

Predictors of anxiety-depression comorbidity in Chinese medical staff: A Random Forest analysis based on the Health Ecology Model

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Abstract

Background

Anxiety-depression comorbidity is a serious issue among medical staff, yet few studies have analyzed its influencing factors using a comprehensive approach. This study aims to explore the prevalence and key predictors of this comorbidity among Chinese medical staff based on the health ecology model.

Methods

A multi-center cross-sectional study was conducted with 1,468 medical staff from 6 hospitals in China. Self-measures including Generalized Anxiety Disorder 7-item (GAD-7), Patient Health Questionnaire-9 (PHQ-9), Self-rated Health Scale, Physical Exercise Questionnaire, Pittsburgh Sleeping Quality Index (PSQI), Night Shift frequency Questionnaire and the Chinese Version Perceived Stress Scale were used to evaluate participants' prevalence of anxiety-depression comorbidity and its influencing factors. The chi-squared test and binary logistic regression were used to analyze the influencing factors of anxiety-depression comorbidity, the random forest model (RFM) was used to determine the importance of the predictors.

Results

The prevalence of anxiety-depression comorbidity was 34.60%. The individual (self-rated health), behavioral (physical exercise, sleep disorder), and living and working (night shift frequency, perceived stress) factors were significantly associated with anxiety-depression comorbidity ($P < 0.05$). Based on the RFM, the top five predictors were higher perceived stress, sleep disorder, poor self-rated health, high night shift frequency and less physical exercise in sequence.

Conclusions

Anxiety-depression comorbidity is highly prevalent among Chinese medical staff. Perceived stress acts as the strongest predictor. Effective interventions should prioritize stress management, sleep improvement, reasonable shift scheduling, and physical exercise to mitigate this mental health burden.

Background

Medical staff's mental health has emerged as a public health issue globally, especially in the context of escalating healthcare demands [1, 2]. Numerous studies have investigated anxiety and depression among medical professionals [3–5], consistently reporting prevalence rates higher than those of the general population in countries such as China and the United States [6]. Globally, the prevalence of anxiety among physicians ranges from 8% to 78.9%, while depression ranges from 4.8% to 66.5% [5].

Similarly, recent research indicates that the prevalence of anxiety and depression in clinical nurses can reach as high as 67.3% and 67.2%, respectively [7]. These statistics underscore the significant mental health challenges inherent in the demanding healthcare environment.

Anxiety-depression comorbidity [8] refers to the co-occurrence of anxiety and depressive symptoms. This condition involves shared risk factors and often leads to the exacerbation of symptoms. Such comorbidity not only diminishes the well-being of medical staff [8] but also compromises healthcare service quality and patient outcomes [9]. Consequently, the anxiety-depression comorbidity of medical staff has received increasing attention from researchers. However, few studies have specifically focused on this comorbidity within the medical workforce. Previous studies have estimated the prevalence of anxiety-depression comorbidity among Chinese medical staff ranging from 14.2% [4] to 23% [3]. Furthermore, while many studies have explored the factors influencing anxiety or depression in isolation, which often focus on single variables such as self-rated health [10], physical activity [11], or sleep disorders [3, 4], few have analyzed medical staff's anxiety-depression comorbidity using a comprehensive, multi-dimensional analytical approach.

The Social Ecological Model of Health [12], often referred to as the Health Ecology Model, emphasizes both individual and social environmental factors. In this framework, health outcomes are viewed as the product of dynamic interactions across five strata: individual characteristics, behavioral characteristics, interpersonal networks, living and working conditions, and the policy environment [13]. While this model has been widely utilized in chronic disease management, it provides a novel theoretical framework for addressing the gaps in the current study. By facilitating multi-level and multi-factor analysis, this model allows for a more accurate identification of high-risk medical staff. Nevertheless, its application in research on anxiety-depression comorbidity remains limited.

Based on this model [12] and previously identified risk factors [14, 15], this study aimed to explore individual (e.g., sex, age, self-rated health), behavioral (e.g., smoking, excessive alcohol consumption, physical exercise, sleep disorder), interpersonal (e.g., marital status, number of children, close friends), living and working conditions (e.g., job position, working years, education level, night shift frequency, perceived stress), and policy environment (e.g., employment contract type) factors that influence anxiety-depression comorbidity in Chinese medical staff (Fig. 1). Additionally, determining the relative importance of these predictors is crucial for prioritizing interventions. To address this, a Random Forest Model (RFM) was employed to rank the influencing factors. This approach is significant for constructing tailored and effective intervention regimens. The findings are expected to provide valuable insights and a theoretical basis for hospital administrators to create supportive environments and targeted psychological interventions, thereby improving the mental health of medical staff in China and enhancing the overall quality of medical services.

The findings are expected to provide valuable insights and theoretical basis for hospital administrators to create supportive environments and targeted psychological interventions, so as to improve the mental health of medical staff in China and further improve the quality of medical services.

Methods

Study design, participants and data collection

In this multi-center cross-sectional study, a convenience sampling method was adopted to recruit medical staff from 6 university affiliated hospitals in Guangzhou, China in May 2022. The inclusion criteria were: (1) possessing a Physician or Nursing License; (2) having been working in the hospital for over one year. The exclusion criteria were: (1) reported a history of malignant tumor or mental illness; (2) on a formal leave during the data collection period.

According to Kendall's sample size determination for multi-factor analysis[16], the sample size should be 10–20 times the number of variables. As 16 independent variables were used in this study, the required sample size was calculated to be 160 cases. Considering a potential 20% invalid response rate, the required sample size was adjusted accordingly, yielding a minimum target of 200 completed questionnaires.

All data were collected via Wenjuanxing platform (www.wjx.cn) and distributed through WeChat by trained investigators at the research hospitals. Participants were instructed to complete the questionnaire anonymously and independently. A total of 1,590 questionnaires were collected. After excluding invalid responses, 1,468 valid questionnaires were included in the final analysis, yielding an effective response rate of 92.33%.

Dependent variable and measures

The dependent variable was anxiety-depression comorbidity. (1) Anxiety: anxiety symptoms were assessed using the questionnaire of Generalized Anxiety Disorder-7 (GAD-7) [17]. The frequency of anxiety symptoms in the past 2 weeks were measured in 7 items using a 4-level Likert scoring method, ranging from 0 to 3 for “not at all” to “almost every day”. A higher score indicates a higher level of anxiety symptoms. A total score ≥ 5 points was suggested for identifying the presence of anxiety symptoms. The Cronbach's α reported in previous studies was 0.920 [17], and it was 0.959 in the current study. (2) Depression: depression was assessed using the questionnaire of Patient Health Questionnaire-9 (PHQ-9) [18]. The frequency of depressive symptoms over the past two weeks was measured across 9 items using a 4-point Likert scale, ranging from 0 to 3 for “not at all” to “almost every day”. A higher score indicates a higher level of depression symptoms. A total score ≥ 5 points was suggested for diagnosis of depression disorder. The Cronbach's α was 0.890 in previous studies [18] and 0.930 in the current study. (3) Anxiety-depression comorbidity: The simultaneous presence of a GAD-7 score ≥ 5 and a PHQ-9 score ≥ 5 indicated the presence of anxiety-depression comorbidity [19]. The prevalence of anxiety-depression comorbidity is the proportion of the number of participants with anxiety-depression comorbidity in the total number of participants.

Independent variables and measures

The independent variables were selected based on the health ecology model [12] and a review of relevant literature [14, 15] including the following: (1) Self-rated health: the Self-rated Health Scale [20] was used to assess medical staff's self-rated health through a single question. participants were asked "How do you think your health is at present?". 5-level Likert scoring method was adopted with 1–5 points assigned to "very bad to excellent". (2) Smoking: smoking is defined as smoking an average of more than one cigarette per day in the last one month[21]; (3) Excessive alcohol consumption: the daily intake of ≥ 50 mL of distilled spirits or ≥ 100 mL of wine [21] in the last one month; (4) Physical exercise: based on the physical activity guideline for the Chinese population [22], the questionnaire was designed to investigate the physical activity items that individuals carried out for at least 10 minutes during their leisure time in the latest week, such as running, swimming, cycling, playing ball, climbing, etc. (5) Sleep disorder: the Chinese version of sleep disorder dimension in Pittsburgh Sleep Quality Index (PSQI)[23, 24] was used. It consists of 9 items. 4-level Likert scoring method was adopted with 0–3 points assigned to 4 choices: no, <once a week, once to twice a week, ≥ 3 times per week. A cumulative score of "0" indicates no sleep disorders, "1–9" indicates mild sleep disorder, "10–18" indicates moderate sleep disorder, and "19–27" indicates severe sleep disorder. The Cronbach's α of this scale was 0.83 [24], and the Cronbach's α measured in this study was 0.857. (6) Night shift frequency: participants were asked "On average, how many night shifts do you typically work per week?". (7) Perceived stress: the Chinese Version Perceived Stress Scale (CPSS) [25, 26] was used to assess the degree to which one's life situations were appraised as stressful in the past month. The scale comprises 14 items using a 5-point Likert scoring method, with response options ranging from 0 (never) to 4 (very often) points. A higher score indicates a higher level of perceived stress. A total score ≥ 26 points was classified as perceived health risk stress (HRS). The CPSS has demonstrated good reliability and validity, with reported Cronbach's α 0.780 [26]. In the present study, the Cronbach's α was 0.816.

Statistical analysis

Data were analyzed using SPSS (version 27.0) and R software (version 4.4.3). Results with $P < 0.05$ indicated statistically significant differences. Count data were reported as the frequency and percentage. Measurement data were expressed as the mean and standard deviation (SD). The χ^2 test was used to compare the difference in the prevalence of anxiety-depression comorbidity among medical staff with different characteristics. Binary logistic regression analysis was used to explore the influencing factors of anxiety-depression comorbidity. The odds ratio (OR) and 95% confidence interval (CI) were calculated. Finally, a random forest model (RFM) was conducted to estimate the importance rank of each influencing factor. The variable importance was quantified by the mean decrease in accuracy when that variable was permuted, with higher values indicating a greater influence on predicting the outcome.

Ethical considerations

This study was approved by the Institutional Review Board of the university affiliated hospital (NO.2020-hs-57). All participants provided informed consent.

Results

Participants' characteristics

A total of 1,468 Chinese medical staff were included in this study. The sample comprised 466 physicians (31.74%) and 1,002 nurses (68.26%). There were 305 males (20.78%) and 1,163 females (79.22%). Regarding marital status, 1,056 (71.93%) married, while 412 (28.07%) were unmarried or widowed. Participants' ages ranged from 20 to 59 years, with a mean age of 34.71 ± 8.61 years. Working experience ranged from 1 to 39 years, with a mean of 12.08 ± 9.00 years. In terms of education, 297 (20.23%) held an associate degree, 951 (64.78%) held a bachelor's degree, and 220 (14.99%) held a master's degree or above.

Prevalence of anxiety-depression comorbidity in medical staff with different characteristics

Of the 1,468 participants, 508 (34.60%) exhibited anxiety-depression comorbidity. Additionally, 253 (17.24%) had either anxiety or depression alone, while 707 (48.16%) were free of both disorders. Among them, the prevalence of anxiety disorder was 561 (38.22%) and depression disorder was 708 (48.23%). Table 1 compared the prevalence of anxiety-depression comorbidity in medical staff with different characteristics in five strata of health ecology model. The groups differed significantly for the following variables: individual characteristics (age, self-rated health), behavioral characteristics (physical exercise, sleep disorder), interpersonal network (close friends), living and working conditions (job position, working years, night shift frequency, perceived stress), $P < 0.05$.

Table 1
Prevalence of anxiety-depression comorbidity among medical staff with different characteristics (*n* = 1468)

Factors	N	No anxiety or depression disorder <i>n</i> (%)	Anxiety or depression disorder <i>n</i> (%)	Anxiety-depression comorbidity <i>n</i> (%)	χ^2	<i>p</i>
Individual characteristics						
Sex						
Male	305	151(49.51)	57(18.69)	97(31.80)	1.491	0.475
Female	1163	556(47.81)	196(16.85)	411(35.34)		
Age (years)						
20–29	486	240(49.38)	88(18.11)	158(32.51)	15.902	0.014
30–39	605	264(43.64)	113(18.68)	228(37.68)		
40–49	257	131(50.97)	34(13.23)	92(35.80)		
50–59	120	72(60.00)	18(15.00)	30(25.00)		
Self-rated health						
Very bad	11	1(9.09)	0(0)	10(90.91)	274.661	<0.001
Bad	96	11(11.46)	14(14.58)	71(73.96)		
Neither good nor bad	594	194(32.66)	125(21.04)	275(46.30)		
Good	496	287(57.86)	92(18.55)	117(23.59)		
Excellent	271	214(78.97)	22(8.11)	35(12.92)		
Behavioral characteristics						
Smoking						
Yes	35	20(57.14)	7(20.00)	8(22.86)	2.190	0.335
No	1433	687(47.94)	246(17.17)	500(34.89)		
Excessive alcohol consumption						
Yes	77	31(40.26)	19(24.68)	27(35.06)	3.669	0.160
No	1391	676(48.60)	234(16.82)	481(34.58)		

Factors	N	No anxiety or depression disorder <i>n</i> (%)	Anxiety or depression disorder <i>n</i> (%)	Anxiety-depression comorbidity <i>n</i> (%)	χ^2	<i>p</i>
Physical exercise						
Yes	942	415(44.06)	157(16.67)	370(39.27)	26.284	<0.001
No	526	292(55.51)	96(18.25)	138(26.24)		
Sleep disorder						
No	312	244(78.21)	33(10.58)	35(11.21)	313.691	<0.001
Mild	841	424(50.42)	158(18.79)	259(30.79)		
Moderate	274	34(12.41)	59(21.53)	181(66.06)		
Severe	41	5(12.20)	3(7.32)	33(80.48)		
Interpersonal network						
Marital status						
Married	1056	509(48.20)	181(17.14)	366(34.66)	0.024	0.988
Unmarried or widowed	412	198(48.06)	72(17.48)	142(34.46)		
Number of children						
0	497	243(48.89)	92(18.51)	162(32.60)	2.880	0.824
1	537	263(48.98)	87(16.20)	187(34.82)		
2	428	199(46.50)	73(17.06)	156(36.44)		
3	6	2(33.33)	1(16.67)	3(50.00)		
Having close friends						
Yes	1256	638(50.80)	208(16.56)	410(32.64)	24.505	<0.001
No	212	69(32.55)	45(21.22)	98(46.23)		
Living and working conditions						
Job position						
Physician	466	241(51.72)	86(18.45)	139(29.83)	6.884	0.032
Nurse	1002	466(46.51)	167(16.67)	369(36.82)		

Factors	N	No anxiety or depression disorder <i>n</i> (%)	Anxiety or depression disorder <i>n</i> (%)	Anxiety-depression comorbidity <i>n</i> (%)	χ^2	<i>p</i>
Working years						
1-4	300	162(54.00)	49(16.33)	89(29.67)	34.291	0.001
5-9	426	188(44.13)	90(21.13)	148(34.74)		
10-14	312	138(44.23)	49(15.71)	125(40.06)		
15-19	122	52(42.62)	27(22.13)	43(35.25)		
20-24	92	46(50.00)	9(9.78)	37(40.22)		
25-29	119	57(47.90)	16(13.45)	46(38.65)		
30-41	97	64(65.98)	13(13.40)	20(20.62)		
Education level						
Associate degree	297	145(48.82)	53(17.85)	99(33.33)	6.271	0.180
Bachelor degree	951	442(46.48)	162(17.03)	347(36.49)		
Master degree or above	220	120(54.55)	38(17.27)	62(28.18)		
Night shift frequency						
No	380	215(56.58)	68(17.89)	97(25.53)	27.782	<0.001
Less than once a week	110	52(47.27)	16(14.55)	42(38.18)		
About once a week	405	198(48.89)	74(18.27)	133(32.84)		
Once to twice a week or more	573	242(42.23)	95(16.58)	236(41.19)		
Perceived health risk stress						
Yes	944	366(38.77)	138(14.62)	440(46.61)	169.059	<0.001
No	524	341(65.08)	115(21.95)	68(12.97)		
Policy environment						
Employment contract type						

Factors	N	No anxiety or depression disorder <i>n</i> (%)	Anxiety or depression disorder <i>n</i> (%)	Anxiety-depression comorbidity <i>n</i> (%)	χ^2	<i>p</i>
Staff on the establishment (in-establishment staff)	733	360(49.11)	127(17.33)	246(33.56)	0.744	0.689
Contractual staff (out-of-establishment staff)	735	374(47.21)	126(17.14)	262(35.65)		

Binary logistic regression analysis

As shown in Table 2, a binary logistic regression analysis of related factors based on health ecology model was performed. Comorbidity status served as the dependent variable (no = 0, yes = 1). Variables showing statistical significance in the univariate analysis Table 1 were included as independent variables, apart from age, which was excluded due to collinearity. All independent variables were entered simultaneously. The results demonstrated that, compared with medical staff with very bad self-rated health, those with excellent self-rated health were less likely to experience anxiety-depression comorbidity ($OR = 0.074$, 95% CI : 0.008 ~ 0.683). Additionally, participants who engaged in leisure-time physical exercise were less likely to have comorbidity ($OR = 0.722$, 95% CI : 0.543 ~ 0.962); medical staff were more likely to experience anxiety-depression comorbidity if they have different levels of sleep disorder ($OR = 3.645 \sim 12.084$, 95% CI : 2.415 ~ 30.889), more night shift frequency ($OR = 1.168$, 95% CI : 1.036 ~ 1.317), and higher perceived stress ($OR = 1.199$, 95% CI : 1.160 ~ 1.240).

Table 2
Binary logistic regression analysis of factors related to anxiety-depression comorbidity in Chinese medical staff ($n = 1468$)

Variables	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>P</i>	<i>OR</i>	95%CI/ Lower	95%CI/ Upper
Constant	-5.319	1.261	17.777	<0.001	0.005		
Individual characteristics							
Self-rated health							
Very bad					1.000		
Bad	-0.984	1.148	0.735	0.391	0.374	0.039	3.548
Neither good nor bad	-1.486	1.123	1.751	0.186	0.226	0.025	2.044
Good	-2.092	1.127	3.445	0.063	0.123	0.014	1.124
Excellent	-2.610	1.137	5.267	0.022	0.074	0.008	0.683
Behavioral characteristics							
Physical exercise							
No					1.000		
Yes	-0.325	0.146	4.961	0.026	0.722	0.543	0.962
Sleep disorder							
No					1.000		
Mild	1.293	0.210	37.945	<0.001	3.645	2.415	5.501
Moderate	2.322	0.243	90.985	<0.001	10.197	6.328	16.433
Severe	2.492	0.479	27.079	<0.001	12.084	4.727	30.889
Interpersonal network							
Having close friends							
Yes					1.000		
No	0.161	0.187	0.739	0.390	1.175	0.814	1.696
Living and working conditions							
Job position							
Physician					1.000		

Variables	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>P</i>	<i>OR</i>	95% <i>CI</i> Lower	95% <i>CI</i> Upper
Nurse	0.063	0.150	0.174	0.676	1.065	0.793	1.430
Working years	0.001	0.008	0.013	0.908	1.001	0.985	1.017
Night shift frequency	0.156	0.061	6.470	0.011	1.168	1.036	1.317
Perceived stress	0.182	0.017	113.851	<0.001	1.199	1.160	1.240

OR: odds ratio; CI: confidence interval; Nagelkerke $R^2 = 0.428$; Hosmer-Lemeshow test: $\chi^2 = 6.652$, $P = 0.575$.

Ranking of predictive contribution of predictors

Finally, the random forest variable importance was determined on mean decrease in accuracy. As shown in Table 3, the top five predictors, in descending order of importance, were: perceived stress, sleep disorder, self-rated health, night shift frequency, and physical exercise.

Table 3
The rank of importance of influencing factors of anxiety-depression comorbidity in random forest model

Rank	Variables	Mean decrease accuracy
1	Perceived stress	69.00
2	Sleep disorder	55.02
3	Self-rated health	27.74
4	Night shift frequency	5.88
5	Physical exercise	1.47
6	Working years	1.01
7	Having close friends	0.92
8	Job position	-0.13

Model evaluation

area under the curve (AUC) = 0.994; Accuracy = 95.23%.

Discussion

This study provides a comprehensive analysis of influencing factors of anxiety-depression comorbidity in Chinese medical staff. By utilizing the health ecology model, we systematically examine factors across five strata: individual characteristics, behavioral characteristics, interpersonal network, living and

working conditions, and policy environment factors. Notably, the random forest model identified the top five predictors as perceived stress, sleep disorder, self-rated health, night shift frequency and physical exercise in sequence, with perceived stress having the greatest impact.

Prevalence of anxiety-depression comorbidity

In the present study, the prevalence of anxiety-depression comorbidity among medical staff in Guangzhou was found to be 34.60%. This rate is notably higher than the 14.2% reported among hospital staff (including administrative personnel) in 304 inland cities in China [4], despite using the same assessment instruments (GAD-7 and PHQ-9). This variation in prevalence rate could result from diverse participants and hospital locations. First, previous research indicates that clinical medical staff generally exhibit higher rates of anxiety or depression compared to administrative staff [4]. Furthermore, Guangzhou, as a first-tier economically developed metropolis, likely imposes greater workload pressures and higher patient volumes on staff in university-affiliated hospitals, thereby exacerbating the risk factors associated with anxiety-depression comorbidity.

Influence of individual and behavioral factors

At the individual strata, self-rated health was significantly associated with comorbidity. Medical staff who perceived their health as poor were more likely to experience anxiety-depression comorbidity. This aligns with previous research suggesting that self-rated health is an important determinant of psychological well-being [10]. Poor self-perceived health may trigger increased health-related worry, which can contribute to the development of anxiety, depression, and their comorbidity.

At the behavioral strata, physical exercise emerged as a significant protective factor, whereas sleep disorder was identified as a risk factor. A systematic review [11] confirmed that physical exercise reduces symptoms of anxiety and depression, likely by promoting neurogenesis and enhancing mood regulation. Conversely, while [3] linked sleep disorders to depression in medical staff, few studies have specifically analyzed its impact on comorbidity. Sleep disorders in this population are often attributable to irregular schedules and high occupational stress, which may exacerbate neuroendocrine dysregulation [27], thereby increasing the risk of mental health issues. Therefore, interventions promoting regular exercise and optimizing sleep hygiene are essential for prevention.

Influence of interpersonal networks

At the interpersonal strata, the univariate analysis of this study found that medical staff with close friends are at a lower risk of anxiety-depression comorbidity. This finding aligns with the study highlighting social support's protective role in the mental health of medical staff[28]. The reason may be that close friends can provide a source of emotional support that can reduce the likelihood of developing anxiety or depression by providing a sense of belonging and understanding. Hospital administrators should strive to build supportive relationships with medical staff and provide psychological support to help them deal with work-life balance and improve the well-being of their staff.

Influence of living and working conditions

At the living and working strata, the significant influencing factors included job position, night shift frequency and perceived stress. (1) Job Position: In this study, the prevalence of anxiety-depression comorbidity in nurses (36.82%) exhibited significantly higher rates than that in physicians (29.83%). Lu et al[3] also found that the prevalence of depression in nurses exhibiting significantly higher rates than that in physicians. This may be because nurses are often exposed to a more high-pressure work environment such as direct patient care responsibilities [3, 8]. The finding indicated that it is urgent to pay attention to reducing medical staff's anxiety and depression, especially nurses. (2) Night Shift Frequency: Staff with frequent night shifts showed a higher likelihood of comorbidity. Shift work has been shown to disrupt circadian rhythms and increase the overall risk of anxiety and depression [29][30]. Given that night shifts are inherent to medical professions, hospitals should optimize shift scheduling and ensure adequate rest periods for recovery. (3) Perceived Stress: Perceived stress refers to the extent to which situations in one's life or work are evaluated as stressful [25]. Among all determinants, perceived stress was identified as the strongest predictor. Higher levels of perceived stress strongly predicted the presence of anxiety-depression comorbidity. This finding aligns with prior study highlighting perceived stress as a critical psychosocial determinant of mental health outcomes in nurses [31] and medical workers [32]. This is because high levels of perceived stress can overwhelm people's coping mechanisms and increase the risk of anxiety or depression [33]. Strategies such as offering support services or mindfulness training [34, 35], may be effective in reducing the risk of anxiety-depression comorbidity among medical staff.

Limitations

Several limitations of this study should be acknowledged. First, the cross-sectional design limits causal inference, future longitudinal studies are needed to explore the causal relationships between these factors and anxiety-depression comorbidity. Second, the reliance on self-reported measures may introduce recall bias, future studies incorporating objective measures may provide more accurate and reliable data. Third, although the health ecology model was employed to capture a wide range of factors, it is possible that certain unmeasured confounding variables were omitted due to the complexity of the system. Future research should consider including a broader range of variables to enhance model explanatory power. By addressing these limitations, future research can generate more comprehensive insights, ultimately providing a solid theoretical basis for the management of anxiety-depression comorbidity among medical staff.

Conclusions

While previous research has extensively examined anxiety and depression in isolation, the potential impact of anxiety-depression comorbidity cannot be overlooked. The current study reveals a substantial prevalence of this comorbidity among medical staff in China. This study provides a comprehensive analysis of the influencing factors of anxiety-depression comorbidity among medical staff, highlighting

the complexity of this issue within the context of the health ecology model. Consequently, hospital administrators should not only prioritize the management of occupational stressors, such as night shifts and perceived stress, but also address behavioral and interpersonal factors. Comprehensive intervention strategies, ranging from promoting physical exercise and optimizing rest environments to enhancing social and emotional support, are essential to effectively mitigate the risk of anxiety-depression comorbidity and improve the overall well-being of medical staff.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Research Ethics Committee of The Second Affiliated Hospital of Guangzhou Medical University (Approval No. : 2020-hs-57), and all participants provided informed consent prior to data collection.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

All authors have made substantial contributions to the work and have approved the final version of the manuscript:YYC (Co-first Author): Formal analysis and original draftYF (Co-first Author): Formal analysis and original draftWXY: Investigation; Review and editingLWY: Investigation; Review and editingYYC: Investigation; Review and editingZWL (Corresponding Author): Conceptualization and Methodology; Investigation; Formal analysis and original draft.

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Data Availability

The data presented in this study are available from the corresponding author upon reasonable request.

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Figures

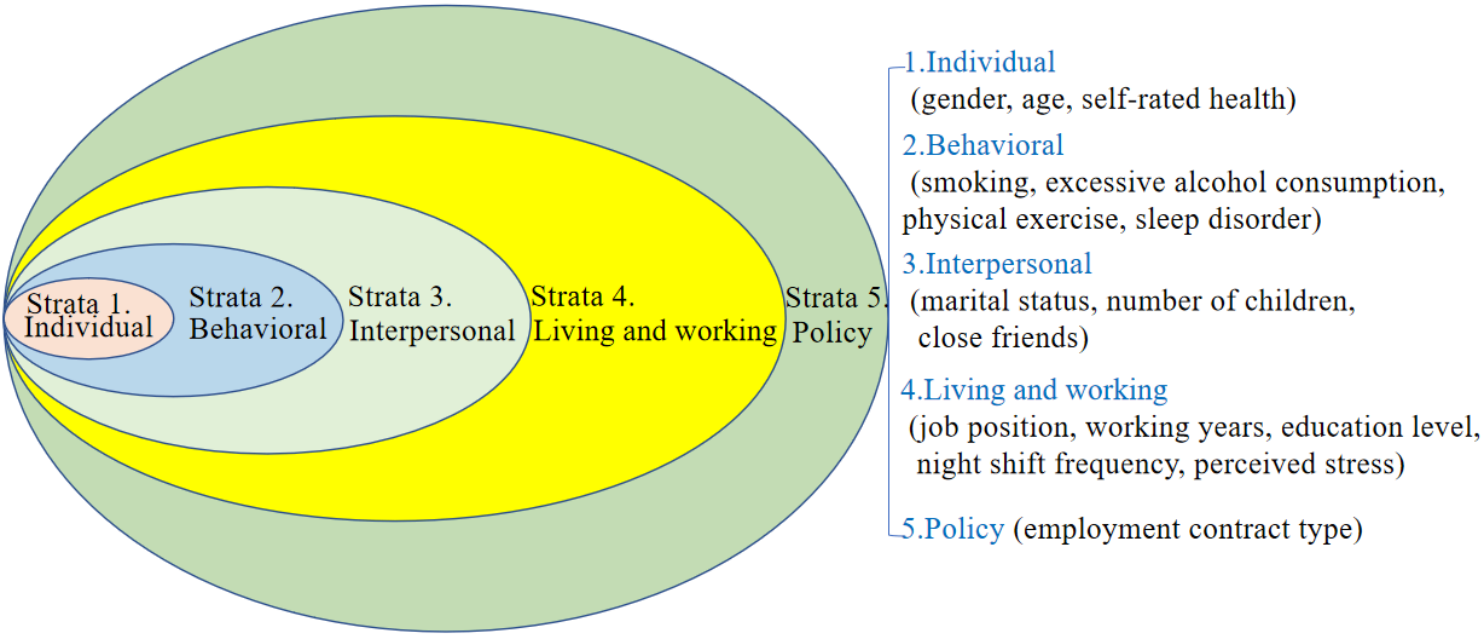


Figure 1

The Health Ecology Model of anxiety-depression comorbidity.