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Association between social health status and depressive symptoms among community-dwelling elderly adults in Zhejiang Province, China*

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Abstract: Objective: Mental disorders of the elderly population in China deserve attention. Social health is significantly associated with depression. This study aimed to evaluate the rate of depressive symptoms and to test the relationships between social health and depressive symptoms among a large sample of community-dwelling elderly adults. Methods: We conducted a cross-sectional study among community-dwelling adults aged 60 years or above in Zhejiang Province, China. Face-to-face interviews were used to complete a structured questionnaire for all participants. We used the Social Health Scale for the Elderly (SHSE) to evaluate social health status and used the short form of the Geriatric Depression Scale to evaluate depressive symptoms. Multivariate logistic regression was used to evaluate the association between social health status and depressive symptoms. Results: Of the total of 3757 participants included, 1887 (50.23%) were female, and the mean±standard deviation (SD) age was (70.0±8.3) years. The rate of depressive symptoms was 25.92%. The social health score was higher in non-depressed participants than in depressed participants (raw score 50.7 vs. 48.3, P<0.001). Participants with “moderate” or “good” social health had a significantly lower risk of depressive symptoms than those with “poor” social health (odds ratio (OR)=0.55, 95% confidence interval (CI): 0.46–0.66 for moderate social health; OR=0.45, 95% CI: 0.35–0.60 for good social health). The association between social health and depressive symptoms was consistent across several subgroups. Conclusions: Social health is significantly inversely associated with depressive symptoms. The SHSE may serve as an efficient screener to identify those elderly adults with social health deficits, but systematic assessment to guide intervention merits further investigation.

Key words: Depressive symptom; Social health; Elderly adult
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1 Introduction

Depression is one of the most prevalent mental disorders in the elderly population and is associated with disability, mortality, and a lower quality of life (Sözeri-Varma, 2012). The prevalence rates vary by age and peak in older adulthood (7.5% among females and 5.5% among males, aged 55–74 years) (Alexopoulos, 2005; World Health Organization, 2017). Elderly individuals who have died of suicide or have a

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history of suicidal behavior are more likely to have experienced depression (Ho et al., 2014). Biological risk factors for geriatric depression include cardiovascular diseases (Ho et al., 2018), stroke (Mak et al., 2013), brain injury (Heok and Ho, 2008), inflammation (Colman, 1986), and other chronic medical diseases (Niti et al., 2007). Studies have shown that socially related factors contribute significantly to depression among the elderly population (Baiyewu et al., 2015; Andrea et al., 2016; Gariépy et al., 2016; Domènech-Abella et al., 2017).

Social health is an important dimension of health, alongside physical and mental health, according to the definition proposed by the World Health Organization (International Health Conference, 2002). Social health contains both individual and social aspects (Carlson et al., 2011). The individual level of social health is usually explained in terms of "well-being" or "adjustment" (Carlson et al., 2011) and can be measured through social support and social adjustment. Social support places an emphasis on the level of support the subject receives from others, while social adjustment focuses on the adaptive capacity of subjects to interact actively with their community. The social level of social health refers to a society in which there is equal opportunity for all and access by all to the goods and services essential to full functioning as a citizen (Russell, 1973), such as the perceived built environment and community management. Although there are numerous studies on the socially related factors among the elderly population in China (Tang et al., 2006; Su et al., 2012; Wang and Zhao, 2012; Uchmanowicz and Gobbens, 2015), few studies have combined the two levels of social health in one study. There have been studies conducted to explore the relationships between social factors and depressive symptoms among community-dwelling elderly adults (Zeng et al., 2013; Yaka et al., 2014; Wang and Blazer, 2015). A study conducted in Macau (China) showed that poor family support and social network were related to depression among 31 community-dwelling old people (Zeng et al., 2013). A cross-sectional study in Shanxi (China) found that social relationships were a significant influencing factor for depression among empty-nest elderly (Zhang et al., 2019). Results from the National Social Life, Health, and Aging Project showed that relationships with family and friends were associated with depressive symptoms (Stokes and Moorman, 2018). However, previous studies failed to combine individual and community levels of social health into one study. Furthermore, evidence from the Chinese older population is still scarce.

A comprehensive structured scale called the Social Health Scale for the Elderly (SHSE) has been developed to fill the gap in social health status measurement (Bao et al., 2018). In this study, we aimed to test the hypothesis that better social health status was significantly associated with a reduced risk of depressive symptoms among a large sample of community-dwelling elderly adults in Zhejiang Province, China.

2 Materials and methods

2.1 Study participants

We conducted a cross-sectional study among the community-dwelling elderly adults in Zhejiang Province from Jan. 1, 2018 to Sept. 30, 2018. A four-stage convenient sampling method was implemented to recruit participants, as shown in Fig. 1. The inclusion criteria were age of 60 years or older and living in the local community for more than five years; these were conveniently sampled in the current study. Elderly people who were bed-ridden, had serious physiological or psychological illness, and/or had hearing disorders were excluded. A face-to-face interview was conducted with each participant to complete a structured questionnaire. The interview was conducted at the community health service center by well-trained medical staff or medical students. Proxy-based interviews or completion of the questionnaire by the participants themselves was not allowed in the current study. This study was approved by the Ethics Committee of School of Medicine, Zhejiang University, Hangzhou, China. Written informed consent was obtained from all participants before the face-to-face interview.

2.2 Assessment of social health

We used short version of the SHSE, the SHSE-S, to evaluate social health status. There are 14 items on this scale. The SHSE has been established and validated for the Hangzhou elderly population. The test-retest variability was 0.77, internal consistency reliability was 0.79, concurrent validity was 0.64, and goodness of fit was 0.97 in construct validity (Bao et al., 2018). The raw score for the SHSE was calculated,

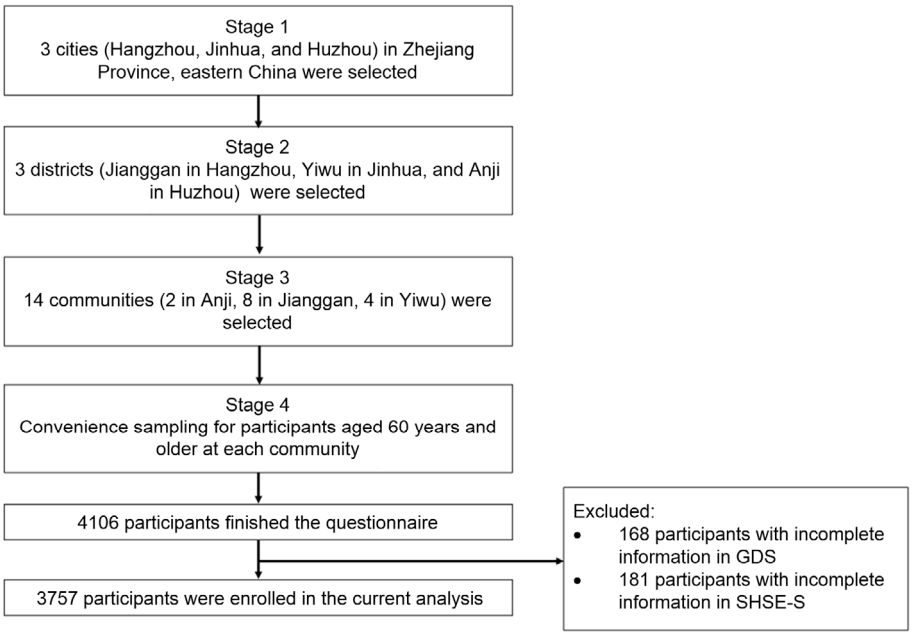

Fig. 1 Flow chart of the current study
GDS: Geriatric Depression Scale; SHSE-S: short version of the Social Health Scale for the Elderly

standardized, and categorized into three levels ("poor," "moderate," and "good") for each participant according to the established Hangzhou norms (Bao et al., 2018). Participants with a standardized score of less than 40 were categorized as having "poor social health," those with a standardized score of 40–59 were categorized as having "moderate social health," and those with a standardized score of 60 or above were categorized as having "good social health."

2.3 Assessment of depressive symptoms

The short form of the Geriatric Depression Scale (GDS-S) was used to assess depressive symptoms in this study. The GDS-S has 15 items coded as 0 (no) or 1 (yes). It has been widely used in numerous studies and appears to be a useful screening instrument for depression in geriatric populations (Lai et al., 2010). For an Asian population, the overall Cronbach's α is 0.80, the intra-class coefficient of test-retest reliability is 0.83, and inter-rater reliability is 0.94 (Nyunt et al., 2009). In this study, participants with a total GDS-15 score of 8 or above were classified as having depressive symptoms (Balsamo et al., 2018).

2.4 Assessment of covariates

Demographic characteristics—age, gender, region, living arrangements, occupation, ethnic status, marital status, education level, and income—were requested of the participants. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared.

Comorbidities, the prevalence of 27 common chronic diseases, were determined using the question "Do you suffer, or have you been told by a doctor within the past year that you were suffering, from any of the following problems?" Chronic diseases included hypertension, ischemic heart disease, cerebrovascular disease, diabetes, chronic obstructive pulmonary disease, Parkinson's disease, arthritis, and osteoarthritis. The number of chronic diseases for each participant was also calculated. Multimorbidity was categorized into four levels (no chronic disease, one kind of disease, two kinds of disease, and three or more kinds of disease).

2.5 Statistical analysis

Continuous variables with normal distribution were presented as mean±standard deviation (SD), while non-normally distributed variables were presented as median±interquartile range (IQR) (Xiao et al., 2018). Categorical variables were presented as frequency and proportions. Differences between depressed and non-depressed participants were tested using a *t*-test or non-parametric Wilcoxon test for continuous

variables and χ^2 tests for categorical variables (Zhu et al., 2017). Covariates that differed significantly between depressed and non-depressed participants were further adjusted in logistic regression models. Three logistic regression models were used to analyze the association between social health and depressive symptoms. Covariates were selected for the logistic regression model on the basis of (1) a significantly different distribution between depressed and non-depressed groups and (2) literature showing that this factor was associated with depressive symptoms (Djernes, 2006). Model I included social health (good, moderate, and poor, with poor as the reference), gender (male or female), age group (60–74 years and ≥75 years), and region (urban or rural). Model II was adjusted for the same covariates in Model I plus living arrangements (living alone or not), marital status (married, widowed, divorced, or never married), and income per month (CNY). Model III was adjusted for the same covariates in Model II plus BMI (continuous), frequency of physical exercise (<1 time per week, 1–2 times per week, or ≥3 times per week), hypertension (prevalence or not), diabetes (prevalence or not), and coronary disease (prevalence or not). The Bonferroni test was used for multiple comparisons in the logistic regression model. The enter method was used to perform the multivariate logistic regression. Tests for linear trends across different levels of social health status were examined by entering the social health levels (poor as 1, moderate as 2, good as 3) into the logistic regression models. Subgroup analyses stratified by gender (male or female), age (60–74 years or ≥75 years), region (urban or rural), living arrangement (living alone or living with others), marital status (married or others), and multimorbidity (yes or no) were conducted and tested to determine if any effect modification existed. All *P* values were two-sided and $P<0.05$ was considered statistically significant. All analyses were performed in R software 3.3.2 (R Core Team, Vienna, Austria).

3 Results

3.1 General information on participants

A total of 4106 participants completed the face-to-face interviews. We excluded 181 participants with incomplete information on the SHSE and 168 participants with incomplete information on the GDS, meaning that 3757 participants were enrolled in the final analysis. Of these, 1887 (50.23%) were female and the mean±SD age was (70.0±8.3) years. In addition, 1444 (38.43%) participants lived in an urban area while 2313 (61.57%) participants lived in a rural area. With regard to living arrangements, 318 (8.46%) participants lived alone while 3439 participants (91.54%) lived with their family. A total of 1070 (28.48%) participants were illiterate or did not finish primary school while 706 (18.79%) had an education level of high school or above.

3.2 Demographic characteristics of depressed and non-depressed participants

Depressive symptoms were present in 25.92% of the study sample. The differences of demographic characteristics between depressed and non-depressed participants are presented in Table 1. Depressed participants had a higher proportion of females ($P<0.001$) and were older than non-depressed participants ($P<0.001$). Those elderly participants with depressive symptoms were more likely to live alone ($P=0.001$) and to be widowed ($P<0.001$). The difference in education level ($P=0.178$) between depressed and non-depressed groups was not significant.

3.3 Health-related characteristics of depressed and non-depressed participants

Differences between depressed and non-depressed participants in terms of health-related characteristics are presented in Table 2. A higher proportion of non-depressed participants engaged in physical exercise than did depressed participants ($P<0.001$). Depressed elderly adults had a higher rate of hypertension (47.95% vs. 43.37%, $P=0.014$), diabetes (20.84% vs. 16.96%, $P=0.008$), and coronary heart disease (26.80% vs. 19.80%, $P<0.001$).

3.4 Social health differences between depressed and non-depressed participants

Depressed participants had a lower social health status than did non-depressed participants (raw score 48.3 vs. 50.7). The raw score was standardized and categorized into three levels according to the previously established Hangzhou norms. A higher proportion of non-depressed participants had good social health than did depressed participants (14.91% vs. 10.99%, $P<0.001$; Table 2).

Table 1 Demographic characteristics of participants according to GDS scores ≥8

Demographic	Number (percentage)		*P* value
	Non-depressed (*n*=2783)	Depressed (*n*=974)	
Gender			<0.001
Male	1449 (52.07)	421 (43.22)	
Female	1334 (47.93)	553 (56.78)	
Age group (year)			<0.001
60–74	1895 (68.09)	575 (59.03)	
≥75	888 (31.91)	399 (40.97)	
Region			<0.001
Rural	1793 (64.43)	520 (53.39)	
Urban	990 (35.57)	454 (46.61)	
Living arrangements			0.001
Living alone	207 (7.44)	111 (11.40)	
Not living alone	2576 (92.56)	863 (88.60)	
Married status			<0.001
Married	2270 (81.57)	705 (72.38)	
Widowed	446 (16.03)	234 (24.02)	
Others	67 (2.41)	35 (3.59)	
Income per month (CNY)			0.001
≤1000	693 (24.90)	229 (23.51)	
1001–2000	1007 (36.18)	306 (31.42)	
2001–3000	382 (13.73)	181 (18.58)	
3001–4000	270 (9.70)	123 (12.63)	
≥4001	341 (12.25)	116 (11.91)	
Unknown	90 (3.23)	19 (1.95)	
Educational level			0.178
Illiterate	786 (28.24)	284 (29.16)	
Primary school	686 (24.65)	250 (25.67)	
Middle school	800 (28.75)	245 (25.15)	
High school or above	511 (18.36)	195 (20.02)	

GDS: Geriatric Depression Scale

Table 2 Health-related characteristics of participants according to GDS score ≥8

Demographic	Number (percentage)		*P* value
	Non-depressed (*n*=2783)	Depressed (*n*=974)	
Physical exercise			<0.001
<1 time per week	1020 (36.65)	480 (49.28)	
1–2 times per week	360 (12.94)	93 (9.55)	
≥3 times per week	1403 (50.41)	401 (41.37)	
Body mass index*	23.34±3.53	23.08±3.41	0.043
Hypertension			0.014
Yes	1207 (43.37)	467 (47.95)	
No	1576 (56.63)	507 (52.05)	
Diabetes			0.008
Yes	472 (16.96)	203 (20.84)	
No	2311 (83.04)	771 (79.16)	
Coronary heart disease			<0.001
Yes	551 (19.80)	261 (26.80)	
No	2232 (80.20)	713 (73.20)	
Number of chronic diseases			<0.001
0	591 (21.24)	145 (14.89)	
1	978 (35.14)	266 (27.31)	
2	616 (22.13)	220 (22.59)	
3 and above	598 (21.49)	343 (35.22)	
Social health scale for elderly			<0.001
Poor	448 (16.10)	257 (26.39)	
Moderate	1920 (68.99)	610 (62.63)	
Good	415 (14.91)	107 (10.99)	

* Body mass index (BMI) is expressed as mean±SD

The logistic regression showed an inverse association between social health status and depressive symptoms. Odds ratios (ORs) (95% confidence intervals (CIs)) for social health level and risk of having depressive symptoms are presented in Table 3. Participants with a moderate social health status had lower OR (0.54 (95% CI: 0.45–0.65)) of having depressive symptoms than did participants with poor social health status, while the OR was 0.44 (95% CI: 0.33–0.58) for participants with good social health status. The linear trend of association of depressive symptoms across different levels of social health was also significant (P<0.001). The results were consistent when other covariates were adjusted in Model II (living arrangements, marital status, and monthly income) and Model III (physical exercise, BMI, hypertension, diabetes, and coronary heart disease).

Subgroup analyses stratified by gender, age, region, living arrangements, and multimorbidity showed that the protective effect of social health against depressive symptoms was significant in all subgroups (Fig. 2). The results also showed that the effects were stronger in certain subgroups, such as participants living alone (OR=0.16, 95% CI: 0.02–0.67) and participants aged 75 years or older (OR=0.21, 95% CI: 0.12–0.39).

Table 3 Association between social health status and depressive symptoms

Social health status	OR (95% CI)		
	Model I[a]	Model II[b]	Model III[c]
Poor	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
Moderate	0.54 (0.45–0.65)	0.55 (0.46–0.67)	0.55 (0.46–0.66)
Good	0.44 (0.33–0.58)	0.46 (0.35–0.61)	0.45 (0.35–0.60)
P for trend	<0.001	<0.001	<0.001

[a] Adjusted for age, gender, and region; [b] Adjusted for covariates in Model I plus living arrangements, marital status, and income per month; [c] Adjusted for covariates in Model II plus physical exercise, body mass index (BMI), hypertension, diabetes, and coronary heart disease. OR: odds ratio; CI: confidence interval; Ref: reference

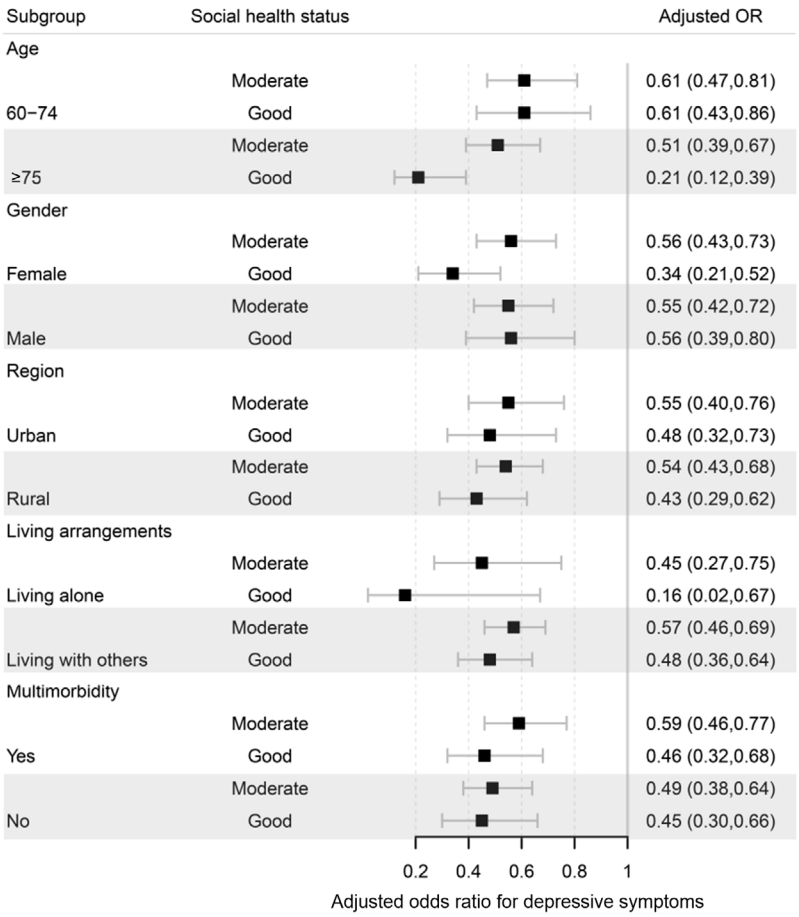

Fig. 2 Subgroup analysis of association between social health status and depressive symptoms using the "poor social health" participants as the reference group

4 Discussion

In this study, we found a significant inverse relationship between higher social health level and the risk of having depressive symptoms among 3757 Chinese community-dwelling elderly adults. Participants with a good social health level had a significantly lower OR for depressive symptoms than did those participants with poor social health status, after adjusting for age, gender, region, living arrangements, marital status, income, BMI, physical exercise, prevalence of hypertension, diabetes, and coronary heart disease. The results indicate that better social health status is associated with good mental health among community-dwelling elderly adults.

Our study found that the rate of depressive symptoms in a sample of Zhejiang community-based elderly adults was 25.92%. A previous population-based study using the Center for Epidemiologic Studies Depression Scale (CES-D) showed the prevalence of self-reported depressive symptoms to be 39.86% (Yu et al., 2012). Another study conducted in Taiwan (China) by Chiu et al. (2005) showed the prevalence of depression to be 20.1%. This heterogeneity in the prevalence of depression may be due to the different populations and different methods of measuring depression. Further population-based studies in national representative samples are still needed.

Previous studies have been conducted to explore the relationships between social factors and depressive symptoms among community-dwelling elderly adults (Zeng et al., 2013; Yaka et al., 2014; Wang and Blazer, 2015). Chen et al. (2016) found that support from the neighborhood significantly affected depressive symptoms among low-income elders. Cao et al. (2015) found that social support mediated the relationship between social capital and geriatric depression. The study by Mechakra-Tahiri et al. (2009) indicated that social support and a lack of conflict in intimate relationships were associated with lower prevalence of depression in the elderly population of Quebec (Canada). Our study combined social support, social adjustment, and perceived neighborhood environment together and confirmed that social health was closely associated with geriatric depressive symptoms, which indicates that improvements to social health status may be an effective way to prevent depression in the older population.

Our findings have some implications for clinical practice for the elderly adults. Given the close association between the social health status and geriatric depressive symptoms, it is essential to identify those elderly adults with social health deficits. The 14-item SHSE scale could serve that purpose alongside face-to-face interviews. Those elderly adults with vulnerable social health levels can be identified by comparing their scores to the established norm. Although this study helps us characterize the nature of social health status and its relationship to depression, there are still several things to do before the SHSE can be used to guide targeted clinical interventions. First, the normative data for the subscales of the SHSE (social support, social adjustment, and perceived neighborhood environment) need to be developed so that the social health deficits of specific individuals can be identified more precisely. Second, further detailed systematic assessments other than the GDS and their association with the SHSE need to be conducted.

Our study also confirmed several health-related factors associated with depressive symptoms, including gender, physical exercise, and number of comorbidities (Chou and Chi, 2002; Chi et al., 2005; George et al., 2014; Holmquist et al., 2017). We observed that women had a significantly higher rate of depressive symptoms than did men, consistent with other studies (Forlani et al., 2014; Kuehner, 2017). Physical exercise or activities may enhance social health among the elderly. A recent study found that horticultural therapy, which involves physical activity and social interaction in a park environment, improves the mental health of the elderly (Ng et al., 2018). Our study also confirms that elderly adults with more chronic diseases have a higher risk of being depressed (Niti et al., 2007). The protective effect of social health remained significant after adjusting for these covariates, which strengthened the robustness of our results. Mobile health technology has been found to be beneficial in managing various psychiatric conditions in the elderly (Zhang et al., 2016; Zhang and Ho, 2017). Further research is required to evaluate the impact of mobile health technology (e.g. smartphone applications) on social health in the elderly.

The strengths of our study include its large sample size, detailed covariates, and reliable evaluation of social health status. However, there are several limitations that should be noted when interpreting our results. First, only association can be inferred from the current study, not causation, due to the inherent nature of the cross-sectional survey design. It should be noted that depressive symptoms can also have an effect on social health status, in terms of social participation, for example. Second, the representativeness of the study sample cannot be estimated due to the convenience sampling strategy and lack of data for those elderly people who refused to participate, limiting the generalizability of our results. The study sample was a little healthier than the elderly population as a whole. Caution should be taken when extrapolating our findings. Third, we used the GDS-15 scale to measure depressive symptoms among the elderly population, which may have caused an overestimation

of the rate of depression when compared to structured interviews. We chose the GDS-15 to measure depression mainly because of the low time costs of this scale, which can overcome fatigue and distraction during the interviewing of elderly adults. The GDS scale also has acceptable reliability and validity and has been widely used for the elderly Chinese population. Fourth, selection bias was inevitable, although no cash was given to participants who completed the interview, only gifts worth 10 CNY. Finally, further studies are needed to explore how the SHSE scale performs in evaluating social health level in comparison to other scales.

5 Conclusions

In this study, we observed an inverse association between social health status and depressive symptoms among a large community-based sample of elderly adults. The association between social health and depressive symptoms was consistent after adjusting for confounding factors. The SHSE may serve as an efficient screener to identify those with social health deficits, but systematic assessment to guide intervention merits further investigation.

Contributors

Kun CHEN is the guarantor of this work and had full access to all of the data in the study. Hong-lei DAI and Zhe-bin YU conceptualized the study and designed the analysis plan. Zhe-bin YU performed all the statistical analyses and Hong-lei DAI drafted the manuscript. Liu-qing YOU revised the manuscript. Min-hua FAN, Hong-wei ZHU, Dan-jie JIANG, Meng-yin WU, Shu-juan LIN, and Xiao-cong ZHANG contributed to the acquisition and interpretation of the data. All authors read and approved the final manuscript.

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Compliance with ethics guidelines

Hong-lei DAI, Zhe-bin YU, Liu-qing YOU, Min-hua FAN, Hong-wei ZHU, Dan-jie JIANG, Meng-yin WU, Shu-juan LIN, Xiao-cong ZHANG, and Kun CHEN declare that they have no conflict of interest.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all participants for being included in the study.

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中文概要

题　目：中国浙江省社区老年人社会健康状况与抑郁症状的相关性研究

目　的：探究在浙江省老年人群中社会健康状况与抑郁症状的相关性。

创新点：采用专为中国老年人群设计的社会健康量表（SHSE-S），在中国人群中首次揭示了社会健康与老年抑郁症状的相关性，为全面提高老年人的健康状况提供科学依据。

方　法：采用多阶段分层抽样的方法，纳入 3757 位浙江省社区常住老年人。采用包含 SHSE-S 和老年抑郁量表（GDS）在内的结构式问卷对老年人进行面对面访谈，采用多因素 Logistic 回归模型以及亚组分析等方法分析社会健康与老年抑郁症状的关联性。

结　论：在浙江省老年人群中，SHSE-S 得分越高，老年人抑郁症状的患病风险越低。该量表可作为社区筛查老年抑郁症状高危人群的工具，对促进老年人群的健康有重要意义。

关键词：抑郁症状；社会健康；老年人