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ORIGINAL RESEARCH

Social Activities and Depressive Symptoms Among Elderly Based on Rural and Urban Differences in China: a National Cross-Sectional Study

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Objective: Depression has become an important global public health problem. Despite the government's efforts, the outlook regarding the health issue of elderly depression in China is still not optimistic. This study explored the association between social activities and depressive symptoms among Chinese urban and rural elderly.

Methods: Data were collected from the 2018 Chinese Longitudinal Healthy Longevity Survey (CLHLS). The study sample included 5101 Chinese adults aged ≥ 65 years. Depressive symptoms were assessed using the 10-item Center for Epidemiologic Studies Depression Scale. Binary logistic regression analyses were used to explore the relationship between social activities and depressive symptoms.

Results: The prevalence rate of depressive symptoms in rural elderly is 1.37 times higher than that in urban elderly. The proportion of elderly persons participating in a social activity less than once monthly, or never having participated in social activities is higher in rural areas than in urban areas. The results from the logistic regression model analysis show that among rural elderly, visiting others' homes or interacting with friends at least once a month or once a week is positively associated with depressive symptoms. Playing cards or mahjong at least once a week or almost daily is negatively associated with depressive symptoms. Participating in organized social activities once a month is negatively associated with depressive symptoms. None of these five activities significantly correlate with depressive symptoms among urban older adults.

Conclusion: This study explored the differences in depressive symptoms among elderly populations in urban and rural China, as well as the impact of social activity participation on depressive symptoms. This study underscores the necessity of targeted social interventions in rural areas to enhance social participation among the elderly and reduce depressive symptoms.

Keywords: social activities, depressive symptoms, urban-rural differences, elderly, China

Introduction

Depression, a mental health condition that severely limits the physical and psycho-social functioning of individuals has become an important global public health problem.[1,2] World Health Organization (WHO) data reported that in 2021, the cumulative number of depression patients in the world is as high as 350 million, and the number of suicides caused by depression is as high as 1 million.[3] The "Mental Health in China 2022" report pointed out approximately 95 million people are suffering from depression in China at present. About 112,000 people commit suicide due to depression every year; the risk of suicide of depressed people is 50 times higher than that of the general population,[4] and the risk of cardiovascular disease is 60% higher among people with depression.[5] From 1990 to 2019, disability-adjusted life years(DALYs) of the Chinese total population caused by depression rose from 5.49 million to 7.56 million, marking a 37.8% rise.[6] At present, depression ranks second in China's disease burden and is expected to rise to the first place in

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the world's disease burden by 2030.[7] As the national economy rapidly develops, advances in medical technology and family planning policies are implemented, the degree of aging in China continues to deepen.[8] To promote sustainable economic development and improve the quality of life and health for the elderly, China must pursue healthy aging to address the challenges of an aging population.[9] Among these, improving late-life depression has become a crucial challenge in promoting healthy aging.[10] Despite the government's efforts, the outlook regarding the health issue of elderly depression in China is still not optimistic: Rong et al,[11] via a meta-analysis, analyzed the results of 22 cross-sectional studies on the prevalence of depression among older Chinese adults between 2010 and 2019 revealed that the depression rate among elderly people in China is on the rise.

Social activities have long been considered an important means of maintaining mental health and alleviating depression.[12] A study of elderly people in Korea found a significant correlation between social activities engagement related to gaming, social activities, cultural activities, outings, information communication, and depression.[13] Social activities can promote interpersonal communication and stimulate thinking activities, which are important factors affecting mental health and depression.[12] For the elderly, participation in social activities can not only relieve depression but can increase the subjective well-being of the elderly. Participation in social activities alleviates symptoms of cognitive decline and reduces the disability rate of the elderly connected to depression, thus improving the health status of the elderly and improving the quality of life in their later years.[14,15] A number of studies have shown that a decrease in the frequency of social activities will increase the rate of disability in the elderly, and participation in social activities has a positive effect on preventing disability and promoting physical and mental health (including reduction of depressive symptoms) in the elderly.[16]

To aid in the analysis of the findings of this study, the authors chose to interpret the findings through the lens of Activity Theory, which is part of the study of aging introduced by Havighurst in 1953.[17] This theory posits that the engagement in social activities increases communication, sense of belonging, self-worth, happiness and longevity, establishment of new social roles, alleviation of and treatment for depressive symptoms, and acts as protection against depression[18–21] as well as reduces the rate of depression.[22] Within the context of China, Activity Theory and "positive aging" have been applied[23,24] and this study adds to the present efforts of promoting healthy aging and the reduction of depressive symptoms among the elderly population in China.[25]

The previous study showed that the depression rate among elderly people in rural China is significantly higher than that of urban elderly people.[26] This may be because, compared to rural areas, the living environment, living conditions, cultural and sports facilities for elderly urban residents in cities are relatively better, giving them more opportunities to participate in social activities.[27] Given that urban-rural differences may affect social activities, and since social activities are an important factor influencing depression in the elderly, this reminds us to pay attention to the impact of urban-rural differences on depression among older adults in China. Therefore, it is particularly necessary to study the relationship between social activities and depression in the elderly based on urban-rural differences.

This study explores and evaluates the relationship between engagement in social activities and the mitigation of depressive symptoms among older individuals within the context of urban and rural areas in China. Specifically, this study examines differences in social activity engagement between rural and urban elderly populations[28,29] and type of social activity engagement by elderly persons and depressive symptoms, and variations in engagement in social activities and depression among rural and elderly populations to address an identified gap in the literature[30] considering the wide distribution of the population in China.

Materials and Methods

Data Source

This study uses a cross-sectional design with data from the 2017/2018 Chinese Longitudinal Healthy Longevity Survey(CLHLS), organized by the Center for Healthy Aging and Development Studies (CHADS) of Peking University. Its collection began in 1998 and was followed up in 2000, 2002, 2005, 2008/2009, 2011/2012, 2014, and 2017/2018, covering basic demographic characteristics, social, economic and health aspects. From 1998 to 2018, eight follow-up surveys were conducted in approximately half of the counties and cities across 23 provinces/municipalities/

autonomous regions nationwide, with a total of 113,000 household visits conducted. The survey primarily targets elderly individuals aged 80 and above, with some inclusion of those aged 65–79 to provide a comparative baseline. Individuals with severe cognitive or physical impairments who are unable to provide informed consent are typically excluded. Recent participants in similar studies or non-residents of the selected areas may also be excluded to avoid data duplication. The CLHLS employs rigorous data collection and quality control measures to ensure the accuracy and reliability of the data. The survey data is widely recognized and used in academic research, resulting in numerous publications in reputable international journals. Policymakers rely on this data to formulate and evaluate policies related to the health and social security of the elderly. The data is nationally representative and has great value in theoretical study. The CLHLS study has got the approval of the Biomedical Ethics Committee of Peking University (IRB00001052-13,074).

The data used in this paper were collected from the 2017/2018 questionnaire of surviving respondents, including the basic status, economic status, physical status, social participation, daily life care, community service, disease treatment and medical expenses of the elderly and their families. A total of 15,874 valid samples were collected. In this paper, the elderly aged 65 and above were selected as the research subjects. After data screening, data outlier removal and deletion of missing cases of five important variables in socio-demographic characteristics, living habits, health status, social activities and depression symptoms, 5101 valid sample data were finally included. Among them, there were more missing data on depression symptom scale, daily activity ability in health status, and chronic diseases.

Variable Selection

Dependent Variable

Depressive symptoms were used as the dependent variable in this study. The CESD-10 was used to assess the participants' risk of depressive symptoms and was added to the 2018 wave of the CLHLS questionnaire for the first time. This scale was compiled by Anderson and used after being translated into the Chinese Language. The Chinese Language version of the scale was proven to be well-validated for the assessment of depression in the general Chinese elderly population. The scale contains 7 forward-scoring and 3 reverse-scoring questions. Every question scored on a scale of 0, 1, 2, and 3 points, with assessment levels categorized as "Never", "Sometimes or Rarely", "Often", and "Always". Responses of "Never" are scored as 0 points, "Sometimes or Rarely" as 1 point, "Often" as 2 points, and "Always" as 3 points. In the scale, questions such as "Do you feel hopeful about the future?" "Do you feel as cheerful as when you were younger?" and "How is the quality of your sleep now?" are reverse-scored. Forward-scored questions are scored as 0–3 points according to the frequency from low to high, and 3–0 points are scored in the reverse direction. The total score for depressive symptoms ranges from 0 to 30 points. Then, by following the recommendation of Andresen,[17] the cut-off point of 10 is used to decide depression.[17] Specifically, if elderly people have an equal or higher score than the cut-off point of 10, then they are classified into the 'yes' group. If the scores were the opposite of this, then this study classified them into 'no' group. Depression will be measured as a binary variable. The code is: 0 = no depressive symptoms, 1 = depressive symptoms.

Independent Variable

Social activities are the independent variable in this study. The score is determined by 5 types of social activities in the CLHLS questionnaire: practicing Taichi, square dancing, playing cards and mahjong, visiting others' homes or interacting with friends, and participating in organized social activities. Respondents answered attending every day, or attending at least once a week, or attending at least once a month, or attending less than once a month or not attending at all. It is measured as a categorical variable. The code is: 1 = attending less than once a month or not attending at all, 2 = attending at least once a month, 3 = attending at least once a week, 4 = attending every day.

Control Variables

Based on previous literature and CLHLS survey data, this study selects variables related to socio-demographic characteristics, lifestyle, and health status that may be associated with depression. We assigned values to these control variables, and some of them needed to be recoded. Socio-demographic characteristics mainly involve gender, age, residential type, marital status, living arrangements, educational level, and economic status. In this study, gender is

categorized into two groups: 0=male, 1=female. Age is divided into three groups, with codes assigned as follows: 1=65-74 years, 2=75-84 years, 3=85 years and above. Place of residence is coded as 0=rural, 1=urban. Marital status is re-coded with values of 0=without spouses, and 1=with spouses. Education level is assigned as 1=illiterate (0 years), 2=primary school (1–6 years), 3=middle school and above (7 years and above). Living arrangements are re-coded as 0=living alone, 1=non-living alone. Economic status is re-coded as 1=affluent, 2=average, 3=financially challenged. Lifestyle variables mainly involve smoking, alcohol consumption, and regular physical activity. Smoking status is coded as 0=non-smoker, 1=smoker. Alcohol consumption status is coded as 0=non-drinker, 1=drinker. Whether engaging in regular physical activity is coded as 0=no regular exercise, 1=regular exercise. Health status variables mainly involve chronic diseases and ADL. Chronic diseases is coded as 0=no chronic diseases, 1=has chronic diseases. ADL is coded as 1=unimpaired, 2=mildly impaired, 3=severely impaired.

Statistical Analyses

The respondents' overall characteristics were described using percentages for categorical data. A between-group comparison was performed using $\chi 2$ test for categorical variables. $\chi 2$ test were conducted to compare the distributions of socio-demographic characteristics, lifestyle, health status, social activities, and depressive symptoms by place of residence. The prevalence of depressive symptoms in different types and frequencies of social activity was analyzed by $\chi 2$ test. Binary logistic regression analysis was used to examine the association between social activity and depressive symptoms. Odds ratios (OR) and 95% confidence intervals (CI) were reported for the logistic regression model. Data were analyzed using the Statistical Package for the Social Sciences version 28.0 (IBM Corp., Armok, NY, USA).

Results

General Characteristics of Subjects

Participants' characteristics are shown in Table 1. A total of 5101 subjects were included, including 2418 males (47.4%), and 2683 females (52.6%), with a mean age of 83.2 years (SD = 11.23), with most of the participants living in rural areas. Among the participants, the proportion of married or cohabited and separated/divorced/widowed/unmarried respectively was 47.3% and 52.7%, respectively. The majority of the elderly people (83.4%) chose to live with their family members or other nursing institutions, and 16.6% lived alone. 44% of the participants were uneducated. The number of elderly people with average economic status is 71.7%. Currently, most elderly people do not smoke or drink alcohol, accounting for 83.3% and 84%, respectively; more than half (62%) do not participate in physical exercise. The percentage of chronic diseases reached 68% and the proportion of ADL patients reached 18.9%. The prevalence of depressive symptoms among older adults was 42.6% (45.9% in rural regions; 33.4% in urban regions, $p < 0.001$). The prevalence rate of depressive symptoms in rural elderly is 1.37 times higher than that in urban elderly. Single-factor analysis shows significant differences among elderly individuals in urban and rural areas in terms of age, educational level, living arrangements, economic status, smoking and drinking habits, engagement in physical exercise, and activities of daily living (ADL).

Social Activity Participation

As Table 2 shows, for the Tai Chi group, 1.7% of participants participated almost daily and 97.3% did not or barely participated. The square dance group had 2.8% of participants participating almost daily and 95.4% did not or barely participated. For visiting others' homes or interacting with friends groups, 27.3% of the participants participated almost daily, and 48.5% did not participate or barely participated. In the cards or mahjong group, 6.9% of participants participated almost daily and 85% did not or barely participated. The organized social activity group had 3.5% of participants participate almost daily and 90.5% did not or barely participated. The proportion of less than once monthly, or never participate in the five activities was higher in rural areas than in urban areas ($p <0.05$). As Table 3 shows, among rural adults, there were significant differences in three social activities (visiting others' homes or interacting with friends, playing cards and mahjong, organized activities) and the prevalence of depressive symptoms. However, among urban

Table 1 Characteristics of the Study Population

Characteristics		Total sample (N=5101)	Rural (N=3758)	Urban (N=1343)	χ^2/t	P value
Gender	Male	2418 (47.4)	1752 (34.3)	666 (13.1)	3.500	0.061
	Female	2683 (52.6)	2006 (39.3)	677 (13.3)		
Age	65–74	1330 (26.1)	1016 (19.9)	314 (6.2)	8.610	**0.014**
	75–84	1534 (30.1)	1133 (22.2)	401 (7.9)		
	85 and above	2237 (43.9)	1609 (31.5)	628 (12.3)		
Marital status	Without spouse	2689 (52.7)	1993 (39.1)	696 (13.6)	0.580	0.446
	With spouse	2412 (47.3)	1765 (34.6)	647 (12.7)		
Living arrangements	Living alone	849 (16.6)	684 (13.4)	165 (3.2)	24.954	**< 0.001**
	Non-living alone	4252 (83.4)	3074 (60.3)	1178 (23.1)		
Educational level	Illiterate	2242 (44)	1911 (37.5)	331 (6.5)	642.300	**< 0.001**
	Primary school	1771 (34.7)	1363 (26.7)	408 (8)		
	Middle school and above	1088 (21.3)	484 (9.5)	604 (11.8)		
Economic status	Affluent	1067 (20.9)	632 (12.4)	435 (8.5)	178.609	**< 0.001**
	Average	3546 (69.5)	2695 (52.8)	851 (16.7)		
	Financially challenged	488 (9.6)	431 (8.4)	57 (1.1)		
Smoking	No	4251 (83.3)	3046 (59.7)	1205 (23.6)	53.566	**< 0.001**
	Yes	850 (16.7)	712 (14)	138 (2.7)		
Alcohol consumption	No	4284 (84)	3117 (61.1)	1167 (22.9)	11.488	**0.001**
	Yes	817 (16)	641 (12.6)	176 (3.5)		
Regular physical activity	No	3165 (62)	2550 (50)	615 (12,1)	204.507	**< 0.001**
	Yes	1936 (38)	1208 (23.7)	728 (14.3)		
Chronic diseases	No	1632 (32)	1363 (26.7)	269 (5.3)	119.925	**< 0.001**
	Yes	3469 (68)	2395 (47)	1074 (21.1)		
ADL	Unimpaired	4134 (81)	3132 (61.4)	1002 (19.6)	53.108	0.053
	Mild impaired	782 (15.3)	517 (10.1)	265 (5.2)		
	Severe impaired	185 (3.6)	109 (2.1)	76 (1.5)		
Depressive Symptoms	No	2929 (57.4)	2034 (39.9)	895 (17.5)	63.406	**< 0.001**
	Yes	2172 (42.6)	1724 (33.8)	448 (8.8)		

Note: Bolded values: <0.05.

older adults, there were significant differences in two types of social activities (Square dancing and organized activities) and the prevalence of depressive symptoms.

Frequency and Type of Social Activity Participation

Table 4 shows the relationship between type, frequency of social activity and depressive symptoms. After controlling for all covariates, among rural older adults, visiting others' homes or interacting with friends at least once a month or once a week is positively associated with depressive symptoms (At least once a month: OR=1.749, 95% CI: 1.322–2.313, p=0; At least once a week: OR=1.237, 95% CI: 1.020–1.501, p=0.030). On the other hand, playing cards or mahjong at least once a week or almost daily is negatively associated with depressive symptoms (At least once a week: OR=0.664, 95% CI: 0.481–0.918, p=0.013; Almost daily: OR=0.692, 95% CI: 0.515–0.929, p=0.014). Additionally, participation in organized social activities once a month is negatively associated with depressive symptoms (OR=0.520, 95% CI: 0.302–0.894, p=0.018). The odds ratio (OR) for organized social activities at least once a month (OR=0.520, 95% CI: 0.302–0.894, p=0.018) is lower than the OR values for playing cards and mahjong. This suggests that organized social activities have a stronger effect in reducing depressive symptoms among rural elderly individuals. However, among urban older adults, none of these five activities show a significant correlation with depressive symptoms. Through the sensitivity analyses, the authors did not observe multicollinearity among the variables.

Table 2 Characteristics of Type and Frequency of Social Activities

Type and frequency of social activities	Total sample (N=5101)	Rural (N=3758)	Urban (N=1343)	χ^2	P value
Tai Chi, (%)				53.205	**< 0.001**
Less than once monthly, or never participate	4965 (97.3)	3697 (72.5)	1268 (24.9)		
At least once a month	11 (0.2)	6 (0.1)	5 (0.1)		
At least once a week	38 (0.7)	17 (0.3)	21 (0.4)		
Almost daily	87 (1.7)	38 (0.7)	49 (1)		
Square dancing, (%)				11.217	**0.011**
Less than once monthly, or never participate	4868 (95.4)	3608 (70.7)	1260 (24.7)		
At least once a month	31 (0.6)	21 (0.4)	10 (0.2)		
At least once a week	58 (1.1)	36 (0.7)	22 (0.4)		
Almost daily	144 (2.8)	93 (1.8)	51 (1.0)		
Visiting others' homes or interacting with friends, (%)				105.732	**< 0.001**
Less than once monthly, or never participate	2474 (48.5)	1675 (32.8)	799 (15.7)		
At least once a month	377 (7.4)	266 (5.2)	111 (2.2)		
At least once a week	859 (16.8)	689 (13.5)	170 (3.3)		
Almost daily	1391 (27.3)	1128 (22.1)	263 (5.2)		
Play cards and mahjong, (%)				2.152	0.541
Less than once monthly, or never participate	4338 (85)	3206 (62.9)	1132 (22.2)		
At least once a month	138 (2.7)	95 (1.9)	43 (0.8)		
At least once a week	271 (5.3)	201 (3.9)	70 (1.4)		
Almost daily	354 (6.9)	256 (5.0)	98 (1.9)		
Organized activities, (%)				166.641	**< 0.001**
Less than once monthly, or never participate	4614 (90.5)	3518 (69)	1069 (21.5)		
At least once a month	159 (3.1)	74 (1.5)	85 (1.7)		
At least once a week	152 (3.0)	80 (1.6)	72 (1.4)		
Almost daily	176 (3.5)	86 (1.7)	90 (1.8)		

Note: Bolded values: <0.05.

Discussion

This study explores and analyses the relationship between social activities and depressive symptoms among elderly individuals in urban and rural China. The research indicates that the prevalence of depressive symptoms is higher among rural elderly individuals compared to their urban counterparts, which is consistent with previous studies.[31,32] This may be related to the significant impact of socioeconomic status on depression symptoms.[14] In addition, China has a typical urban-rural duality in society. This duality includes differences in the development levels between urban and rural productive forces that lead to a disparity in social activities resources, inequality in resource allocation opportunities, and the income and welfare gap between urban and rural elderly people.[33] Rural elderly individuals are also confronted with significant economic pressure including limited economic income (both from agricultural efforts and financial support from children).[34,35]

Furthermore, rural elderly individuals often rely on agricultural work to supplement their income. However, this type of work often involves prolonged physical labor, which can take a toll on their health over time. The physical strain and demanding nature of agricultural work may lead to a decline in physical function among elderly individuals living in rural areas. As a result, they may experience difficulties in performing daily activities, which can contribute to feelings of loss, isolation, and loneliness. These negative emotions, compounded by factors such as limited access to healthcare and social support services in rural areas, can contribute to higher levels of depressive symptoms among rural elderly populations.[36] In comparison, elderly individuals residing in urban areas generally experience favorable economic circumstances, benefiting from essential financial provisions like retirement pensions and a minimal living allowance.[14] These resources are not only sufficient to meet their living needs but also contribute to fostering a sense of security among them.[37] Overall, economic hardship and poor health conditions may contribute to higher anxiety levels

Table 3 Prevalence of Depressive Symptoms in Different Type and Frequency of Social Activity Participation

Type and frequency of social activities	Total sample (N=5101)		Rural (%)		χ^2	P value	Urban (%)		χ^2	P value
	χ^2	P value	No	Yes			No	Yes		
Tai Chi, (%)	7.694	**0.049**			1.890	0.607			6.112	0.093
Less than once monthly, or never participate			2001 (53.2)	1696 (45.1)			836 (62.2)	432 (32.2)		
At least once a month			3 (0.1)	3 (0.1)			3 (0.2)	2 (0.1)		
At least once a week			7 (0.2)	10 (0.3)			17 (1.3)	4 (0.3)		
Almost daily			23 (0.6)	15 (0.4)			39 (2.9)	10 (0.7)		
Square dancing, (%)	11.537	**0.009**			3.707	0.295			8.285	**0.036**
Less than once monthly, or never participate			1945 (51.8)	1663 (44.3)						
At least once a month			10 (0.3)	11 (0.3)			10 (0.2)			
At least once a week			20 (0.5)	16 (0.4)			22 (0.4)			
Almost daily			59 (1.6)	34 (0.9)			51 (1.0)			
Visiting others' homes or interacting with friends, (%)	28.416	**< 0.001**			37.366	**< 0.001**			9.251	0.260
Less than once monthly, or never participate			863 (23))	812 (21.6)			507 (37.8)	292 (21.7)		
At least once a month			120 (3.2)	146 (3.9)			79 (5.9)	32 (2.4)		
At least once a week			360 (9.6)	329 (8.8)			119 (8.9)	51 (3.8)		
Almost daily			691 (18.4)	437 (11.6)			190 (14.1)	73 (5.4)		
Play cards and mahjong, (%)	40.909	**< 0.001**			41.157	**< 0.001**			5.925	0.115
Less than once monthly, or never participate			1670 (44.4)	1536 (40.9)			747 (55.6)	385 (28.7)		
At least once a month			53 (1.4)	42 (1.1)			27 (2.0)	16 (1.2)		
At least once a week			137 (3.6)	64 (1.7)			45 (3.4)	25 (1.9)		
Almost daily			174 (4.6)	82 (2.2)			76 (5.7)	22 (1.6)		
Organized activities, (%)	24.268	**< 0.001**			9.509	**0.023**			12.105	**0.007**
Less than once monthly, or never participate			1889 (50.3)	1629 (43.3)			710 (52.9)	386 (28.7)		
At least once a month			53 (1.4)	21 (0.6)			58 (4.3)	27 (2.0)		
At least once a week			44 (1.2)	36 (1.0)			55 (4.1)	17 (1.3)		
Almost daily			48 (1.3)	38 (1.0)			72 (5.4)	18 (1.3)		

Note: Bolded values: <0.05.

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Table 4 Binary Logistic Regression Model Testing the Association Between Social Activities and Depressive Symptoms Among Urban and Rural Elderly

Social activities	Rural			Urban		
	OR	95% CI	P value	OR	95% CI	P value
Tai Chi (ref. No and rare participant)						
At least once monthly	0.643	0.105–3.947	0.633	1.546	0.222–10.752	0.659
At least once weekly	2.230	0.770–6.456	0.139	0.615	0.193–1.959	0.411
Almost daily	1.048	0.504–2.176	0.901	0.828	0.386–1.777	0.627
Square dancing (ref. No and rare participant)						
At least once monthly	1.276	0.520–3.131	0.595	1.380	0.334–5.700	0.656
At least once weekly	1.011	0.476–2.149	0.977	1.274	0.473–3.434	0.632
Almost daily	1.056	0.653–1.709	0.825	0.666	0.292–1.518	0.333
Visiting others' homes or interacting with friends (ref. No and rare participant)						
At least once a month	1.749	1.322–2.313	**< 0.001**	0.838	0.523–1.341	0.461
At least once a week	1.237	1.020–1.501	**0.030**	1.007	0.680–1.491	0.971
Almost daily	0.954	0.801–1.137	0.598	1.029	0.726–1.458	0.871
Play cards and mahjong (ref. No and rare participant)						
At least once a month	1.155	0.742–1.797	0.524	1.422	0.713–2.837	0.317
At least once a week	0.664	0.481–0.918	**0.013**	1.528	0.884–2.642	0.129
Almost daily	0.692	0.515–0.929	**0.014**	0.731	0.432–1.238	0.244
Organized activities (ref. No and rare participant)						
At least once a month	0.520	0.302–0.894	**0.018**	1.065	0.638–1.779	0.810
At least once a week	1.222	0.759–1.969	0.410	0.735	0.399–1.354	0.324
Almost daily	1.327	0.828–2.129	0.240	0.618	0.348–1.099	0.101
Gender (ref. Male)	0.986	0.836–1.162	0.863	1.091	0.822–1.449	0.545
Age (ref. 65–74)						
75–84	1.017	0.843–1.227	0.860	1.786	1.241–2.570	**0.002**
85 and above	1.034	0.838–1.275	0.756	1.481	0.972–2.256	0.068
Marital status (ref. Without spouse)						
With spouse	0.871	0.732–1.036	0.118	0.850	0.620–1.164	0.310
Living arrangements (ref. Living alone)						
Not living alone	0.709	0.586–0.857	**< 0.001**	1.043	0.703–1.547	0.836
Educational level (ref. Lliterate)						
Primary school	0.830	0.704–0.979	**0.027**	1.318	0.939–1.851	0.110
Middle school and above	0.706	0.551–0.904	**0.006**	1.303	0,913–1,861	0.145
Economic status (ref. Affluent)						
Average	1.786	1.474–2.165	**< 0.001**	1.690	1.281–2.228	**< 0.001**
Financially challenged	4.119	3.129–5.421	**< 0.001**	4.437	2.421–8.132	**< 0.001**
Smoking (ref. No)						
Yes	1.049	0.864–1.273	0.630	0.549	0.346–0.873	**0.011**
Alcohol consumption (ref. No)						
Yes	0.689	0.566–0.839	**< 0.001**	0.984	0.658–1.469	0.936
Regular physical activity (ref. No)						
Yes	0.610	0.523–0.713	**< 0.001**	0.571	0.435–0.749	**< 0.001**
ADL (ref. Unimpaired)						
Mild impaired	1.410	1.143–1.739	**0.001**	1.093	0.782–1.526	0.603
Severe impaired	2.185	1.408–3.390	**< 0.001**	1.850	1.091–3.140	**0.023**
Chronic diseases (ref. No)						
Yes	1.204	1.044–1.389	**0.011**	1.014	0.749–1.372	0.929

Note: Bolded values: <0.05.

among rural elderly individuals. This could potentially lead to a propensity for negative emotions and an increased incidence of depressive symptoms.[38]

This study indicates that the proportion of rural elderly with no or little participation in social activities was significantly higher than that of urban elderly, which is consistent with other studies.[37–39] There are possibly several

reasons for this. First, the level of participation could be due to disparity in material resources, power distribution, levels of education, need for social communication and economic status in rural areas.[40–42] Second, participation occurs more frequently when the basic necessities of food, clothing and personal safety are guaranteed.[42] Third, the rural elderly have as a priority the care-taking of left behind grandchildren when their offspring move to large cities to seek employment. In contrast, urban elderly are usually better educated, have a fixed income and persist in maintaining their social roles within their family and society,[28] enabling them to be more participative in social activities.

The study results show that visiting others' homes or interacting with friends at least once a month or once a week is positively associated with depressive symptoms among rural elderly, which is contrary to other findings.[31,43] This may be due to the fact that CLHLS is a study of old people above 65, hence it is different from other databases.[12] The rural elderly show more variation and uniqueness. Just visiting others' homes or interacting with friends may not fully satisfy their need to love and be cared for. Because of the unique living conditions in the countryside, they often visit and socialize with friends and lack new resources of social support.[44] Additionally, most of the empty-nest elderly are in rural areas, as their children may be working in cities and living far away, leading to emotional fluctuations during interactions with friends, and these fluctuations interactions produce depression, anxiety and other negative emotions. Frequent visits and interaction with friends but lack of the physical type of social activity also increases the risk of depression.[45] Furthermore, our findings indicate that playing cards or mahjong at least once a week or almost daily was negatively associated with depressive symptoms among rural elderly. This is possibly due to the lack of additional resources (eg libraries, reading rooms, recreational fitness facilities, and leisure spaces in many rural areas). Playing cards or mahjong have become the most common form of entertainment for elderly individuals in rural communities.[46] This social activity not only helps maintain harmonious relationships among family and friends but also provides a platform to alleviate and relax from the daily stresses of life. Moreover, playing mahjong serves as a means to bring together loved ones and friends, offering a solid foundation of emotional support.[47] As a result, it can contribute to reducing the occurrence of depression.

Findings indicate that participation in organized social activities once a month is negatively associated with depressive symptoms. Moreover, compared to playing cards or mahjong at least once a month or almost daily, participating in organized social activities such as community gatherings or events on a monthly basis has a more significant impact on reducing depressive symptoms among rural elderly individuals. This result is likely due to the fact that organized social activities typically involve a broader range of social interactions, allowing for exchanges with people of different backgrounds and interests, thereby providing a richer and more diverse social experience. This diversity may be more effective in alleviating feelings of loneliness and social isolation, and consequently reducing depressive symptoms, compared to the routine activities like playing cards or mahjong common in rural areas. Additionally, organized social activities are often associated with community engagement and volunteerism, which can provide elderly individuals with a sense of social participation and belonging to their community. Engaging in meaningful social activities may enhance their self-esteem and sense of self-worth, further alleviating depressive symptoms. Joining an organized interest group or activity can help them experience novel and exciting encounters, potentially having a positive impact on their symptoms of depression.[38] Therefore, village committees and various organizations and institutions should promote various types of social activities, including community gatherings, volunteer services, study groups, etc., to meet the diverse interests and needs of elderly individuals. Additionally, providing rural mental health support and resources during social activities, such as psychological counseling and support groups, can help elderly individuals better cope with mental health challenges such as depression.

In addition, the authors found that among the urban elderly, none of these five activities show a significant correlation with depressive symptoms. Possible explanations include, on one hand, the more advanced infrastructure in urban areas provides elderly individuals with increased opportunities for social participation and a more diverse range of activities: the positive impact of social engagement on alleviating depression appears to be more evident among urban elderly.[48] On the other hand, and compared to their rural counterparts, urban elderly already have higher levels of social involvement. Therefore, these common types of social activities may lack novelty for the urban elderly, potentially resulting in less significant benefits and influence. For example, certain urban medical institutions or psychological counseling centers have successfully offered diagnostic and therapeutic services as well as health education for urban elderly by providing

psychological counseling services. They also employ various methods to achieve the goal of reducing symptoms of depression.[38]

Limitations

Some limitations of this study need to be taken into consideration. First, because this is a cross-sectional study, no causal inference can be made. It is possible that the participants' depressive symptoms prevented them from participating in social activities. Second, based on existing research, quality rather than quantity of social activity is a better predictor of mental health outcomes.[49] This prior finding is shown also in the present research. Third, the survey is mainly based on oral/verbal accounts, which may lead to the risk of inaccurate answers leading to biased results. Finally, the participants in this study were community dwellers who were relatively healthy. Therefore, the findings cannot be generalized to hospitalized elderly patients. Despite these limitations, the study adds to the research on depressive symptoms in the elderly, highlighting the importance of rural-urban differences in the relationship between types of social activities and depressive symptoms in the elderly.

Conclusion

This study explored the differences in depressive symptoms among elderly populations in urban and rural China, as well as the impact of social activity participation on depressive symptoms. The results indicated a higher prevalence of depressive symptoms among rural elderly compared to urban elderly. The proportion of rural elderly who did not participate or participated infrequently in social activities was significantly higher than that of urban elderly, reflecting notable socioeconomic and infrastructural disparities between urban and rural areas. The frequency of visiting others' homes or interacting with friends was positively correlated with depressive symptoms among rural elderly, possibly indicating a lack of adequate social support and emotional fulfillment in these interactions. Conversely, playing cards or mahjong and participating in organized social activities were negatively correlated with depressive symptoms among rural elderly, suggesting that these activities could provide crucial social interaction and emotional support, thereby reducing depressive symptoms. However, none of these five activities showed significant correlations with depressive symptoms among urban elderly, possibly due to more advanced social infrastructure and a wider range of activity options in urban areas. This study underscores the necessity of targeted social interventions in rural areas to enhance social participation among the elderly and reduce depressive symptoms. It recommends policymakers to invest in rural infrastructure, promote organized social activities, and meet the emotional and social needs of the rural elderly, thereby enhancing their overall health and quality of life. Moreover, raising awareness of healthy lifestyles among the elderly through advocating for health education and promoting social integration is crucial. Encouraging them to participate in social activities related to health promotion can also help them take proactive steps in managing their own health. This is of significant importance for healthy aging.

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Ethics Approval and Consent to Participate

The CLHLS study has got the approval of the Biomedical Ethics Committee of Peking University (IRB00001052-13074). All participants (including minor and illiterate) provided their written informed consent to participate in this study. All methods were carried out in accordance with relevant guidelines and regulations for research ethics. It also received an exemption from the MUSSIRB.

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Disclosure

The authors report no conflicts of interest in this work.

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