Review Article

ANXIETY AND DEPRESSION SYMPTOMS AMONG OLDER CHINESE MIGRANTS: A NETWORK ANALYSIS

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Abstract

Introduction: With the development of an aging society, anxiety and depression are common psychological problems in elderly individuals. Therefore, in view of the mental health problems of older migrants, this study investigated the network structure of anxiety and depression symptoms in older migrants in China and determined the central symptoms and bridge symptoms, which provide key symptoms to ensure the mental health of older migrants in our country and further prevent anxiety and depression problems in older migrants.

Materials and Methods: To understand the symptoms of depression and anxiety in older Chinese migrants, 469 older migrants were investigated. Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-9), and anxiety symptoms were measured using the Anxiety Scale in the Hospital Anxiety and Depression Questionnaire (HADS-A). Build networks with network analysis. A Gaussian graph model is used to construct an undirected network with a partial correlation coefficient, in which the nodes connected by edges are connected.

Results: The strongest inverse edge connections in the network were for "Relax" in anxiety and "Motor" in depression, and the strongest edges were concentrated in symptoms on the anxiety scale. It was also revealed that the bridge symptoms in the network were "Relax" and "Restless" in anxiety and "Guilt" in depressive symptoms. Central symptoms in the network include "Restless", "Relax" and "Fear" in anxiety and "Guilt" in depression.

Conclusion: The anxiety symptoms of "restlessness" and "relax" have a great impact on the mental health network of migrant elders. Future intervention and prevention targets could focus on anxiety symptoms in older migrants. *ASEAN Journal of Psychiatry, Vol. 25 (6) August, 2024; 1-15.*

Keywords: Older Migrants; Anxiety; Depression; Network Analysis; Mental Health

Introduction

The Coronavirus Disease 2019 (COVID-19) epidemic represented the first serious emergent public health crisis since the Severe Acute Respiratory Syndrome (SARS) outbreak. When a crisis threatens people's lives, it may bring a series of negative psychological reactions [1]. In the context of COVID-19, this was exacerbated by the high infectivity and fatality rates; elderly people were most at risk from COVID-19, and mood effects were pronounced among older adults [2]. Psychological problems in people following COVID-19 have attracted a large amount of research interest [3].

Elderly people are at high risk of COVID-19 infection, and elderly people with chronic basic diseases are more likely to be aggravated by COVID-19 [4]. Moreover, COVID-19 has greatly affected their psychological condition, further aggravating their illness. In a prior study, during the COVID-19 pandemic, symptoms such as feeling anxious (n=23.28 percent), feeling sad (n=33.41 percent), and worrying (n=37.46 percent) were often reported by elderly people [5]. In the study of Bendau et al., the elderly have little knowledge about COVID-19, COVID-19 is still widespread, and relatives and friends are discussing relevant information, which might have promoted an escalation of fears and anxieties, especially

among older adults with generalized anxiety disorder [6]. In addition to the "less gathering" policy during the epidemic, many elderly people are not familiar with the utilization of the Internet themselves. Long-term home living has cut off the communication channels between elderly people and the outside world, increased the loneliness of elderly people, and increased the probability of anxiety and depression in elderly people [7]. According to a study of older adults in Chile, confinement resulted in great stress and concern for older adults, increasing their levels of anxiety, depressive symptoms, and other health problems, such as memory problems, stomach or bowel problems, feeling down and sleeping problems [8]. The increase in health problems and feelings of anxiety was associated with increased depressive symptoms during COVID-19 confinement [9].

This study focuses on older migrants in China taking care of their children and offspring. Given the cultural virtues of filial piety and familial care, the phenomenon of older migrants along with adult children in China is often considered a positive manifestation of traditional support and values [10]. These older migrants may be viewed as a happy group due to benefits associated with family reunion and reciprocal support from adults. However, an increasing number of studies describe challenges facing these older migrants and resultant mental health impacts. It has been found that immigration has a negative impact on their psychology [11]. Migrant elders lack a sense of belonging and suffer from a higher probability of depression and lower subjective well-being. Previous network analysis studies have noted that subjective well-being is correlated with depressive symptoms (suicidal depression). The main reason is that migration may affect a family's neighborhood network or social functioning. It shows that social functioning is an important social determinant of health (i.e., social participation, loneliness) and has impacts on health outcomes (i.e., health-related quality of life, cognitive impairment, dementia, depression and mortality) [12-15].

However, a prior study assumed that the positive aspects of migration (e.g., family reunion) in influencing mental health outnumbered the negative aspects of migration (e.g., broken neighborhood network) among middle-aged and older adults in China [16]. Previous research is controversial. Previous studies have focused more on the anxiety and depression of older adults or the loneliness of older migrants after COVID-19. However, there is a lack of psychological research on older Chinese migrants after the COVID-19 pandemic. The results of older migrants in Belgium and the Netherlands indicate that the coronavirus pandemic had an important impact on older Chinese migrants' social life. A total of 21.4% of older Chinese migrants have experienced increased loneliness [17]. Therefore, it is urgent to investigate the psychological status of migrant elders during the COVID-19 epidemic and its relationship with subjective well-being. This study aims to explore the network relationship between subjective well-being, anxiety and depression and determine the correlation to provide clues for improving the subjective well-being of older migrants during the epidemic period.

Compared to more traditional statistical approaches, network analysis considers all variables for drawing a complex network that visually depicts the interrelations between variables [18]. Network analysis enables us to visualize the relationships between internal variables in anxiety and depression symptoms in older Chinese migrants and to explore indicators between variables such as strength and expected influence. Therefore, it is necessary to investigate symptoms of depression and anxiety in older migrants after the COVID-19 pandemic from a network perspective to provide related clinical implications. Moreover, the results of this study provide reference policy recommendations for older Chinese migrants on how to maintain mental health and alleviate anxiety and depression after the COVID-19 epidemic.

Materials and Methods

Participants

This study involved first-phase survey data from the Social Science Foundation Project of China, which is a follow-up study on the mechanism of intergenerational relationships on the mental health of older migrants. These data were collected from September 2019 to September 2020 in Nanjing, China. The participants in this study were recruited from 7 districts that were first randomly selected in Nanjing (Qinhuai, Qixia, Gulou, Xuanwu, Jianye, Yuhuatai, and Jiangning Districts), and 3 communities were randomly selected in each district.

We obeyed the following criteria to select the

participants: (1) aged 50 and above, without gender restriction; (2) having a household registration (Hukou) out of Nanjing; and (3) lived in Nanjing for over 10 years. Finally, a total of 469 questionnaires met the criteria in this study.

Measures

Hospital Anxiety and Depression Scale (HADS-A): HADS scale consists of 14 items of self-report questionnaires, including two subscales, which describe the anxiety (HADS-A) and depression (HADS-D) of the participants. This study selected the anxiety subscale (HADS-A) as the scale to measure the anxiety of the migrant elderly. The anxiety scale includes seven questions, and the score of each item varies from 0 to 3 points (referred to as "never", "a little", "yes but not serious" and "very serious", respectively), and the sum of the scores ranges from 0 to 21 points. The higher the score, the higher the level of anxiety severity. The reliability of the HADS-A scale for older migrants in Nanjing is high, and the internal consistency is excellent (Cronbach's α=0.815).

Patient Health Questionnaire-9 (PHQ-9): The Patient Health Questionnaire-9 (PHQ-9) is a self-report measure designed for criteria-based diagnoses of depression in primary care [19]. This questionnaire includes 9 questions. The score of each item varies from 0 to 3 points (referred to as "never", "several days", "half the days" and "almost every day", respectively), and the sum of the scores ranges from 0 to 27 points. The higher the score, the greater the probability of suffering from depressive symptoms. The internal consistency of the PHQ-9 score was excellent in the study (Cronbach's α=0.814).

Data analysis

The descriptive analysis of these data is based on SPSS 27.0, with 469 valid questionnaires. The comorbid depression and anxiety network analysis was performed using R software [20].

Network analysis

The network analysis adopts the Gaussian graph model, which proposes an undirected network model with a partial correlation coefficient [21]. In the Gaussian graph model, nodes represent items or symptoms, and edges represent partial correlation coefficients between two nodes. The Gaussian graph model can provide the following information: (1) The edges in GGM can be interpreted without relying on causal interpretation, and it shows which items can be predicted by other items; (2) If there is an edge between two nodes, there may be a potential causal relationship between these two nodes. The GGM model can predict the potential causal relationship [22]. Therefore, we use the mgm package in R version 4.1.2 to build a Gaussian graph model using the glasso function and use the "least absolute shrinkage and selection operator" (Lasso) regularization analysis, which reduces all weak partial correlations between nodes to absolute zero [23]. Then, only the most meaningful edges are left [24]. In the drawn graph model, the red edge between nodes represents the negative correlation between the two nodes, and the green edge represents the positive correlation. The thickness of the edges represents the tightness of the relationship between nodes. A thicker edge means a stronger correlation between two adjacent nodes. The colored part in the circle around the nodes represents the predictability of the node. We use the qgraph package to visualize the network. The most central node is placed in the middle of the network.

Network accuracy and stability

This study uses the bootnet package in R version 4.1.2 to calculate the accuracy and Stability (CS) of the network. The accuracy of the network is calculated by calculating the 95 percent bootstrap CI of the edge weight, and nonparametric bootstrapping (1000 bootstrap samples) is used to construct the CI [25]. Narrow CI edges have higher accuracy, which proves that the accuracy of edges is better [26]. This study uses the framework of the case-dropping subset bootstrap to test the stability of the data. This study proposes a measure that terms the correlation stability coefficient or the CS coefficient. Previous research shows that the CS coefficient should not be less than 0.25, preferably more than 0.5, which can effectively prove the stability of network data [18]. This study uses the bootstrap difference test to test whether there is a significant difference between edges and nodes [19]. If the leading CI contains 0, it means that the difference is meaningless.

Node centrality and expected influence

In the qgraph network, the central node is positioned in the middle of the network. The indicators of node centrality mainly include strength, between-ness and closeness. The high value symptoms of strength, between-ness and closeness are considered important [20].

Previous studies have shown that among these three centrality indicators, strength centrality can explain the centrality of network analysis more clearly and is more direct than the interpretation of between-ness and closeness [21]. The higher the strength centrality, the more likely it is that this symptom will occur at the same time as other symptoms. In this study, we use the Expected Influence (EI) indicator to evaluate nodes with high impact. EI is similar to the strength, but EI retains the positive and negative values of the edge weight, which is more applicable to the network of this study than the strength centrality [22]. Expected influence is defined as the sum of the value of all edges connecting to a specific node. EI assesses the impact of a node on its neighboring nodes (sharing an edge). The higher the expected influence, the more important it is in the network. In addition, we used R-package network tools to calculate the bridge expected influence for each node and then identified the bridge symptoms. Bridge expected influence is defined as the sum of the value of all edges connecting a specific node with nodes in the other community. Higher bridge expected influence values indicate a greater extent of increasing risk of contagion to other communities. In the current network, nodes were divided into two communities in advance: one community included nine depression symptoms (PHQ-9), and the other community consisted of seven anxiety symptoms (HADS-A). To identify bridge symptoms, we conducted a rigorous method with a blind 90th percentile cut-off on the value of bridge expected influence to avoid the confirmation bias that might arise when we interpret bridge centrality statistics. Moreover, we used the R package mgm to compute the predictability for each node. Predictability refers to the extent to which the variance of a node can be explained by all of its neighbors. Predictability can reflect the control ability of the network: When the predictability of a node is high, we can control it *via* its neighboring nodes; when the predictability of a node is low, we can directly intervene on itself or look for other variables out of the network to control. The higher the EI value of a node is, the greater the impact on its connected nodes. Therefore, taking intervention measures against nodes with high EI values can better inhibit them from connecting other nodes.

Network comparison

This study uses the Network Comparison Test package of R version 4.1.2. The Network Comparison Test (NCT) is a novel method to directly test for differences between networks of two datasets, which is applicable to the study of the differences in the network distribution of the anxiety and depression scale for gender or other demographic indicators among migrant elders. This test is a two-tailed permutation test in which the difference in the network structure of the two groups is calculated repeatedly (1,000 times) for randomly regrouped individuals [23]. With the EBIC parameter set at 0.5, following the GLASSO procedure. Specifically, this evaluated the null hypothesis that the network connectivity was similar in the randomly regrouped permutations of participants [3]. In this study, the NCT is made for the network diagram of different demographic indicators of the elderly migrants. In NCT, the total strength of the network diagram (assuming that the network structure between different indicators is the same) and one-to-one edge strength (assuming that each edge is the same in the queue) are tested.

Results

Descriptive statistics

Among the 469 participants, the average age range was 65 to 69 years old, of which 322 were female participants, accounting for 68.7 percent. Of the 469 participants, 396 elders were married, 65 elders were widowed, and 8 elders were divorced (Tables 1 and 2). The majority of the elderly are junior high school or below, accounting for 82.1 percent (385). In the survey scale, 7.1% (31) of the older migrants without anxiety symptoms received scores ranging from 0 to 7; the score of 41.6% (195) of the elders ranging from 8 to 10 received suspicious anxiety symptoms. The elderly with anxiety scores ranging from 11 to 21 points accounted for 51.8% (243), and even one of them scored 20 points. The scoring standard of the PHQ-9 scale is as follows: 0 to 4 points indicates no depression; 5 to 9 points indicates mild depression; 10 to 14 points indicates moderate depression; 15 to 19 points indicates relatively serious depression; and 20 to 27 points indicates severe depression. Among the migrant elders in Nanjing, 44.6% (209) had no depressive symptoms. Older migrants with mild depression accounted for 42.9% (201), and older migrants with moderate depression accounted for 10.2% (48). The older migrants with relatively severe depression accounted for 2.1% (10) and 0.2% (1) of the older migrants with severe depression.

Table 1. Mean scores, standard deviations, predictability and abbreviation for each item of the HADS-A and PHQ-9.

Tool	Items	Abbreviation	M ± SD	Pre
HADS-A	A1. Feeling nervous or excited	Tension	1.53 ± 0.586	0.444
	A2. Having the feeling of fear	Fear	1.59 ± 0.684	0.584
	A3. The worried thoughts always in mind	Worry	1.54 ± 0.648	0.425
	A4. Sit quietly and feel relaxed	Relax	2.04 ± 0.956	0.147
	A5. A series of scared feelings	Butterflies in the stomach	1.37 ± 0.541	0.422
	A6. Feel uneasy because as had to keep moving	Restless	1.69 ± 0.81	0.674
	A7. Suddenly feel panic	Intense fear	1.74 ± 0.85	0.661
PHQ-9	D1. Having little interest in doing things	Anhedonia	0.71 ± 0.713	0.365
	D2. Always feel low, frustrated, or hopeless	Sad mood	0.55 ± 0.65	0.454
	D3. Cannot enter or maintain a comfortable sleep	Sleep	1.01 ± 0.905	0.24
	D4. Feel tired and lack vitality	Energy	0.86 ± 0.811	0.376
	D5. Have poor appetite or overeating	Appetite	0.45 ± 0.661	0.275
	D6. Have a bad feeling	Guilt	0.42 ± 0.631	0.394
	D7. Attention is unable to concentrate	Concentration	0.61 ± 0.713	0.231
	D8. Movements or speaking are so slow	Motor	0.62 ± 0.664	0.314
	D9. Self-harm would be better	Self-harm	0.24 ± 0.567	0.34
Note: M=Mean; SD=Standard Deviation; Pre=Predictability.				

Table 2. Statistical description.

Variables		older migrants (n=469)	Groups
		n (percent)	p
Gender	Male	147 (31.3)	-
	Female	322 (68.7)	
Marital status	Married with spouse	396(84.4)	<0.001
	Widowed	65 (13.9)	
	Divorced	8 (1.7)	
Education level	No formal education	122 (26)	<0.001
	Elementary school	144 (30.7)	
	Junior high school	119 (25.4)	
	High school	64 (13.6)	
	College and above	20 (4.3)	

Network structure

There are 120 possible edges in the overall network diagram of the older migrants, of which 78 are not zero (65 percent). The negative correlation is obvious between the flowing edges, and the connection between "relax" and "motor" (weight=-0.073) was the strongest negative edge, followed by "concentration" and "sad mood" (weight=-0.045). The edge between "restless" and "intense fear" (weight=0.57) was the strongest edge in the anxiety community, followed by "tension" and "fear" (weight=0.38) and the edge between "restless" and "butterflies in the stomach" (weight=0.28). Additionally, the strength of the edge between "worry" and "fear" (weight=0.26) is also obviously high. In the depression community, the connection between the nodes "anhedonia" and "sad mood" (weight=0.31) was the strongest edge, and the edges between "worthless" and "suicide" (weight=0.3) were also definitely strong. The edge between "restless" and "intense fear" has a significant difference from all other edges, and this edge strength is higher, which has a significant difference from more than 90% of other edges (Figure 1). Bootstrapped 95% confidence intervals indicated that the accuracy of edge weights was relatively reliable and accurate. Moreover, in the current network, the bootstrapped difference test for edge weights indicates that the six strongest edge weights are significantly different from approximately 90% to 100% of the other edge weights. Node predictability is visualized as a circle around the node in Figure 2a. The value of node predictability ranges from 15% to 68%, and the average is 40%. This indicates that on average, 40 percent of the variance of nodes in the current network can be explained by their neighboring nodes. Among them, nodes A2 (fear), A6 (restless) and A7 (intense fear) are highly predictive, and node A6 (restless) has a maximum of 68 percent, indicating that its 68 percent variance can be explained by the symptoms of surrounding nodes. The predictability of the A4 (relax) node is only 15 percent, indicating that only 15 percent of its variance can be explained by the symptoms of surrounding nodes. In the expected influence diagram of this study, the strength and expected influence of "fear", "restless", "intense fear" and "guilt" nodes are higher, and the values of these nodes are greater than 0.9, indicating that the correlation of "fear", "restless", "intense fear" and "guilt" is higher in the network (Figure 2b). Among them, the expected influence values of "relax" and "sleep" are low, indicating that their correlation is weak in the whole network. Figure 3 shows the bridge symptoms of the network. In the bridge EI diagram, "relax" and "fear" in the HADS-A and "guilt" in the PHQ-9 are bridge symptoms. This shows that "relax" and "fear" in the current network are most likely to increase the risk of depression and anxiety symptoms. However, the "guilt" in depressive symptoms has the greatest risk of development to anxious symptoms.

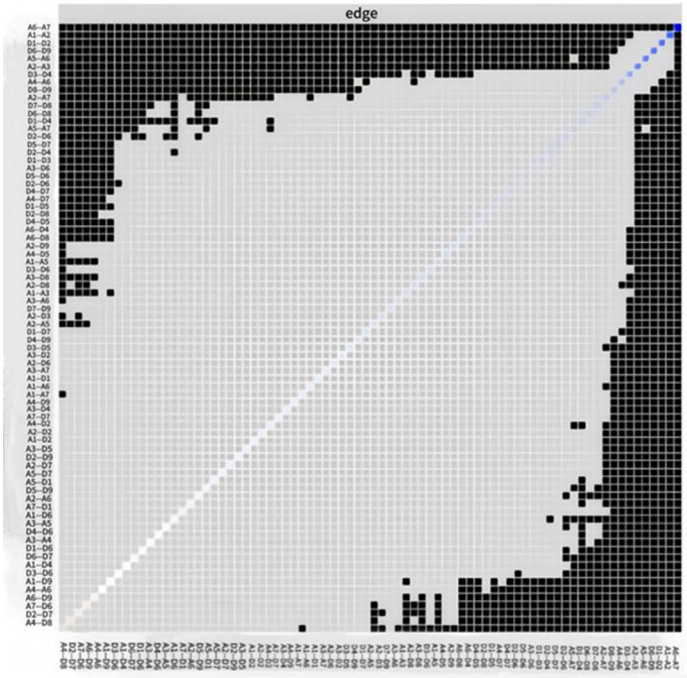

Figure 1. Edge differences between restless and intense fear.

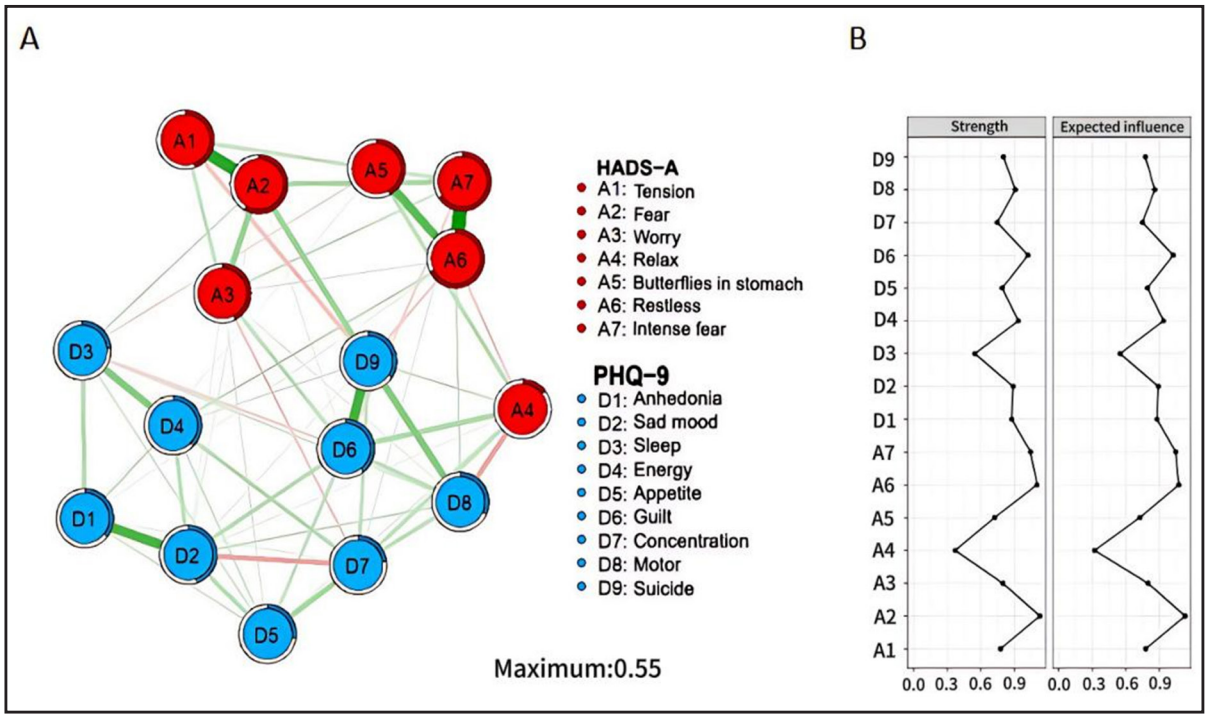

Figure 2. The network structures of anxiety and depressive symptoms. (A) All older migrants (B) Strength and expected influence.

Network stability

The expected relative influence CS value of nodes is 0.52, indicating good stability (Figure 4).

The accuracy and Stability (CS) value of the node is 0.6, which indicates that the stability of the network is good (Figures 5 and 6).

Moreover, the bootstrapped difference tests for node expected influences show that the expected influences of the three symptoms with the highest expected influences are significantly different from approximately 50 percent to 88 percent of the other symptoms (Figure 7).

In the bootstrap diagram of the overall network, the gray area is narrow, the 95% CI is high, the edge accuracy of the network results is good, and the accuracy of the network is high.

Flow network of Subjective Well-Being (SWB)

Figure 8 shows a flow chart. According to previous studies, subjective well-being and depression and anxious symptoms are negatively correlated. In the flow chart, "suicide" and SWB (weight=-0.38) have the strongest negative correlation, followed by "sad mood" and "worry" (weight=-0.13), and the last directly connected node is "anhedonia".

The confounding effects of gender, marriage and education on the depression and anxiety network model

From the overall NCT difference diagram, it can be seen that the difference between male and female network diagrams is not significant (p=0.933), and the difference in strength between male and female network diagrams is not significant (p=0.869).

In terms of education, 226 people (56.8 percent) were illiterate and educated in primary school, and 243 people (51.8 percent) were educated in secondary school or above.

There was no significant difference between the overall network diagram and the strength network diagram of the two cultural levels (p=283; p=0.3).

In terms of marriage, 77.4% (363) of the elderly with spouses and 22.6% (106) of the elderly who were widowed or divorced had no significant difference between the overall network diagram and the strength of the elders with or without spouses (p=0.628; p=0.707) (Figure 9).

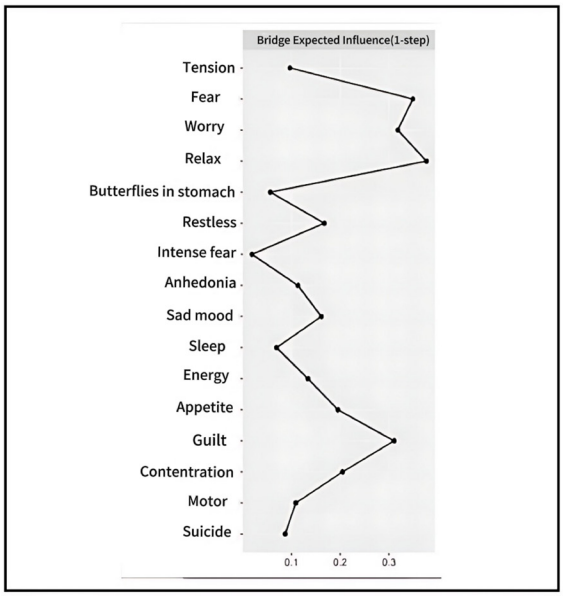

Figure 3. Centrality plot depicting the expected bridge influence of each symptom in the network.

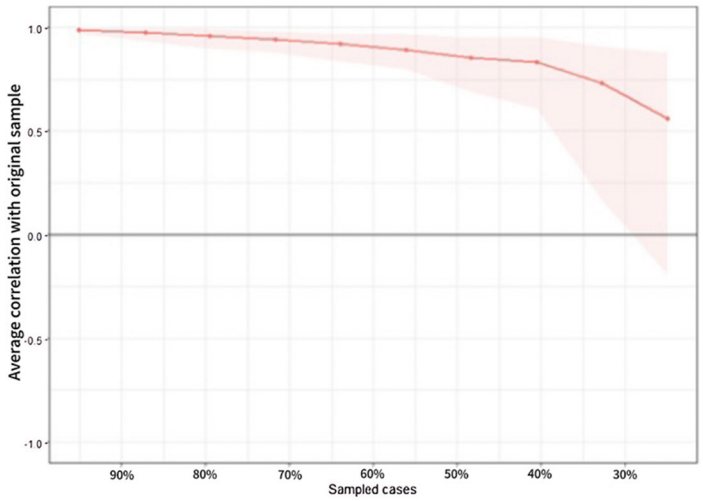

Figure 4. Bridge expected influence accuracy and stability. Note: (—) Bridge expected influence.

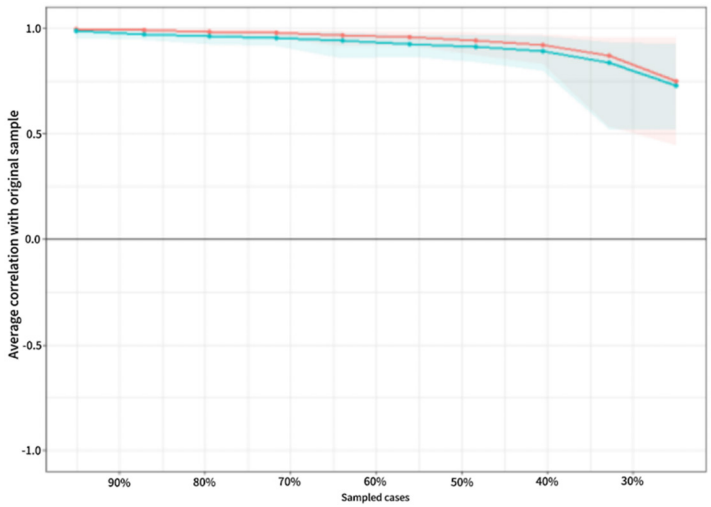

Figure 5. Accuracy and stability. Note: (—) Expected influence; (—) Strength.

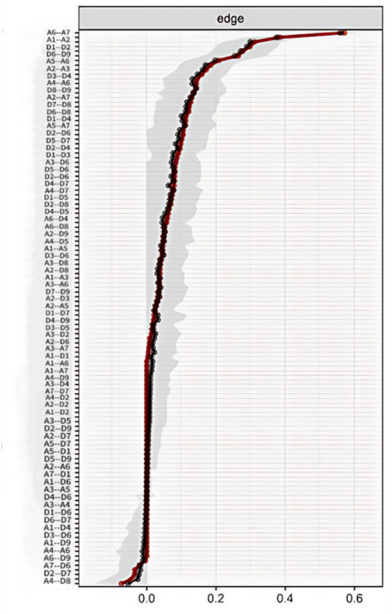

Figure 6. Bootstrapped difference tests for node expected influences. Note: (•) Bootstrap; (•) Sample.

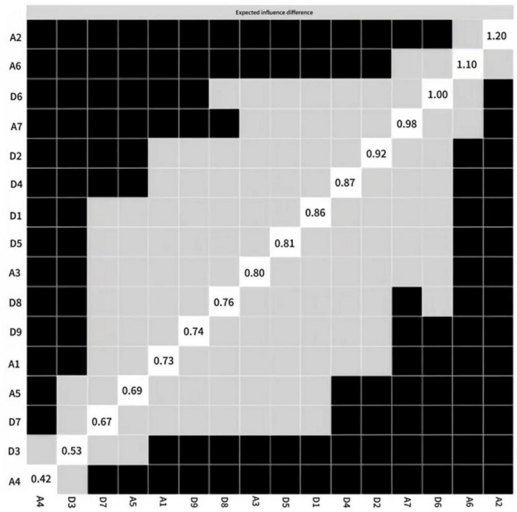

Figure 7. Expected influence difference.

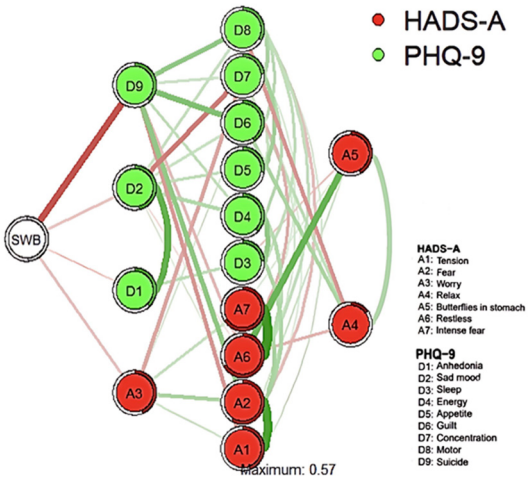

Figure 8. Flow network of subjective well-being.

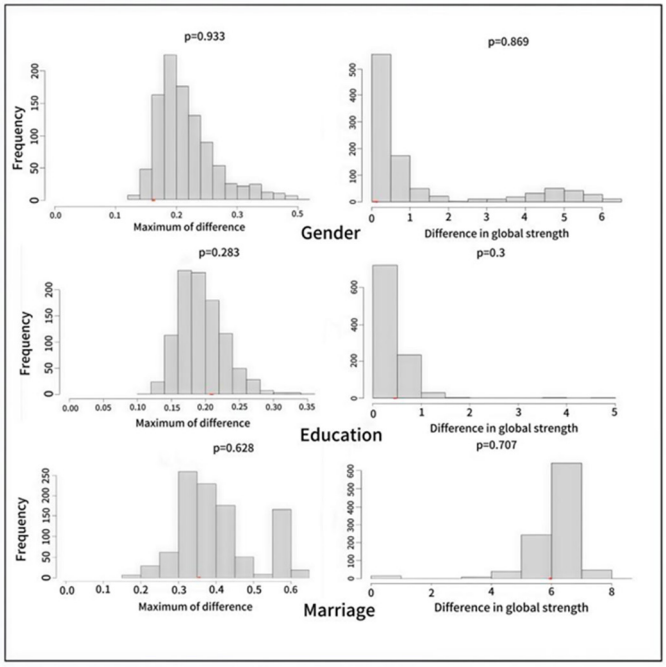

Figure 9. The confounding effects network model.

Discussion

To the best of our knowledge, this was the first study that characterized the network structure of depression and anxiety and their associations with subjective well-being in older Chinese migrants (N=469) during the COVID-19 pandemic. Network analysis was conducted to find the most critical problems leading to depression or anxiety among older migrants. Additionally, this study supports researchers in setting up accurate personalized programs to ensure mental health. The current study used network analysis to conceptualize the HADS-A and PHQ-9 questionnaires, as well as depression and anxiety symptoms in migrant elders from China. We also tested for basic demographic differences in each of our models.

Similar to previous studies, in the study of Lei Ren et al., "tension" and "worry" (weight=0.25), "restless" and "intense fear" (weight=0.24), and "fear" and "worry" (weight=0.20) were strongly correlated in the anxiety community [24]. In the current study, "anhedonia" and "sad mood" were the strongest predictors of depression symptoms. In previous studies, more attention has been given to the relationship between anhedonia and depressed mood or depression [25,26]. The strong correlation between these two nodes may be specific to older migrants in China, and further research is needed to confirm its relevance. In this study, the "fear" node is the most important symptom in the anxiety and depression network, followed by "restless", "intense fear" and "guilt". These symptoms are essential and influential in terms of understanding the structure of the depression and anxiety network model in this population. In the depression and anxiety network model, "restlessness" and "guilt" are the main symptoms among Chinese individuals. In previous studies, most older migrants used the GADS scale to evaluate anxiety. Similar to the findings in the GAD scale, "restless" symptoms are of great importance. "Worthless" is the most important symptom, which is consistent with previous studies on PHQ depression symptoms, whether before COVID-19 or during COVID-19 [27,28]. The fear and panic of "fear" and "intense fear" nodes found in this study become the main symptoms. According to a previous study in Italy and Spain, 50% of elderly individuals aged over 50 reported feeling more sadness and depression than before COVID-19. A study on elderly individuals in Spain found that health literacy affected people's fear of COVID-19. The massive amounts of information related to COVID-19 on social media exceeded the information-processing capacity of the individuals, which led to a higher level of COVID-19 epidemic fear [29]. Especially for elderly individuals who do not have high health literacy at present, they cannot accurately filter false information, and they cannot avoid panic [30]. During the COVID-19 pandemic, China

mainly adopted the policy of advising citizens to "go out less", which led the elders to stay away from social places. The lack of socialization as a result of social isolation or curfew has pushed individuals into emptiness and caused an increased tendency for psychological disorders. The China Mobile Population Development Report 2016 pointed out that the main reasons for the flow of the elderly include taking care of children and providing for the aged and employment. Many families experienced economic pressure and social pressure during the epidemic [31].

More pressure on family members also brought more serious psychological burden, including anxiety, fear and other psychological behaviors. In a study of countries in the Middle East and North Africa, it was found that many families have economic problems such as unemployment or wage decline caused by COVID-19 [32]. This will lead to psychological problems for people affected by economic pressure and bring psychological pressure to other members of the affected families.

The network analysis revealed that bridge symptoms connecting depression and anxiety communities included "relax" in the HADS-A and "fear" and "guilt" in the PHQ-9. The results of these bridge symptoms in other studies are consistent [33-35]. "Relax" is the bridge center symptom in HIV patients and in patients who have been diagnosed with anxiety and depression [33,35]. Clinically, bridge symptoms, as well as communities, can be regarded as trans-diagnostic, and interventions that target them are more likely to be effective for both disorders. Elderly individuals can relax through clinical relaxation exercises or behavioral activation when facing situations that are difficult to relax [35].

A study on the physical and mental health of elderly individuals in Britain during the epidemic period pointed out that, especially during the isolation period, elderly individuals who have a part of private outdoor activity space will be better able to relax their body and mind [36]. Khalaf et al, and other researchers found that during the COVID-19 pandemic, elderly individuals' fear score was significantly positively correlated with the score of the HADS Anxiety and Depression Scale [37]. Moreover, the negative attitude of fear and anxiety and depression would present a vicious cycle, which may lead to higher levels of anxiety and depression symptoms in elderly individuals. In the existing studies, "guilt" is rarely found as a bridge symptom or an intermediate variable of anxiety and depression, which may be because most of the subjects in this study are women. Female elderly individuals have proven to have more emotional reactions to anxiety symptoms and stronger psychological reactions to emergencies such as COVID-19, and the prevalence of depression symptoms in women is higher than that in men [38,39].

It may be caused by psychological factors such as biology or cognitive impairment [40]. Most of the subjects in this study had a low level of education. Previous studies have noted that stresses in lower education/occupation groups would have resulted directly from the effects of COVID-19 [41]. Therefore, how "guilt" acts as a bridge between anxiety and depression can provide ideas for follow-up research.

Subjective Well-Being (SWB) is defined as a personal perception and experience of the proper balance of positive and negative emotions, cognitive and emotional assessments of one's life and life satisfaction [42]. Subjective well-being includes two dimensions: Life satisfaction and emotional state. The second dimension of subjective well-being concerns the emotional state; in particular, the affects can be positive (trust, joy, happiness) or negative (worry, fear) [43]. In this study, we focus on the anxiety and depression symptoms of older migrants. In previous studies, SWB and anxiety symptoms were directly negatively correlated, and there was a correlation between depression and SWB [44,45].

The possible reason is that during COVID-19, elderly individuals will pay more attention to their own health. In particular, many elderly people suffer from chronic diseases, which has deepened their concern and may be accompanied by family pressure and economic pressure brought about by mobility. Therefore, SWB is directly related to anxiety and depression symptoms. SWB leading to anxiety is directly related to anxiety and depression symptoms and has the strongest negative correlation with "suicide". In a study of data collection from 81 countries, it was found that negative interpersonal emotions may lead to increased suicidal emotions, thus reducing subjective well-being [46].

Positive emotions can prevent suicide and improve subjective well-being. An increasing number of studies have put suicide and subjective well-being into the network for analysis, but no research

currently believes that suicide has the strongest direct negative correlation with subjective well-being in anxiety and depression symptoms [47,48]. Liang et al., and others found that the suicide intention of the elderly after COVID-19's flow was higher than that before COVID-19's prevalence, and it was pointed out that the increase in suicide intention may be due to their pessimistic attitude towards the epidemic [49]. It leads to a despairing attitude towards life, which increases the tendency of suicide. Second, mass social isolation, although essential public health measures, may lead to some negative psychosocial and physical problems that could increase the risk for suicidality among migrant adults [50]. Third, public transport in many regions has been suspended to lower the risk of disease transmission [51].

Many elderly people even have chronic diseases or psychological diseases. In this case, they cannot go to the hospital in time, which may increase their tendency to commit suicide. Fourth, the migrant elders care for their children and other reasons. Many families faced economic pressure and other problems during the COVID-19 period, which made the psychological burden of the elderly population heavier. Thinking that they had increased the burden on their children and resulting in dangerous thoughts.

In this study, there is no significant difference in the network diagram of older migrants with different genders, educational backgrounds and marital statuses. It may be that most of the research subjects in this study were elderly women with spouses. The most likely reason for their mobility is to take care of their children, so the network difference is small.

Strengths and limitations

The strength of this study is the use of the network approach to visualize the correlation of depression and anxiety symptoms in older Chinese migrants during the COVID-19 pandemic. However, several limitations should be noted. First, this is a cross-sectional study aimed at the early stage of the pandemic, so the causal relationship between variables cannot be established, and further exploration is needed in a longitudinal study. Second, this study is only a network analysis of older migrants in China, and the results of bridge symptoms and central symptoms are difficult to generalize to other groups. The next step is to study anxiety and depression in a larger range of older migrants and find universality. Third, this study used the elderly self-assessment scale for anxiety and depression symptoms, which cannot completely identify elderly individuals who truly have anxiety and depression.

Conclusion

These correlations between symptoms should be considered for policy making and for the development of new interventions to lower the prevalence of anxiety and depression in elderly people. In future research, we can compare and analyze the similarities and differences in older migrants' networks across countries and regions, and we can conduct longitudinal research according to the time span.

When devising policies and interventions to reduce anxiety and depression rates among elderly people, it's vital to consider symptom interrelationships. Targeted efforts should focus on addressing the bridge symptom of "guilt," as indicated in this study, linking anxiety and depression. Enhancing life quality, bolstering social safety nets for older Chinese migrants, and related strategies can mitigate suicide risks and enhance subjective well-being. Future research should longitudinally explore psychological mechanisms influencing older Chinese migrants, comparing network analysis across countries and regions, thereby alleviating their anxiety and depression symptoms from a psychological perspective. Understanding these dynamics could inform more effective interventions tailored to their psychological needs.

Disclosure

Ethics approval and consent to participate

This paper has passed the ethical approval of Nanjing Medical University.

Consent for publication

The publication of this paper has obtained the consent of the research subjects.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Qian Tang and Ruoxiu Zhang explained the use of network analysis methods, and Chi Zhang analysed the data of older migrants in the early stage of the epidemic. Yuefan Zhao was a major contributor to writing the manuscript. All authors read and approved the final manuscript.

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