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Family Functioning, Anxiety and Depression in Chinese Higher Vocational School Students: A Network Analysis

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Purpose: Network analysis is a statistical method that explores the complex interrelationships among variables by representing them as nodes and edges in a network structure. This study aimed to examine the interconnections between family functioning, anxiety, and depression among vocational school students through network analysis approach.

Participants and Methods: A sample of 2728 higher vocational school students participated in a survey utilizing the Family APGAR Index Questionnaire (APGAR), Generalized Anxiety Disorder Scale (GAD-7), and Patient Health Questionnaire (PHQ-9). Meanwhile, a network analysis was conducted to investigate the interrelationships between family functioning, anxiety, and depression symptoms among the higher vocational school students.

Results: The network analysis revealed that node APGAR2 ("Partnership") exhibited the highest strength, followed by node GAD5 ("Restlessness"); node GAD7 ("Negative future anticipation"), PHQ9 ("Suicidal ideation"), and PHQ6 ("Guilty") were bridge nodes linking family functioning, anxiety and depressive symptoms in the sample. The results of the Network comparisons test between male and female indicated that the edge weights and global strength did not exhibit a statistically significant difference.

Conclusion: These results emphasized that certain anxiety symptoms and family functioning nodes are more central than others, and thus play a more critical role in the family functioning-anxiety-depression network, which highlight potential targeting symptoms to be considered in future interventions.

Keywords: network analysis, family functioning, anxiety, depression, higher vocational college students

Introduction

Vocational education is an integral part of China's education system, which is designed to meet the growing demand for the training of qualified skilled workers.[1] According to the Report on the Development of Vocational Education in China (2012–2022), there were 16 million higher vocational school students enrolled in approximately 1486 vocational schools by the end of 2021, which accounted for nearly half (45.85%) of the college students in China.[2] To be admitted as a vocational student in China, individuals must meet the following requirements: completion of senior high school education or equivalent, passing the specialized vocational college entrance examination, and meeting specific requirements set by individual institutions. Despite being almost evenly matched in numbers with college students in academic universities, this group has not yet received the attention it deserves. Compared to their peers in traditional academic universities, vocational students are more likely to be involved in physical inactivity,[3] screen-based sedentary behaviors,[4] social exclusion,[5] school bullying,[6,7] social prejudice,[8–13] suicidal ideation[3,4,14–16] and non-suicidal self-injury behaviors,[14,15] and they usually

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process lower levels of cultural capital,[17] subjective social status,[18] certainty about the future,[19,20] prospective income,[21–23] and thus leads this group to be the susceptible target of mental illness,[16] such as depression and anxiety. For example, the prevalence of depression and anxiety was 57.5% and 30.8% for Chinese vocational medicine students.[24] A similar situation was also revealed for vocational college nursing students (depression: 28.7%; anxiety: 41.7%), which is significantly higher than the norms for Chinese college students.[25]

To reduce anxiety and depression, family therapy could be an effective option,[26,27] which focuses on improving family functioning. Family functioning is a multifaceted construct encompassing the creation of a supportive environment that facilitates the fulfillment of developmental and social needs for each family member. This concept comprises several key dimensions: (1) Adaptive resource management: The capacity to effectively allocate and utilize resources during periods of adversity. (2) Equitable distribution of responsibilities: Ensuring fair participation in decision-making processes and fostering collaborative partnerships among family members. (3) Mutual encouragement: Promoting reciprocal support for individual growth and personal development within the family unit. (4) Cultivation of empathetic bonds: Nurturing affectionate relationships and emotional connections that foster a sense of belonging and understanding among family members. (5) Problem-solving facilitation: Providing assistance and guidance to family members in addressing and resolving challenges they encounter.[28] Family systems theory posits that inadequacies in fulfilling these fundamental familial roles may precipitate a range of clinical manifestations among household members. This perspective emphasizes the crucial interplay between family dynamics and the emergence of health-related challenges within the familial context.[29] Consequently, a lack of transparent communication and meaningful interaction among family members can lead to interpersonal estrangement within dysfunctional households. This alienation may result in the accumulation of negative affect, potentially impacting the social adjustment capabilities of family members and ultimately contributing to the onset of psychological disorders, including anxiety and depressive states.[30] Among Chinese medical vocational students, positive family function was found to be significantly associated with less depression and anxiety symptoms.[24]

Investigations into the co-occurrence of anxiety, depression, and family functioning have predominantly utilized syndromic evaluations based on aggregate scale scores. However, these composite measures encompass diverse individual manifestations that may stem from distinct psychoneurological mechanisms.[31–33] This approach potentially obscures the nuanced impact of specific facets of family functioning on anxiety and depression-related indicators, thereby limiting our understanding of how targeted improvements in familial interactions during therapeutic interventions may ameliorate these psychological distresses. Moreover, contemporary researchers conceptualize family functioning, anxiety, and depression as interconnected systems, wherein alterations in one component precipitate cascading effects throughout the network.[34] Given this systemic perspective, a more sophisticated analytical approach is warranted to elucidate the intricate relationships among these constructs. Consequently, network analysis emerges as a crucial methodological tool for investigating the complex interplay between familial dynamics, anxious tendencies, and depressive manifestations among students in higher vocational education settings. This approach allows for a more granular examination of the multifaceted connections between specific aspects of family functioning and individual symptoms of anxiety and depression, potentially revealing intervention targets that may have been overlooked by traditional aggregate score analyses. For example, Wu et al[35] used network analysis to explore the association between depressive symptoms and stressful life events in Chinese vocational school students aged 14–19, and they found that "fatigue" was the central depressive symptom, and "guilt", "sad mood", and "school dislike" acted as bridges to life stressors.

Network analysis treats symptoms as components of mental disorders,[36,37] with the onset and progression of these disorders attributed to robust causal interactions among symptoms.[36,38] Therefore, a primary objective of the network analysis approach is to identify the most influential symptoms within the underlying symptom network, defined as highly central symptoms. Furthermore, these central symptoms may exhibit a greater propensity to activate other symptoms within the network, thereby exacerbating mental disorders.[37,39,40]

The comorbidity of anxiety and depression is highly prevalent, and recent studies have focused on network analysis to explore the phenomenon of comorbid depression and anxiety among students.[41–44] For example, Tao et al employed network analysis to elucidate the complex interplay among depressive symptoms, anxiety, and sleep disturbance, identifying that sleep dissatisfaction, poor sleep quality, and uncontrollable worry were centrality symptoms; sleep, guilt, restlessness, irritability, and feeling afraid can function as bridge symptoms. An investigation was conducted to explore the gender differences in

depression, anxiety and sleep disturbances symptoms among Chinese college students. The research revealed that "satisfaction with current sleep pattern", "worry about different things" and "irritable" appeared to be the most central symptoms in the female network. In the male network, "satisfaction with current sleep pattern", "tired or little energy" and "feeling down, hopeless" were the most central symptoms.[42] Another study examined the relationships between depression, anxiety, and insomnia symptoms among Chinese college students. The analysis revealed that "Fatigue", "Restlessness", "Uncontrollable worrying", "Worry too much", and "Sleep insufficiency" were identified as central symptoms, "Fatigue", "Restlessness", and "Irritability" acting as bridge symptoms.[43] Furthermore, network analysis have been conducted to examine the interplay between anxiety and depression across various demographic groups, revealing that core symptoms exhibit variability among these groups, for instance, studies have reported distinct symptom profiles among residents of Macau,[45] caregivers of psychiatric patients,[46] adolescents,[47] psychiatric sample.[32] These findings underscore the heterogeneity in symptomatology and the importance of considering group-specific characteristics in mental health research and intervention strategies. To our knowledge, only one previous study explored the associations among family functioning, anxiety, and depression symptoms on disabled population by network analysis. This study found that nodes PHQ4 ("Energy"), APGAR3 ("Growth"), GAD1 ("Nervousness") were central nodes; PHQ9 ("Suicide ideation"), PHQ6 ("Worthlessness"), GAD1 ("Nervousness"), and GAD5 ("Restlessness") were bridge nodes.[48] However, no studies have utilized network analysis to explore the link between anxiety, depression and family functioning in college student populations, especially in higher vocational school students. Identifying the central symptoms and bridge nodes in the family functioning-anxiety-depression network can help identify risk factors for anxiety and depression, develop effective prevention and interventions, and reduce the incidence of psychological disorders for higher vocational school students.

Sex difference is another vital dimension to be considered when investigating the association between family functioning and psychopathology.[49,50] With more interpersonal sensitivity,[51] females would exhibit more negative emotions than males when dealing with interpersonal stressors,[52–54] such as family functioning difficulties. However, whether it is the same case for Chinese higher vocational school students remains to be determined. Considering the fact that more psychological distress was shown in female higher vocational school students than male counterparts,[8,55,56] it is imperative to explore the potential role of sex differences underlying the connection between family functioning and depression/anxiety to inform sex-specific family interventions in the future.

In summary, this study uses network analysis to clarify the complex relationship between family functioning, anxiety and depression symptoms in higher vocational school students and the potential sex differences, precisely identifying the core symptoms of the family functioning-anxiety-depression network in higher vocational school students, and providing a foundation for precise family therapy.

Material and Methods

Participants and Procedure

This study employed a convenience sampling strategy, collecting data through an online survey, where eligible students were asked to complete the questionnaire by scanning a QR code with their mobile phones, ensuring that participants were genuine vocational college students. We administered the questionnaire between July 12 and July 30, 2024, targeting students fulfilling specific eligibility criteria: (1) aged 18 years or above; (2) proficient in understanding the Chinese language and the survey's content; and (3) participating voluntarily. Informed consent was secured electronically for each participant, with the provision that they could opt out at any juncture, safeguarding their voluntary and informed engagement. A total of 2728 students from higher vocational schools were included in the formal analysis (see "Participant Characteristics" part and Table 1 for details). The study was executed in compliance with the Declaration of Helsinki and received approval from the Ethics Committee at Ningxia University.

Measurements

Family Functioning

The Family APGAR Index Questionnaire (APGAR) was used to evaluate family functionality on a 3-point Likert scale from 0 (rarely) to 2 (always).[28] The assessment encompassed five key dimensions: adaptability (referring to the family's

Table 1 Demographic Characteristics of the Participants

Variable	Mean/N	SD/%
Gender (male)	1692	62
Age (years)	19.36	1.16
Ethnicity (Han)	2676	98
Birth order in the family		
Only child	584	21.4
First	1056	38.7
Second	809	29.6
Third	169	6.1
Other / Others	110	4.0
Family residential area		
Urban area within the province	1212	44.4
Urban area outside the province	674	24.7
Rural area within the province	483	17.7
Rural area outside the province	359	13.1
Family financial situation		
Very good	169	6.1
Fairly good	390	14.2
Average	1670	61.2
Difficult	384	14
Severely difficult	115	4.2
PHQ-9	16.02	5.54
GAD-7	11.79	4.61
APGAR	10.49	2.73

Abbreviations: PHQ-9, The Patient Health Questionnaire-9; GAD-7, The Generalized Anxiety Scale-7; APGAR, The Family APGAR Index Questionnaire.

ability to mobilize internal and external resources to tackle crises that threaten the family's stability), collaboration (demonstrating the shared responsibility for decision-making and child-rearing among family members), development (indicating the family members' mutual support and guidance in achieving personal development and self-fulfillment), warmth (reflecting the display of care and warmth in familial relationships), and dedication (measuring the dedication to devote time to the well-being and development of family members). A cumulative score from 0 to 3 signifies severe family dysfunction, a score of 4 to 6 suggests moderate dysfunction, and a score ranging from 7 to 10 is considered indicative of a well-functioning family. The Cronbach's α was 0.93 for APGAR in the present study.

Anxiety

We utilized the 7-item Generalized Anxiety Disorder scale (GAD-7) to measure symptoms of anxiety. The GAD-7 assesses common anxiety indicators, with scoring for each item ranging from 0 (never) to 3 (almost daily), yielding a total score between 0 and 21 that indicates the severity of anxiety.[57] The GAD-7 has demonstrated reliability and validity in evaluating anxiety among general outpatients in China.[58] In this study, the Cronbach's α was 0.96.

Depression

Depressive symptoms were assessed with the 9-item Patient Health Questionnaire (PHQ-9).[59] Each item rated from 0 ("not at all") to 3 ("nearly every day"), culminating in a total score that spans from 0 to 27, with higher scores indicating greater severity of depression. The PHQ-9 has been validated for its reliability and validity in assessing depressive symptoms among individuals in China.[60] The Cronbach's α was 0.94 for PHQ-9 in the present study.

Statistical Analyses

Network Estimation

According to the recommendations,[61] the network model comprising 23 indicators was constructed utilizing the EBICglasso function in the "qgraph" package.[62] Symptoms are represented as nodes, with their interconnections depicted by edges. Additionally, the predictability of each node was evaluated using the "mgm" package.[63] A node with elevated predictability is suggested to be influenced by its neighboring nodes. The mean predictability across all nodes in the network indicates the degree to which the network is influenced by external factors. A higher average predictability suggests that the network's internal structure is more predictive, with less reliance on external variance.[63] Furthermore, edges within the network can manifest as positive (denoted by green lines) or negative (denoted by red lines). The strength of these connections is visually represented by the thickness and saturation of the edges, with nodes having stronger connections or more connections placed in closer spatial proximity.[64]

Estimation of Centrality and Bridge Centrality

Centrality is a metric that quantifies the direct relevance of a node to other nodes within a network. Utilizing the centralityPlot function from the "qgraph" package,[62] three indices of centrality were determined to gauge the significance of each node.[65] To assess the central nodes in the network, the expected influence (EI) was computed, which sums the raw values, rather than merely their absolute values. EI captures the overall positive connectivity surrounding a node, as it accounts for both positive and negative edges.[66] Bridge centrality identifies the critical nodes that connect distinct network communities. The assessment of network centrality and the identification of bridge nodes were conducted with the "bootnet" and "networktools" packages.[64]

Network Accuracy and Stability Estimation

The "bootnet" package was employed to calculate the accuracy and stability of the network using bootstrapping methods. First, bootstrapping was utilized to compute the 95% confidence intervals (CIs) for the accuracy of edge weights. Then, the stability of the centrality indices was assessed through a case-drop bootstrap, which measures the stability of correlations.[67] The CS-coefficient should be above 0.5 but at least above 0.25.[64]

Results

Participant Characteristics

A total of 2728 students from higher vocational schools were surveyed, with an average age of 19.36 (ranging from 18 to 25 years old, SD = 1.16). The sample comprised 1692 males (62%) and 1036 females (38%). The mean (±SD) scores for the PHQ-9, GAD-7, and APGAR were 16.02 ± 5.54, 11.79 ± 4.61, and 10.49 ± 2.73, respectively. Demographic characteristics of the participants are summarized in Table 1.

Network Structure

Figure 1 illustrates the network of family functioning, anxiety and depression symptoms among higher vocational school students. Ring pie charts are used to denote the predictability of each node, with a mean overall predictability score of 0.70 (range: 0.56–0.79) as specified in Supplementary Table S1. In the family functionality network, node APGAR1 ("Adaptation") demonstrated the strongest direct connection to node APGAR2 ("Partnership"). This was followed by the link between nodes APGAR2 ("Partnership") and APGAR4 ("Affection"). In the depression network, node PHQ1 ("Anhedonia") showed the most significant direct correlation with the node PHQ2 ("Depressed mood"), which was followed by the link between nodes PHQ2 ("Depressed mood") and PHQ4 ("Energy"). Within the anxiety symptoms, node GAD3 ("Worry too much") demonstrated the strongest direct connection to node GAD2 ("Uncontrollable Worrying"). This was followed by a strong connection between nodes GAD1 ("Nervousness") and GAD2 ("Uncontrollable Worrying").

Centrality and Bridge Centrality

Figure 2 illustrates the centrality and bridge strength of nodes within the network of higher vocational school students. Notably, the node APGAR2 ("Partnership",) exhibited the highest strength, followed by node GAD5 ("Restlessness").

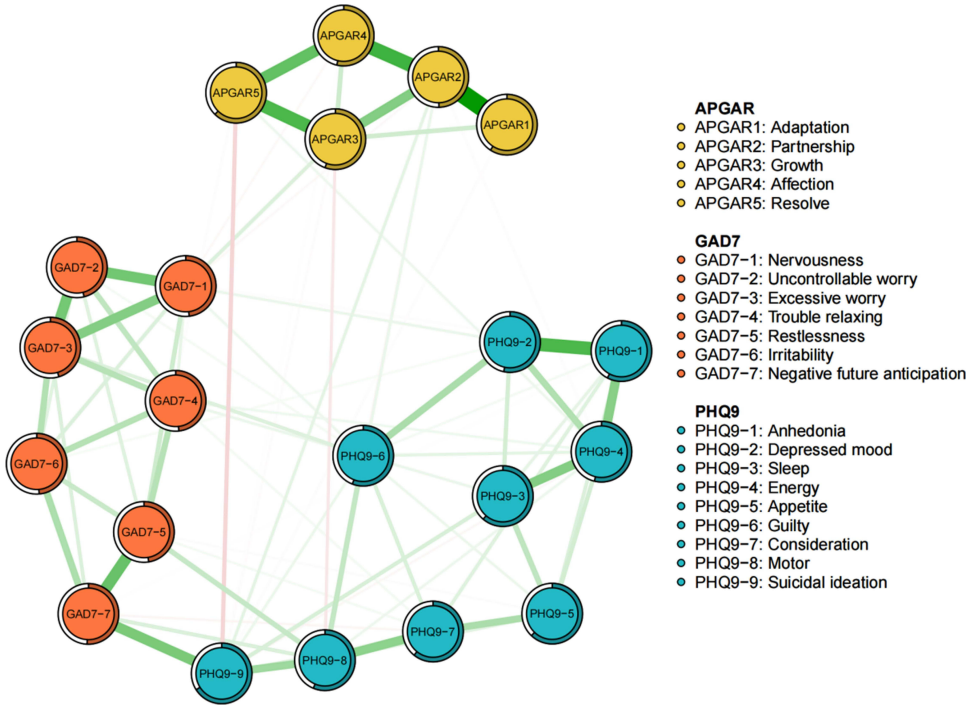

Figure 1 Network of family functioning, anxiety, and depression nodes in higher vocational school students. The thickness and darkness of the edges signify the strength of the association between nodes. The color-coding of the edges represents the nature of the correlation, with green indicating a positive relationship and red signifying a negative one.

For expected influence, the node GAD5 ("Restlessness") was the most influential, with node APGAR2 ("Partnership") ranking second. In terms of bridge strength, nodes GAD7 ("Negative future anticipation"), PHQ9 ("Suicidal ideation"), PHQ6 ("Guilty"), PHQ8 ("Motor") and GAD1 ("Nervousness") were stronger compared to the majority of other nodes, as detailed in Supplementary Figure S1.

Network Accuracy and Stability

The assessment of edge stability revealed moderate consistency within the estimated networks. While substantial overlap was observed in 95% of the edge weight confidence intervals (CIs). Some instances of non-overlap also existed (as depicted in Supplementary Figure S2). Furthermore, the estimation of the edge weight differences demonstrated that the higher stability edges were significantly different from other edges in the network (Supplementary Figure S3). The non-parametric bootstrapped difference test for strength demonstrated that the nodes APGAR2 ("Partnership") and GAD5 ("Restlessness") had the highest strength compared to other symptoms (Supplementary Figure S4). Concurrently, the stability of the centrality index was quantified, with the centrality strength stability coefficient (CS-coefficient) recording a value of 0.749, as shown in Figure 3.

Network Comparisons

The findings revealed no significant difference in the edge weights and global strength ($M = 0.14$, $p = 0.34$; $S = 0.03$, $p = 0.81$) (Figure 4). The similarity coefficient, with a value of $S = 0.11$, denoted a high degree of resemblance between the compared networks (see Supplementary Figure S5).

Subsequent figures delineate the network structures for females and males, as presented in Figure 4. In the central plot, for females, node GAD5 ("Restlessness") exhibits the highest strength value, while for males, it is PHQ4 ("Energy"). Females exhibit the highest expected influence at node PHQ4 ("Energy"); whereas males show it at node APGAR2 ("Partnership") (see Figure 5). The stability estimates for the centrality index disclosed that the centrality bridge strength stability coefficients (CS-coefficients) were 0.52 and 0.59 respectively. Similarly, centrality

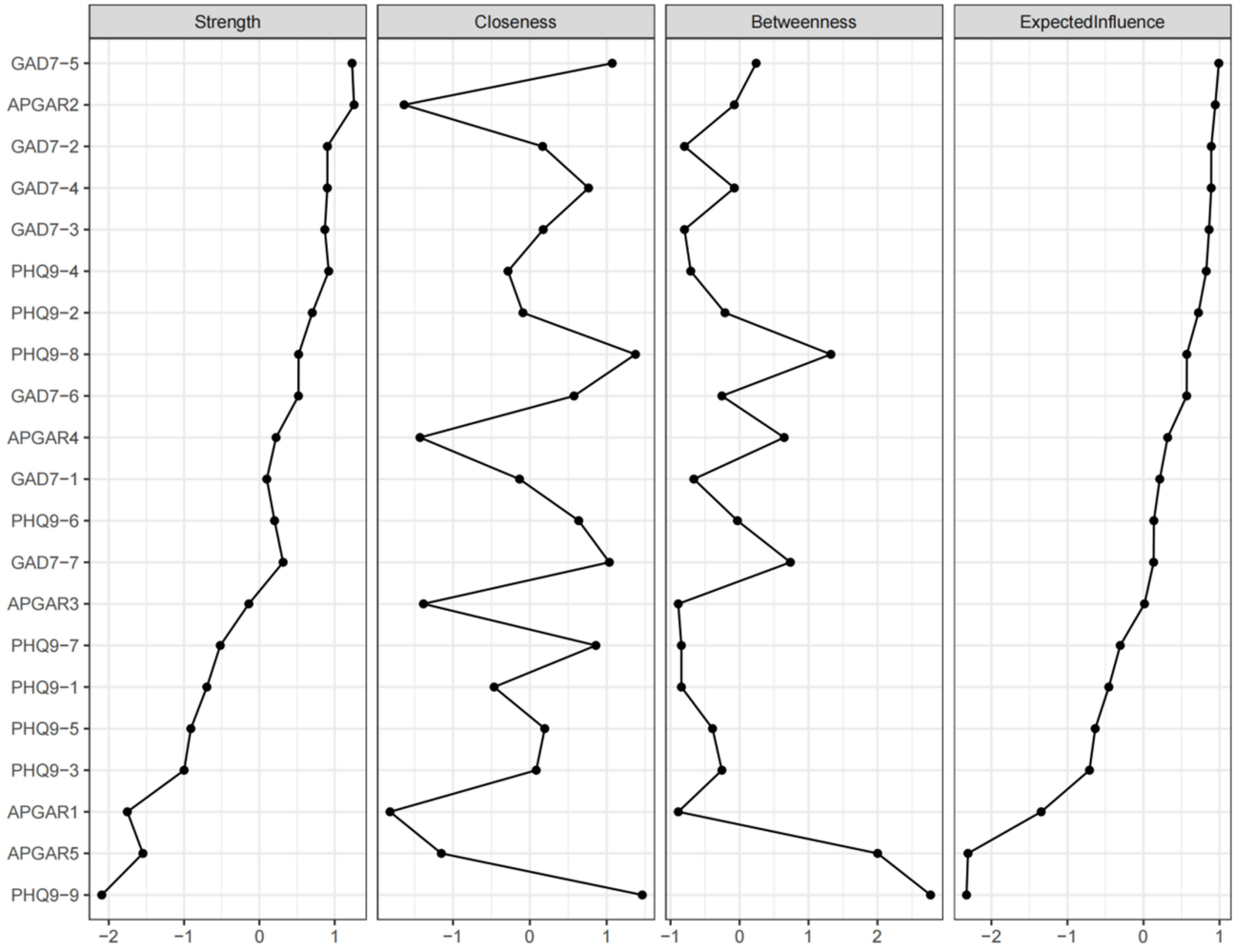

Figure 2 Node strength centrality within the estimated network. Centrality plot delineates the centrality of each node, measured across various centrality metrics including strength, closeness, betweenness, and expected influence.

bridge expected influence stability coefficients (CS-coefficients) were 0.52 and 0.59, respectively (see Supplementary Figure S6).

Discussion

This study employed network analysis to construct the network of family functioning, anxiety and depression symptoms among higher vocational school students. The key findings were as follows: (1) The nodes GAD5 ("Restlessness"), APGAR2 ("Partnership"), GAD2 ("Uncontrollable worry") and GAD4 ("Trouble relaxing") emerged as central nodes; (2) The bridge nodes linking family functioning, anxiety and depressive symptoms in the sample were GAD7 ("Negative future anticipation"), GAD1 ("Nervousness"), PHQ9 ("Suicide ideation"), PHQ6 ("Guilty"), and PHQ8 ("Motor").

GAD5 ("Restlessness") was identified as the most central node within the network of family functioning, anxiety, and depression among higher vocational school students. This finding suggests that restlessness is more than a symptom; it is a significant factor influencing the complex dynamics between family functioning and mental health in higher vocational school students. Identifying restlessness as a core concern allows for the development of more targeted mental health interventions, potentially including mindfulness techniques,[68,69] physical activity programs,[70,71] or cognitive behavioral therapy.[72,73] Furthermore, recognizing the centrality of restlessness leads to a more comprehensive understanding of family support, which emphasizes the need for a stable and supportive environment that can ameliorate restlessness and its mental health repercussions. Additionally, GAD4 ("Trouble relaxing") and GAD2 ("Uncontrollable worry") were

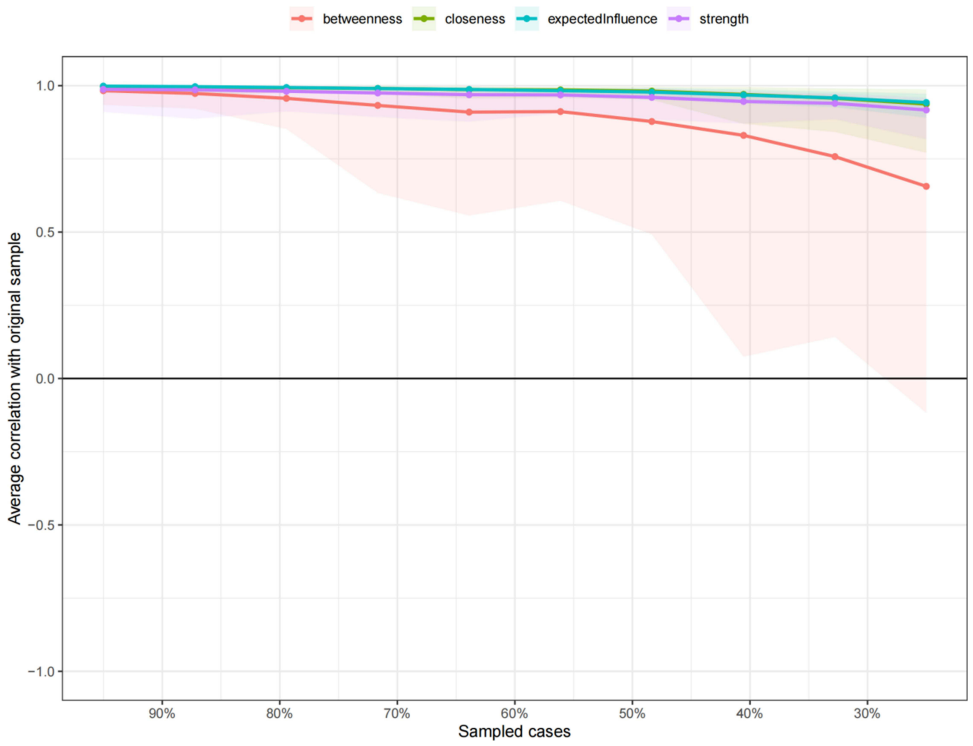

Figure 3 The stability of centrality indices by using case dropping subset bootstrap method. The horizontal axis shows the percentage of the original sample size used in each bootstrap iteration. On the vertical axis, the mean correlations are plotted, comparing the centrality indices of the original network with those recalculated from networks after the sequential exclusion of cases.

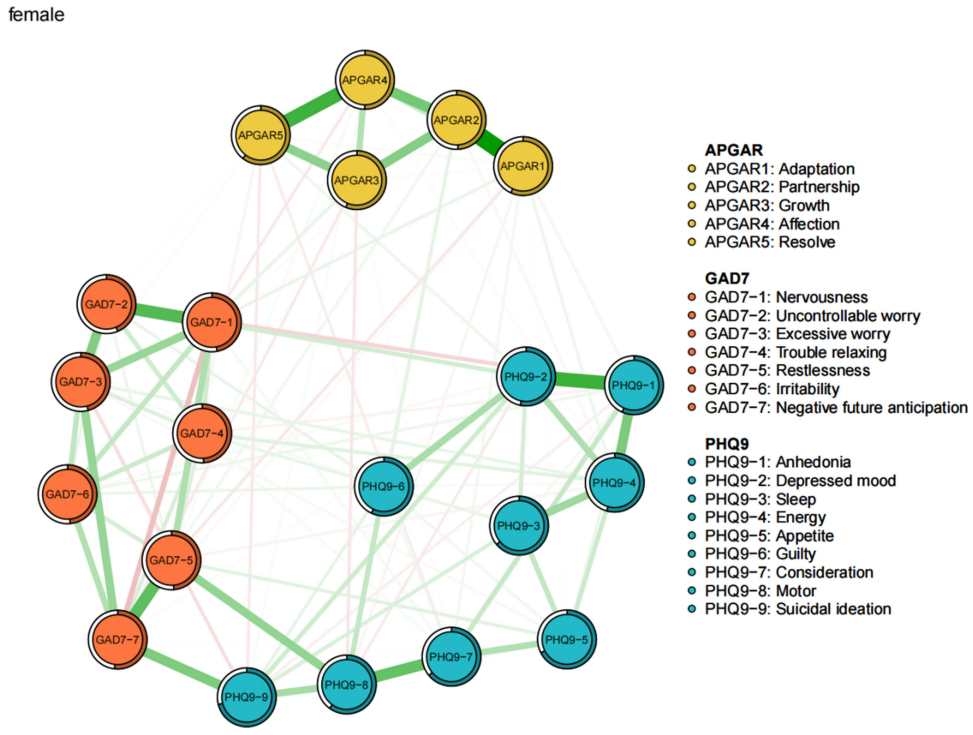

Figure 4 Continued.

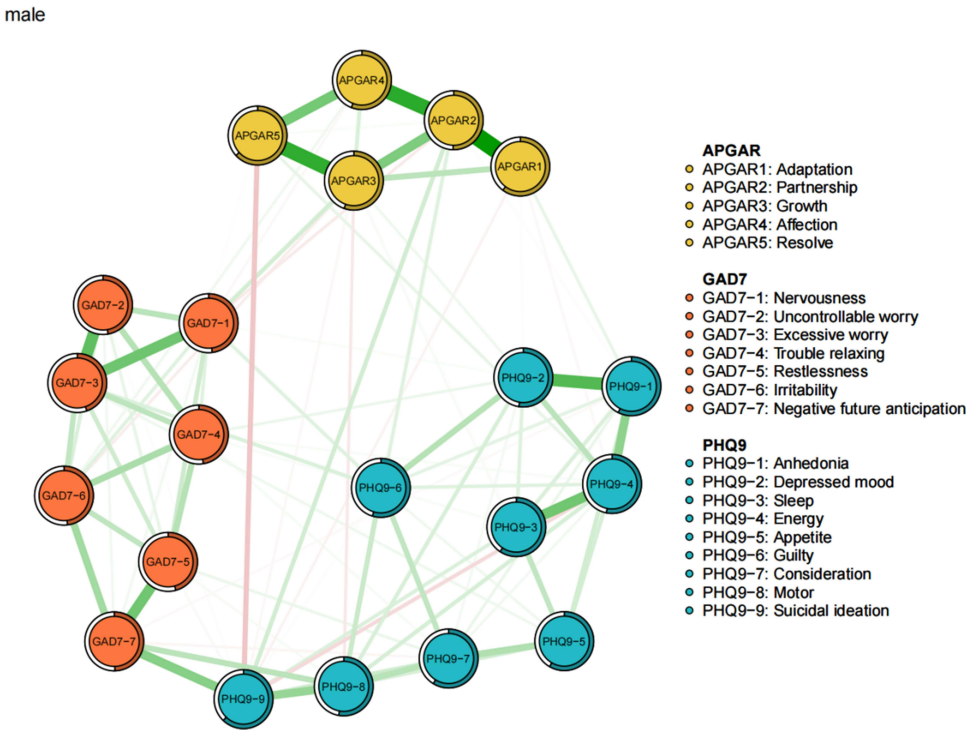

Figure 4 Network of family functioning, anxiety, and depression nodes in higher vocational school students.

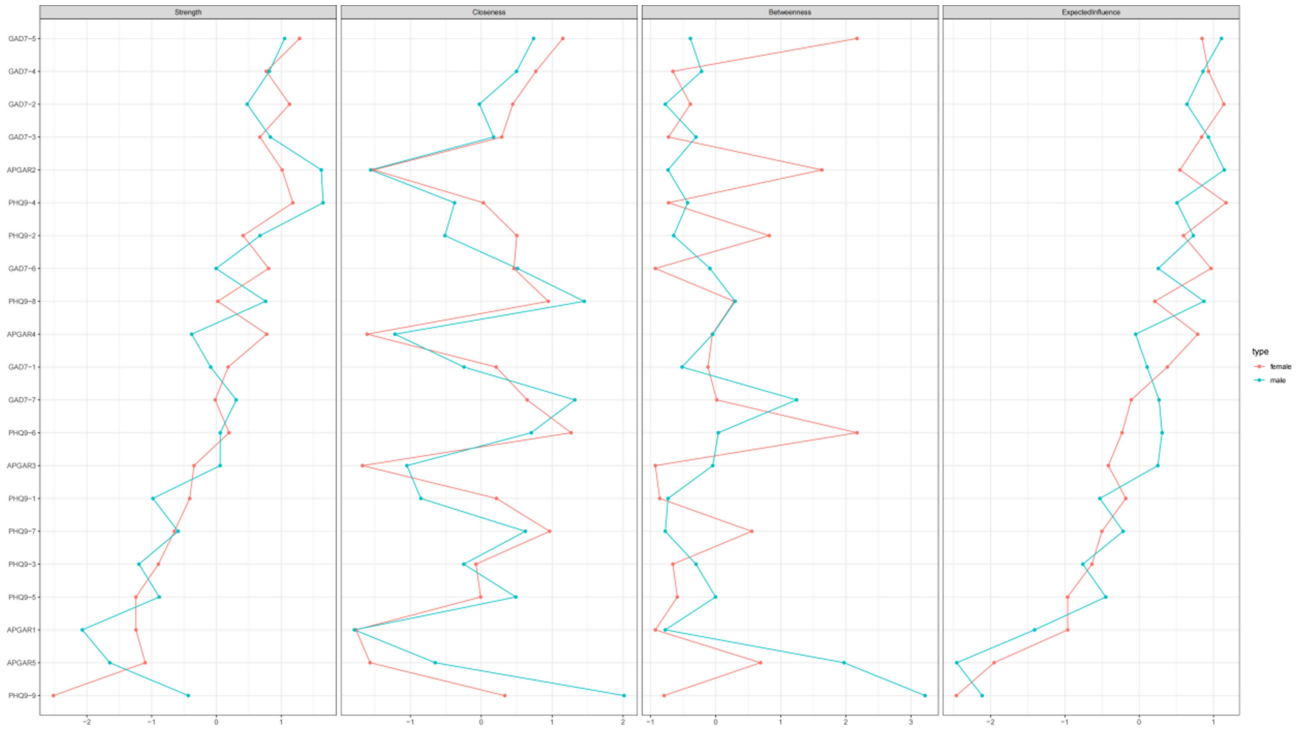

Figure 5 Node strength centrality of the estimated network.

identified as other central symptoms in the family functioning-anxiety-depression network. Acknowledging this interconnection can guide the development of more comprehensive therapeutic strategies. Interventions could be enhanced by incorporating relaxation techniques[74] and cognitive restructuring[75,76] to address these pivotal symptoms, which may, in turn, bolster family unity and decrease levels of anxiety and depression. The nodes GAD4 ("Trouble relaxing") and GAD2 ("Uncontrollable worry") in the network also highlights the necessity for family-oriented interventions. Such interventions should aim to cultivate an environment that facilitates relaxation and alleviates uncontrollable worry, thereby contributing to the enhancement of the students' overall mental health.

The node APGAR2 ("Partnership"), another central node in this network analysis, signifies the mutual sharing of decision-making and nurturing duties among family members. It suggests that a supportive family milieu may exert a beneficial impact on mitigating anxiety and depressive symptoms. Given that higher vocational school students may be in a transitional period from dependence to independence, familial involvement and backing in decision-making could facilitate this adaptation and potentially diminish the incidence of psychological distress.

The Family Systems Theory posits that families consist of interdependent subsystems that collaborate to fulfill the family system's functions effectively, fostering positive interactions and the well-being of all family members.[28] This perspective implies that the harmonious collaboration among family members is essential for the optimal performance of family roles. Consequently, in the context of family therapy, it is imperative for therapists to heighten family members' awareness, foster affirmative and reciprocal relationships, and encourage the robust development of the family system, thereby ameliorating individual mental health conditions.[77]

Meanwhile, this study identified that nodes GAD7 ("Negative future anticipation"), PHQ9 ("Suicidal ideation"), PHQ6 ("Guilty"), PHQ8 ("Motor") and GAD1 ("Nervousness") were bridge symptoms in this network. GAD7 ("Negative future anticipation"), may indicate students' apprehensions and uncertainties regarding the future, potentially intensifying anxiety and impacting their academic and vocational perspectives. Specifically, "Negative future anticipation" could denote a profound sense of hopelessness, thereby worsening depressive and anxious conditions. "Suicidal ideation", being an especially critical symptom, necessitates prompt attention as it is a significant predictor of suicidal acts and a pivotal intervention point. Research has indicated that enhancing the familial milieu at age 14 may ameliorate the repercussions of childhood family adversities on the adolescent emergence of nonsuicidal self-injury (NSSI).[78] Another study revealed that both family functioning and avoidance/emotion-focused coping strategy predicted NSSI, with the association between family functioning and NSSI being mediated by avoidance/emotion-focused coping strategy.[79]

The PHQ6 ("Guilty") as a bridge symptom replicated previous findings of Chinese vocational school students with younger age (14–19 years old).[35] In their study, they found study pressure from family would lead to the feeling of "Guilty",[35] which might through the parental emphasis on their sacrifice on children's learning during the everyday parent–child communication. Another potential explanation about this might be the self-esteem issues or perceptions of personal failure which leads to increased isolation and mental distress. The PHQ8 ("Motor") identified as a bridge symptom confirmed the findings of a recent review about the previous network models of depressive and anxiety symptoms.[44] The PHQ8 ("Motor") could point to physical expressions of psychological distress, which can impair daily activities and social engagements. Node GAD1 ("Nervousness") is a prevalent symptom of anxiety disorders, can result in an elevated state of arousal, hindering concentration and decision-making processes.

The identification of these bridge symptoms within the network highlights the necessity for interventions that specifically target these issues to ameliorate the mental health of students. For example, cognitive behavioral therapy (CBT) could effectively challenge pessimistic future expectations and mitigate guilt sensations.[80] Support groups or family therapy could assist in regulating nervousness and offer a secure environment for students to articulate their apprehensions and anxieties. Additionally, physical activity programs could be beneficial in alleviating motor symptoms and improving overall mental well-being. The current findings suggest that a tailored approach, focusing on these bridge symptoms could more effectively disrupt the cycle of mental health issues and improve the overall quality of life in higher vocational school students. Consequently, the activation of bridge symptoms might increase the risk of disorder through activation of other symptoms by the resulting symptom, targeted interventions for bridge components may prevent the development of clinical disorders.[64] These results indicated therapists could target the resolve of family members during family therapy to reduce suicidal ideation

and enhance the level of activity of college students, thereby improving the network of anxiety and depression symptoms and alleviating negative emotions of higher vocational school students.

Against our prediction, no six differences were revealed, which replicated previous studies about the network of comorbidity between depression and anxiety.[47,81,82] This may be due to a variety of reasons. Firstly, the uniform educational system and curriculum in Chinese higher vocational schools might foster similar psychological profiles and responses to family dynamics among students, irrespective of gender. Secondly, the cultural emphasis on shared values and social harmony within Chinese society could lead to a convergence in coping strategies and emotional expression among students, reducing gender-based disparities. Additionally, the methodological rigor of the study, including the selection of appropriate assessment tools and the application of robust statistical techniques, may have been effective in capturing subtle variations but not sufficient to detect significant gender differences, possibly due to the sample size or the inherent variability within the population. Furthermore, the complex interplay of biological, psychological, and social determinants that influence the constructs of anxiety and depression may result in a network structure that does not distinctly differentiate between male and female students. Lastly, the resilience and adaptability of students in navigating family-related challenges might manifest similarly across genders, contributing to the observed non-significant findings. Future research with larger and more diverse samples could elucidate the nuances of gender differences in the relationship between family functioning and mental health outcomes among students.

This research advances our theoretical understanding in several ways. First, it extends network theory of mental disorders, especially the comorbidity between depression and anxiety, to higher vocational school students, which represents a significant yet understudied population in China's education system. Second, it further validates and contributes to family systems theory by identifying specific pathways through which family dynamics influence mental health outcomes in vocational students.

Our findings suggest several key therapeutic directions: (1) Enhancing mutual trust and family cohesion; (2) Creating a supportive and relaxed family atmosphere; (3) Addressing negative future expectations; (4) Implementing targeted interventions for suicidal ideation and feelings of guilt; (5) For the school stakeholders, it is important for them to recognize the importance of family-related factors for the development of mental health issues for students and it is imperative to develop healthy and sustainable cooperation between schools and families to protect the students' mental health as a most recent review[83] suggested. These findings have important implications for clinical practice in family therapy, school-based mental health services, and family-based preventive interventions.

Although this study has some clinical implications for improving anxiety and depression in vocational school students through family therapy, there are some limitations that need to be mentioned: (1) Cross-sectional data cannot infer causality, so longitudinal design needs to be employed for future studies. (2) The population included in this study were all Chinese higher vocational school students who volunteered to participate, larger and more representative sample size is warranted in the future to retest and generalized the current findings. Moreover, whether the current findings can be transferred to other populations needs to be examined as well, such as undergraduates in academic universities. (3) In the current study, only family functioning was explored, and other family-related factors, especially some certain culturally specific family dynamics (like the pressure for academic success, filial piety, or hierarchical family structures), might play a unique role in the onset or maintenance of mental health issues as well. The inclusion of other critical family-related factors in future studies using network analysis can reveal the culturally embedded patterns that are central to the problem, leading to culturally sensitive interventions.

Conclusion

In conclusion, for Chinese higher vocational school students, "Restlessness", "Partnership", "Uncontrollable worry" and "Trouble relaxing" emerged as central nodes of family functioning-anxiety-depression network. In addition, "Negative future anticipation", "Nervousness", "Suicide ideation", "Guilty", and "Motor" were identified as bridge nodes linking family functioning, anxiety and depression symptoms. All these core nodes and bridge nodes could be treated as targets for tailored interventions in the future. Future research should also focus on longitudinal studies to establish causal relationships and explore the generalizability of these findings to other populations.

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Disclosure

The authors report no conflicts of interest in this work.

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