Research article

Nomogram reliability for predicting potential risk in postgraduate medical students with anxiety symptoms

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ABSTRACT

Purpose: This research aims to develop a Nomogram for exact anxiety symptoms prediction in postgraduate medical students so that they may be identified as high-risk individuals early and get focused care.
Methods: Using a convenient sampling method, for case-control matching, 126 participants with anxiety symptoms and 774 participants of the same age and gender but without anxiety symptoms were designated as the case group and control group, respectively. Multivariable logistic regression analysis was utilized to identify influencing factors for anxiety symptoms, then used to design and verify a Nomogram of anxiety symptoms.
Results: Multivariate logistic regression analysis showed that lack of social support (OR = 0.95, 95%CI: 0.91–0.99), low life satisfaction (OR = 0.91, 95%CI: 0.86–0.95), low subjective well-being (OR = 0.58, 95%CI: 0.41–0.83) and frequent tobacco and alcohol use (OR = 1.75, 95%CI: 1.10–2.80) were independent predictors of anxiety symptoms in postgraduate medical students ($P < 0.05$). The Nomogram risk prediction model based on the above four independent prediction factors was established, and the verified C-index (Concordance index) is 0.787 (95%CI: 0.744–0.803, $P < 0.001$).
Conclusions: Anxiety symptoms in postgraduate medical students are influenced by various variables. The Nomogram prediction model has high accuracy, validity, and reliability, which can provide reference for predicting anxiety symptoms in postgraduate medical students.

1. Introduction

Postgraduate medical students are a particular group of students with high clinical practice stress and academic pressures (Zhong et al., 2019). The empirical literature has found that anxiety and depression are common among medical students (Wilkes et al., 2019) and in China (Shi et al., 2015). If anxiety symptoms are not detected and intervened promptly, it will affect learning performance (Owens et al., 2012) and negatively impact their satisfaction with life (Beutel et al., 2010; Hoseini-Esfidarjani et al., 2022). It is worth noting that the adverse effects of anxiety are often overlooked compared to depression (Quek et al., 2019). First of all, anxiety usually leads to the emergence of negative emotions such as fear (Papenfuss and Ostafin, 2021), which can affect work habits

and attitudes, work relationships, and performance in varying degrees (Mortensen, 2014). Secondly, anxiety has been shown to harm the nervous system (Richards and Bertram, 2000). For example, anxiety can cause sympathetic excitation, resulting in vasoconstriction, increased blood pressure, and increased heart rate, which can trigger cardiovascular diseases such as hypertension, coronary heart disease, stroke, and heart failure in individuals and can further cause acute exacerbation of these pathologies (Fiedorowicz et al., 2011). Furthermore, anxiety and depression share several common etiological processes (Garber et al., 2016). Anxiety can cause sleep disorders, irritable bowel syndrome, blood pressure, unstable blood sugar, slowed thinking, and reduced and delayed speech and movement due to the body being under prolonged stress (Härter et al., 2003). The frequent co-occurrence of anxiety and

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depression can lead to the accumulation of negative emotions that may eventually lead to self-harm or even suicide (Zhang et al., 2019).

On the one hand, postgraduate medical students must participate in clinical practice and undertake the tremendous pressure from scientific research (Peng et al., 2022). On the other hand, in China, with enlarging enrollment in medical colleges, the pressure on the employment of postgraduate medical students is growing (Zhang, 2019). Owing to the popularization of higher education and the pressure from the employment market, risks from the investment in higher education for medical students are becoming higher and higher. These factors may make anxiety among medical students grow with each passing day.

In recent years, many scholars have begun to use various methods to predict the probability of anxiety symptoms in different populations (Moshe et al., 2021; Jothi and Husain, 2021; Bokma et al., 2022). However, it remains a challenge to determine in advance the potential risk of anxiety symptoms in the high-stress population. The Nomograms are considered reliable tools for quantifying the risk of clinical adverse events by creating simple and intuitive predictive model plots. In recent years, the Nomograms have also been used in clinical practice to predict anxiety symptoms (Hu et al., 2022; Dang et al., 2022). Compared with other predictive statistics methods, the Nomogram provides an intuitive and visual icon model. It provides an intuitive, visual, and understandable clinical diagnostic tool for accurate screening and intervention of anxiety symptoms (Huang et al., 2021). So this study aimed to establish a Nomogram risk prediction model for anxiety symptoms, develop a clinical diagnostic tool to assess the potential risk of anxiety symptoms of each postgraduate medical student, to take targeted interventions. It is noteworthy that medical students' personal traits, subjective feelings, external environment, and behavioral models have been considered essential aspects affecting their mental health (Thuma et al., 2020). Thus, based on previous studies, our study incorporated factors that might affect anxiety symptoms of postgraduate medical students into the Nomogram prediction model. On the one hand, all factors in the study were from the perspectives of personal traits (e.g., meaning in life), subjective feelings (e.g., subjective well-being and life satisfaction), the external environment (e.g., social support and family function), and behavioral patterns (e.g., alcohol and tobacco use). On the other hand, relatively brief measurement tools were also a key consideration. Considering the practical values of the Nomogram, only the selection of relatively short questionnaire or scales to construct prediction models can genuinely promote the application of clinical tools in practice.

Therefore, all questionnaire and scales selected for this study were within ten items. Finally, following the principles of accuracy and objectivity, only questionnaire or scales with proven reliability and validity in the Chinese sample were selected for this study to develop a measurement tool that can predict the potential risk of anxiety symptoms in postgraduate medical students effectively.

2. Methods

2.1. Participants

A total of 937 people responded to a poll that was conducted online. Postgraduate medical students from the Graduate Department of The Second Affiliated Hospital of Nanchang University were selected by a convenient sampling method. To avoid Socially Desirable Responding (Gnambs and Kaspar, 2017), three attention check items were set in the online questionnaire. Participants who answered all the attention check items correctly were considered to be qualified. Following the exclusion of the participants who did not meet the criteria, the final sample consisted of 900 individuals. All participants in the study were postgraduate medical students, most of whom enrolled in a Master's programme (n = 826, 91.8%) and the rest of students were from Doctoral programme (n = 74, 8.2%). There were 453 males (50.3%) and 447 females (49.7%) in the study, and their age range was from 26 to 59 years old (27.01 ± 3.03). The study has been approved by The Biomedical Research Ethics Committee of The Second Affiliated Hospital of Nanchang University: Research and Clinical Review [2019] No. (096).

2.2. Research design

2.2.1. Case-control study

In the Graduate Department of The Second Affiliated Hospital of Nanchang University, a case-control study was conducted. This study was conducted through a psychological census, therefore, it was expected that all postgraduate medical students in the university affiliated hospital would be included in the study. However, it was considered that having had a psychiatric disorder may have an impact on the results of the study. Exclusion criterion was also set for this study: having a mental illness as an exclusion criterion for the study. According to university regulations, if a postgraduate medical student is diagnosed with a mental illness, he/ she must submit the relevant medical records to the Graduate Department. Therefore, as requested by the ethics committee, the researchers communicated with the Deans of the Graduate Department, with their consent, the study referred to the medical records from the graduate department and those postgraduate medical students who had been diagnosed with a mental illness were excluded from this study. This study used the GAD-7 as the most important measurement tool. The 7-item Generalized Anxiety Disorder Scale (GAD-7), often known as the GAD-7, is a scale consisting of seven questions that is used to assess the degree to which postgraduate medical students are affected by anxiety symptoms. If a postgraduate medical student' score on the scale was high, it indicates that his anxiety symptoms are more severe. There are four specific criterions for distinguishing anxiety symptoms: GAD-7 score < 5 was defined as no anxiety, GAD-7 score from 5 to 9 was defined as mild anxiety, GAD-7 score from 10 to 14 was defined as moderate anxiety, and GAD-7 score from 10 to 14 was defined as severe anxiety. According to the research design, the study used the GAD-7 scores as a criterion to determine whether the postgraduate medical students belonged to the case group or control group. Specifically, postgraduate medical students were considered to have some degree of anxiety symptoms (whether it was mild anxiety, moderate anxiety or severe anxiety, this study judged that anxiety symptoms) as long as their GAD-7 score was greater than 5. As the study's case group, 126 postgraduate medical students who scored more than 5 on GAD-7 were selected. In contrast, a total of 774 participants who scored less than 5 on GAD-7 were assigned to the control group. All work were completed online, including the process for grouping postgraduate medical students according to the GAD-7 score. There were no statistically significant differences in gender and age between the case group and the control group ($P < 0.05$), indicating that the above-mentioned basic demographic information was equitably comparable between the case group and the control group. The case group had a significantly higher prevalence of anxiety symptoms than the control group did.

2.2.2. Questionnaire survey

An online survey was used to gather data for an investigation of the mental health status of postgraduate medical students. The most important parts of the online survey were the items in the questionnaire and scales. Prior to the start of the online survey, a single set of instructions was provided to participants, and they were required to finish the questionnaire and scales within the allotted amount of time. Two teachers from the Graduate Department who had been trained by researchers in the study were responsible for distributing the questionnaire to the students (which included the Family APGAR Scale, the Chinese Social Support Rating Scale, the Subjective Well-being Scale, the Meaning in Life Questionnaire, the Satisfaction With Life Scale, the Tobacco and Alcohol Use Scale and the 7-item Generalized Anxiety Disorder Scale). The students were also told that if they encountered any problems when conducting the online survey, they could ask questions to the two teachers at any time, and the two teachers would answer their questions related to the online survey in real time. The online questionnaire and

scales were sent to different WeChat groups where the postgraduate medical students participating in the study were, and the students were asked to fill them out immediately upon receipt by using their smartphones.

2.3. Measurement tools

2.3.1. Family function

A three-point scale was chosen to serve as the method of scoring for the Family APGAR Scale (APGAR; Karimi et al., 2022), which is a scale consisting of five separate phrases. The value of this assessment according to the Cronbach alpha was 0.89.

2.3.2. Social support

A four-point scale was used for the Chinese Social Support Rating Scale (SSRS; Cheng et al., 2008), which is an 11-item scale. This particular evaluation yielded a Cronbach alpha value of 0.75.

2.3.3. Life satisfaction

The Satisfaction With Life Scale (SWLS; Wang et al., 2009) consists of five items, a seven-point Likert scale was used and 0.91 was the Cronbach alpha for this evaluation.

2.3.4. Subjective well-being

The Subjective Well-being Scale (Campbell, 1976) consists of a single question, "Overall, how happy do you feel you are?" And a Likert scale with seven points was used. Given that there is only one question on the subjective well-being scale, this study used the criterion-related validity as an indicator to evaluate the scale. The Satisfaction With Life Scale (SWLS; Wang et al., 2009) was used as the criterion-related validity scale to calculate the criterion-related validity of subjective well-being scale. The criterion validity of subjective well-being scale was 0.69.

2.3.5. Meaning in life

The Meaning in Life Questionnaire (MLQ; Semma et al., 2019) is a 10-item questionnaire that uses a seven-point Likert scale to measure the search for significance as well as the presence of meaning in one's life. In this particular analysis, the Cronbach alpha was equal to 0.86.

2.3.6. Alcohol and tobacco use

The Tobacco and Alcohol Use Scale that was developed by Ye et al. (2011) is a four-item scale, and the researchers decided to use a six-point scale for scoring. The Cronbach alpha for this evaluation was a value of 0.72.

2.3.7. Anxiety symptoms

A three-point scale was used in the development of the 7-item Generalized Anxiety Disorder Scale (GAD-7; Spitzer et al., 2006). This scale comprised of seven different phrases. This particular evaluation yielded a Cronbach alpha value of 0.93.

2.4. Statistical analysis

The questionnaire and scales were distributed by participants scanning the OR codes of Wenjuanxing, Wenjuanxing is a platform that provides services comparable to those offered by Amazon Mechanical Turk. And then the researchers recorded the data. SPSS 25.0 was used for descriptive statistics of all variables, as well as subsequent Chi-square test, independent sample t-test, univariate logistic regression analysis, and multivariate logistic regression analysis. R language was used for constructing a Nomogram prediction model. $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of baseline value between the case group and the control group

A total of 126 participants (14.0%) of postgraduate medical students whose score of GAD-7 $\geq$ 5 were taken into the case group, and 774 participants (86.0%) of postgraduate medical students were in the control group. No significant difference was found in the general data ($P \geq$ 0.05). Between the case and control groups, there were substantial differences in family function, social support, subjective well-being, satisfaction with life, and alcohol and tobacco use ($P < 0.05$; see Table 1).

3.2. Univariate logistic regression analysis and multivariate logistic regression analysis of anxiety symptoms

Univariate logistic regression analysis showed that family function (OR = 0.77, 95%CI: 0.71–0.82), social support (OR = 0.89, 95%CI: 0.86–0.92), subjective well-being (OR = 0.32, 95%CI: 0.24–0.42), life satisfaction (OR = 0.85, 95%CI: 0.82–0.88), meaning in life (OR = 0.96, 95%CI: 0.95–0.98), alcohol and tobacco use (OR = 1.17, 95%CI: 1.19–2.64) could affect the anxiety symptoms of postgraduate medical students (see Table 2). Then, these factors were further included in the multivariate logistic regression analysis by using a step-by-step method, and the results showed that social support (OR = 0.95, 95%CI: 0.91–0.99) and subjective well-being (OR = 0.58, 95%CI: 0.41–0.83), life satisfaction (OR = 0.91, 95%CI: 0.86–0.95), alcohol and tobacco use (OR = 1.75, 95%CI: 1.10–2.80) were independent predictors of anxiety symptoms in postgraduate medical students ($P < 0.05$). The specific data was shown in Table 3.

3.3. Nomogram for anxiety symptoms

Anxiety symptoms of postgraduate medical students were taken as the dependent variable (Anxiety symptoms are present = 1, No anxiety symptoms = 0), and the independent variables were selected by multivariate logistic regression analysis as the independent predictors. The Nomogram analysis was performed by R language to calculate the total

Table 1. Baseline value of the control group and the case group.

Variable		The control group ($n = 774$)	The case group ($n = 126$)	χ^2/t	P
Gender	Female	384 (49.62%)	63 (50.00%)	-0.08	0.936
	Male	390 (50.38%)	63 (50.00%)		
Age		26.99 ± 3.43	27.10 ± 2.71	-0.35	0.725
Family function		7.22 ± 2.50	5.33 ± 2.73	7.77	<0.001
Social support		36.06 ± 6.40	32.06 ± 5.25	8.37	<0.001
Subjective well-being		5.00 ± 0.87	4.21 ± 0.88	9.38	<0.001
Life satisfaction		22.67 ± 5.51	17.20 ± 5.73	10.29	<0.001
Meaning in Life		51.00 ± 9.26	47.40 ± 9.33	4.04	<0.001
Alcohol and tobacco use		1.09 ± 0.32	1.20 ± 0.58	-2.02	0.003

Table 2. Univariate logistic regression analysis of anxiety symptoms.

Variable	β	SE	$waldx^2$	OR	95%CI	P
Gender	0.02	0.19	0.01	1.02	0.70–1.48	0.936
Age	0.01	0.03	0.13	1.01	0.96–1.07	0.724
Family function	-0.27	0.04	51.17	0.77	0.71–0.82	<0.001
Social support	-0.12	0.02	46.47	0.89	0.86–0.88	<0.001
Subjective well-being	-1.14	0.14	70.02	0.32	0.24–0.42	<0.001
Life satisfaction	-0.17	0.02	81.50	0.85	0.82–0.88	<0.001
Meaning in Life	-0.04	0.01	15.51	0.96	0.96–0.98	<0.001
Alcohol and tobacco use	1.77	0.20	8.02	1.77	1.19–2.64	0.005

Table 3. Multivariate logistic regression analysis of anxiety symptoms.

Variable	β	SE	$waldx^2$	OR	95%CI	P
Social support	-0.06	0.02	7.04	0.95	0.91–0.99	0.008
Subjective well-being	-0.54	0.18	8.70	0.58	0.41–0.83	<0.001
Life satisfaction	0.10	0.03	16.05	0.91	0.86–0.95	0.003
Alcohol and tobacco use	0.56	0.24	5.35	1.75	1.10–2.80	0.021
Constant	3.62	0.86	17.70	37.43		<0.001

score of all variables, and the total score of each factor was calculated. The total score ranged from 135 to 290, and the corresponding risk ranged from 0.10 to 0.90. The higher the score, the higher the risk of anxiety symptoms. The scores, points, total points and potential risks of each variable are shown in Figure 1.

In this study, a total of 4 independent predictors were screened out and integrated to establish a visual Nomogram model. According to the Nomogram, the scores of the Chinese Social Support Rating Scale, the Satisfaction With Life Scale, the Subjective Well-being Scale, and the Tobacco and Alcohol Use Scale for postgraduate medical students can be evaluated by vertical lines at the top of the Nomogram to get different scores (The default score is 0–100). Then the scores of all variables were

added to obtain the total scores, and the likelihood of anxiety symptoms could be found on the risk line of anxiety symptoms of postgraduate medical students through the total scoreline. For example, a postgraduate medical student with the score of 29 on the Chinese Social Support Rating Scale (59 on the points axis of the Nomogram), 20 on the Satisfaction With Life Scale (50 on the points axis of the Nomogram), 4 on the Subjective Well-being Scale (56 in the points axis of the Nomogram), and 2.25 for the Tobacco and Alcohol Use Scale (24 in the points axis of the Nomogram). The total score of the Nomogram analysis of anxiety risk would be (59 + 50+56 + 24) = 189. The probability of anxiety symptoms of the postgraduate medical student was found to be 36% according to the risk line of anxiety symptoms.

### 3.4. DCA and ROC curve evaluation

When it came to forecasting the possible risk of anxiety symptoms among postgraduate medical students, the Nomogram showed a strong Concordance index of 0.787. It can be seen that the model has a good discrimination coefficient and accuracy (Zhang et al., 2022). The Correction curve was close to the standard curve, and the predictive value was basically consistent with the measured value, as shown in Figure 2. AUC (Area Under Curve) of ROC (Receiver Operating Characteristic) Curve was 0.787, 95%CI: 0.744–0.803 ($P < 0.001$), and this showed that all the models had good prediction accuracy as shown in Figure 3. In addition, DCA (Decision Curve Analysis) showed that the Nomogram model had a high clinical value in the range of 1%–65%, which further proved that the Nomogram model could accurately predict the anxiety symptoms of postgraduate medical students, as shown in Figure 4.

4. Discussion

It is reported that most medical students are plagued by anxiety symptoms to a greater or lesser extent (Mohamed, 2022). In addition to the adverse effects of anxiety on the physical and mental health of individuals, the harm it causes to their cognitive function should not be
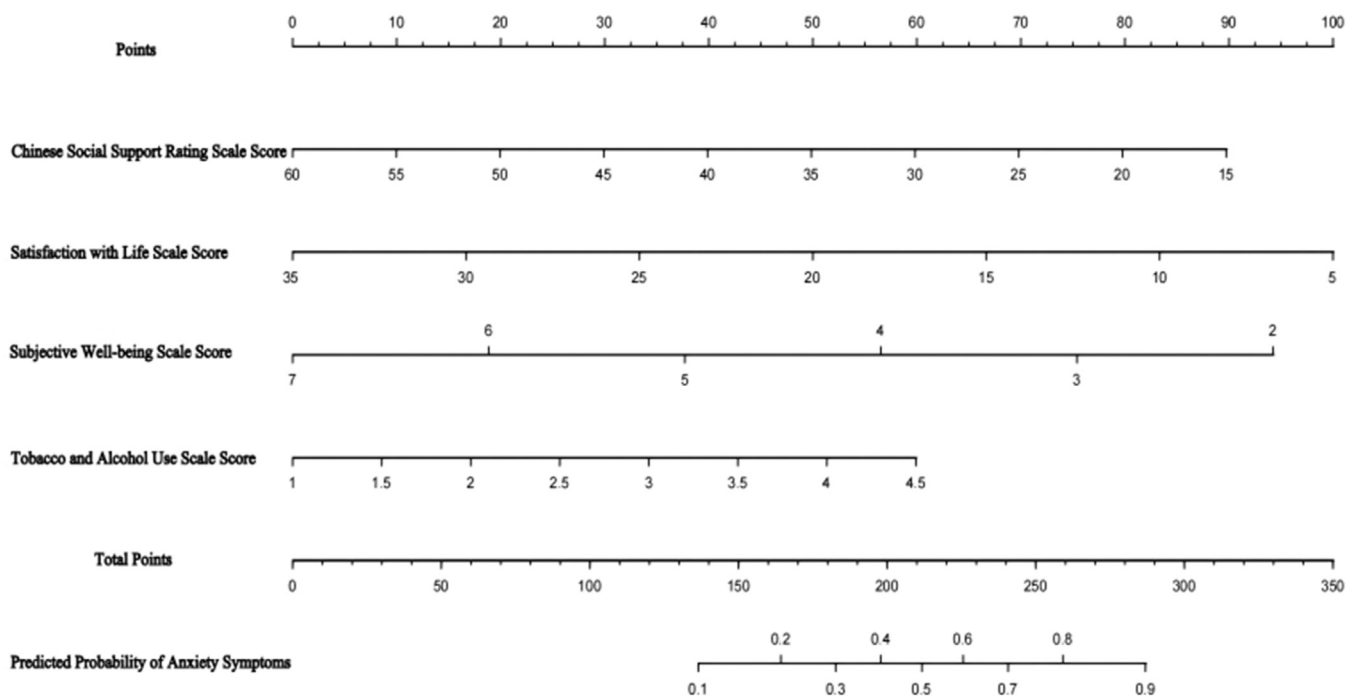
Figure 1. Nomogram for anxiety symptoms of postgraduate medical students.
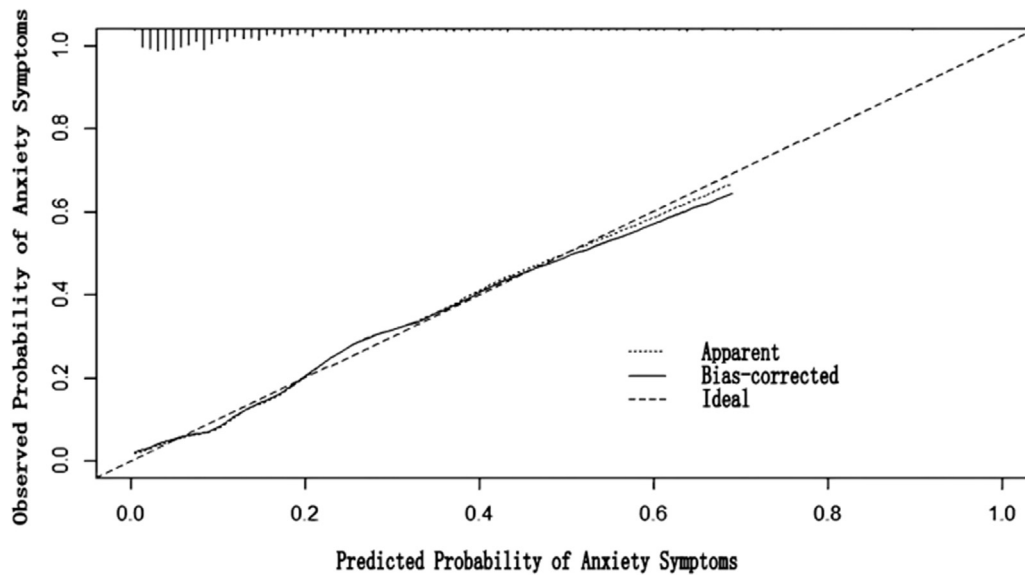
Figure 2. Nomogram predicted the probability of anxiety symptoms among postgraduate medical students. *Note.* The x-axis shows the predicted probability of anxiety symptoms, and the y-axis shows the observed probability of anxiety symptoms.

ignored. Anxiety will damage individual goal-directed attention, working memory, and sensorimotor function (Runswick et al., 2018). Previous studies have confirmed that anxiety is ever-present in all health-care organizations (Edmonstone, 2021). For medical students, the chronic presence of anxiety symptoms can lead to more severe insomnia (Mohamed et al., 2020), which will undoubtedly affect the performance of medical students during the period of studies and clinical practice (Chandavarkar et al., 2007). Previous studies have also confirmed that anxiety is ever-present in all health-care organizations (Edmonstone, 2021). And the negative impact is likely to persist, because most medical students still choose to work in the healthcare industry after graduation. Considering the specificity, necessity and irreplaceability of clinicians'

Figure 3. Receiver Operating Characteristic Curve for Nomogram Area under the curve was 0.787 (95% confidence interval 0.744–0.803).

work, ignoring these negative effects can result in irreparable consequences, including patient suffering and even death. Therefore, increased attention to postgraduate medical student's anxiety has important implications for the entire health care industry. In this study, the relevance ratio of anxiety symptoms among postgraduate medical students was 14.00%, lower than the results of the study on undergraduate medical students (Mao et al., 2019), which may be related to the following factors: on the one hand, postgraduate medical students tend to be mature in their value orientation (Tan et al., 2021) and have good emotional management ability during their postgraduate period (Li et al., 2021). On the other hand, in recent years, in order to improve the mental health of medical students, more and more medical colleges have tended to add mental health courses to postgraduate medical students' curricula to help them to learn knowledge which was related to the cultivation of abilities of self-support and help-seeking (Ling et al., 2019).

The multivariate logistic regression analysis results showed that lack of social support, low subjective well-being, low satisfaction with life, and frequent use of alcohol and tobacco were independent predictors of anxiety symptoms in postgraduate medical students. First of all, the more social support, the more help postgraduate medical students get when they encounter difficulties in their professional studies, clinical practice, and daily life, which significantly reduces the probability of anxiety symptoms (Ao et al., 2020). Secondly, life satisfaction is a comprehensive judgment of their life, it affects personal ideals, beliefs, life goals, and behavioral orientation as a cognitive factor. Individuals with low life satisfaction are more easily confused because of a lack of purpose and fulfillment (Mei et al., 2021). However, it takes many years of professional study and clinical practice to become a true clinician for a medical student. There are many uncertainties in the long cycle of research and practice. In the face of uncertainties, medical students without purpose and fulfillment are more likely to have excessive worries about their future, which further increases the possibility of anxiety symptoms for postgraduate medical students (Liu et al., 2021). In addition, according to the goal-structure-change theory, better mental function, including individual growth, adaptation, the pursuit of challenges, and solving difficulties, is also an essential aspect of well-being (Zhang and Lin, 2018). Postgraduate medical students with low subjective well-being usually have poor adaptability. When they encounter problems, they are prone to high tension and low self-esteem, then they find it difficult to regain confidence from other sources. However, postgraduate medical students
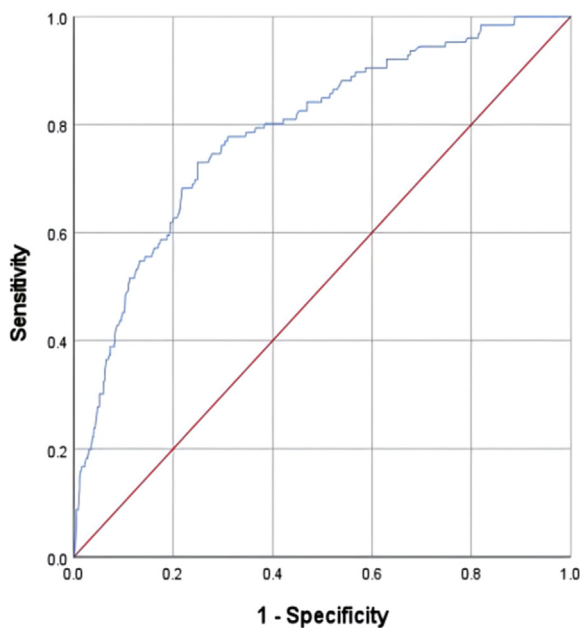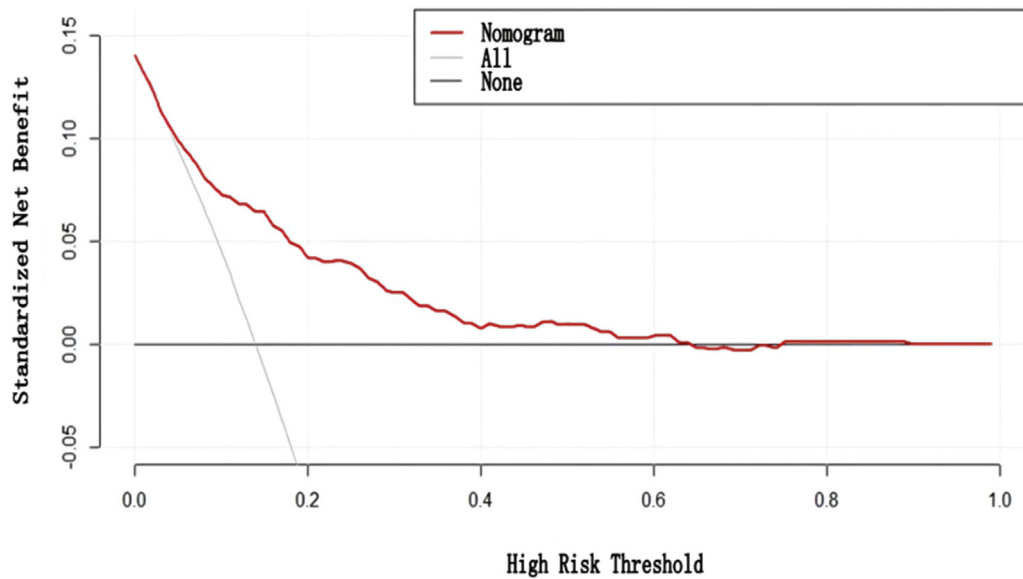
Figure 4. Correction curve and decision curve analysis of nomogram.

with more increased subjective well-being are more willing to pursue professional study and clinical practice challenges, more creative, and wiser in solving difficulties (Corkhill et al., 2014). They will also have higher efficiency and productivity in their studies, and therefore they will feel less anxious (Schmidt and Hansson, 2018). Finally, when alcohol and tobacco users encounter problems, they tend to smoke or drink to paralyze themselves and temporarily escape from reality. They have low self-control ability and inadequate social support system. With the frequent use of alcohol and tobacco, their physical, mental, and social function might be impaired (Lovell et al., 2018). In the long term, their frequent use of tobacco and alcohol increases the likelihood of anxiety symptoms among postgraduate medical students (Sharma et al., 2021).

Previous studies usually applied generalized linear modelling (logistic regression) or structural equation modelling to evaluate the risk factors of anxiety symptoms in medical students (Saddik et al., 2020). However, the conclusions drawn from the above methods are worth considering in many aspects. On the one hand, different influencing factors may have a different impact on the probability of anxiety symptoms, and the influence weight of each factor on the occurrence of anxiety symptoms is not the same. On the other hand, all of the above studies focused on the group level, and could not provide a personalized risk assessment of anxiety symptoms for medical students with different characteristics. However, the Nomogram solves the above problems well. It is a graph drawn on the same plane using graduated line segments after simultaneously integrating multiple indicators on the basis of multi-factor regression analysis (Chen et al., 2018). The probability of occurrence of clinical events in the statistical prediction model can be simply presented in the form of the score through graphs, which can evaluate the risk of anxiety symptoms of each medical student. The Nomogram prediction model established in the study included social support, subjective well-being, satisfaction with life, and alcohol and tobacco use. In practice, the Nomogram can be useful both for postgraduate medical students themselves and medical school administrators. For postgraduate medical students, they can anticipate their potential risk of developing anxiety symptoms based on their condition. For example, a postgraduate medical student can always get through difficulties by seeking help from his or her social support system, be satisfied with his or her current life situation. And he considers his life to be very blessed, and rarely smokes or drinks alcohol. Then he can probably know that he is at low risk of developing anxiety symptoms in future based on his situation. This forethought may not seem impressive.

But it helps individuals relieve stress and make the optimal treatment decisions when they need to, which also have positive impact on preventing other types of mental illness (Zhang et al., 2022). For medical school administrators, the Nomogram offers new ideas on how to prevent anxiety symptoms in postgraduate medical students. According to the weight of each influencing factor in the Nomogram of this study, university administrators can individually predict the probability of anxiety symptoms through the scores of each item of the postgraduate medical student, and they can identify high-risk groups as early as possible and give them critical attention and positive guidance. There is strong evidence that social support, especially perceived social support, is a health protection factor for medical students (Casapulla et al., 2021). Therefore, medical education administrators need pay attention to the social support system of postgraduate medical students, strengthen the communication between universities and their families, and encourage postgraduate medical students to get more support from the community, university and family. At the same time, the well-being and life satisfaction of medical students also deserve to be taken seriously, and for medical students, high well-being and life satisfaction usually mean they have the ability to control the situation, with good emotional control and stress resistance (Muntean et al., 2022). So university affiliated hospital administrators should pay attention to the trends in life satisfaction and subjective well-being of medical students during the period of study and clinical practice (Preoteasa et al., 2015). When their satisfaction with life and subjective well-being are poor, the institution has a responsibility to immediately give ideological advice, professional support, and economic aid to those postgraduate medical students who are in need (Casey et al., 2016). Finally, university counseling center would actively carry out psychological counseling and health education in the training process of postgraduates, encourage postgraduate medical students to find healthy emotional counseling methods, and assist them in the development of good lifestyle patterns that would lessen their dependence on cigarettes and alcohol in their day-to-day activities (Balogh et al., 2018; Gajda et al., 2021).

In conclusion, on the one hand, postgraduate medical students can intuitively know the possibility of anxiety symptoms in the future according to their scores of various factors on the Nomogram from the perspective of postgraduate medical students and further encourage them to adjust their lifestyle and change their attitude toward life according to the influencing factors shown in the Nomogram (i.e., reducing the use of tobacco and alcohol or looking for help from their social

support system) and reduce the risk of developing anxiety symptoms. On the other hand, the probability of anxiety symptoms among postgraduate medical students can be effectively predicted by the Nomogram established in the study from the perspective of universities to identify high-risk groups and take targeted intervention measures for minimizing the possibility of anxiety symptoms in postgraduate medical students. Accordingly, the Nomogram will play an increasingly important role in developing healthcare services. Ultimately, in China, physical and mental health in future clinicians will be guaranteed.

5. Limitation

Notable limitations of this research are provided below. First, the influences on anxiety symptoms chosen for this study may be insufficient; there is a wide variety of sources that influence anxiety symptoms in postgraduate medical students, and although every effort was made to consider influences from multiple sources, there may have been important influences that were overlooked in this study. Second, despite the fact that the scales and questionnaire used for this research were widely used in the Chinese population, there is no doubt that picking several measuring instruments might measure a variable more precisely than using a single questionnaire or scale alone. The collection of basic information on the participants in this research is still incomplete, and it is important to evaluate the impact of certain demographic characteristics. Additionally, this study collected data from a university affiliated hospital during the same time period, a cross-section of the general population, and cannot confidently infer causality from the relationship between influencing factors and anxiety symptoms. If possible, future longitudinal studies to further validate the reliability and validity of the Nomogram.

6. Conclusions

The presence of anxiety symptoms among postgraduate medical students has been linked to various influences. Some of these characteristics include social support, satisfaction with life, subjective well-being, and the use of alcohol and tobacco. Our team has created a Nomogram to forecast the likelihood that postgraduate medical students would exhibit anxiety symptoms. The advantage of having a shorter Nomogram for particular anxiety symptoms is in line with a larger goal to build to save time and increase productivity. The Nomogram may also be helpful to higher education administration in determining the likelihood of an increased risk of anxiety symptoms experienced by postgraduate medical students. Screening, diagnosis, and anxiety treatment that is specifically tailored to the needs of postgraduate medical students will be made more accessible as a result of this.

Declarations

Author contribution statement

Zewen Huang; Lejun Zhang: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Junyu Wang: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Tingting Wang; Lu Xu: Contributed reagents, materials, analysis tools or data.

Xialing Yang: Performed the experiments.

Heli Lu: Conceived and designed the experiments; Performed the experiments.

Data availability statement

The authors do not have permission to share data.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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