-8 includes 8 items asking about the insomnia symptoms, waking symptoms, and daytime consequences within the past half month [47]. Its Chinese version showed satisfactory psychometric properties in Chinese general adolescent populations [48]. YSIS-8 is rated on the Likert 5-point scale and a higher score indicates more severe insomnia symptoms. Scores of the YSIS-8 on the current sample range from 8 to 40 and the Cronbach α score reaches 0.885, showing good consistency and reliability.

Self-compassion

Self-compassion was measured using the Self-Compassion Scale (SCS) developed by Neff [49]. The SCS consists of 26 items and 2 dimensions, positive self-compassion and negative self-compassion, each of which contains 3 sub-dimensions, namely self-kindness, a sense of common humanity, mindfulness for positive self-compassion and self-judgment, isolation, and over-identification for negative self-compassion. The SCS was rated using the Likert 5-point scale with 1–5 indicating "never" to "always". The Chinese version of SCS was reviewed by Chen et al. [50] and showed good validity and reliability. Scores of the SCS on the current sample range from 50 to 122 with a higher score indicating better ability of self-compassion. The Cronbach α score reaches 0.789, indicating acceptable consistency and reliability.

Covariates

The following demographic and socioeconomic variables were included as the covariates for the analysis: age (in years); gender (male vs. female); and socioeconomic status (SES; the combination of three items: education level of father and mother, the level of family monthly income).

Data analysis

We found no missing value in the data across all scales. After the missing data estimation, we calculated the sums of item responses in each scale to produce the scale scores. All scales scores were nearly normally distributed with the value of skewness ranging from -1.45 to 0.94 and the value of kurtosis ranging from -0.64 to 0.789. Then, we conducted the descriptive statistics. Next, the confirmative factor analysis (CFA) employing the maximum likelihood was conducted using the R package *lavaan* (a package that can be used to estimate a variety of latent variable models such as CFA and structural equation modelling) to estimate whether the structure of the used scales fit in our sample [51]. A total of four CFA models were tested: a one-factor model for the GAD-7, a one-factor model for the YSIS-8, a two-staged two-factor model for the SCS, and a three-factor model for the JSPE-NS. The Chi-square test for model fit (χ^2), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) were estimated. In terms of the criterion, CFI and TLI should be higher than 0.90, and greater than 0.95 would be better. Additionally, RMSEA and SRMR of well-fitted model should be lower than 0.08 [52].

After that, we first estimated the mediating effect of insomnia on the predictive effect of empathy on anxiety. Then, two competing moderated mediation models were estimated using the structural equation modelling framework in Mplus. The two competing models shared the same outcome variable (anxiety), predictor variable (empathy), moderator variable (self-compassion), and mediator variable (insomnia). In one model, self-compassion moderated the path of empathy to insomnia, and differently, in the other model, self-compassion moderated the path of insomnia to anxiety. The estimation of these two models follows the framework of the latent moderate structural equation (LMS) and contains three steps: 1) estimating the basic moderated mediation model (containing all variables but not the interaction term); 2) adding the interaction term and estimating the moderated mediation model; 3) estimating the coefficient of the moderated mediating effect. In the current study, we conducted 1,000 times of bootstrapping in each model to make our results robust. Gender, age, and SES were controlled in both moderated mediation models. A p-value of <0.05 was considered statistically significant. We additionally conducted a reverse moderated mediation analysis, testing the model in which anxiety was the predictor variable while empathy was the outcome variable [53, 54].

Results

Descriptive statistics and correlations

Descriptive statistics for the demographic information and the primary scales are presented in Table 1.

The Pearson correlations between variables were calculated and shown in Table 2. The results show that empathy shares a negative relation with both anxiety (Hypothesis 1) and insomnia (Hypothesis 2). Meanwhile, insomnia is proven to be significantly positively related to anxiety (Hypothesis 3). Apart from that, self-compassion shows significantly strong negative relations with both anxiety and insomnia (Hypothesis 4), which needs to be clarified by further model competition. Meanwhile, we also calculated the prevalence rates of anxiety and insomnia according to the cut-off scores (7 for GAD-7 and 22

Table 1 Descriptive statistics of the sample

Variable	*N*	*M*	*SD*
Outcome variable			
Anxiety	1161	4.82	4.34
Predictor variable			
Empathy	1161	108.55	14.27
Mediator variable			
Insomnia	1161	18.20	6.45
Moderator variable			
Self-compassion	1161	84.84	9.43
Control variable			
Age	1161	18.37	2.37
Gender	1161	-	-
Female	923	-	-
Male	238	-	-
Family socioeconomic status	1161	6.30	2.25

M is means, *SD* is the standard deviation

for YSIS-8) proposed by previous studies [48, 55]. In the current sample, the prevalence rate is 18.24% for anxiety and 26.76% for insomnia.

Confirmative factor analysis (CFA)

Before moving to the estimation of the structural equation model (SEM), we first conducted CFAs to examine the factorial structure of SCS, JSPE-NS, and the one-dimensionality for GAD-7, and YSIS-8. CFAs demonstrated that all four scales showed acceptable fit indices with the lowest comparative fit index (CFI) = 0.788. In addition, SCS, JSPE-NS, GAD-7, and YSIS-8 were slightly modified based on the modification index. The correlations between the residuals of items that were described similarly and belong to the same dimension were added to the model (e.g. "When I'm down, I remind myself that there are lots of other people in the world feeling like I am" and "When I'm feeling down, I tend to feel like most other people are probably happier than I am"). After modification, CFAs indicated that four scales showed good fit indices, with the highest Standardized Root Mean Square Residual (RMSEA) being 0.075, the lowest CFI reaching 0.892 and the lowest Tucker-Lewis Index reaching 0.877. More detailed information about the fit indices of CFAs for each scale and the modified measurement model can be found in Table S1 in the supplementary material.

Mediation analysis

The mediation model in which insomnia mediated the predictive effect of empathy on anxiety was conducted. The results of regression analysis demonstrated that empathy could significantly negatively predict insomnia ($\beta = -0.097$, $p < 0.05$), anxiety ($\beta = -0.105$, $p < 0.05$), and insomnia could significantly predict anxiety ($\beta = 0.520$, $p < 0.001$). Moreover, the indirect effect was equal to -0.081 and was also proved to be significant ($p < 0.05$) with the confidence interval (level of confidence = 95%, bootstrap = 1000 times) ranging from -0.197 to -0.063.

In addition, considering the reverse model, we tested the mediation model in which insomnia mediated the predictive effect of anxiety on empathy. The results of regression analysis showed that despite anxiety could significantly predict insomnia ($\beta = 0.527$, $p < 0.001$) and empathy ($\beta = -0.138$, $p < 0.01$), insomnia failed to predict empathy ($\beta = -0.015$, $p = 0.811$). Meanwhile, the result of the bootstrap also showed that the indirect effect is equal to -0.005 and is not significant ($p = 0.814$) and the confidence interval (level of confidence = 95%, bootstrap = 1000 times) covered the range of -0.048 to 0.025 with 0 included. Detailed information on the mediation model is illustrated in Table 3.

Moderated mediation analysis using LMS

Following the framework of LMS, we first estimate the latent moderated mediation model in which self-compassion moderates the path between empathy and insomnia. In this part, we first test model 0 (see Fig. 1a, a model including all related variables but not latent variable

Table 2 Pearson correlations between variables

	1	2	3	4	5	6
Self-compassion	1					
Empathy	0.24***	1				
Anxiety	-0.41***	-0.11***	1			
Insomnia	-0.30***	-0.14***	0.48***	1		
SES	0.15***	0.00	-0.02	-0.05	1	
Age	-0.08***	-0.18***	0.00	0.09***	-0.21	1

*$p<0.05$

**$p<0.01$

***$p<0.001$ (2–tailed)

Table 3 Regression and mediation analysis, comparing two models with the reverse direction

Test	B	SE	CI.lower	CI.Higher	β	z	*P*
Empathy > Anxiety	-0.168	0.085	-0.345	-0.018	-0.105	-1.971	< .05
Empathy > Insomnia	-0.161	0.075	-0.414	-0.128	-0.097	-2.163	< .05
Insomnia > Anxiety	0.501	0.038	0.414	0.568	0.520	13.330	< .001
Empathy > Insomnia > Anxiety	-0.081	0.034	-0.197	-0.063		-3.820	< .001
Anxiety > Empathy	-0.087	0.031	-0.140	-0.016	-0.138	-2.779	< .01
Anxiety > Insomnia	0.548	0.045	0.465	0.645	0.527	12.0771	< .001
Insomnia > Empathy	-0.009	0.037	-0.100	0.054	-0.015	-0.239	0.811
Anxiety > Insomnia > Empathy	-0.005	0.021	-0.048	0.025		-0.235	0.814

Level of confidence: 95%. *N* = 1000 bootstrapped resamples. B = Unstandardized regression coefficient. SE = Standard Error. CI.lower = 95% Lower Confidence Interval. CI.Higher = 95% Higher Confidence Interval. β = standardized regression coefficient. Age, gender, and SES were controlled

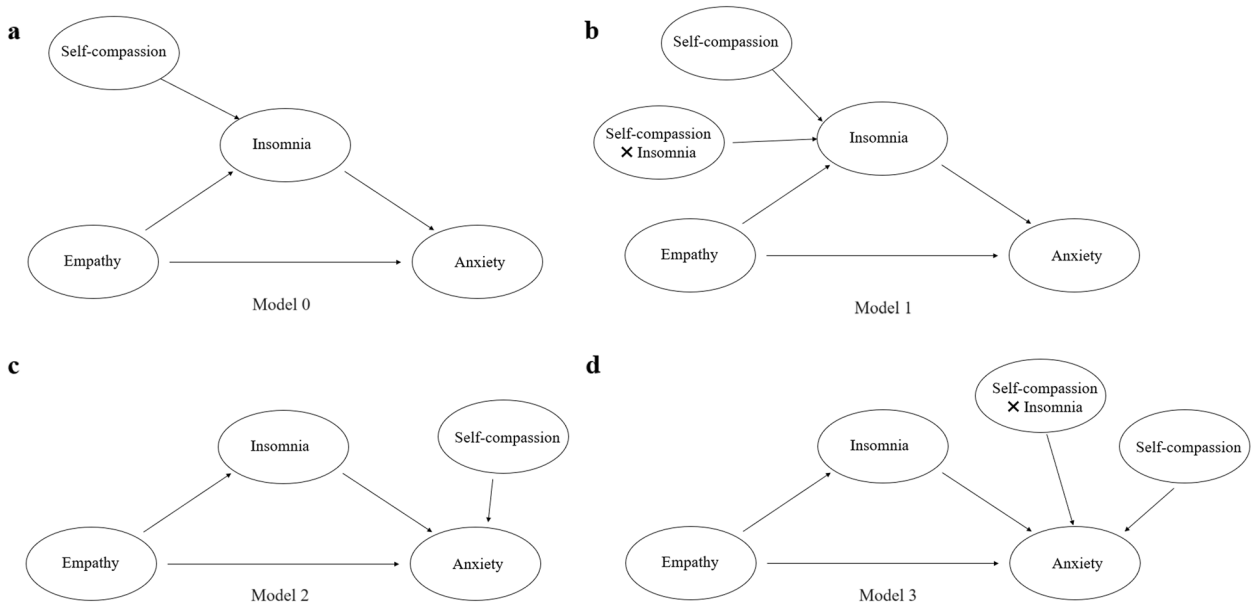

Fig. 1 Latent moderated mediation models

interaction). The model fit indices demonstrated that model 0 fitted well with RMSEA = 0.040, CFI = 0.893, and TLI = 0.888. Indeed, model 1 (see Fig. 1b, a model with all related variables and the latent variable interaction) was tested. Compared to model 0, the Akaike Information Criteria (AIC) increased by 792.78. Meanwhile, the log-likelihood for H0 value for model 1 is 396.3 less than that for model 0. The value of -2LL is not significant. Indeed, model 1 did not fit better than model 0, which indicated that self-compassion did not moderate the path between empathy and insomnia.

Similarly, we then estimated the latent moderated mediation model in which self-compassion moderates the path between insomnia and anxiety. In this part, we first tested model 2 (see Fig. 1c, a model that includes all variables but not latent variable interaction). The model fit indices demonstrated that model 2 fitted well with RMSEA = 0.04, CFI = 0.894, and TLI = 0.889. Indeed, model 3 (see Fig. 1d, a model with all related variables and the latent variable interaction) was tested. Compared to model 0, the value of AIC decreased by 11,722.991 and the value of -2LL reached 11,720.99, which showed a significant difference and indicated that model 3 fit better than model 2.

Based on this, we further estimated the mediating effect. The result showed that the estimation of the indirect effect is equal to 0.329 with the confidence interval covering the range of 0.123 to 0.742, which did not include 0. Indeed, insomnia significantly mediated the relation between empathy and anxiety. In detail, the results showed that empathy could negatively predict insomnia (β = -0.155, $p < 0.001$) and insomnia could positively predict anxiety (β = 0.415, $p < 0.001$). Meanwhile, the results also indicated that empathy could not predict

anxiety directly (β = 0.177, $p = 0.082$). The total model presentation with standardized regression coefficients is presented in Fig. 2.

Furthermore, we compared the moderating effects under the different values of self-compassion. The results demonstrated that the negative relation linking insomnia and anxiety is stronger when the level of self-compassion is lower. More specifically, when the individuals showed a higher level of self-compassion (M + SD), the positive predictive effect of insomnia on anxiety was weaker (B = 0.212, $p < 0.001$). When the individuals obtained a lower level of self-compassion (M-SD), the positive predictive effect of insomnia on anxiety was stronger (B = 0.580, $p < 0.001$). Moreover, we also estimated the indirect effect of empathy on anxiety under different levels of self-compassion. The results indicated that when obtaining a higher level of self-compassion, the indirect effect of empathy on anxiety through insomnia was weaker (B = -0.053, $p < 0.01$). When individuals showed a lower level of self-compassion, the indirect effect of empathy on anxiety through insomnia was stronger (B = -0.144, $p < 0.01$). The results of the moderated mediating effects are illustrated in Table 4.

Discussion

The present research focuses on the association and complex mechanism between empathy and anxiety among nursing students, testing the mediated effect of insomnia and the moderated effect of self-compassion at the same time. What's more, the present study provided the prevalence rates of anxiety and insomnia among nursing students according to the cut-off scores of GAD-7 and YSIS-8. This study yielded several important findings, which need to be further discussed.

The result of the current study showed that among nursing students, empathy was negatively associated with anxiety. This finding is consistent with previous studies that have found empathy is negatively related to anxiety [15, 16], supporting Hypothesis 1. Although few previous studies have found a positive relation between empathy and anxiety [19, 56–58], most of these studies have involved the general population or healthcare workers facing stressful situations (i.e., informal dementia caregivers) as subjects. Differing from the general people, empathy is a core professional ability of nursing students or nurses [59]. In other words, empathy is highly correlated with nursing professional competence, which will have an impact on the mental health of nursing students [60]. Additionally, unlike formal clinical workers, the nursing student subjects in this study had not yet formally entered the nursing profession and some had not yet started their internships. Thus, nursing students may face fewer clinical situations that are too difficult or stressful to handle and are less likely to experience anxiety due to exhaustion [61]. Considering these reasons, it is reasonable that the current finding suggests a negative relation between empathy and anxiety among nursing students.

Examination of the mediated role of insomnia between empathy and anxiety showed that insomnia significantly

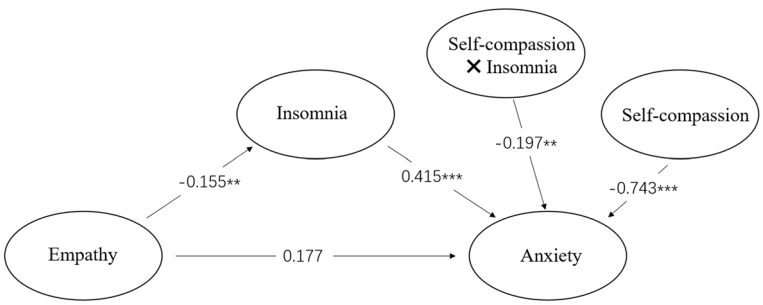

Fig. 2 The moderated mediation model with standardized regression coefficients. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (2–tailed)

Table 4 Analyses of conditional indirect effects of empathy on anxiety mediated through insomnia and moderated by self-compassion

Self-compassion	B	SE	CI.lower	CI.Higher	z	*P*
M-SD (-0.140)	-0.144	0.045	-0.255	-0.059	-2.952	< .01
M (-0.007)	-0.098	0.030	-0.165	-0.039	-3.057	< .01
M + SD (0.126)	-0.053	0.018	-0.095	-0.019	-2.778	< .01

Level of confidence: 95%. SE = Standard Error. *N* = 1000 bootstrapped resamples. CI.lower = 95% Lower Confidence Interval. CI.Higher = 95% Higher Confidence Interval. Age, gender, and SES were controlled

mediated the relation between empathy and anxiety among nursing students. Specifically, empathy could negatively predict insomnia and insomnia could positively predict anxiety. Meanwhile, by examining the reverse model, the results indicated that insomnia cannot predict empathy and the mediation effect of insomnia on the direct relation from anxiety to empathy is also not significant. One possible explanation may be that empathy, in the current study, characterized as the ability to understand the feelings of patients [45], should be considered as a stable trait and may not change by the daily sleeping quality or anxiety state. This result further proved the predictability of empathy towards insomnia to anxiety. This finding is consistent with Hypothesis 2. This finding further validates that insomnia is a vital indicator of mental health problems, as proven by a large body of literature [23, 62]. Thus, previous intervention plans targeting insomnia [63, 64] may be helpful in protecting the mental health of nursing students. Besides, a phenomenon found in this study deserves concern. In terms of the prevalence rates of anxiety and insomnia in the subjects of this research, they are 18.24% and 26.76% for anxiety and insomnia, respectively. Although the prevalence rate for anxiety was slightly lower than that obtained in the previous meta-analysis results [65, 66], the prevalence rate for sleep disorders was slightly higher than that derived from the meta-analysis [67, 68]. This phenomenon may reveal that although some Chinese nursing students do not have anxiety, given the more prominent insomnia, it is still necessary to pay attention and intervene in a timely manner to avoid further development of anxiety.

For the test of the moderated effect of self-compassion, this study yielded that self-compassion moderated the positive relation between insomnia and anxiety but not the negative relation between empathy and insomnia. This finding rejects Hypothesis 3 but supports Hypothesis 4. This finding is consistent with other studies, supporting that self-compassion is a positive psychological variable that can buffer the detrimental effects of stressful events and protect the mental health of people [34, 35]. Since nursing is a challenging job related to plenty of stressful and tough events [1], the mental health of nurses and nursing students needs additional concern. In combination with previous research and the findings of this study, nursing schools may consider using Mindfulness-Based Stress Reduction (MBSR) to improve the empathy and self-compassion of nursing students [69], protecting their mental health.

Limitations and conclusion

The present study aims at exploring the complex relation and mechanism between empathy and anxiety, recruiting nursing students as subjects. First, the prevalence rates of anxiety and insomnia in the current sample are 18.24% and 26.76%, respectively. Second, this study proved that empathy was negatively related to anxiety and insomnia served as a mediator between empathy and anxiety. Third, it was proven that self-compassion moderated the relation between insomnia and anxiety, supporting the protective role of self-compassion on individuals' mental health. Based on these findings, this study suggests that the education of nursing students should highlight the importance of fostering empathy and self-compassion. Besides, the intervention on insomnia may be helpful in reducing the levels of anxiety among nursing students.

Despite the important findings provided by the results of this study, there are still some shortcomings that need to be pointed out. First, in this study, we did not consider the different dimensions of empathy while empathy has two components – cognitive empathy and affective empathy. However, previous literature suggests that the relation between empathy and anxiety may vary across different components of empathy [19, 56]. Thus, future studies can further explore the relation between different components of empathy and anxiety among nurses or nursing students. Second, even though this study examined not only the mediation model in which insomnia mediated the predictive effect of empathy on anxiety but also the reverse model, this study is still a cross-sectional study. Therefore, the causal relation and the direction between empathy and anxiety still need to be further examined through longitudinal studies. Third, it should be noted that most of the nursing students in the current study did not start nursing internships when they participated in the survey. Clinical or nursing internships have effects on the emotional state and the empathy of students [70, 71]. Future research could consider using a longitudinal study to track empathy and anxiety in a cohort of students to explore whether the relation between empathy and anxiety changes depending on the students' various learning stages. Fourth, the current study employed convenient sampling, which may influence the generalization of findings in the current study to all nursing students. Thus, the results yielded from the present research need to be validated by future studies.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12912-024-02238-8.

Supplementary Material 1

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Authors' contributions
Conceptualization: G. L. and Y. T.; Methodology and writing: Q. T. and X. Z.; Review and editing: X. L. and Y. Lv; Data collecting: Y. Li and Y. X.; All authors read and approved the final manuscript.

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Availability of data and materials
The datasets are available from the corresponding authors on request.

Declarations

Ethics approval and consent to participate
This study was reviewed and approved by the ethical committee of Beijing Normal University (Date: 26 September 2022; Reference number: 202209230104). Informed consent was obtained from all subjects involved in the study. Written informed consent for publication was waived because the description of the purpose of the study was at the beginning of the questionnaire and the questionnaire included an item about informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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