

Depressive symptoms and health service utilization among Chinese middle aged and older adults: A national population-based longitudinal survey

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Abstract

Background: The prevalence of depressive symptoms has been steadily increasing in recent years, however middle aged and older adults was less likely to use mental health services. The aims of this study were to 1) examine the cross-sectional and longitudinal relationships between depressive symptoms and health services utilization among Chinese middle-aged and older adults; and 2) evaluate whether there exists a rural-urban difference in such relationships.

Methods: Data was obtained from China Health and Retirement Longitudinal Study (CHARLS) in 2013 and 2015, a nationally representative survey of 13,551 adults aged 45 years and above in China. Multivariate logistic regression analyses were conducted to assess the cross-sectional and longitudinal relationship between depressive symptoms and health services utilization in the whole sample, and urban and rural subsamples respectively.

Results: Depressive symptoms were positively associated with a greater likelihood of outpatient and inpatient health services utilization. In addition, the relationships between depressive symptoms and health service use were consistent across rural and urban settings, indicating the robustness of such findings across geographic areas.

Conclusions: Findings indicate that depressive symptoms are significantly associated with both in-patient and out-patient health service utilization among Chinese adults. Screening for depressive symptoms needs to be incorporated in these care settings in China.

Background

The prevalence of depressive symptoms has been steadily increasing in recent years due to medical improvement and cultural and social transitions [1]. A recent meta analytic review suggested that approximately 17–24% of adults in China experience depressive symptoms [2, 3]. It has been well documented that depressive symptoms are associated with disability, and mortality [4, 5]. However, according to the results of World Health Organization (WHO) world mental health surveys in 17 countries, middle aged and older adults was less likely to use mental health services, and unmet needs for mental health treatment were pervasive in developing countries [6]. Thus, describing the relationship between mental health service utilization and depressive symptoms can increase public awareness of mental disorders among Chinese middle aged and older people.

An emerging body of literature in Western countries examined the relationship between depressive symptoms and utilization of health services worldwide. Various studies indicated depressive symptoms are related to health service use [7, 8]. A previous population-based study in the United States (U.S.) reported that Chinese immigrants with depressive symptoms had nearly two times higher odds of acute care utilization than their counterparts (i.e. hospitalization and emergency department visits) [9]. However, whether such relationship hold true for middle aged and older adults in China remains unclear. Additionally, previous studies used cross-sectional designs, which make causal inferences difficult to determine. An improved understanding of the relationship between depressive symptoms and health services utilization in Chinese middle aged and older adults is, therefore, warranted for several reasons.

First, mental health service infrastructure in mainland China is less developed than many Western countries [10]. Furthermore, depression and depressive symptoms are often expressed in somatic symptoms, such as insomnia and chest pain, among Chinese adults [11]. As a result, Chinese middle aged and older adults in mainland China are more likely to have distinct help seeking behaviors from their counterparts in, for example, the United States where the mental health system is more established [12]. Considering the underdeveloped mental health services in China and culturally-informed presentation of depressive symptoms in this population, an enhanced understanding of the relationship between depressive symptoms and utilization of health services in this population is needed.

Furthermore, what are also unique to mainland China's middle aged and older population are the salient mental health disparities between urban and rural communities in China. Chinese adults in rural areas have consistently reported much higher rates of mental health disorders than their urban counterparts [13], with studies reporting up to 60% of mental disorder prevalence among rural Chinese adults [14]. Additionally, compared to rural areas in China, urban Chinese cities tend to have more mental health resources and services [15]. However, the rural-urban disparities in mental health and related health seeking behaviors remain largely unexplored [3].

To address these significant knowledge gaps, the present study aimed to 1) examine the cross-sectional and longitudinal relationships between depressive symptoms and health services utilization among Chinese middle aged and older adults; and 2) evaluate whether there exists a rural-urban difference in such relationships.

Design And Methods

Data Source, Procedure and Participants

This paper used data from China Health and Retirement Longitudinal Study (CHARLS), a nationally representative survey of more than 17,000 Chinese adults aged 45 years and above from rural and urban China. Since 2011, CHARLS collected information on respondents' socio-demographic characteristics, retirement and economic well-being, and health-related behaviors and health services utilization every two years. Participants were selected using a multistage, stratified, cluster sampling strategy. First, 150 counties in China were randomly selected, according to geographical location and relative level of socioeconomic development. Second, in each county, three major villages were selected, with probability proportional to population size. Third, all households in each selected unit were included in the sampling frame, and 24 households were randomly drawn from all the households. Finally, within each selected household, one member over 45 years old was selected as a subject of the survey. The baseline survey of the CHARLS involved 17,708

respondents, in 2011. Detailed information on sampling has been published elsewhere [6]. The analytic sample in this present study included a total of 13,551 individuals who completed the survey in both 2013 and 2015 (representing 77% of the baseline population).

Measurement

Participant's utilization of inpatient and outpatient care services in 2013 and 2015 were dependent variables in this study. Inpatient care service use was assessed by asking "Have you received inpatient care in the past year?" Participants responded yes/no. Outpatient service use was measured by asking "In the last month have you visited a public hospital, private hospital, public health center, clinic, or health worker's or doctor's practice, or been visited by a health worker or for outpatient care?" Participants responded yes/no. The same questions were asked in both waves (2013 and 2015).

Depressive symptoms were assessed using the 10-item Center for Epidemiological Studies Depression Scale (CESD-10), a widely-used instrument of depressive symptoms in community samples [16]. Participants responded the extent to which they experienced ten symptoms during the last week, such as sleep problems and feeling that everything was an effort, on a four-point Likert scale: 0 (less than 1 day), 1 (1–2 days), 2 (3–4 days), or 3 (5–7 days). Total score ranged from 0 to 30, with higher scores indicating greater levels of depressive symptoms. Previous study reported satisfactory psychometric properties of CESD-10 among Chinese adults [17]. A cut-off point of 12 was adopted in the present study to define the presence of clinically significant depressive symptoms because a previous study reported that a cut-off of 12 has a specificity of and a sensitivity of to detect depression [18]. The Cronbach's alpha of the scale was 0.80 in the study sample.

Significant covariates reported in previous studies were included as covariates [1, 2, 6]. Sociodemographic variables included age (in years), gender (male/female), marital status (married/not married), education (in years), self-reported health (good/fair/poor), chronic disease (yes/no), smoking history (yes/no), family monthly income, residential type (urban/rural) and medical insurance (yes/no). Region (eastern region/central region/western region) and Hukou status (agriculture/non-agricultural) were added to capture socioeconomic characteristics that are unique to Chinese middle aged and older adults.

Statistical Analyses

Data were analyzed using Stata Version 14. Descriptive statistics were calculated to describe the sociodemographic and health characteristics of the sample. Chi-square tests (for categorical variables) and t-tests (for continuous variables) were used to determine if there existed any rural/urban difference in participants' demographic and health characteristics. Meantime, these methods were also conducted to compare depressive symptoms and socio-demographic characteristics by inpatient and outpatient care utilization. Multivariate logistic regression analyses were conducted using 2013 data to assess the cross-sectional relationship between depressive symptoms and health services utilization in the whole sample, and urban and rural subsamples respectively, controlling for covariates. To examine the longitudinal relationship, multivariate logistic regression analyses were conducted using self-reported depressive symptoms in 2013 as independent variable and health service use in 2015 as the dependent variable. Considering the large sample size (> 10,000), a conservative p value (i.e. $p < .01$) was adopted to establish statistical significance in the present study [19, 20].

Results

Descriptive statistics

Descriptive analyses for the participants in 2013 were presented in Table 1. Of the 13,551 participants, 51.62% (number (N) = 6,995) were female, 89.92% (N = 12,172) have spouse, 79.63% (N = 10,790) have agricultural Hukou, and 44.59% (N = 6,042) have smoking history. In addition, about 62.73% (N = 8,500) of participants were living in rural areas, the distribution of the sample was 38.64% (N = 5,236) from east region, 25.43% (N = 3,446) from central region, and 35.93% (N = 4,869) from west region. The mean age was 59.30 (SD = 9.14), and the average years of education was 5.39.

Table 1
Health-care service utilization and socio-demographic characteristics of the sample.

Variable	Total Frequency (%)	Urban (%)	Rural (%)	P-value
Inpatient care in 2013				0.006
Not have	11867(87.57)	4372(86.56)	7495(88.18)	
Have	1684(12.43)	679(13.44)	1005(11.82)	
Outpatient care in 2013				0.703
Not have	10533(77.73)	3935(77.91)	6598(77.62)	
Have	3018(22.27)	1116(22.09)	1902(22.38)	
Inpatient care in 2015				0.011
Not have	11637(85.88)	4288(84.89)	7349(86.46)	
Have	1914(14.12)	763(15.11)	1151(13.54)	
Outpatient care in 2015				0.226
Not have	10754(79.36)	4036(79.90)	6718(79.04)	
Have	2797(20.64)	1015(20.10)	1782(20.96)	
Gender				0.028
Male	6556(48.38)	2382(47.16)	4174(49.11)	
Female	6995(51.62)	2669(52.84)	4326(50.89)	
Marry status				0.518
Not have spouse	1379(10.18)	503(9.96)	876(10.31)	
Have spouse	12172(89.92)	4548(90.04)	7624(89.69)	
Hukou status				< 0.001
Non-agricultural hukou	2761(20.37)	2374(85.98)	387(14.02)	
Agricultural hukou	10790(79.63)	2677(24.81)	8113(75.19)	
Smoking history				< 0.001
Not have	7509(55.41)	2888(57.18)	4621(54.36)	
Have	6042(44.59)	2163(42.82)	3879(45.64)	
Medical insurance				0.507
Not have	441(3.25)	171(3.39)	270(5.35)	
Have	13110(96.75)	4880(96.61)	8230(94.65)	
Self-report health				< 0.001
Good	3182(23.48)	1296(25.66)	1886(22.19)	
Fair	7196(53.10)	2835(56.13)	4361(51.31)	
Poor	3173(23.42)	920(18.21)	2253(26.50)	
Chronic Disease				0.730
Not have	3813(28.14)	1430(28.31)	2383(28.04)	
Have	9738(71.86)	3621(71.69)	6117(71.96)	
Current living place				
Rural	8500(62.73)	–	–	
Urban	5051(37.27)	–	–	
Region				< 0.001
East	5236(38.64)	2166(42.88)	3070(36.12)	
Note: a.Std. was Standard deviation;				
b. "1.000" was the results of keeping 3 decimal places. c. Income was logarithm.				

Variable	Total Frequency (%)	Urban (%)	Rural (%)	P-value
Central	3446(25.43)	1262(24.99)	2184(25.69)	
West	4869(35.93)	1623(32.13)	3246(38.19)	
Depression				< 0.001
Not have	10354(76.41)	4120(81.57)	6234(73.34)	
Have	3197(23.59)	931(18.43)	2266(26.66)	
Variable	Mean(Std.)			
Age	59.30(9.14)	59.44(9.22)	59.21(9.09)	0.147
Education years	5.39(4.15)	6.75(4.25)	4.59(3.88)	< 0.001
Income	4.29(1.04)	4.63(1.01)	4.10(1.01)	< 0.001
N	13551	8500	5051	
Note: a.Std. was Standard deviation;				
b. "1.000" was the results of keeping 3 decimal places. c. Income was logarithm.				

In terms of self-report health status, 23.48% of participants reported that their health status was good, while the rates for fair and poor status were 53.10% and 23.42%, respectively. About 27.88% of the respondents were found to have depressive symptoms using 10 as the threshold. In addition, most participants (71.86%) indicated that they have chronic diseases. Overall, compared to Chinese urban population, rural people were more likely to receive outpatient care, and more likely to have depressive symptoms (22.38% & 26.66%).

In terms of health care utilization, in 2013, the proportion of participants who received inpatient care and outpatient care were 12.43% and 22.27%, while the rate of inpatient care and outpatient care were 14.12%, 20.64% in 2015, respectively.

Bivariate Correlation Analyses

Table 2 shows the results of comparison of depressive symptoms and socio-demographic characteristics by inpatient and outpatient care utilization in 2013. Participants without spouse, having non-agricultural hukou, having medical insurance, poor self-report health status, having chronic diseases, living in urban areas currently, from west region, with depressive symptoms were more likely to receive inpatient care. Similarly, participants without spouse, having medical insurance, poor self-report health status, having chronic diseases, from west region, with old age, high education and depressive symptoms were more likely to receive outpatient care.

Table 2
Comparison of depress symptoms and socio-demographic characteristics by inpatient and outpatient care utilization in 2013 (N = 13551).

Variable	Inpatient		P-value	Outpatient		P-value
	Not have	have		Not have	have	
Gender			0.236			< 0.000
Male	6103(87.25)	892(12.75)		5237(74.87)	1758(25.13)	
Female	5764(87.92)	792(12.08)		5296(80.78)	1260(19.22)	
Marry status			0.011			0.001
Not have spouse	1178(85.42)	201(14.58)		1022(74.11)	357(25.89)	
Have spouse	10689(87.82)	1483(12.18)		9511(78.14)	2661(21.86)	
Hukou status			0.004			0.445
Non-agricultural hukou	2373(85.95)	388(14.05)		2161(78.27)	600(21.73)	
Agricultural hukou	9494(87.99)	1296(12.01)		8372(77.59)	2418(22.41)	
Smoking history			0.377			< 0.000
Not have	6559(87.35)	950(12.65)		5673(75.55)	1836(24.45)	
Have	5308(87.85)	734(12.15)		4860(80.44)	1182(19.56)	
Medical insurance			< 0.000			0.045
Not have	410(92.97)	31(7.03)		360(81.63)	81(18.37)	
Have	11457(87.39)	1653(12.61)		10173(77.60)	2937(22.40)	
Self-report health			< 0.000			< 0.000
Good	2992(94.03)	190 (5.97)		2849(89.53)	333(10.47)	
Fair	6485(90.12)	711(9.88)		5720(79.49)	1476(20.51)	
Poor	2390(75.32)	783(24.68)		1964(61.90)	1209(38.10)	
Chronic			< 0.000			< 0.000
Not have	3605(95.54)	208(5.46)		3374(88.49)	439(11.51)	
Have	8262(84.84)	1476(15.16)		7159(73.52)	2579(26.48)	
Current living place			0.006			0.703
Rural	7495(88.18)	1005(11.82)		6598(77.62)	1902(22.38)	
Urban	4372(86.56)	679(13.44)		3935(77.91)	1116(22.09)	
Region			< 0.000			< 0.000
East	4729(90.32)	507(9.68)		4250(81.17)	986(18.83)	
Central	2983(86.56)	463(13.44)		2624(76.15)	822(23.85)	
West	4155(85.34)	714(14.66)		3659(75.15)	1210(24.85)	
Depress			< 0.000			< 0.000
Not have	9277(89.60)	978(10.40)		8380(80.93)	1974(19.07)	
Have	3072(81.01)	706(18.99)		2153(67.34)	1044(32.66)	
Variable	Mean(Std)	Mean(Std)	P-value	Mean(Std)	Mean(Std)	P-value
Age	59.00(9.07)	61.40(9.39)	< 0.000	59.14(9.09)	59.84(9.29)	< 0.000
Education years	5.44(4.16)	5.10(4.10)	0.002	5.48(4.15)	5.11(4.17)	< 0.000
Income	4.29(1.04)	4.31(1.02)	0.400	4.28(1.04)	4.35(1.04)	< 0.001
Note: Std was Standard deviation						

Binary Logistic Regression Analyses

Logistic analyses were used to assess the relationship between depressive symptoms and health services utilization among Chinese middle aged and older adults in 2013. For participants' health services utilization in 2013 (Table 3), after adjusting for sociodemographic and other covariates, depressive symptoms were significantly associated with inpatient care (OR 1.349, 95% CI 1.194–1.524) and outpatient care (OR 1.366, 95% CI 1.238–1.508). Compared to rural residents, urban elderly adults were more likely to seek inpatient care (OR 1.244, 95%CI 1.094–1.414).

Table 3

Logistic regression analysis for the relationship between depress symptoms and health care utilization among Chinese middle aged and older adults in 2013.

Variable	Model1 Inpatient care in 2013 (Full model) OR [95%CI]	Model2 Outpatient care in 2013 (Full model) OR [95%CI]	Model3 Inpatient care in 2013 (Rural) OR [95%CI]	Model4 Outpatient care in 2013 (Rural) OR [95%CI]	Model5 Inpatient care in 2013 (Urban) OR [95%CI]	Model6 Outpatient care in 2013 (Urban) OR [95%CI]
Depression (Not have)						
Have	1.349*** [1.194,1.524]	1.366*** [1.238,1.508]	1.276** [1.096,1.486]	1.400*** [1.241,1.578]	1.496*** [1.219,1.835]	1.287** [1.082,1.531]
Age	1.024*** [1.018,1.031]	1.005+ [1.000,1.010]	1.018*** [1.009,1.026]	1.007* [1.000,1.013]	1.035*** [1.024,1.045]	1.002[0.993,1.010]
Education years	1.005[0.989,1.021]	1.007 [0.994,1.019]	1.012[0.991,1.034]	1.008[0.992,1.025]	0.999[0.976,1.024]	1.005[0.985,1.025]
Gender(Female)						
Male	1.107[0.941,1.304]	0.877* [0.769,1.000]	0.971[0.781,1.207]	0.846+ [0.713,1.004]	1.301* [1.013,1.669]	0.934[0.759,1.149]
Marry status (Not have spouse)						
Have spouse	1.077[0.906,1.281]	0.929[0.807,1.069]	0.970[0.780,1.206]	0.965[0.809,1.152]	1.241[0.929,1.660]	0.867[0.687,1.093]
Hukou status (Non-agricultural hukou)						
Agricultural hukou	0.873+[0.745,1.023]	1.023[0.898,1.166]	0.820[0.599,1.124]	1.085[0.828,1.424]	0.853 [0.703,1.035]	1.009[0.862,1.181]
Smoking history (Not have)						
Have	0.929[0.794,1.087]	0.873* [0.769,0.991]	0.990[0.805,1.217]	0.890[0.755,1.048]	0.853[0.669,1.087]	0.845 [0.689,1.036]
Medical insurance (Not have)						
Have	1.819** [1.245,2.657]	1.196[0.927,1.544]	1.522+ [0.958,2.418]	1.174[0.847,1.626]	2.430** [1.252,4.714]	1.214[0.805,1.833]
Self-report health (Good)						
Fair	1.422*** [1.199,1.686]	1.824*** [1.600,2.078]	1.182[0.946,1.477]	1.829*** [1.538,2.175]	1.807*** [1.385,2.358]	1.828*** [1.498,2.231]
Poor	3.639*** [3.033,4.366]	3.627*** [3.136,4.195]	2.989*** [2.371,3.769]	3.595*** [2.981,4.336]	4.848*** [3.615,6.502]	3.720*** [2.943,4.702]
Chronic (Not have)						
Have	1.955*** [1.668,2.291]	1.897*** [1.690,2.130]	2.150*** [1.743,2.653]	1.909*** [1.647,2.213]	1.703*** [1.335,2.172]	1.889*** [1.568,2.276]
Current living place (Rural)						
Urban	1.244*** [1.094,1.414]	1.044[0.941,1.157]				
Region (East)						
Central	1.323*** [1.152,1.520]	1.224*** [1.098,1.365]	1.322** [1.102,1.587]	1.442*** [1.253,1.658]	1.330** [1.072,1.649]	0.952[0.799,1.134]

Note: a. OR: Odds Ratio;

b. Parentheses was reference group and 95% confidence interval of odds ratio;

c. "1.000/0.000" was the results of keeping 3 decimal places.

d. *** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.1

Variable	Model1 Inpatient care in 2013 (Full model) OR [95%CI]	Model2 Outpatient care in 2013 (Full model) OR [95%CI]	Model3 Inpatient care in 2013 (Rural) OR [95%CI]	Model4 Outpatient care in 2013 (Rural) OR [95%CI]	Model5 Inpatient care in 2013 (Urban) OR [95%CI]	Model6 Outpatient care in 2013 (Urban) OR [95%CI]
West	1.416*** [1.247,1.607]	1.230*** [1.113,1.359]	1.393*** [1.181,1.643]	1.341*** [1.180,1.526]	1.466*** [1.200,1.791]	1.096[0.933,1.288]
Income	1.074* [1.016,1.135]	1.133*** [1.084,1.184]	1.102** [1.027,1.182]	1.121*** [1.061,1.185]	1.029[0.941,1.126]	1.148*** [1.065,1.238]
Constant	0.003*** [0.002,0.006]	0.029*** [0.017,0.050]	0.006*** [0.002,0.016]	0.023*** [0.011,0.048]	0.001*** [0.000,0.005]	0.041*** [0.017,0.095]
R2	0.080	0.070	0.074	0.077	0.094	0.061
N	13551	13551	8500	8500	5051	5051
Note: a. OR: Odds Ratio;						
b. Parentheses was reference group and 95% confidence interval of odds ratio;						
c. "1.000/0.000" was the results of keeping 3 decimal places.						
d. *** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.1						

In the rural sample, depressive symptoms were significantly associated with inpatient care (OR 1.276, 95% CI 1.096–1.486) and outpatient care (OR 1.400, 95% CI 1.241–1.578). In the urban sample, depressive symptoms were significantly associated with inpatient care (OR 1.496, 95% CI 1.219–1.835) and outpatient care (OR 1.287, 95% CI 1.082–1.531).

Table 4 shows the longitudinal relationship between depressive symptoms in 2013 and health care utilization in 2015.

Table 4

Logistic regression analysis for the relationship between depress symptoms and health care utilization among Chinese older adults in 2015.

Variable	Model1 Inpatient care in 2015 (Full model) OR [95%CI]	Model2 Outpatient care in 2015 (Full model) OR [95%CI]	Model3 Inpatient care in 2015 (Rural) OR [95%CI]	Model4 Outpatient care in 2015 (Rural) OR [95%CI]	Model5 Inpatient care in 2015 (Urban) OR [95%CI]	Model6 Outpatient care in 2015 (Urban) OR [95%CI]
Depression (Not have)						
Have	1.209**[1.075,1.360]	1.394*** [1.261,1.542]	1.219** [1.055,1.408]	1.399*** [1.238,1.581]	1.190+ [0.972,1.458]	1.369*** [1.146,1.636]
Age	1.032***[1.026,1.038]	1.004[0.999,1.009]	1.027*** [1.019,1.035]	1.005[0.998,1.012]	1.040*** [1.030,1.050]	1.001[0.993,1.010]
Education years	1.0004[0.9857,1.0152]	1.016* [1.003,1.028]	0.999[0.979,1.019]	1.010[0.994,1.026]	1.003[0.981,1.026]	1.028** [1.007,1.049]
Gender(Female)						
Male	1.083[0.930,1.261]	0.883+ [0.774,1.008]	1.134[0.927,1.388]	0.837* [0.705,0.993]	1.003[0.793,1.268]	0.964[0.780,1.191]
Marry status (Not have spouse)						
Have spouse	0.934[0.798,1.092]	0.995[0.862,1.149]	0.788* [0.649,0.956]	1.002[0.837,1.199]	1.250 [0.954,1.636]	0.955[0.749,1.217]
Hukou status (Non-agricultural hukou)						
Agricultural hukou	0.823*[0.709,0.955]	0.979[0.858,1.117]	0.842[0.626,1.133]	0.762* [0.594,0.979]	0.819* [0.684,0.982]	1.091[0.929,1.281]
Smoking history (Not have)						
Have	0.909[0.786,1.053]	0.909[0.800,1.033]	0.845+ [0.698,1.023]	0.894[0.759,1.052]	1.013[0.807,1.272]	0.926[0.753,1.139]
Medical insurance (Not have)						
Have	1.260[0.924,1.718]	1.157[0.896,1.493]	1.219[0.819,1.812]	1.072[0.781,1.472]	1.295[0.788,2.130]	1.327[0.861,2.045]
Self-report health (Good)						
Fair	1.384***[1.193,1.606]	1.389*** [1.230,1.568]	1.458*** [1.189,1.788]	1.264** [1.082,1.476]	1.303* [1.047,1.622]	1.605*** [1.320,1.952]
Poor	2.343***[1.986,2.765]	1.905*** [1.655,2.192]	2.416*** [1.940,3.008]	1.633*** [1.370,1.946]	2.267*** [1.751,2.937]	2.472*** [1.951,3.133]
Chronic (Not have)						
Have	1.982***[1.718,2.287]	1.725*** [1.542,1.931]	2.115*** [1.751,2.555]	1.828*** [1.584,2.110]	1.807*** [1.450,2.251]	1.579*** [1.315,1.897]
Current living place (Rural)						
Urban	1.128+[0.999,1.274]	0.945[0.851,1.049]				
Region (East)						
Central	1.101[0.967,1.254]	1.148* [1.029,1.280]	1.090[0.919,1.293]	1.216** [1.057,1.399]	1.125[0.920,1.376]	1.060 [0.890,1.264]
Note: a. OR: Odds Ratio;						
b. Parentheses was reference group and 95% confidence interval of odds ratio;						
c. "1.000" was the results of keeping 3 decimal places.						
d. *** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.1						

Variable	Model1 Inpatient care in 2015 (Full model) OR [95%CI]	Model2 Outpatient care in 2015 (Full model) OR [95%CI]	Model3 Inpatient care in 2015 (Rural) OR [95%CI]	Model4 Outpatient care in 2015 (Rural) OR [95%CI]	Model5 Inpatient care in 2015 (Urban) OR [95%CI]	Model6 Outpatient care in 2015 (Urban) OR [95%CI]
West	1.264***[1.125,1.421]	1.148** [1.039,1.269]	1.241** [1.066,1.444]	1.259*** [1.108,1.430]	1.296** [1.077,1.560]	0.979[0.829,1.156]
Income	1.038[0.986,1.091]	1.070** [1.024,1.119]	1.044[0.979,1.113]	1.063* [1.006,1.123]	1.024[0.942,1.112]	1.078+ [1.000,1.163]
Constant	0.006***[0.003,0.012]	0.056*** [0.032,0.095]	0.009*** [0.004,0.022]	0.075*** [0.037,0.152]	0.004*** [0.001,0.010]	0.045*** [0.019,0.107]
R2	0.056	0.033	0.057	0.035	0.055	0.034
N	13551	13551	8500	8500	5051	5051
Note: a. OR: Odds Ratio;						
b. Parentheses was reference group and 95% confidence interval of odds ratio;						
c. "1.000" was the results of keeping 3 decimal places.						
d. *** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.1						

The relationship between depressive symptoms and participants' health services utilization was further verified by full models (Table 4). In the whole sample, depressive symptoms were significantly associated with inpatient care (OR 1.209, 95% CI 1.075–1.360) and outpatient care (OR 1.394, 95% CI 1.261–1.542). Adopting a conservative p value of .01, such relationship persists across other sub-models except Model 5. The relationship between depressive symptoms and participants' inpatient care utilization was weak in rural sample (OR 1.219, 95% CI 1.055–1.408) and urban sample (OR 1.190, 95% CI 0.972–1.458).

Discussion And Implications

Discussion

Consistent with an emerging body of literature on the relationship between depressive symptoms and adults' health services utilization, the study findings show a consistent association between depressive symptoms and inpatient and outpatient service use among Chinese middle aged and older adults. Unlike previous literature that predominantly focused on health services utilization in acute care settings, the present study investigated Chinese adults' health services utilization in both inpatient and outpatient settings.

First, depressive symptoms were positively associated with a greater likelihood of outpatient health services utilization. Due to relatively low awareness of mental disorders in mainland China, middle aged and older adults are more likely to present somatic symptoms when they experience depressive symptoms [6]. Thus, it has been well documented that depressive symptoms and depression among middle aged and older adults are largely underdiagnosed and under-treated in primary care settings [21]. As a result, Chinese middle aged and older adults with depressive symptoms may seek care from physicians. It is consisted with priors' studies, which found that when an elderly person is not diagnosed for depression, this person may unnecessarily use healthcare services such as outpatient visits to primary care physicians, emergency departments, and urgent care centers, thereby increasing medical resource utilization [8]. Therefore, appropriate screening and treatment of depressive symptoms need to be incorporated in clinical encounters, thereby preventing the onset of depression and associated physical diseases, and improving the quality of life among elderly in China.

Furthermore, the findings suggest that depressive symptoms were also related to Chinese middle aged and older adults' utilization of inpatient health services. It is likely that middle aged and older adults experience chronic medical conditions that often comorbid with depressive symptoms, such as diabetes and heart disease [22]. When experiencing somatic symptoms of depression, Chinese middle aged and older adults may likely to misinterpret these signs as their physical conditions getting worse. This may possibly explain the increased inpatient service use because, as their depression further develops, they start to think outpatient services are simply not enough. Another possible explanation is because of depression associated disability and functional decline. Depressed adults are less likely to adapt well to their physical conditions and often will have increased burden of disease due to low motivation to manage their physical conditions [23]. Consequently, as their physical health further deteriorates, their inpatient services utilization will increase. A final

possible explanation is due to over-investigation and unnecessary referral to hospitalization often known as “a diagnostic stumbling block” in the mainland China healthcare system. One distinct characteristic of mainland China’s healthcare system is that most patients seek primary and secondary healthcare services in tertiary hospitals. Somatic symptoms and hypochondriasis due to depression may be misdiagnosed as worse physical conditions, resulting in inappropriate treatment and referral to inpatient care.

It is also worth noting that the relationships between depressive symptoms and health service use were consistent across rural and urban settings, indicating the robustness of such findings across geographic areas. Moreover, the findings suggest Chinese old adults in urban areas had a higher rate of utilization of health service in general than those in rural areas. Many factors play an important role in explaining this result. First, this may partly be attributable to the urban-rural inequality in health care in China. Ma et al [24] said that there had long been large urban-rural disparities in health and health care in China due to urban-rural dualistic systems. Moreover, health care is related with income [25]. The expense of health services, especially inpatient service, most part of which cannot be reimbursed by Chinese public health system, might be responsible for the lower rate of health services utilization among rural residents. Additionally, depression literacy or traditional cultural can also affect utilization of health services among old people with depression. It was found that those who lived outside major cities regarded counselors or psychologists as less helpful than those who lived in major metropolitan cities [26].

Implications For Public Health Policy

First, an early screening and intervention to improve primary care providers’ recognition of depression symptoms and to provide specialized mental health treatments may reduce the chances of elderly people suffering from chronic diseases, physical discomfort, and even committing suicide. Specifically, China have implemented a public health policy which was applied to the free adult preventive care services among adults aged 65 and over since 2017. However, these services mainly focus on physical examinations; thus, they should be extended to mental status examinations by adding a CES-D survey to serve as the initial attempt to detect depressive symptoms. Secondly, it is necessary to provide a well-established set of interventions and routine medical checkups to high risk groups among elderly people, especially rural people. Thirdly, in view of the various comorbid chronic conditions and complex care needs of elderly people, it is believed that comprehensive geriatric assessments such as outpatient geriatric evaluation and management is a possible approach to reduce the burden of morbidity and medical utilization. This would enable better screening for depression among elderly patients with chronic disease.

Strengths And Limitations

Different from existing studies, most of which focus on Chinese geriatric immigrants and health services in emergency department, this study used a sample of geriatric participants from mainland China and investigated the relationship between geriatric depression and both in- and out-patient services utilization. Several limitations should be considered when interpreting the findings. First, CES-D is a depressive symptom screening tool rather than clinical diagnostic measure. Future studies need to validate the findings using clinical diagnostic measures of depressive symptoms. Second, both depressive symptoms and health care utilization were self-reported, which may be subject to recall bias. Particularly, considering stigma associated with mental illness among Chinese populations, depressive symptoms may be underreported. Lastly, other potential variable that may predict health service use, such as health beliefs and health literacy, were not included in the present study.

Conclusion

The study findings suggest that depressive symptoms are significantly associated with both in-patient and out-patient health service utilization in Chinese middle aged and older adults. Screening for depressive symptoms needs to be incorporated in these care settings in China. Appropriate treatment of depressive symptoms and timely referrals to mental health services may optimize utilization of health services among Chinese middle aged and older adults.

Abbreviations

CHARLS: China Health and Retirement Longitudinal Study; WHO: World Health Organization; US: United States; CESD-10: 10-item Center for Epidemiological Studies Depression Scale; N: number; Std.:Standard deviation; OR: Odds Ratio; 95% CI: 95% confidence interval.

Declarations

Ethics approval and consent to participate: The study protocol was approved by the Institutional Review Board of Peking University, Beijing, China. All participants gave written consent after being informed to the aim of the survey and their rights to refuse to participate.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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