Original Article

Sociodemographic Disparity of the Depression Prevalence in China: Findings from the China Health and Retirement Longitudinal Study

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SUMMARY

Background: Few studies have investigated the sociodemographic impact on depression prevalence. This study aimed to describe the prevalence of depression according to sociodemographic characteristics.

Methods: A cross-sectional study was performed and involved 17,708 middle-aged and elderly participants (≥ 45 years old) from the China Health and Retirement Longitudinal Study (CHARLS). Depression was diagnosed by Center for Epidemiological Studies Depression Scale-10 (CES-D) score. Multivariable logistic regression model was used to analyze the association between sociodemographic factors and depression by providing odd ratios (ORs) and 95% confidence intervals (CIs).

Results: The prevalence of depression in the middle-aged and elderly was 37.1% (30.2% for men and 43.2% for women, respectively). Multivariable logistic regression model showed that odds of depression in women was 1.82 (95% CI: 1.68−1.97) times than in men, while the odds of depression in rural area was 1.42 (95% CI: 1.31−1.55) times than in urban area. Moreover, the depression prevalence was positively associated with age, and negatively associated with body mass index (BMI), education and household income level (p for trend < 0.001). Compared with participants living in North region, the ORs and 95% CIs of depression among participants who lived in East, South-Central, North-West, South-West, and North-East regions were 0.81 (0.71−0.93), 0.95 (0.83−1.08), 1.36 (1.15−1.62), 1.26 (1.09−1.45), and 0.84 (0.70−1.00), respectively.

Conclusions: There was about one third of Chinese middle-aged and elderly having depression. Prior measures should be taken among high-risk middle-aged and elderly with lower education and income levels, older women, living in rural area or west China.

1. Introduction

Depression is a common mental disorder among middle-aged and elderly Chinese populations. A national study showed that high depression symptom score caused not only disability but also suicide.[1] According to the World Health Organization, more than 300 million people of all ages suffer from depression in globally. Mental and substance use disorders accounted for 183.9 million DALYs or 7.4% of total disease burden in worldwide.[2]

In globally, the depression prevalence varies by region, from a low of 9% in African Region to a high of 27% in South-East Asia Region.[3] In China, depression prevalence ranged from 11% to 57% among people aged over 60 years in different surveys.[4] A previous study reported that the prevalence of depression was higher among older women than men. The prevalence also varied with economic status, with higher rates of depression among older people in the lowest income group.[5] A population-based cross-sectional survey showed that depression prevalence was higher in participants from Beijing than those from Shanghai.[6]

The Chinese population is ageing dramatically. In China, the number of people aged 60 years or over will increases from 168 million in 2010 to 402 million in 2040.[7] Environmental background, socioeconomic development, and population density varied in China. Thus, China provide a unique opportunity to examine the sociodemographic disparity of the depression prevalence. Exploring the depression prevalence according to sociodemographic disparity would not only provide scientific evidence for health care allocation but would also examine the underlying risk factors for depression.

Although several studies explored the prevalence of depression in China, few studies investigated the sociodemographic disparity of depression prevalence and the association with sociodemographic factors. And those studies only have relative small sample size, thus the findings might not be generalized to other populations. Therefore, we aimed to examine the prevalence of depression and the association with sociodemographic factors among a middle-aged and elderly Chinese population.

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2. Methods

2.1. Study population

The data was from the baseline survey of a nationwide cohort study, the China Health and Retirement Longitudinal Study (CHARLS). The baseline survey was conducted in 28 provinces across the country from June 2011 to March 2010. The participants will be followed up every two years. The participants of the CHARLS were selected using a 4-stage, stratified, cluster sampling method. The primary sampling units (PSUs) were administrative villages (*cun*) in rural areas and neighborhoods (*shequ*) in urban areas. A detailed sampling information of CHARLS has been published previously.[8] The baseline survey involved 17,708 within 10,257 households middle-aged and elderly participants (≥ 45 years old). The response rate of this survey was 80.5%. In the present study, 15,271 participants were included in the final analysis.

2.2. Data collection

The baseline survey was implemented by trained interviewers through a face-to-face household interview. The training of the interviewers was conducted by staff who have field investigation experience using the same standard, and completed the simulated practice. Sociodemographic characteristics including birth date, education degree, marital status was obtained using a standardized questionnaire during household interview.

The general health examination was performed at the same time. Height and weight were measured for one time with participants wearing light indoor clothing and no shoes. Height was measured with Seca[TM] 213 height instrument and weight was measured with Omron[TM] HN-286 weight scale. Body mass index (BMI), calculated as weight in kilograms divided by the square of the height in meters. Overweight and obesity were defined according to the classifications for Asian populations as a BMI of 24.0 to 27.9 kg/m^2 and a BMI of ≥ 28.0 kg/m^2, respectively.[9]

2.3. Assessment of depression

All the participants of CHARLS were measured depression using the ten-term Center for Epidemiological Studies Depression Scale-10 (CES-D). A previous study concluded that the CES-D 10 indicated adequate reliability and validity for the community-dwelling middle-aged and elderly population in China.[10] The CES-D 10 contains ten items and the answers of each item had 4 points Likert scale from '< 1 day' to '1−2 days' to '3−4 days' to '5−7 days'. Each item was scored varying from 0 to 3 with the total possible summary score of 0 to 30. Higher scores indicated higher levels of depression symptoms. Previous survey showed that a cutoff point of 10 had optimal threshold to identify clinically significant depression.[11] Thus, the current study used 10 as the cutoff to generate the binary depression symptom variable (1 = yes, 0 = no).

2.4. Statistical analysis

The continuous variables were presented as means ± standard deviation (SD) and compared between groups using one-way ANOVA. The categorical variables were expressed as percentages and compared by the chi-square test. The results of logistic regression model for prevalence of depression were presented using odd ratios (ORs) and 95% confidence intervals (CIs). In the multi-variable model, we adjusted for age, sex, area, education, BMI, income, and region. A 2-sided *p* value < 0.05 was used to determine statistical significance. Data cleaning and statistical analyses were performed using SPSS (version 17.0; SPSS, Chicago, IL, USA).

2.5. Ethics statement

The current study is a secondary analysis of the public data of the CHARLS. The CHARLS has been approved by the Ethical Review Committee of Peking University, and all participants signed informed consent at the time of participation.

3. Results

The sociodemographic characteristics of the 15,271 participants according to sex are shown in Table 1. Male participants were older and with lower level of BMI (22.9 kg/m^2 for men and 23.9 kg/m^2 for women, respectively). About half of the individuals had average level of self-reported household income. The proportion of participants who had primary school and below education level was much higher among women, compared with men.

The overall and sex-specific prevalence of depression are shown in Table 2. The prevalence of depression in our analysis was 37.1% in the total sample, 30.2% in men, and 43.2% in women. The prevalence of depression was positive associated with age. Participants living in rural area had higher depression prevalence, compared with urban residents. The prevalence of depression was higher among individuals who had primary school and below education level (43.4%). Depression prevalence among normal weight group (40.2%) was higher than those in overweight group (33.6%) and obesity group (32.3%). The prevalence of depression was negative associated with household income levels. Depression prevalence were relatively higher among participants living in North-West region (45.8%) and South-West region (45.7%).

Table 1
Sociodemographic characteristics of the subjects according to sex.

Variables	Men	Women	*p*-value[a]
Age (years)	59.70 ± 9.56	58.09 ± 10.06	< 0.001
BMI (kg/m^2)	22.92 ± 3.40	23.90 ± 3.82	< 0.001
Area, n (%)			0.01
Urban	2843 (39.43)	3340 (41.45)	
Rural	4368 (60.57)	4717 (58.55)	
Education, n (%)			< 0.001
Primary school and below	4093 (56.77)	5997 (74.47)	
Junior school	1905 (26.42)	1298 (16.12)	
High school	952 (13.20)	633 (7.86)	
College and above	260 (3.61)	125 (1.55)	
Income, n (%)			< 0.001
Poor	794 (11.13)	1073 (13.49)	
Relatively poor	2352 (32.96)	2401 (30.18)	
Average	3743 (52.46)	4268 (53.65)	
Relatively high	233 (3.27)	197 (2.48)	
Very high	13 (0.18)	16 (0.20)	
Region, n (%)			0.90
North	1011 (14.02)	1128 (14.00)	
East	2202 (30.54)	2403 (29.82)	
South-Central	1739 (24.12)	1957 (24.29)	
North-West	522 (7.24)	589 (7.31)	
South-West	1203 (16.68)	1350 (16.76)	
North-East	534 (7.41)	630 (7.82)	

BMI, body mass index.
[a] Continuous variables were compared by ANOVA. Categorical variables were compared between groups using the chi-square test.

Table 2
Prevalence of depression according to sociodemographic characteristics.

	Total	Men	Women
Total	5658 (37.05)	2179 (30.22)	3479 (43.17)
Age, n (%)			
< 50	1037 (30.99)	315 (23.94)	722 (35.58)
50–59	1873 (35.25)	714 (28.18)	1158 (41.67)
60–69	1728 (41.01)	717 (33.6)	1011 (48.63)
≥ 70	1019 (42.55)	433 (35.32)	586 (50.13)
Area, n (%)			
Urban	1825 (29.51)	667 (23.46)	1158 (34.67)
Rural	3833 (42.19)	1512 (34.62)	2320 (49.18)
Education, n (%)			
Primary school and below	4383 (43.43)	1497 (36.57)	2885 (48.11)
Junior school	894 (27.91)	476 (24.99)	418 (32.20)
High school	328 (20.68)	177 (18.59)	151 (23.85)
College and above	52 (13.51)	29 (11.15)	23 (18.40)
BMI, n (%)			
Normal	3070 (40.15)	1349 (33.65)	1721 (47.33)
Overweight	1263 (33.57)	380 (24.19)	883 (40.30)
Obesity	461 (32.26)	111 (23.27)	349 (36.74)
Income, n (%)			
Poor	1168 (62.56)	439 (55.29)	729 (67.94)
Relatively poor	1997 (42.01)	838 (35.63)	1159 (48.27)
Average	2342 (29.23)	853 (22.79)	1488 (34.86)
Relatively high	85 (19.77)	27 (11.59)	58 (29.44)
Very high	6 (20.69)	2 (15.38)	4 (25.00)
Region, n (%)			
North	771 (36.04)	280 (27.7)	491 (43.53)
East	1490 (32.36)	589 (26.75)	901 (37.49)
South-Central	1340 (36.25)	511 (29.38)	829 (42.36)
North-West	509 (45.81)	201 (38.51)	308 (52.29)
South-West	1168 (45.71)	461 (38.32)	706 (52.30)
North-East	380 (32.65)	137 (25.66)	137 (25.66)

BMI, body mass index.

Association between sociodemographic characteristics and depression risk is shown in Table 3. The odd ratio of depression was higher among women (OR 1.82: 95% CI [1.68–1.97]) in final adjusted model. The prevalence of depression was higher among participants living inrural area (OR 1.42: 95% CI [1.31–1.55]), compared with those living in urban area. The depression prevalence was positive associated with age (p for trend < 0.001). In the final multivariable model, compared with individuals in primary school and below education level, participants in junior school, high school, and college and above education levels were significantly associated with a decreased risk of depression (OR 0.73 [95% CI 0.66–0.81], 0.48 [0.41–0.56] and 0.40 [0.27–0.58], respectively) (p for trend < 0.001). Depression prevalence was much higher among participants who had lower household income levels and those lived in North-West and South-West regions. After further stratified by sex, the results did not materially change (Table 4).

There existed a significantly difference in the prevalence of depression according to geographic region (Fig. 1 and Table 2). The East and North-East regions had the lowest prevalence of depression (32.4% and 32.7%, respectively), followed by North (36.0%) and South-Central (36.3%). The South-West and North-West regions had the highest prevalence of depression (45.7% and 45.8%, respectively). In the final multivariable model, compared with participants living in North region, the ORs and 95% CIs for depression among individuals who lived in East, South-Central, North-West, South-West, and North-East regions were 0.81 (0.71–0.93), 0.95 (0.83–1.08), 1.36 (1.15–1.62), 1.26 (1.09–1.45), and 0.84 (0.70–1.00), respectively (Table 3).

4. Discussion

In the present study, we investigate the prevalence of depression according to sociodemographic characteristics among a middle-aged and elderly Chinese population. Our results suggested that older women, rural residents, lower levels of education, BMI, and household income were underlying risk factors for depression. In addition, there existed remarkable variation in the prevalence of depression according to regional disparity: the East and North-East regions had the lowest prevalence of depression, followed by North and South-Central. The South-West and North-West regions had the highest prevalence of depression.

In our study, the prevalence of depression was 37.1%. The prevalence of depression among Chinese older population vary across the studies because of the difference in samples, measurement tools, and cut-off points.[12,13] A systematic review demonstrated that depression prevalence ranged from 11% to 57% among populations aged over 60 years.[14] A meta-analysis of 81 studies found that the pooled prevalence of depression among Chinese older adults was 23.6%.[15]

Table 3
Odd ratios and 95% confidence intervals for depression according to sociodemographic characteristics.

	Univariate model	Multivariate model [a]
Sex		
Men	1.00 (reference)	1.00 (reference)
Women	1.75 (1.64–1.88)	1.82 (1.68–1.97)
Age, years		
< 50	1.00 (reference)	1.00 (reference)
50–59	1.21 (1.11–1.33)	1.26 (1.13–1.41)
60–69	1.55 (1.41–1.70)	1.47 (1.31–1.64)
≥ 70	1.65 (1.48–1.84)	1.55 (1.36–1.77)
p-trend	< 0.001	< 0.001
Area		
Urban	1.00 (reference)	1.00 (reference)
Rural	1.74 (1.63–1.87)	1.42 (1.31–1.55)
Education		
Primary school and below	1.00 (reference)	1.00 (reference)
Junior school	0.50 (0.46–0.55)	0.73 (0.66–0.81)
High school	0.34 (0.30–0.39)	0.48 (0.41–0.56)
College and above	0.20 (0.15–0.27)	0.40 (0.27–0.58)
p-trend	< 0.001	< 0.001
BMI		
Normal	1.00 (reference)	1.00 (reference)
Overweight	0.75 (0.69–0.82)	0.82 (0.75–0.90)
Obesity	0.71 (0.63–0.80)	0.77 (0.68–0.88)
p-trend	< 0.001	< 0.001
Income		
Poor	1.00 (reference)	1.00 (reference)
Relatively poor	0.16 (0.06–0.39)	0.12 (0.04–0.36)
Average	0.15 (0.11–0.19)	0.17 (0.13–0.23)
Relatively high	0.25 (0.22–0.28)	0.27 (0.24–0.30)
Very high	0.43 (0.39–0.48)	0.51 (0.45–0.58)
p-trend	< 0.001	< 0.001
Region		
North	1.00 (reference)	1.00 (reference)
East	0.85 (0.76–0.95)	0.81 (0.71–0.93)
South-Central	1.01 (0.90–1.13)	0.95 (0.83–1.08)
North-West	1.50 (1.30–1.74)	1.36 (1.15–1.62)
South-West	1.49 (1.33–1.68)	1.26 (1.09–1.45)
North-East	0.86 (0.74–1.00)	0.84 (0.70–1.00)
p-value	< 0.001	< 0.001

BMI, body mass index.
[a] Adjusted for the age, sex, area, education, BMI, income, and region. Except the variable of interest.

Table 4
Odd ratios and 95% confidence intervals for depression according to sex.

	Multivariate model [a]	
	Men	Women
Age, years		
< 50	1.00 (reference)	1.00 (reference)
50–59	1.20 (1.02–1.41)	1.29 (1.13–1.46)
60–69	1.38 (1.17–1.63)	1.58 (1.38–1.81)
≥ 70	1.47 (1.21–1.78)	1.69 (1.43–1.99)
p-trend	< 0.001	< 0.001
Area		
Urban	1.00 (reference)	1.00 (reference)
Rural	1.39 (1.23–1.56)	1.51 (1.36–1.67)
Education		
Primary school and below	1.00 (reference)	1.00 (reference)
Junior school	0.72 (0.63–0.83)	0.65 (0.57–0.75)
High school	0.54 (0.45–0.65)	0.45 (0.37–0.56)
College and above	0.36 (0.24–0.54)	0.40 (0.25–0.65)
p-trend	< 0.001	< 0.001
BMI		
Normal	1.00 (reference)	1.00 (reference)
Overweight	0.78 (0.68–0.90)	0.86 (0.77–0.97)
Obesity	0.76 (0.60–0.97)	0.79 (0.68–0.92)
p-trend	< 0.001	< 0.001
Income		
Poor	1.00 (reference)	1.00 (reference)
Relatively poor	0.16 (0.04–0.75)	0.13 (0.04–0.43)
Average	0.12 (0.08–0.19)	0.20 (0.15–0.29)
Relatively high	0.26 (0.22–0.30)	0.27 (0.23–0.31)
Very high	0.49 (0.41–0.58)	0.49 (0.42–0.57)
p-trend	< 0.001	< 0.001
Region		
North	1.00 (reference)	1.00 (reference)
East	0.95 (0.79–1.13)	0.71 (0.61–0.83)
South-Central	1.01 (0.84–1.21)	0.85 (0.73–1.00)
North-West	1.60 (1.26–2.03)	1.17 (0.94–1.45)
South-West	1.43 (1.18–1.74)	1.15 (0.97–1.36)
North-East	0.95 (0.74–1.23)	0.81 (0.65–1.00)
p-value	< 0.001	< 0.001

BMI, body mass index.
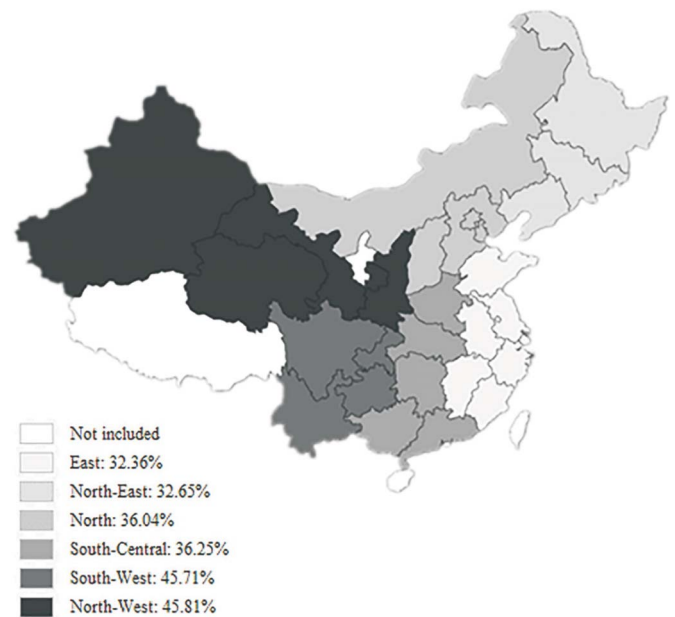[a] Adjusted for the age, area, education, BMI, income, and region. Except the variable of interest.

Fig. 1. Prevalence of depression in different regions of China. North: two cities (Beijing and Tianjin) and three provinces (Hebei, Shanxi, and Inner Mongolia); East: one city (Shanghai) and six provinces (Shandong, Jiangsu, Anhui, Zhejiang, Fujian, and Jiangxi); South-Central: five provinces (Hubei, Hunan, Henan, Guangdong, and Guangxi); North-West: four province (Qinghai, Shanxi, Gansu, and Xinjiang); South-West: one city (Chongqing) and three provinces (Sichuan, Yunnan, and Guizhou); North-East: three provinces (Liaoning, Jilin, and Heilongjiang); Not included: Hainan, Ningxia, Tibet, and Taiwan.

Numerous survey indicated that the prevalence of depression was positive related to age,[16,17] similar as the present study. However, a cross-sectional survey found a negative association between age and depression.[6] Several studies found no association between depression prevalence and age.[15,18] In addition, our results demonstrated that the prevalence of depression was significantly higher among women than men, consistent with previous survey.[19,20] The possible explanations for this gender variation may be related to the lower social status, education levels and economic income among women.

Several studies demonstrated that sociodemographic status was associated with depression,[21] similar as our findings. For example, the prevalence of depression was lower among participants who received more education than those who received less education. Subjects with a lower education level might be associated with limited ability to adjusted their mental status and maintain positive emotions. The prevalence of depression significantly decreased among subjects who lived in urban area then those in rural area, and those who had higher household income level, consistent with previous study.[18] The variation may be due to the different living conditions and health care services.

Several survey found a positive association,[22] some studies found a negative relationship[23] between depression and obesity. A systematic review to examine the longitudinal association between overweight or obesity and depression found that overweight/obesity is an independent risk factor for incident depression.[24] Our study demonstrated that the prevalence of depression was less common among overweight/obesity participants, compared to individuals with normal weight. This inverse association between depression and weight support the "Jolly Fat" hypothesis.[25] A possible explanation for the negative association between weight and depression is that depression produces loss of appetite which subsequently induces weight loss.[26] Further studies are needed to explore the causal relationship between depression and obesity.

The present study demonstrated the prevalence of depression existed a remarkable regional variation in China. Residents in South-West and North-West regions had a much higher prevalence of depression than those in East and North-East regions. There were several possible explanations for this regional variation. First, economic development is much higher in East and North regions than in West region, which may contribute to the low prevalence of depression. Additionally, the percentage of residents living in rural area is greater in West region, compared with other regions, and the prevalence of depression is significantly higher among subjects who lived in rural area. Third, there exists difference in environmental and genetic factors between regions in China which may contribute to the variation of depression prevalence.

This study has several strengths. Firstly, there are few studies to examine the sociodemographic disparity of depression prevalence in China. Secondly, our findings may be relatively reliable because that the CHARLS survey included the depression data from 28 provinces in China. Thirdly, because of the population-based design, the face-to-face structured interview, and the relative large sample size in the present cross-sectional study, the findings might be more

convincible. Fourthly, our findings may provide important public health implications for the prevention of depression and the allocation of healthcare resource in different regions.

Several limitations should be considered. Firstly, this is a cross-sectional study and more prospective studies are warranted to validate our findings. Secondly, participants included in the present study were middle-aged and elderly Chinese populations, therefore the findings might not be generalized to other populations. Thirdly, the diagnosis of depression was based on self-reported depression symptoms using the ten-term CES-D and no clinical diagnostic interview was carried out to validate the results, which might slightly bias our results.

5. Conclusion

In conclusion, the present study indicates that the prevalence of depression among middle-aged and elderly Chinese populations is high. About one third of Chinese middle-aged and elderly have depression. Prior measures should be taken among high-risk population with lower education and income levels, older women, living in rural area or west China. Further cohort studies are needed to identify the prospective association between sociodemographic factors, diet and lifestyle factors with depression risk among Chinese populations.

Acknowledgements

Conflict of interest

The authors declare no conflict of interest.

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