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# Relationships Between Burnout and Neuroticism Among Emergency Department Nurses: A Network Analysis

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**Keywords:** burnout | network analysis | neuroticism | nurses

## ABSTRACT

**Aim:** Although neuroticism has a negative impact on burnout among healthcare workers, there is little research exploring the specific interactions between different components of burnout and neuroticism. This study aims to investigate this relationship among nurses in Emergency Departments (ED) through network analysis method (NAM).

**Design:** A cross-sectional investigative survey was conducted.

**Methods:** A total of 408 Chinese nurses were recruited from ED of five hospitals in 2023 through Questionnaire Star. Components of burnout were measured by the 15-item Maslach Burnout Inventory-General Survey (MBI-GS), while components of neuroticism were measured by a subscale of the Eysenck Personality Questionnaire-Revised, Short Scale for Chinese (EPQ-RSC) questionnaire. NAM was applied to build relationship between components of burnout and neuroticism and identify the bridge expected influence (BEI).

**Results:** Within burnout-neuroticism network, the relations between the components of burnout and neuroticism were mainly positive. Nt5 ('Anxious')-EE1 ('Exhausted'; weight = 0.281) and Nt5 ('Anxious')-EE5 ('Breakdown'; weight = 0.280) had stronger connections. Among the neuroticism, Nt5 ('Anxious') showed the strongest positive BEI, while Nt12 ('Guilty') showed the strongest negative BEI. Feeling anxiety and less guilt conscience in neuroticism were the critical factors to impact burnout of nurses in ED. Awareness of these relationships can help to develop strategies to identify and curtail burnout.

**Patient or Public Contribution:** A total of 408 emergency nurses participated in this survey.

**Abbreviations:** CS, correlation stability; EBIC, Extended Bayesian Information Criterion; ED, emergency departments; EPQ-RSC, Eysenck Personality Questionnaire-Revised, Short Scale for Chinese; GGM, Gaussian Graphical Model; ILO, International Labour Organization; LASSO, Least Absolute Shrinkage and Selection Operator; MBI-GS, Maslach Burnout Inventory-General Survey; NAM, network analysis method; NICU, Neonatal Intensive Care Unit.

Yinjuan Zhang, Jicheng Sun, and Chao Wu have contributed equally to this work.

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## 1 | Introduction

The concept ‘burnout’ has been applied formally until Freudenberg put forward it in the 1970s, which explained such phenomena that individuals suffer from physiological and psychological exhaustion due to excessive pressure (Lahana et al. 2017). The World Health Organization has explained burnout as an occupational syndrome resulting from chronic workplace stress that has not been successfully managed (WHO 2022). Globally, burnout is an important problem as it adversely affects the job performance (Jiang et al. 2021).

A meta-analysis in 2023 covering over 30 countries reported the global prevalence of nursing burnout was 30.0% (Ge et al. 2023). A systematic review in 2021 showed nurses in Asia experienced more severe burnout compared with that of Americans and Europe (Xie et al. 2021). Furthermore, a national survey of 138,279 nurses from 243 hospitals in China identified that a prevalence of burnout was 34.0% (Li et al. 2023). Thus, nursing burnout is a highly prevalent and serious mental health issue both in China and globally. Burnout has detrimental consequences on nurses and patients, such as diminished productivity, high rates of turnover and even increased medical errors (Duan-Porter et al. 2018; Choi et al. 2018). Furthermore, the incidence of heart disease, chronic pain, gastrointestinal distress and psychiatric mental illness among nurses is rising due to burnout. It is estimated that the United States spent \$125 billion to \$190 billion annually on addressing health problems associated with burnout (Goh, Pfeiffer, and Zenios 2016).

It is well recognised that physical demands and psychological stress in emergency department (ED) rank the top in all of the healthcare field (Wersebe et al. 2018). Emergency nurses experienced comparably heavy chronic stressors in workplace (Gray et al. 2019), thus suffering from higher levels of burnout than nurses in other departments (e.g., Chor et al. 2021). A systematic review identified a high rate of burnout among this subgroup, which ranged from 48% to 58% (Gualano et al. 2021). Investigations found that neuroticism is positive related with professional stress and burnout (Yao et al. 2018; Bianchi 2018; Albendin-García et al. 2022). One recent network structure model evidenced that neuroticism has been identified as a critical target to relieve burnout among healthcare workers, suggesting neuroticism may be contributing to the underlying cause of burnout (Wang et al. 2024). Therefore, it is of great significance to explore the complex connections between components of neuroticism and burnout in ED nurses.

## 2 | Background

WHO in 2022 announced the implementation of 11th of the International Classification of Disease (ICD-11 2022), in which burnout is defined as a syndrome characterised by emotional exhaustion (EE), depersonalisation (DP) and lower personal accomplishment (PA). Multiple factors lead to physical and mental illness stress because of burnout for ED nurses (Liu et al. 2018). According to Maslach (Hyman 2021), contributors of burnout can be summarised into two categories: work environment and individual-level factors. The former was recognised as the main cause, which encompassed aspects of occupational environment,

such as traumatic events, excessive patients, institutional culture and decision-making power (Serrao et al. 2021). Most literatures focus on work environment. However, each individual in the identical work environment may not suffer from burnout equally. Consequently, the latter (individual-level factors), such as gender, age, marital status and poor communication, were another significant risk factors. Nevertheless, researchers have acknowledged that personality traits have been found to contribute to the development of burnout (Narang et al. 2022). The individual's perceptions of occupational stress and how he or she handles burnout are substantially influenced by personality features (Broeck et al. 2016), which serve as a predictor of the occurrence of burnout syndrome (Parks-Leduc, Feldman, and Bardi 2015).

Neuroticism, a special dimension of personality trait, is explained as a factor with high tendency to experience passive emotions (e.g., fear, anxiety and nervousness), to more readily perceive situations as threatening or stressful, and to respond quickly and strongly to such environments with greater negative affect (Wrzus et al. 2021). Neurotic individuals are more likely to express negative emotions, maladjustment and sensitivity to stress (Anicich et al. 2020). The passive emotion related with neuroticism has been associated with the high risk of psychiatric disorders and physical illness, such as depression, burnout and a series of cardiovascular disease outcomes (Mahmood et al. 2023; Rhee et al. 2023). Previous studies have demonstrated that nurses with high level of neuroticism perceived much occupational stress and burnout than those with low level of neuroticism when experiencing the same negative events (Yao et al. 2018; Barr 2018; Pelin et al. 2023). More recently, researchers indicated neuroticism negatively related with burnout of ICU personnel, and reflected an increasing in psychopathology scores (Pakou et al. 2024). Thus, neuroticism may act as the critical role to impact the development of burnout in nurses.

Most existing researches usually described the relations between burnout and neuroticism based on the latent variable model using the total scores of the two questionnaires by purely correlational approaches (Mengxin et al. 2022; Emilia et al. 2017), which were based on the assumption of linear relation. But the specific relationships between the components of burnout and neuroticism are lacking. Consequently, a more in-depth exploration between the components of the two variables will be demanded.

In order to solve the above problem, network analysis method (NAM) was adopted to explore the quantitative relationships between the components of burnout and neuroticism in ED from the point of view of mathematics. NAM could build a network model of the relationships between complex psychological variables, and then visualise the importance of each variable in a network, which are composed of nodes and edges. The former represents the components of variables, while the latter represents the relationship between nodes. Recently, NAM has received extensive attention from researchers, and has been widely applied in the fields of clinical and social psychology (Vanzhula, Kinkel-Ram, and Levinson 2021; Verkuilen et al. 2021). Compared with traditional approaches, NAM identifies the requisite key points to accurately interpret psychopathological mechanisms and develop targeted intervention strategies.

Therefore, the study applied the superiority of NAM to further elucidate the relationships between the components of burnout and neuroticism in order to create and implement effective targeted interventions to reduce burnout. The aims of the current study are twofold: (1) to explore the specific connections between the components of neuroticism and burnout and (2) to identify the most influential node of neuroticism on the components of burnout.

### 3 | Methods

#### 3.1 | Study Design and Sample

The study was a cross-sectional investigative study. Data collection was conducted from February to June in 2023 through an internet-based data collecting tool due to COVID-19 in China. We recruited participants from the top five Grade III-A General Hospitals of Shaanxi province, including Xijing Hospital, the First Affiliated Hospital of Xi'an Jiaotong University, Tangdu hospital, the Second Affiliated Hospital of Xi'an Jiaotong University and Shaanxi People's Hospital. Participants joining the study needed to meet the following inclusion criteria: (1) be Chinese registered and full-time nurses working in ED; (2) aged 18 years or older. Participants who were practical nurses or had physical disease were excluded from the study. According to the guidelines proposed by Kline (2016), the sample size should range from 10 to 20 times the quantity of variables, then add a potential lost sample rate of 15%. Thus, the survey needs to target a size of participants from 380 to 759.

To ensure the accuracy of the online survey, we called in advance with the nurse leaders in ED to explain the inclusion and exclusion criteria of the study. After that, an online survey link was sent to nurses by nurse leaders. At last, we checked the answers and deleted the questionnaires with missing items after the survey. A total of 421 nurses participated in our study. 13 questionnaires were excluded due to incomplete information, and the effective rate of questionnaire completion was 97%. The number of final participants in this study was 408.

#### 3.2 | Measures

We investigated demographic data from all participants including age, gender, marriage, year of experiences and education level for this study.

##### 3.2.1 | Maslach Burnout Inventory-General Survey (MBI-GS) Scale

Maslach Burnout Inventory-General Survey (MBI-GS) was widely used to measure burnout in occupational environments, which was jointly compiled by Maslach and Jackson (1981). Li and his team in China translated and revised it. The Chinese version scale included emotional exhaustion (EE, five items), depersonalisation (DP, four items), and induced personal accomplishment (PA, six items). The scores of every item ranged from 0 ('never') to 6 ('every day'). Overall, the higher were the scores on EE and DP and the lower on PA, the higher were the level

of burnout. MBI-GS (Chinese version) has been widely applied since its inception, and is proved to possess good internal consistency, reliability and construct validity (Luo et al. 2022). The internal consistency coefficients of the three dimensions were 0.88, 0.83 and 0.82, respectively. The Cronbach's alpha coefficient for MBI-GS was 0.872 in this study.

##### 3.2.2 | Eysenck Personality Questionnaire-Revised, Short Scale for Chinese (EPQ-RSC)

The study applied the neuroticism subscale of the Eysenck Personality Questionnaire-Revised, Short Scale for Chinese (EPQ-RSC) to assess neuroticism. EPQ-R was developed by Eysenck and Eysenck. Qian Mingyi, Wu Guocheng, and other scholars of Peking University in China carried out revisions and formed the EPQ-RSC based on the EPQ-R (Qian et al. 2000), which was a widely used tool in the assessment of personality. The neuroticism dimension in this study consisted of 12 items, and the score of each item included 1 ('yes') and 2 ('no'). A higher score indicated a lower level of neuroticism. The subscale has been validated in the Chinese population (Ren et al. 2024; Jing et al. 2024; Pan et al. 2024; Zhang, Zhong, et al. 2024). The reliability of neuroticism was evidenced in this study with a Cronbach's alpha of 0.865.

#### 3.3 | Analysis

The current network was carried out in R language, and R4.0.0 software was used to build the network model. The R-package was used to fit the Gaussian Graphical Model (GGM) with 15 variables from burnout and 12 variables from neuroticism. The lines in GGM could be interpreted as partial correlation coefficients. The Least Absolute Shrinkage and Selection Operator (LASSO) and Extended Bayesian Information Criterion (EBIC) were employed to delete weak connections and generate a concise network on the basis of a partial correlation network, and the qgraph package was used to visualise the network. The tuning parameter value was set to 0.5 to balance the trade-off between sensitivity and specificity. In addition, the layout of the current network was based on the Fruchterman-Reinforce algorithm. The edge colour of green indicated that the connection was positive, and red was negative. The edge thickness and saturation indicated connection strength. The stronger the connection, the thicker the edge, and the more saturated it was.

Two communities were defined for the present study, including the burnout community and the neuroticism community. The bridge expected influence (BEI) of network was calculated by R package network tools, which were used to identify bridge nodes that linked the burnout community and the neuroticism community. In according with extant literature (Robinaugh, Millner, and McNally 2016), BEI was more appropriate than other bridge centrality for estimating bridge nodes with both positive and negative links in the network. A higher value of BEI in a network meant a higher likelihood of activating or deactivating capacity to other communities.

R-package bootnet was used to check the accuracy and stability of the network model. The accuracy of the edge weight

value was tested by calculating its estimated confidence interval (95% CI). The stability of BEI was assessed by computing the correlation stability (CS) coefficient, in which above 0.5 was ideal and should not be below 0.25 (Armour et al. 2017). In order to check the difference between edge weights and node expected influence, bootstrapped difference tests were also conducted.

3.4 | Ethics

The study was approved by the Ethics Committee of the first Affiliated hospital of Shaanxi University of Chinese Medicine (No. SZFYIEC-YJ-2020-38). Participants were anonymous, and all identifying information was removed during data analysis. The online survey was divided into two sections. Firstly, there was an informed consent statement that specified the methods, purposes and anonymity of personal information in the research. After reading the statement for five minutes, participants can click ‘I agree’ or ‘I disagree’. When participant clicked ‘I agree’ and then came to the second section, they need to complete the questionnaire one by one.

4 | Results

4.1 | Descriptive Statistics

The study consisted of 408 participants (388 women, 20 men), of whom 310 (76.0%) were from 18 to 30years old. Regarding other demographics, majority of participants were married (60.0%), 286 (70.0%) received higher education (i.e., undergraduate/college or above), 257 (63.0%) had worked less than 5 years, and 212 (58.1%) had middle professional title. Description variables of participants were shown in Table 1, and the average scores of neuroticism and burnout were given in Table 2.

4.2 | Network Structure

The network structure of the burnout community and the neuroticism community was shown in Figure 1A. In the burnout community, there were two clusters and one isolated node around the neuroticism community. Cluster 1 was positive correlations, except zero connections, which consisted of PA2 (‘Contributing’), PA3 (‘Good at job’), PA4 (‘Happy’), PA5 (‘Worthwhile’), and PA6 (‘Confident’). Cluster 2 comprised nine nodes, which were DP1 (‘Less interested’), DP2 (‘Less enthusiastic’), DP3 (‘Doubt significance’), DP4 (‘Indifferent’), EE1 (‘Exhausted’), EE2 (‘Used up’), EE3 (‘Tired’), EE4 (‘Stressed’), and EE5 (‘Breakdown’), among which all of the non-zero connections were also positive. Moreover, the four strongest edges were DP1 (‘Less interested’)-DP2 (‘Less enthusiastic’; weight = 0.368), PA2 (‘Contributing’)-PA3 (‘Good at job’; weight = 0.340), and PA5 (‘Worthwhile’)-PA6 (‘Confident’; weight = 0.340). In the neuroticism community, there was one close cluster surrounded by burnout nodes, among which Nt3 (‘Irritable’) was one isolated node. The three strongest edges were Nt7 (‘Worried’)-Nt11 (‘Lonely’; weight = 0.890), Nt7 (‘Worried’)-Nt5 (‘Anxious’; weight = 0.790) and Nt8 (‘Sensitive’)-Nt10 (‘Suffering’; weight = 0.664).

TABLE 1 | Demographic characteristics of the participants.

Characteristics	Variables	N (%)
Age	18–30	310 (76.0%)
	31–40	69 (16.9%)
	≥ 41	29 (7.1%)
Gender	Female	388 (95.1%)
	Male	20 (4.9%)
Marriage	Married	245 (60.0%)
	Single or divorced	163 (40.0%)
Education level	High school	122 (30.0%)
	Undergraduate	274 (67.1%)
	Postgraduate	12 (2.9%)
Working years	1–5	257 (63.0%)
	6–10	70 (17.1%)
	≥ 11	81 (19.9%)
Professional title	Junior	147 (36.0%)
	Middle	212 (52.0%)
	Senior	49 (12.0%)

In the between-communities, three strongest negative edges were found in the present network, including Nt5 (‘Anxious’)-EE1 (‘Exhausted’; weight = −0.281), Nt5 (‘Anxious’)-EE5 (‘Breakdown’; weight = −0.280), Nt1 (‘Go up and down’)-EE1 (‘Exhausted’; weight = −0.157), Nt2 (‘Miserable’)-DP1 (‘Less interested’; weight = −0.122), Nt11 (‘Lonely’)-DP2 (‘Less enthusiastic’; weight = −0.121), Nt6 (‘Nervous’)-PA4 (‘Happy’; weight = −0.119) and Nt7 (‘Worried’)-EE2 (‘Used up’; weight = −0.117). The bootstrapped 95% confidence interval was relatively narrow, indicating that edges in the current network were considered to be accurate (Figure 2). Figure 3 shows the bootstrapped difference test for edge weights (Table 3).

The node BEI was shown in Figure 1B. In the neuroticism community, it was found that Nt5 (‘Anxious’) had the lowest BEI, and Nt12 (‘Guilty’) had the highest BEI, which meant Nt5 (‘Anxious’) had the strongest positive connection, and Nt12 (‘Guilty’) had the strongest negative connection with components of burnout in the view of network. Furthermore, EE1 (‘Exhausted’) and EE5 (‘Breakdown’) had the lowest BEI in the burnout community, which meant that they had the strongest positive connection with the components of neuroticism. The CS-coefficient of node BEI was 0.44, indicating that the network was stable (Figures 4 and 5).

5 | Discussion

To the best of our knowledge, this present study was the first to explore the specific connections between the components of burnout and neuroticism using network analysis among ED nurses. Within the community of burnout components,



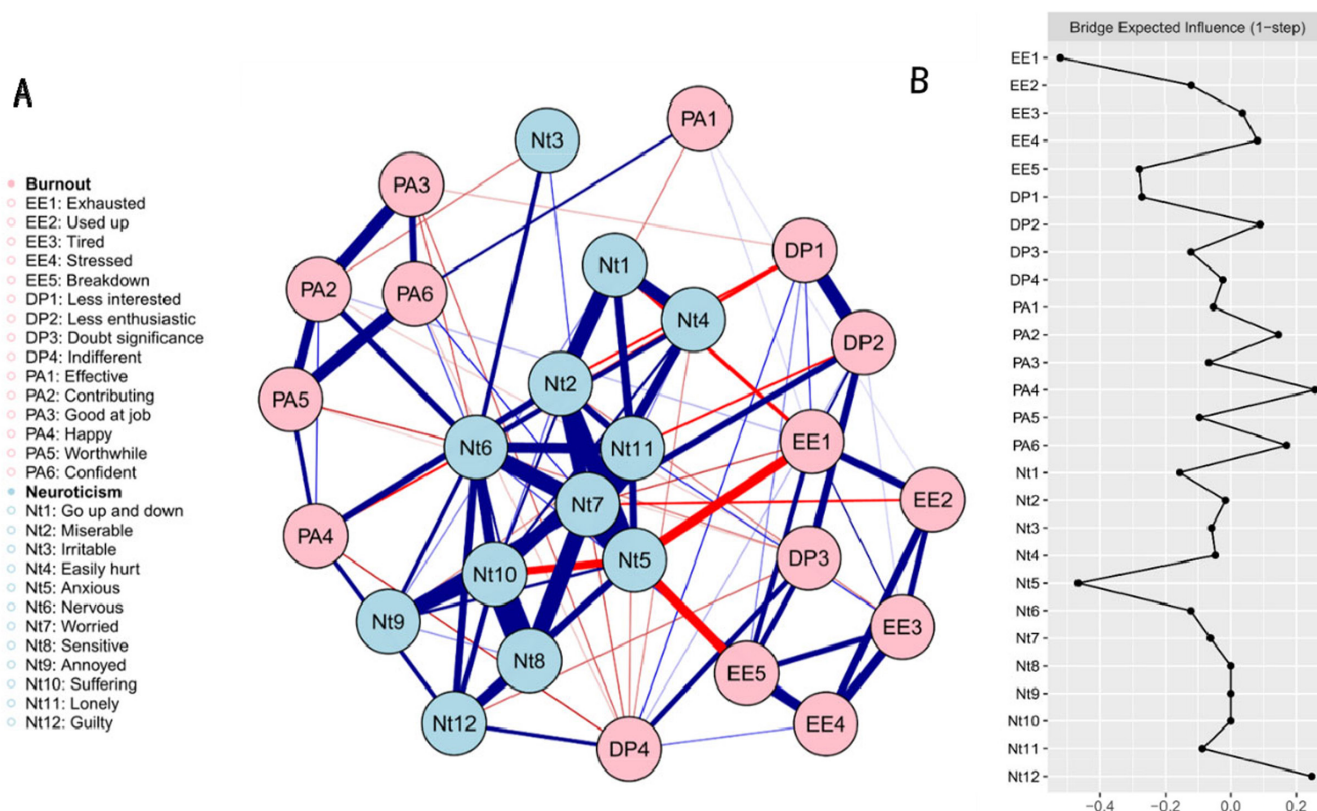
**TABLE 2** | Average scores of items in neuroticism and burnout network (N=408).

Variables	Abbr	M	SD
<i>Burnout</i>			
EE1: Working makes me feel exhausted	Exhausted	3.64	0.76
EE2: I feel used up at the end of the day	Used up	3.87	0.77
EE3: I feel tired when I have to face another day's work in the morning	Tired	3.56	0.84
EE4: Working all day is really stressful for me	Stressed	3.57	0.87
EE5: Working makes me feel breakdown	Breakdown	3.12	0.96
DP1: I have become less and less interested toward work since I took this job	Less interested	3.19	1.03
DP2: I have become less as enthusiastic about my work as before	Less enthusiastic	3.14	1.01
DP3: I doubt the significance of my work	Doubt significance	2.96	1.10
DP4: I have become more and more indifferent in the contribution of my job	Indifferent	2.88	1.06
PA1: I deal effectively with the problems in my work	Effective	3.95	0.62
PA2: I feel that I am contributing to my company	Contributing	3.68	0.99
PA3: In my opinion, I am good at my job	Good at job	3.83	0.94
PA4: I feel very happy when I accomplish some tasks of my job	Happy	3.76	0.91
PA5: I have done a lot of worthwhile work	Worthwhile	3.51	0.88
PA6: I am confident that I can accomplish all tasks effectively	Confident	3.91	0.73
<i>Neuroticism</i>			
Nt1: Do your moods often go up and down	Go up and down	1.24	0.42
Nt2: Do you ever feel 'just miserable' for no reason	Miserable	1.45	0.50
Nt3: Are you an irritable person	Irritable	1.49	0.49
Nt4: Are your feelings easily hurt	Easily hurt	1.32	0.46
Nt5: Do you often feel 'extremely anxious'	Anxious	1.52	0.50
Nt6: Do you think you are a nervous person	Nervous	1.53	0.49
Nt7: Are you a worried person	Worried	1.53	0.45
Nt8: Do you think you are a sensitive or overstretched person	Sensitive	1.35	0.48
Nt9: Are you annoyed for too long after an embarrassing experience	Annoyed	1.19	0.39
Nt10: Do you feel suffering because of your nervousness	Suffering	1.44	0.47
Nt11: Do you often feel lonely	Lonely	1.43	0.48
Nt12: Are you often troubled about feelings of guilt	Guilty	1.67	0.43

Abbreviations: Abbr, Abbreviation; M, Mean; SD, standard deviation.

the three highest weights of positive edges were 'Less interested'—'Less enthusiastic', 'Contributing'—'Good at job' and 'Worthwhile'—'Confident'. The finding was in keeping with our previous study, which discovered 'Less interested'—'Less enthusiastic' was the strongest connection in exploring the relationships between burnout and depression in nurses (Zhang, Wu, et al. 2024). The above result implied that lacking of interests was associated with less enthusiastic in nursing work (Ren et al. 2021). Another study also observed that stronger relations existed in 'Contributing'—'Good at job' and 'Worthwhile'—'Confident' among medical staff (Chen et al. 2022). The major reason was that patients in ED suffered from acute stages of diseases and unpredictable trauma, which made emergency

nurses had lower decision authority than nurses working in other departments (O'Callaghan et al. 2020). Thus, it is necessary to take measures to motivate the interest and achievement of emergency nurses. Within the community of neuroticism components, the three positive edges with the highest weights were 'Worried'—'Lonely', 'Worried'—'Anxious' and 'Sensitive'—'Suffering', which were similar to the previous investigations among nurses (Wersebe et al. 2018; Duan-Porter et al. 2018). Owing to greater exposure to fast-paced environment and high frequency of conflicts between nurses and patients (Adriaenssens, Gucht, and Maes 2015), emergency nurses were in a worried and sensitive environment, thus leading to feel lonely and anxious.

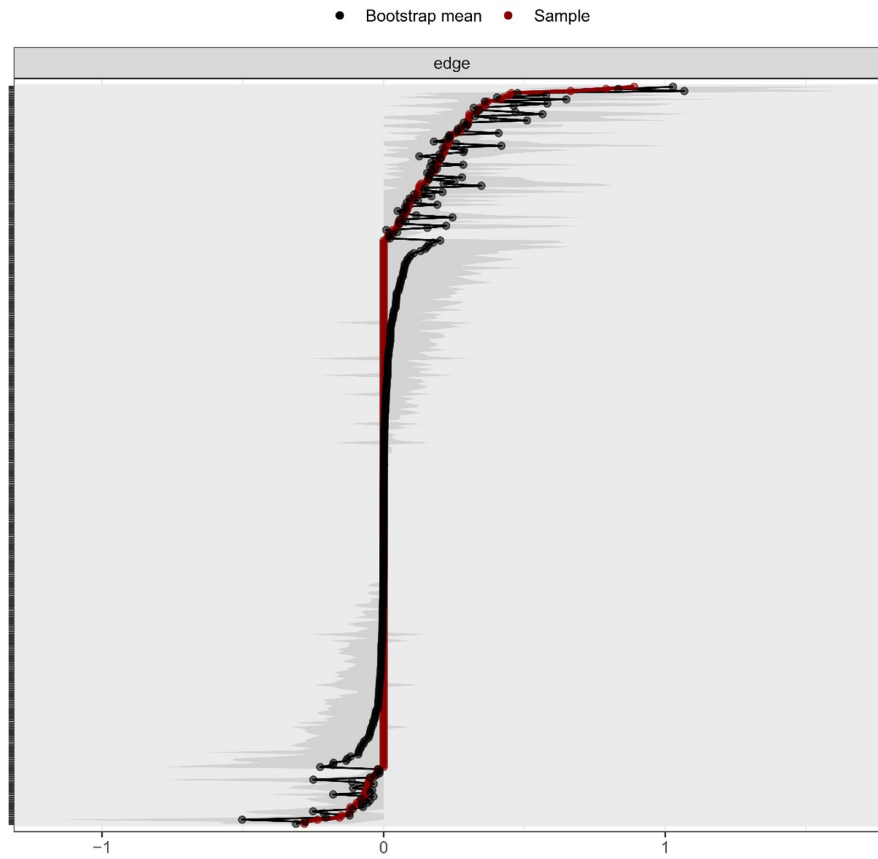


**FIGURE 1** | (A) Network of items of burnout and neuroticism. The edge colour of blue indicates that the connection was positive, and red indicates that it was negative. The edge thickness and saturation indicate connection strength. The stronger the connection, the thicker the edge. (B) Bridge expected influence of burnout and neuroticism items in the present network (raw score). The results were analysed by raw scores.

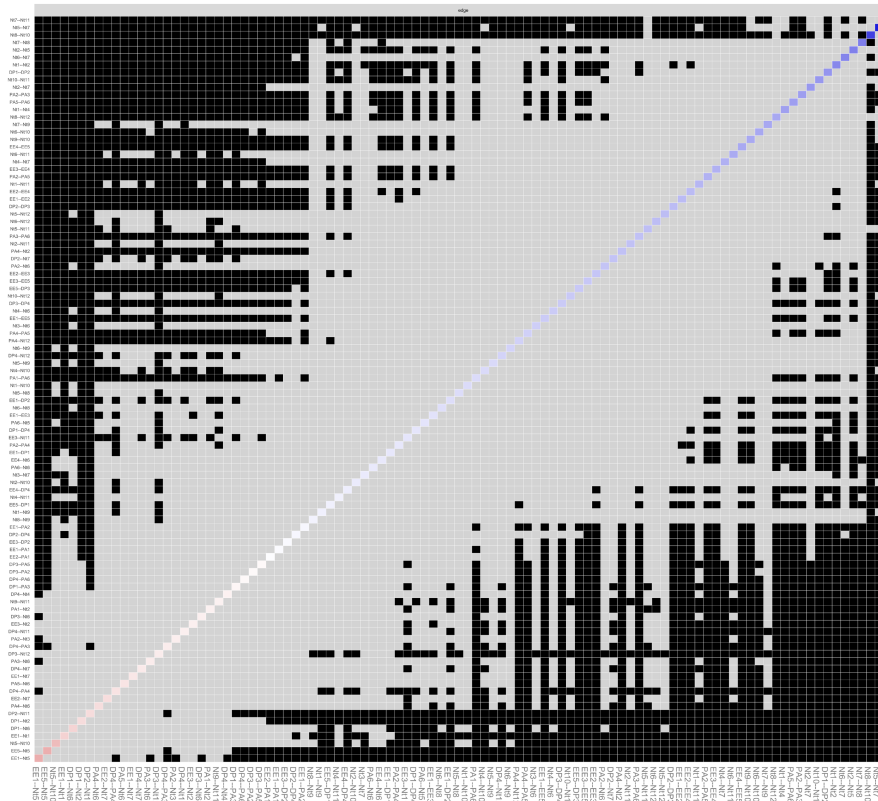
Within the burnout-neuroticism network, the results showed that the majority of edges were positive, which was in accordance with the evidence that higher levels of neuroticism were correlated with a higher prevalence of burnout (Holman et al. 2018; Vincent et al. 2022; Simeng et al. 2022). The two strongest edges were ‘Anxious’-‘Exhausted’ and ‘Anxious’-‘Breakdown’, which revealed the close relationships between anxiety and emotion exhaustion in emergency nurses. The finding is also related with previous research (Biganeh et al. 2021). Anxiety has impacted the way that medical staff perform their work tasks, frequently leading to the occurrence of exhaustion (Pérez-Fuentes et al. 2019). Some related investigations have demonstrated that nursing personnel who expressed relaxed feeling (e.g., agreeable and entertaining) showed lower levels of emotion exhaustion (Yu, Jiang, and Shen 2016; María et al. 2019). For ‘Go up and down’-‘Exhausted’, individuals with unstable emotions were less able to control their emotions when faced with high stress situations, and exhibited defence actions that increased their exhaustion (Ntantana et al. 2017).

Within the present network, node bridge centrality focused on the importance of each component of neuroticism related to burnout. Paying more attention to the bridge node could block the path and restrain from the occurrence of burnout. As a consequence, this provides managers with an effective intervention target. In the community of neuroticism, ‘Anxious’ had the highest positive value of BEI, and ‘Guilty’ had the highest negative value, which implied that anxiety emotion and guilt

conscience were critical nodes bridging the community of burnout. Krystyna proved that neuroticism influenced the susceptibility to burnout, and anxiety was an important determinant of burnout by exploring burnout models (Krystyna et al. 2019). Implementing measures to lower anxiety may be an effective way to lower the prevalence of burnout in ED nurses. Regarding sense of guilt, our findings run counter to those of a previous study, which found that self-forgiveness (contrary to guilt) was both positively related to psychosocial well-being and inversely associated with psychological distress outcomes among middle-age nurses (Katelyn et al. 2020). Hence, the difference of results could be explained by age difference in different participants. In our study, the majority of participants were young-aged females, who may have weak sense of guilt during working. Evidenced that excessive feeling of guilt did pose an increased risk for internalised distress and may be related to burnout as a consequence of the emotion of self-hate (Barr 2020). The feeling of guilt, however, is sometimes associated with empathy and conscience about the well-being of patients to some extent, which may enhance the enthusiasm and was inversely related to burnout (Jacob et al. 2022). Therefore, addressing burnout of ED nurses may involve reducing anxiety and enhancing sense of guilt. In addition to, in the community of burnout, ‘Exhausted’ and ‘Breakdown’ had the highest value of BEI, which implied that emotion exhaustion was important nodes to bridge the community of neuroticism. Thus, it indicated lowering the level of emotion exhaustion could relieve the level of neuroticism in ED nurses.



**FIGURE 2** | Accuracy of edge weights. The red line depicts the sample edge weights and the grey bar depicts the bootstrapped confidence interval.



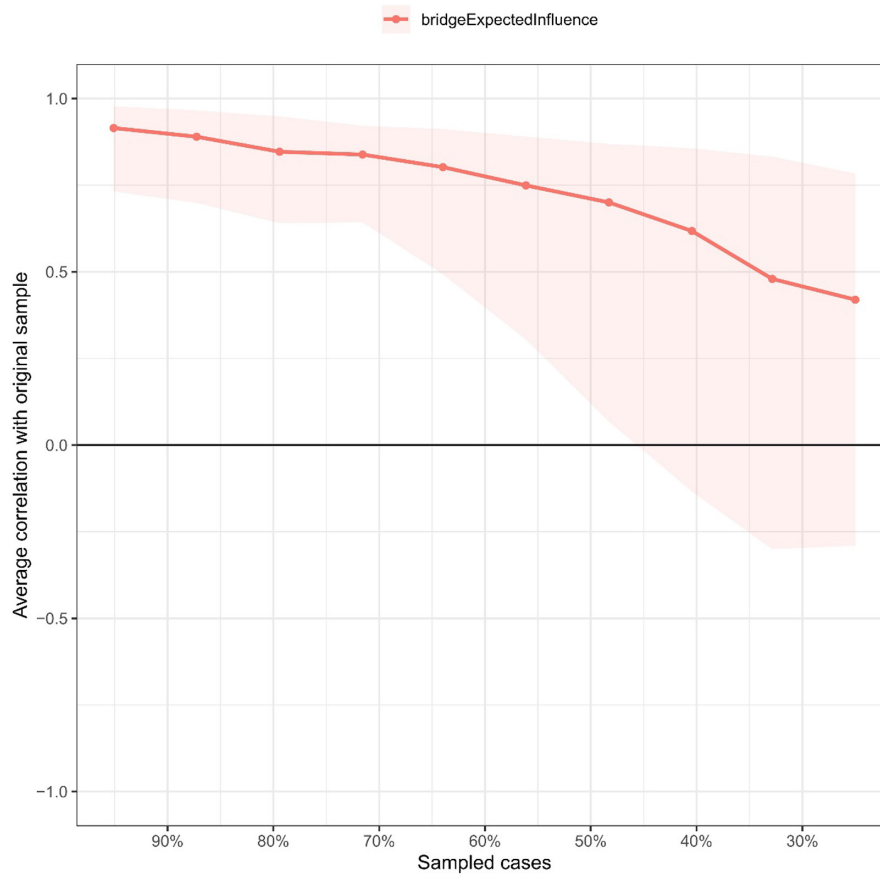
**FIGURE 3** | Bootstrapped difference test for edge weights. The black box indicates that edge weights of the two corresponding variables have a significant difference ( $p < 0.05$ ). The grey box indicates no significant difference ( $p > 0.05$ ).

**TABLE 3** | Correlation matrix of burnout and neuroticism items.

	EE1	EE2	EE3	EE4	EE5	DP1	DP2	DP3	DP4	PA1	PA2	PA3	PA4	PA5	PA6	Nt1	Nt2	Nt3	Nt4	Nt5	Nt6	Nt7	Nt8	Nt9	Nt10	Nt11	Nt12
EE1																											
EE2	0.24																										
EE3	0.10	0.20																									
EE4	0.00	0.24	0.27																								
EE5	0.18	0.00	0.19	0.30																							
DP1	0.08	0.00	0.00	0.00	0.05																						
DP2	0.12	0.00	0.02	0.00	0.00	0.37																					
DP3	0.00	0.00	0.00	0.00	0.19	0.00	0.23																				
DP4	0.00	0.00	0.00	0.06	0.00	0.09	0.03	0.19																			
PA1	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00																		
PA2	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00																	
PA3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34																
PA4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00															
PA5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.16														
PA6	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.34													
Nt1	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00												
Nt2	0.00	0.00	-0.06	0.00	0.00	-0.12	0.00	0.00	0.00	-0.05	0.00	0.00	0.21	0.00	0.00	0.42											
Nt3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.06	0.00	0.00	0.00	0.00	0.00	0.00										
Nt4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00								
Nt5	-0.28	0.00	0.00	0.00	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00						
Nt6	0.00	0.00	0.00	0.08	0.00	-0.15	0.00	-0.05	0.00	0.06	0.21	-0.07	-0.12	-0.10	0.08	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nt7	-0.08	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nt8	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nt9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.13	0.16	0.30	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
Nt10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.12	0.07	0.00	0.13	-0.24	0.30	0.00	0.66	0.30	0.30	0.19	0.00
Nt11	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.22	0.00	0.05	0.23	0.30	0.89	0.00	-0.05	0.36	0.00	0.00
Nt12	0.01	0.00	0.00	0.00	0.00	0.06	0.08	-0.07	0.15	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.00	0.30	0.00	0.19	0.00	0.00

Note: EE1—Exhausted, EE2—Used up, EE3—Tired, EE4—Stressed, EE5—Breakdown, DP1—Less interested, DP2—Less enthusiastic, DP3—Doubt significance, DP4—Indifferent, PA1—Effective, PA2—Contributing, PA3—Good at job, PA4—Happy, PA5—Worthwhile, PA6—Confident. Nt1—Go up and down, Nt2—Miserable, Nt3—Irritable, Nt4—Easily hurt, Nt5—Anxious, Nt6—Nervous, Nt7—Worried, Nt8—Sensitive, Nt9—Annoyed, Nt10—Suffering, Nt11—Lonely, Nt12—Guilty. The results were analysed by raw scores.





**FIGURE 4** | Stability of node bridge expected influences. The red bar represents the average correlation between node bridge expected influences in the full sample and subsample with the red area depicting the 2.5th quantile to the 97.5th quantile.

Group training or mental health lectures that focus on understanding and coping with anxiety and sense of guilt may be beneficial to relieve burnout. Besides, previous meta-analyses have demonstrated that adults who scored higher on negative emotion (e.g., anxiety) reported lower levels of physical activity (Sutin et al. 2016; Wilson and Dishman 2015; Tiia et al. 2020). Consequently, nurse managers could organise physical exercise activities to relieve anxiety in daily work, in order to reduce the level of burnout. Peter demonstrated that sense of guilt could be improved by psychoeducation in the holistic management of burnout in nurses of Neonatal Intensive Care Unit (NICU) (Peter 2022).

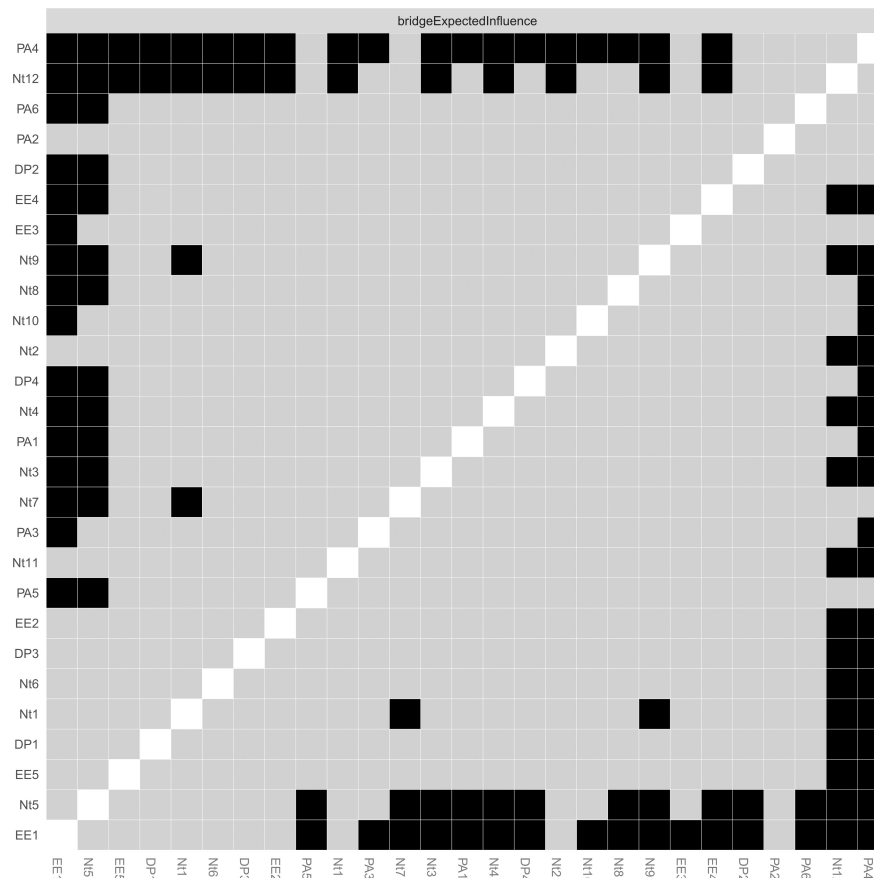
In aggregate, anxiety and guilt conscience in ED nurses were critical factors affecting burnout from the perspective of network, and it was essential to provide interventions to reduce burnout. Moreover, assessments of personality might assist in improving recruit staff members with the requisite personality factors in ED (Farfán et al. 2020). Individuals showing less anxiety and moderate guilt conscience would be more suitable for ED. In fact, experts suggested that people who possessed certain characteristics tend to choose specific medical specialties and positions (Milić et al. 2020). For example, psychiatrists may tend to show higher openness and lower conscientiousness scores than general practitioners (Mullola et al. 2018; Bexelius et al. 2016).

## 5.1 | Limitation

The limitations of this study concern sample selection and methodological design. In the former aspect, the participants we recruited were emergency nurses from Shaanxi province, which probably limited the generalisation of our findings to other groups. It will be worthwhile to explore the relations between the two variables among nurses working in other departments and countries. Moreover, the majority of the participants in this research were female nurses. Future studies should recruit as many as male nurses to validate the inner relationship between burnout and neuroticism. In terms of network analysis applied in this study, this cross-sectional study did not establish a causal relation between the most central component and other components or how they interacted with each other. A longitudinal study to explore the causal relationship is needed.

## 6 | Conclusion

In summary, this study is the first research exploring the specific connection between components of burnout and neuroticism by network structure in emergency nurses. Feeling of anxiety and guilt conscience has strongest connection with burnout. The finding provides some approaches (e.g., reducing anxiety and enhancing guilt conscience) to implement targeted intervention



**FIGURE 5** | Bootstrapped difference test for node bridge expected influences. The black boxes indicate node bridge expected influences that do differ significantly from one another ( $p < 0.05$ ), while the grey boxes indicate node bridge expected influences that don't differ significantly ( $p > 0.05$ ).

for reducing burnout among nurses in ED. Further studies are expected to expand the participants in other departments and explore personalised interventions based on the level of anxiety and sense of guilt among ED nurses.

#### Author Contributions

**Yinjuan Zhang, Wendong Hu** and **Hongjuan Lang** designed the method of current study. **Yinjuan Zhang** and **Chao Wu** were in charge of collecting and analysing data of participants. **Chao Shen** was responsible for algorithm of network analysis. **Yinjuan Zhang** and **Jicheng Sun** wrote the original manuscript. **Zhujiang Ma** proposed suggestions for publication. All authors contributed to revising and approved the final version of the paper.

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#### Ethics Statement

The study adhered to the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of 'REDACTED' (No. 'REDACTED'). The questionnaire was completed online through Questionnaire Star after informed consent was obtained.

#### Consent

The authors have nothing to report.

#### Conflicts of Interest

The authors declare no conflicts of interest.

#### Data Availability Statement

The data that supported this research are available and can be obtained by from the corresponding authors. For the protection of privacy and ethics restriction, the data cannot be made publicly available.

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