

Association Between Social Capital and Anxiety Among Older Adults in China: A Cross-Sectional Study

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Purpose: Social capital is one key determinant of older adults' mental health, yet its link with various demographic variables and anxiety among older adults in China remains underreported. This study investigated whether there is an interactive effect of social capital and demographic factors on anxiety among Chinese older adults.

Methods: A sample of 5115 Chinese older adults (≥ 60 years old) was extracted from cross-sectional survey data in the 2018 Chinese Longitudinal Health and Longevity Study (CLHLS). Data on demographic characteristics, social capital, and anxiety were collected. Binary logistic regression models and a classification and regression tree model (CART) were performed to assess the association between social capital and anxiety.

Results: The finding of this study showed that the prevalence of anxiety among Chinese older adults was 13.04% (667/5115), subjects who were female (OR = 1.649; 95% CI: 1.336–2.036), with medium-level of annual family income (OR = 0.598; 95% CI: 0.476–0.751), with reporting 1–2 diseases (OR = 1.743; 95% CI: 1.322–2.298), with medium-level of interpersonal trust (OR = 0.668; 95% CI: 0.533–0.837), social participation (OR = 0.521; 95% CI: 0.390–0.696), social support (OR = 0.431; 95% CI: 0.264–0.703) were at a lesser risk of developing anxiety. We also noted the interactive relationship of social capital associated with anxiety, which indicated that special attention and efforts should be paid to older adults who were females, with lower interpersonal trust, annual family income, and lower social participation to maintain sound mental status.

Conclusion: Our findings indicate that social capital is associated with anxiety in Chinese older adults. This implies that social capital, especially in terms of gender, annual family income, interpersonal trust, and social participation may be significant for alleviating anxiety in later life.

Keywords: anxiety, interpersonal trust, social participation, social support, older adults, decision tree

Introduction

The escalating prevalence of mental health issues among older persons is a primary worldwide public health concern. Studies have shown that anxiety, a negative emotional state, has a negative influence on the health and well-being of older people.^{1,2} This effect includes correlations with dementia and cognitive decline, leading to a degraded quality of life for older persons.^{3,4} As the aging population grows, it is critical not to underestimate the relevance of anxiety when measuring the mental well-being of older adults, with significant consequences impacting a proportion ranging from 2.4% to 29.8%.^{5,6} During the first year of the COVID-19 pandemic, the World Health Organization recorded a remarkable 25.6% increase in worldwide instances of anxiety disorders (ADs).⁵ In China, the estimated incidence of anxiety disorders among older persons is 6.79%, with an anxiety symptom rate of 22.11%.^{7–9} Given China's fast and inevitable aging trend,¹⁰ addressing the issue of reducing

anxiety and promoting healthy adaptation and management becomes critical in public health research. This issue is highlighted not just by the individual effect on mental health but also by the more significant implications for the aging population's general well-being and quality of life.

Social capital is pivotal in influencing mental health, encompassing various organizational characteristics (eg, interpersonal networks, reciprocity, and social trust, facilitating coordinated actions, and enhancing societal efficiency).^{11,12} Prior research has robustly confirmed a positive association between social capital and psychological well-being, particularly among older adults with limited healthcare resources access.^{13,14} Notably, social capital mitigates the likelihood of mental health problems by alleviating chronic negative emotions experienced by individuals. Older adults with high social capital exhibit mental health odds 5.73 times higher than those with low social capital.¹⁵ This result was attributed to two primary factors: firstly, social capital promotes increased physical activity, subsequently contributing to improved health status. Secondly, social capital fosters positive attitudes; wielding a more substantial influence on health status than physical activity.¹⁶ These findings were corroborated by studies among Nordic region's older populations.¹⁷ In China, recent studies of older adults' social capital were linked with mental well-being,¹⁸ demographic variables,¹⁹ cognitive capacities,²⁰ and depression.²¹ However, investigations associating older Chinese people's social capital with anxiety remains underreported.

The desire to alleviate anxiety has emerged as a pivotal motivation for older adults to actively seek social support and engage in social participation, thereby avoiding the persistence of low-level stress that leads to mental illnesses.²² The dimensions of social capital, including social support, trust, and participation, have been shown in previous research to exert significant effects on older adults' mental health.^{23–25} Research has demonstrated that positive social engagement significantly alleviates negative emotions and enhances their mental health.²⁶ For instance, an Australian residential aged care facility's telephone befriending intervention program demonstrated that social support can effectively reduce anxiety, empowering older individuals to regain confidence and actively participate in community social activities.^{27,28} However, within China's socio-cultural context, excessive social involvement may inadvertently elevate interpersonal stress and lead to behaviors such as smoking and drinking, reduce family interactions, and contribute to heightened mental stress, anxiety, and psychological problems.²⁹ Therefore, there is a need to further investigate how older Chinese people's social capital influences their anxiety.

Older individuals' anxiety is subject to a multitude of influencing factors, among which lower levels of social capital have been identified as significant contributors.^{30–32} Even though numerous research has been conducted on these factors, more needs to be done to confirm how they might interact with social capital to affect anxiety outcomes. Most studies reported a combination of decision tree models and logistic regression in analyzing the factors related to self-reported health status or studies about the relationship between social capital and anxiety among older adults in specific provinces or cities,^{33,34} but few have extended to a national level.

To address existing studies' limitations, we utilized an analytical approach to scrutinize the intricate interactions among diverse demographic variables that impact the health status of the elderly population.³⁵ Moreover, we utilized large-scale national data to improve the generalizability of the findings. Therefore, this study investigated whether there is an interactive effect of social capital and demographic factors on anxiety among Chinese older adults. By delving into these multifaceted relationships, we can formulate targeted and efficacious interventions that may prove valuable to combat anxiety among older individuals.

Methods

Study Population and Data Source

This study was based on data from the cohort study conducted by the Center for Health and Family Research on Aging at Peking University using the Chinese Longitudinal Health and Longevity Study (CLHLS) in 2018 (<https://opendata.pku.edu.cn/dataverse/CHADS>).³⁶ The CLHLS recruited a sample of older adults in China through a simple random sampling process covering approximately half of the counties and cities across 22 of the country's 31 provinces.^{37,38} This study focused on the cross-sectional survey data from the 2018 wave. We used an analytic sample that featured 5115 older adults after excluding those aged below 60 years and those who had reported incomplete data on the independent and dependent variables of interest. Figure 1 illustrates the screening process.

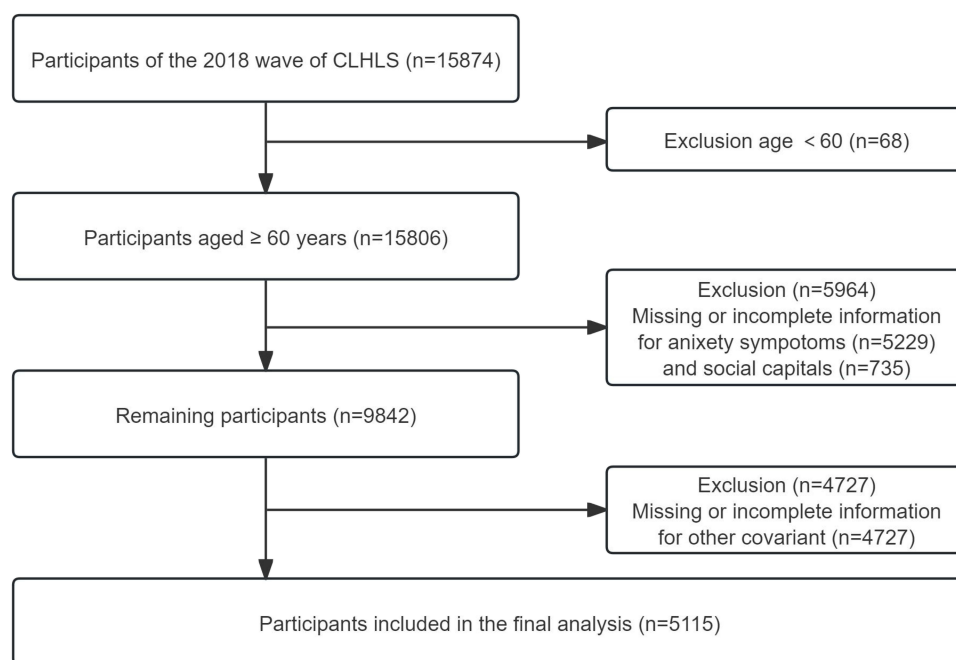


Figure 1 Flowchart of the study population.

Measurements

Demographic Characteristic

The demographic characteristics of the older adults used for this study were provided by information on gender, age, residence, marital status, education, cigarette smoking, alcohol consumption, pension insurance participation, annual family income, living arrangements, and the number of chronic diseases.

Measurement of Social Capital

Choosing social capital measures has led to varying findings in studies examining the relationship between social capital and health outcomes. Previous studies using individual-level social capital measures have consistently shown a strong association with positive health outcomes.^{39–41} This study captures individual-level social capital, incorporating elements including interpersonal trust, social engagement, and social support. These factors have been identified as important indicators of social capital related to health and healthcare utilization changes.^{30–32} We assessed social capital using three variables: interpersonal trust, which represents cognitive social capital; social participation, which represents structural social capital; and social support, which represents output.

Social capital, the main independent variable, was assessed by 3 questions in line with previous studies.⁴²

1. Question about interpersonal trust: “Do you often think that people around you are not trustworthy?” A score of zero points was assigned for “Often or always”, one point for “Sometimes”, and two points for “rarely or never”.
2. Question about social participation: “Do you currently participate in the following activities?” A total of 10 activities including household chores (cooking and bringing up children, etc). Tai chi, square dancing, visiting and socializing with friends, planting flowers or keeping pets, reading books and newspapers, raising poultry or livestock, playing cards or mahjong and other card games, watching TV and listening to the radio, participating in organized social activities were evaluated. The responses for each activity were assigned a value according to whether or not they were engaged in the activity, and then the responses for the 10 activities, were summed up and reassigned a value according to the following rules: “0 = not engaged in social activities, 1 = engaged in 1–2 social activities, 2 = engaged in 3 or more social activities”, respectively.

3. Question about social support: “Who is your primary caregiver when you are in poor health?” No points indicated no caregiver, one point indicated care by a housekeeper, neighbor, friend, or volunteer, and two points indicated care by parents, children, daughter or son-in-law, or other relatives.

The total score ranged from zero to six, with a higher score indicating a higher level of social capital.

Measurement of Anxiety

Anxiety, the dependent variable in this study, was evaluated by the seven-item Generalized Anxiety Disorder (GAD-7) scale,⁴³ which has been validated among Chinese older adults.^{44,45} Participants were asked the frequency with which they experienced the following symptoms in the past two weeks: “Feeling uneasy, worried, and annoyed”, “Being unable to control or stop worrying”, “Worrying excessively about different things”, “Feeling very tense and having difficulty relaxing”, “Feeling very anxious and having trouble sitting still”, “Being easily annoyed”, and “Feeling like something terrible is happening” (0 = never, 1 = for several days, 2 = over half the days, 3 = almost every day). The total score was calculated by summing the scores for each item, with a total score of between zero and 21. Higher scores indicated a greater severity of anxiety. Cut-off points of 5, 10, and 15 represent mild, moderate, and severe levels of anxiety, respectively. The scale has been shown to have good reliability and validity in Chinese populations.⁴⁶

Measurement of Other Variables

Information on the demographic and health-related variables was collected. These variables included gender (male, female), age (60–69, 70–79, ≥ 80 years old), residence (urban, rural), education levels: (educated (literate), uneducated (illiterate)), marital status (married, unmarried), pension insurance participation (yes, no), annual family income ($\leq 10,000$ yuan, 10,000–29,999 yuan, 30,000–89,999 yuan; $\geq 90,000$ yuan), living arrangement (living alone, living with family member(s), living in the aged care facilities), number of chronic diseases (0, 1–2, ≥ 3). We inquired about the medical background of the subjects, specifically if they had been identified with cardiovascular illnesses (hypertension, coronary heart disease, stroke, etc.), diabetes, chronic bronchitis, arthritis, dementia, cancer, depression, or liver or kidney-related ailments. The count of persistent ailments was determined according to the participants’ responses. Meanwhile, information on smoking and drinking status was also collected.

Statistical Analysis

Means, standard deviations, and composition ratios were used to describe the quantitative data. A binary logistic regression and decision tree models were constructed for the factors associated with anxiety among older adults. The decision tree model was based on the chi-square automatic interaction detection (CHAID) algorithm and used a pre-pruning technique to control the growth of the decision tree with a growth level of three and minimum sample sizes of 200 and 100 for the parent and child nodes, respectively. The differences between the two models were assessed using Receiver Operating Characteristic (ROC) curves. The ROC curves were plotted and exhibited by MedCalc v20.0.14 software. The two-sided test level was 0.05, with data analyzed using SPSS Statistics 25.0 (IBM Corp., Armonk, NY, USA).

Results

Demographic Characteristics

A total of 5115 participants (aged 60–116, mean 83.39 ± 11.58) were enrolled in this study. The sample were mostly comprised of females ($n = 2846$; 55.6%), married ($n = 2257$; 44.1%), city residents ($n = 2661$; 52.0%), educated ($n = 2581$; 50.5%), smoked ($n = 4283$; 83.7%) and drank ($n = 4547$; 88.9%). Over two-thirds of the participants had pension insurance ($n = 3188$; 62.3%). The majority lived with their family ($n = 4171$; 81.5%), with annual income of 30,000–89,999 yuan ($n = 1636$; 32.0%), and without chronic diseases ($n = 2428$; 47.5%) (Table 1).

Binary Logistic Regression Analysis of Factors Associated with Anxiety

Table 2 shows the results of the binary logistic regression model. Participants who were female (OR = 1.649; 95% CI: 1.336–2.036), with a medium annual family income (OR = 0.598; 95% CI: 0.476–0.751) had higher anxiety experiences.

Table 1 Demographic Characteristics and Univariate Logistic Regression Analysis of Associated Factors of Anxiety in the Group of Older Adults (n=5115)

Variables	N (%)	Wald χ^2	P
Gender			
Male	2269 (44.4)	21.691	<0.001
Female	2846 (55.6)		
Age (years)			
60–69	705 (13.8)	21.696	<0.001
70–79	1397 (27.3)	20.822	<0.001
≥80	3013 (58.9)	5.218	0.022
Residence			
City	2661 (52.0)	0.008	0.930
Rural	2454 (48.0)		
Education levels			
Educated (literate)	2581 (50.5)	3.278	0.070
Uneducated (illiterate)	2534 (49.5)		
Marital status			
Married	2858 (55.9)	3.179	0.075
Unmarried	2257 (44.1)		
Cigarette smoking			
No	4283 (83.7)	1.087	0.297
Yes	832 (16.3)		
Alcohol consumption			
No	4547 (88.9)	5.707	0.017
Yes	568 (11.1)		
Pension insurance participation			
No	3188 (62.3)	0.033	0.855
Yes	1927 (37.7)		
Annual family income			
Less than 10,000 yuan (very low income)	1496 (29.2)	23.040	<0.001
100,00–29,999 yuan (low-income)	1207 (23.6)	11.759	<0.001
30,000–89,999 yuan (medium income)	1636 (32.0)	19.430	<0.001
90000 yuan and above (high income)	776 (15.2)	8.231	0.004

(Continued)

Table 1 (Continued).

Variables	N (%)	Wald χ^2	P
Living arrangement			
With family member(s)	4171 (81.5)	3.084	0.214
Alone	856 (16.7)	2.494	0.114
Aged care facilities	88 (1.7)	0.873	0.350
Number of chronic diseases			
0	2428 (47.5)	17.879	<0.001
1–2	2165 (42.3)	15.492	<0.001
≥ 3	522 (10.2)	8.008	0.005
Interpersonal trust level			
Low (always/often)	819 (16.0)	138.800	<0.001
Medium (sometimes)	590 (11.5)	12.278	<0.001
High (seldom/never)	3706 (72.5)	40.530	<0.001
Social participation level			
Low (no activity participation)	499 (9.8)	19.881	<0.001
Medium (1–2 kinds of activities)	1571 (30.7)	19.420	<0.001
High (above 3 kinds of activities)	3045 (59.5)	7.874	0.005
Social support level			
Low (self-support)	97 (1.9)	15.805	<0.001
Medium (social support)	124 (2.4)	11.399	<0.001
High (family support)	4894 (95.7)	4.568	0.030
Anxiety			
No	4448 (87.0)	–	–
Yes	667 (13.0)	–	–

Table 2 Binary Logistic Regression Analysis of Associated Factors of Anxiety in the Group of Older Adults

Variables	β	SE	Wald χ^2	P	OR (95% CI)
Gender					
Male (reference)	0.500	0.107	21.691	<0.001	1.649 (1.336–2.036)
Age group (y old)					
60–69 (reference)			21.696	<0.001	1
70–79	–0.672	0.147	20.822	<0.001	0.511 (0.383–0.682)
≥ 80	–0.316	0.138	5.218	0.022	0.729 (0.556–0.956)

(Continued)

Table 2 (Continued).

Variables	β	SE	Wald χ^2	P	OR (95% CI)
Alcohol consumption					
No (reference)	-0.424	0.177	5.707	0.017	0.655 (0.463~0.927)
Annual family income					
Less than 10,000 yuan (very low income) (reference)			23.040	<0.001	1
100,00–29,999 yuan (low-income) (reference)	-0.500	0.146	11.759	<0.001	0.607 (0.465~0.807)
30,000–89,999 yuan (medium income) (reference)	-0.514	0.117	19.430	<0.001	0.598 (0.476~0.751)
90000 yuan and above (high income) (reference)	-0.337	0.117	8.231	0.004	0.714 (0.567~0.899)
Number of chronic diseases					
0 (reference)			17.879	<0.001	1
1–2	0.555	0.141	15.492	<0.001	1.743 (1.322~2.298)
≥ 3	0.262	0.092	8.008	0.005	1.299 (1.084~1.557)
Interpersonal trust level					
Low (reference)			138.800	<0.001	1
Medium	-0.404	0.115	12.278	<0.001	0.668 (0.533~0.837)
High	0.878	0.138	40.530	<0.001	2.406 (1.836~3.152)
Social participation level					
Low (reference)			19.881	<0.001	1
Medium	-0.652	0.148	19.420	<0.001	0.521 (0.390~0.696)
High	-0.401	0.143	7.874	0.005	0.670 (0.506~0.886)
Social support level					
Low (reference)			15.805	<0.001	1
Medium	-0.842	0.249	11.399	<0.001	0.431 (0.264~0.703)
High	-0.218	0.365	0.357	0.550	0.804 (0.393~1.645)

Notes: The independent variables and their assignments were as follows: gender: 0 = male, 1 = female; age: 0 = 60–69 years old, 1 = 70–79 years old, 2 = >80 years old; education levels: 0 = educated (literate), 1 = uneducated (illiterate); alcohol consumption: 0 = no, 1 = yes; annual family income: 0 = less than 10,000 yuan, 1 = 1–29,999 yuan, 2 = 3–89,999 yuan; 3 = 50000 yuan and above; the number of chronic diseases: 0 = low, 1 = medium, 2 = high; trust in people: 0 = low, 1 = medium, 2 = high; social participation level: 0 = low, 1 = medium, 2 = high; social support level: 0 = low, 1 = medium, 2 = high.

The odds of developing anxiety increased with the number of diseases were the highest among respondents reporting 1–2 diseases (OR = 1.743; 95% CI: 1.322–2.298). Individuals with higher interpersonal trust (OR = 0.668; 95% CI: 0.533–0.837), social participation (OR = 0.521; 95% CI: 0.390–0.696), social support (OR = 0.431; 95% CI: 0.264–0.703) were at a lesser risk of developing anxiety.

Decision Tree Model Analysis of the Factors Influencing Anxiety Based on the CHAID Algorithm

The results of the classification and regression tree (CART) model are shown in Figure 2. The development of anxiety was associated with gender, education levels, annual family income, interpersonal trust, and social participation. Furthermore, we observed interactive effects among different dimensions of social capital and diverse variables.

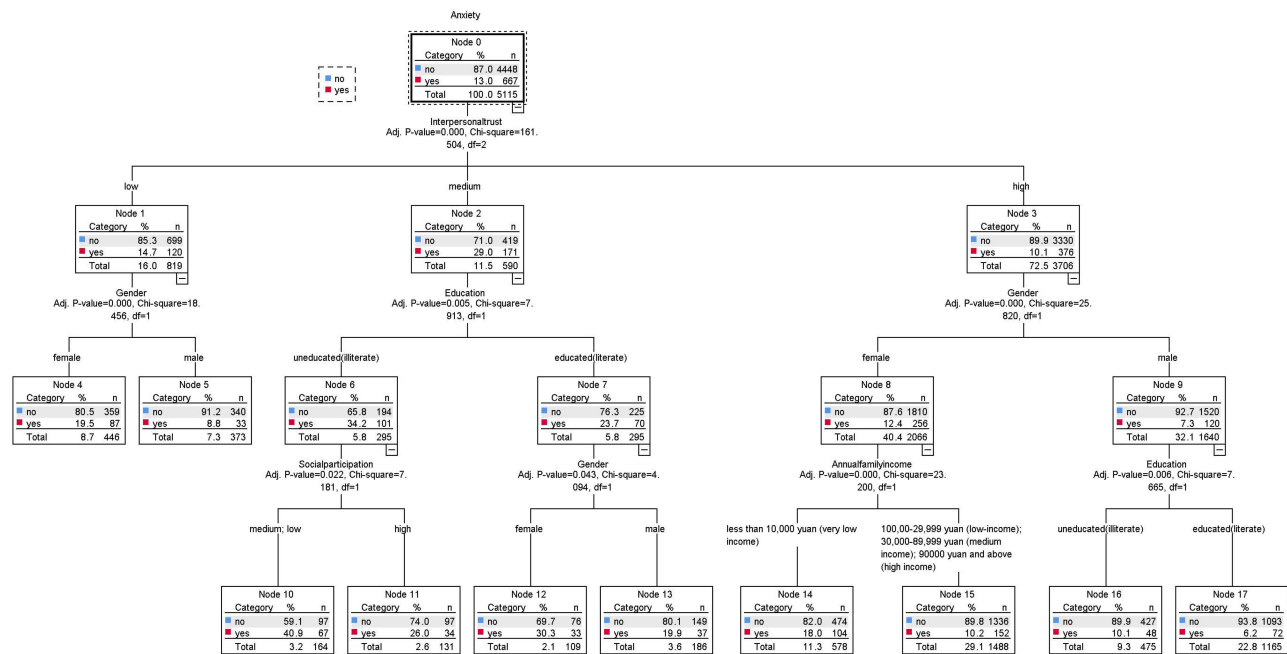


Figure 2 Decision tree model analysis of associated factors of the community older adults' anxiety based on the CHAID algorithm.

Our analyses reveal that interpersonal trust emerges as the most influential factor associated with anxiety. Accordingly, we segmented the sample into subsets based on this pivotal factor. Within Node 1, participants characterized by low levels of interpersonal trust, particularly females (Node 4), exhibited a heightened susceptibility to anxiety compared to males. Conversely, those situated in Node 2, characterized by a medium level of interpersonal trust, and who were illiterate (Node 6) while actively engaging in social participation (Node 10), were found to be most prone to experiencing anxiety. Meanwhile, respondents with an educational background (Node 7) and females (Node 12) were also more inclined to experience anxiety compared to their male counterparts (Node 13).

Individuals reporting high levels of interpersonal trust (Node 3), males (Node 9), and those with an education (Node 17) were identified as the least likely to experience anxiety. In a distinct pattern, females (Node 8) with very low annual incomes (less than 10,000 yuan) (Node 14) demonstrated a higher likelihood of suffering from anxiety when contrasted with individuals with higher family incomes (Node 15).

Comparison of the Prediction Results Between the Binary Logistic Regression and Decision Tree Models

Table 3 shows the comparison of the prediction results between the binary logistic regression and decision tree models. The area under the curve (AUC) with 95% confidence intervals (CI) for the binary logistic regression and decision tree models were 0.685 (0.663–0.707) and 0.644 (0.641–0.686), as illustrated in Figure 3. Both models exhibit AUC values

Table 3 Comparison of the Prediction Results Between the Binary Logistic Regression and Decision Tree Models

Indicators	AUC	SE	P	Specificity	Sensitivity	95% CI
Binary logistic regression	0.685	0.011	<0.001	66.3%	61.2%	0.663–0.707
CART model	0.664	0.012	<0.001	71.9%	54.3%	0.641–0.686

Abbreviations: CART, classification and regression tree model; CHAID, chi-square automatic interaction detection; ROC, Receiver Operating Characteristic; AUC, area under the curve; SE, standard error; P, p value; CI, confidence intervals; CLHLS, Chinese Longitudinal Health and Longevity Study; Ads, Anxiety Disorders; GAD-7, Generalized Anxiety Disorder.

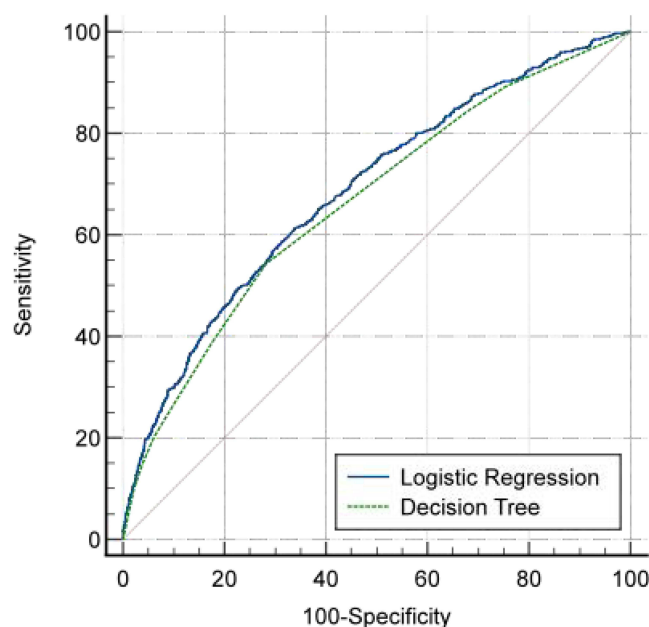


Figure 3 Comparison of the ROC curves of the binary logistic regression and decision tree models.

close to 0.700, indicating practical significance in their predictive capabilities and a degree of realism. The binary logistic regression model demonstrated a higher sensitivity (61.2%) in comparison to the decision tree model (54.3%). Conversely, the decision tree model exhibited greater specificity (71.9%) compared to the binary logistic regression model (66.3%).

Discussion

This study investigated the prevalence of anxiety, the association between social capital and anxiety, the interactive effect of social capital, and demographic factors on anxiety, and compared the predictive effects of social capital and anxiety among a large national sample of older adults in China. Our results confirmed the link between social capital and anxiety. They also showed that social capital and some other factors can make people more likely to develop anxiety later in life. This suggests that social capital is important for keeping older people's mental health in good shape.

The finding of this study showed that the prevalence of anxiety among Chinese older adults was 13.04% (667/5115). Comparatively, this result is higher than the anxiety rate of older adults in Guangzhou City (7.9%),⁴⁷ and lower than those in Shanghai city (17.0%) during the COVID-19 isolation period.⁴⁸ Across all studies, the same scale was used to measure anxiety. The participants in this study reported an anxiety level that is within the range of anxiety levels in previous studies.^{49,50} The variability may be related to geographic characteristics, sample size, population distribution, and measurement time point, and especially the strict social isolation against the COVID-19 pandemic that compromised the mental health of older adults. Therefore, it is crucial for older adult health policymakers to consider these variabilities in providing relevant programs to prevent or minimize their anxiety.

Relation of Social Capital Factors to Anxiety in Older Adults

The binary logistic analysis found that the prevalence of anxiety in older adults decreased with increasing levels of interpersonal trust. This finding suggests that study participants can experience less anxiety if they have high levels of interpersonal trust. This finding is consistent with Okamoto et al.⁵¹ and Zhang et al.⁴⁹ Increasing interpersonal trust among older adults living in nursing homes, through enhancing interpersonal communication, providing emotional support, and increasing the sense of safe belonging, may reduce loneliness and the burden of interpersonal interactions.⁴⁹ Moreover, a Japanese study highlighted that interpersonal trust serves as the strongest indicator of social capital associated with suicide, and increasing trust levels at both the individual and community

levels can effectively reduce suicidal ideation among older adults facing mental stress.⁵¹ Hence, interpersonal trust constitutes a critical component of positive interpersonal relationships that underpin the harmonious development of individuals and society.^{52,53} Therefore, older adult programs may focus on strengthening interpersonal trust (eg, open and respectful communication, inclusive healthcare practices) within the family, caregivers, and community.

Interestingly, the CART model showed that older adults with a medium level of interpersonal trust had higher rates of anxiety than those with low levels (29.0% vs 14.7%). This finding is consonant to the reports of Cheng et al⁵⁴ and Que et al.⁴² This group may struggle with striking a balance between trust and suspicion, leading to tension or defensiveness during social interactions. They expect to gain trust but hesitate to accept help or kindness from others, resulting in excessive psychological burden and anxiety if they are unable to gain practical benefits from social interactions. On the other hand, if they have an excessive level of trust in specific people and are easily incited and guided emotionally by those they trust, a crisis of trust when it occurs, can cause a huge psychological gap and result in severe psychological stress reaction.⁵⁰ Conversely, promoting interpersonal trust in strangers had a positive effect on an individual's mental health.⁵⁵ Therefore, we suggest that regular group activities in older adults may play a crucial role in increasing their sense of control and awareness in situations that test their trust and values, thus improving trust between individuals and reducing anxiety.

Older adults with high levels of social participation showed a lower prevalence of anxiety than those with low levels of participation in this study. Thus, supporting the findings of Chen et al⁵⁶ and Zhao et al.⁵⁷ This suggests that actively participating in social activities can reduce anxiety among older adults, and drawing on a diverse pattern of social participation can significantly improve their mental health and reduce the risk of negative emotions. Meanwhile, Zhao et al⁵⁷ pointed out that there was a negative association between social participation and depression in older adults and that increasing the level of social participation could reduce the occurrence of depression. Through participating in social activities, older adults can enhance their physical fitness and gain a clearer understanding of their social role, as well as identify their goals and increase their sense of self-worth. This, in turn, can reduce the development of anxiety. Therefore, we strongly recommend that communities make programs and opportunities to improve their recreational facilities and offer a diverse array of activities tailored to the interests of older adults, such as chess, tai chi, and square dancing. This will provide them with opportunities to enrich their social lives and improve their overall well-being.

We found that the higher the level of social support, the lower the prevalence of anxiety among older adults. This result indicates that increasing the level of social support among older adults can reduce the rate of anxiety. This finding is parallel to that of Long et al⁵⁸ and Li et al.⁵⁹ Older adults typically have a limited source of social support, relying mainly on family members, such as spouses and children.^{58,59} As their physical capabilities decline, leading to reduced passive social participation, they may require increased support from family members to maintain their physical and psychological well-being.⁶⁰ Jiang et al⁶¹ found that increasing the level of family support for older people in the community can ensure that they receive the material support, physical care, and emotional support they need from their relatives. This can help to reduce loneliness and improve their quality of life in old age, supporting the results of this study. Hence, involving family members in the care plan and social activities of older adults and utilizing community resources may enhance social connections, thereby reducing anxiety occurrences.

Influence of Demographic Characteristics on Anxiety in Older Adults

This study identified annual family income, education, and the number of chronic diseases as factors associated with anxiety among older adults. Higher annual family income and educational status were found to be linked to a lower risk of anxiety, highlighting the impact of economic and educational status on the mental health of older adults. These findings were echoes the study of Li et al⁶² and Li et al.⁶³ This income-related protective effect on anxiety could be attributed to improved access to healthcare and resources which benefit to reducing anxiety.⁶² Older adults with good household economic status, who are generally more educated, have a better ability to obtain and understand health information and cope with life stress, contributing to their reduced risk of anxiety.⁶³ The government and healthcare workers should take into consideration older adults' economic status and educational level in providing healthcare services that could reduce their anxiety and improve their mental health. Therefore, the government needs to make greater efforts to improve older adults' healthcare services. Thereby, reducing the inequality of access to health resources due to their economic status.⁶⁴

This study of older people also found that a greater number of chronic diseases correlated with a higher prevalence of anxiety. This finding extends the health anxiety model,⁶⁵ wherein individuals with chronic diseases tend to experience worsening anxiety levels due to a preoccupation with the disease's chronicity. With their long duration, slow progression, and ongoing treatment requirements, chronic diseases can easily result in a variety of complications, leading to decreased self-care ability and self-esteem, which can further contribute to anxiety.⁶⁶ Considering these findings, it is recommended that geriatric health management be strengthened to improve the monitoring and management of chronic diseases, such as hypertension and diabetes, to enhance the quality of life for older adults.

In this study, the CART model plots revealed that the prevalence of anxiety among the educated (literate) and with a medium level of interpersonal trust older was lower in males than in females. This implies that older women are more susceptible to stereotypical societal gender expectations to experience an increased burden and therefore have a higher risk of anxiety. The decision tree model plot also indicated that among older male adults with high levels of interpersonal trust, the prevalence of anxiety was higher among illiterate men, which aligns with the findings of Zhang et al.⁶⁷ This may be attributed to the older adults with a high level of education being able to regulate their mindset and keep their bodies and minds happy through daily activities, such as reading, to relieve anxiety.²¹ Nevertheless, healthcare workers are encouraged provide an inclusive care to older adults that transcends socio-economic status, gender, race, and health conditions.

Effect of Comparison of the Application of Binary Logistic Regression and the CART Model

The finding in this study showed that gender, annual family income, interpersonal trust, and social participation were revealed as factors associated with older adults' anxiety in both the binary logistic regression and the CART model. The latter, however, further identified the best grouping variables and splitting points based on statistical significance tests, resulting in a tree diagram showing the interactions among factors and their significance in different subgroups. To fully demonstrate the interactions between variables, all independent variables were included in the analysis before modeling, resulting in the development of different classification rules based on the effects of the target variables.⁶⁸ For example, social participation was correlated with anxiety among illiterate older adults indicating a medium level of interpersonal trust, while it was not significant among those who were educated.

The area under the ROC curves of the binary logistic regression and decision tree models were 0.685 and 0.644, respectively. Both approach 0.700, indicating that the two models have a similar level of predictive effectiveness. However, each model has its strengths, with the binary logistic regression model performing better in sensitivity and the decision tree model showing higher specificity. Combining these two models can compensate for the individual limitations in the analysis of factors influencing anxiety in older adults and aid in accurately identifying the related factors. Future studies might explore the role of social capital in older adults' anxiety by combining these two models and thus further refine our understanding of this complex issue.

By and large, this study involved some limitations. Firstly, this study has adopted self-reported measurements writing the variables, which can be subjective, and recall or social desirability bias may have affected participants' responses. Secondly, this study used a cross-sectional design, hence causal relationships could not be determined. Therefore, to address these limitations, future researchers are encouraged to utilize longitudinal or experimental research to determine causality among study variables. Qualitative study designs could uncover new narratives and enhance the depth of study variables.

Conclusion

In summary, we observed an association between social capital and anxiety among the older population. Specifically, it is proposed that social group activities aimed at increasing levels of interpersonal trust, social participation, and social support may be implemented to enhance social capital in older adults. These activities should be designed to relieve anxiety and promote positive aging, with a particular focus on building interpersonal trust. Interpersonal trust, a cornerstone of social capital that minimizes anxiety, could be strengthened with the collective efforts of older adults' families, community resources, and healthcare workers, provided they have open and respectful communication while fostering inclusive care regardless of socio-economic status, religion, race, gender, age, and beliefs.

Ethical Considerations

The CLHLS study was approved by the Ethics Committees for Human Research at Peking University (Reference number: IRB00001052–13074) and Duke University (Reference number: Pro00062871). Informed consent was obtained from each participant before their participation. The CLHLS data are hosted on the Peking University Open Research Data Platform, where access to the raw data requires formal permission. For this study, the data were obtained through the application and approval of a data use agreement.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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