Current Psychology (2023) 42:27186–27193
https://doi.org/10.1007/s12144-022-03782-9

Chronic disease and depression among the elderly in China: the mediating role of instrumental activities of daily living and the moderating role of area of residence

Jing Yuan[1] · Yan Wang[1] · Zejun Liu[2]

Accepted: 15 September 2022 / Published online: 14 October 2022

Abstract
Chronic diseases are associated with depressive symptoms in older adults. However, the mechanism of this relation is not clear. In this study, we explored the mediating role of instrumental activities of daily living and the moderating role of area of residence in the relationship between chronic diseases and depression. The data was from the Chinese Longitudinal Healthy Longevity Study. Results showed that chronic diseases were positively correlated with depression, and negatively associated with instrumental activities of daily living (IADLs). Moreover, IADLs mediated the relationship between chronic diseases and depression. In addition, area of residence (rural/urban) moderated the relation between IADLs and depression, such that this negative relation was stronger for old adults lived in rural area than for urban area. These results have important significance for prevention and intervention of depression in the elderly.

Keywords Older adults · Chronic disease · Depression · Instrumental activities of daily living · Area of residence

Introduction

The number of elderly people is increasing around the world, including China. By 2019, the number of people aged 60 or above in China had reached 254 million, accounting for 18.1% of the total population (National Bureau of Statistics of China, 2019). It is predicted the number of people aged 60 and above is peak at 488 million, accounting for 35.6% of the total population by 2050 (United Nations Department of Economic and Social Affairs 2019). Aging-related issues are becoming increasingly serious. Depression is the most common mental disorder in later life, affecting 10–20% of older adults in the world (Ames et al., 2010; Barua et al., 2011; Byers et al., 2010; Prina et al., 2011). In China, the prevalence of depression was 20.3% in urban areas and 31.8% in rural areas in middle-aged and older adults (Wu et al., 2019). Depression among the elders significantly increases risk of physical health problems, suicide, mortality, and reduced physical, executive and social functioning (Wright & Thorpe, 2016; Hegeman et al. 2016; Elderkin-Thompson et al., 2006). For example, older adults with moderately severe depression were 48 times more likely to have suicidal thoughts than those with no or mild symptoms of depression (Rossom et al. 2019). Because of its serious consequences, geriatric depression has received more and more attention from researchers (Vanderhorst & Mclaren, 2005; Tomás et al., 2019).

Chronic diseases and depression

Chronic disease and multimorbidity (characterized by two or more chronic diseases) are one of the most important factors affecting depression in the elderly (Cao et al. 2015; Li et al., 2015). Chronic diseases refer to long-term and persistent diseases that affect patients' normal functioning. Among the elderly (≥ 60 years old) in China, the prevalence of chronic diseases among urban residents was as high as 87.0% (Hu et al., 2015). Chronic diseases have the potential to induce profound changes in the life of patients, reducing the quality of life and resulting negative emotion (Sprangers et al., 2000; Barlow et al., 2015) used growth-curve models and

✉ Jing Yuan
yuanjing_0312@126.com

[1] School of Nursing, Hebei University, Baoding, Hebei, China

[2] Department of Psychology, Educational College, Shanghai Normal University, Shanghai, China

found that loneliness increased linearly over time among participants who reported high rather than low baseline levels of chronic disease.

The association between chronic diseases and depression has been confirmed in many studies (Ma, 2018; Xue et al., 2017; Xiao et al., 2018; Olvera et al., 2016; Niti et al., 2007; Vu et al., 2018, 2019; Ng et al., 2022; Zhang et al., 2011). Compared with those without chronic diseases, the elderly with at least one chronic physical condition reported a high prevalence of depression (3.2% vs. 9.3–23%) (Moussavi et al. 2007). Jiang et al. (2020) used data collected from the China Health and Retirement Longitudinal Study (CHARLS), and found that in middle-aged and elderly people 12 kinds of chronic diseases (hypertension, diabetes, dyslipidemia, cancer, chronic lung disease, liver disease, heart failure, stroke, kidney disease, arthritis or rheumatism, asthma, digestive disease) and multimorbidity were significantly associated with depression. Further analysis showed that among the chronic diseases, asthma patients had the highest prevalence of depression (57.68%) and hypertension patients had the lowest prevalence (37.21%). In a longitude study, Chou and Chi (2002) examined the impact of a series of chronic diseases on change in depressive symptoms among the older people in Hong Kong with multiple regression models. They found that arthritis was associated with depressive symptoms three years later. In addition, older adults with multimorbidity were reported to be two to three times more likely to develop depression than the elderly without multimorbidity (Read et al., 2017). Although studies have confirmed an association between chronic illness and depressive symptoms among middle-aged and elderly people, there is little research on the potential pathway of this relationship.

The medicating role of instrumental activities of daily living

The disability in older adults can be measured in a number of ways, one of which is instrumental activities of daily living (IADLs). The IADLs function represents the activities that are required to independently adapt to the environment, such as shopping, transportation, housekeeping etc. (Lawton & Brody, 1969). The inability to perform IADLs was associated with poorer quality of life, increased health care costs and risk of mortality (Thompson et al., 2012). As we know, as people get older, it becomes more and more difficult to continue living as a capable, active and strong person. Guo et al. (2020) conducted binary logistic regressions to evaluate the associations between baseline isolation, loneliness and functional capacity (includes activities of daily living (ADLs) and IADLs) in Chinese older adults, and found social isolation was significantly associated with functional disability.

The impact of individual chronic diseases on disability in function in the elderly has been studied for a long time (Yokota et al., 2015; Gulley et al., 2018; Griffith et al., 2010) used data from Canadian Study of Health and Aging, and found that five chronic diseases (foot problems, arthritis, cognitive impairment, heart problems and vision) made the largest contribution to ADLs- and IADLs-related functional disabilities. They revealed chronic diseases accounted for nearly 50% of the IADLs-related disability. Bowling et al. (2011) found decline in IADLs occurred in 35% in older adults with chronic kidney disease. Calderón-Larrañaga et al. (2018) used data from a longitudinal study and found that the speed of multimorbidity development was a strong prognostic factor for disability related to ADLs and IADLs.

In addition, impairment in IADLs is also associated with depression (Kiosses & Alexopoulos, 2005; Kim et al., 2018). In Lam et al. (2014)' s study, they performed a cross-sectional survey to examine the relationship between IADLs and depression, and found IADLs function significantly decreased as depression levels increased in older adults. As for the direction of causation, sometimes, functional limitation is seen as the cause of depressive symptoms. Han (2002) conducted a longitudinal study to examine the baseline depressive symptoms and subsequent changes in functional disability among a sample of 6,714 community-dwelling older adults, and found depressive symptoms at baseline predicted a greater deterioration of ADLs and IADLs impairments.

The moderating role of area of residence

There are significant urban-rural differences in access to healthcare in developing countries. In China, where more than half of the population lives in rural areas, the proportion of the elderly is much higher. The China Health and Nutrition survey showed that compared with urban areas a 30% increased mortality for those aged 50 and over in rural areas (Zimmer et al., 2007; Su et al., 2012) compared levels of depression among empty-nest elderly who living in the rural and urban area in Wuhan, China, and found the rural empty-nest elderly had a higher depression score than the urban. Cheng et al. (2020) also provided evidence of urban–rural differences in mental health among adults (mean age 58.5) in China. In their study, they found rural participants reported more symptoms of anxiety and depression compared to urban participants. As for the relationship of IADLs and area of residence, Zhao et al. (2021) used data from CHARLS 2015, including 11,176 participants aged 45 and older. They estimated the effect of multimorbidity on IADLs disability with multivariable logistic regression models, and

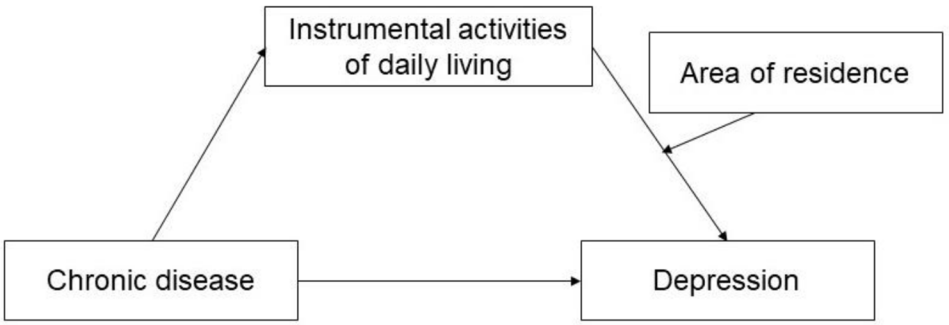

Fig. 1 Moderated mediation model

found compared to the rural older adults, the impact of multimorbidity on IADLs limitation was lower in the elderly living in urban areas.

The current study

Aging is a major challenge facing all countries in the world. The prevalence of chronic diseases in the elderly is very high, and affect their mental health. However, there is fewer study to explore the mechanism of relationship between chronic diseases and depression. By review the literature, the current study examined the effect of chronic diseases on depression among Chinese older adults and explored whether this relationship was indirectly linked via IADLs. In addition, we also tested the moderating role of area of residence in the association between IADLs and depression. Therefore, the following hypothesis was proposed: (1) chronic diseases would be positively related to depression in elders and this relationship was expected to be partly explained by IADLs. (2) Area of residence would moderate the relationship between IADLs and depression, that is, this association would be stronger for elders lived in rural area than for urban area. The proposed mediated moderation model is illustrated in Fig. 1.

Methods

Data sources

The data in this paper were from the Chinese Longitudinal Healthy Longevity Study (CLHLS) -2018 cross sectional dataset. CLHLS is conducted by Peking University Health Aging and Development Research Center/National Academy of Development. The survey covers 23 provinces and autonomous regions across China, and the survey subjects are the elderly aged 65 and above and their adult children aged 35–64. The survey includes questionnaire for interviews to the surviving participants and questionnaire addressed to a close family member of the deceased interviewees. The survey contents of surviving participants included basic status of the elderly and their families, socioeconomic background and family structure, economic sources and economic status, self-assessment of health and quality of life, cognitive function, personality and psychological characteristics, daily activities, lifestyle, life care, disease treatment and medical expenses.

Participants

Our criteria for screening participants were as follows: (1) lived in their current area of residence for more than ten years; (2) had at least one chronic disease and had been diagnosed by the hospital; (3) there was no missing data for any variable.

Based on these criteria, there were 1557 participants whose ages ranged from 65 to 117 ($M = 82.57$, $SD = 10.54$) in the present study, including male 712 (45.7%), female 845 (54.3%); urban 413 (26.5%), rural 1144 (73.5%); living with household member(s) 1244 (79.9%), living alone 285 (18.3%), living in an institution 28 (1.8%). All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Research Ethics Committees.

Measures

Demographic information and chronic diseases

Demographic information included age, gender, co-residence of participants (living with household members/alone/in an institution), area of residence (urban or rural areas). In the original survey, there were three options of area of residence, city, town and rural, respectively. We considered both town and rural as rural areas, city as urban areas in the present study. In the current study, we did not use *hukou*, which is commonly used in other studies (Li et al., 2016; Kuang & Liu, 2012), as the basis for distinguishing between urban and rural areas. Instead, we used the

criterion of "lived in their current area of residence for more than ten years" as the basis for distinguishing.

The chronic diseases were measured by two questions: (1) diagnosed by hospital or not? (2) disability in daily life. If the chronic disease was diagnosed by hospital, the score of disability in daily life caused by it would be taken into account. In this study, we made a reverse of the score of disability (1 = no, 2 = more or less, 3 = rather serious) from the original survey (1 = rather serious, 2 = more or less, 3 = no). There were 25 kinds of chronic diseases, such as hypertension, diabetes, heart disease, etc. We took each chronic disease as an item and added up the scores of disabilities in the diagnosed chronic disease as the severity of chronic diseases. The higher the score, the more severe the chronic diseases.

Depression

The depression was assessed by CES-D-10 (Center for Epidemiologic Studies Depression Scale-10) (Andresen et al., 1994). In the CLHLS, participants were required to rate each item on a 5-point Likert scale ranging from 1 (always) to 5 (never). To make it easier to understand, we scored items 1, 2, 3, 4, 6, 8, and 9 in reverse. The sum scores can range from 10 to 50, with higher scores indicating higher degrees of depression. The Cronbach's alpha coefficient was 0.80 CES-D-10 in this study.

IADLs

Eight items in CLHLS were used to measure the IADLs in this study. The items were taken from the Lawton Instrumental Activities of Daily Living Scale (Lawton & Brody, 1969), some of which were localized. The items were as following: (1) able to go outside to visit neighbors? (2) able to go shopping by yourself? (3) able to make food by yourself? (4) able to wash clothes? (5) able to walk one kilometer? (6) able to carry 5 kg weight? (7) able to crouch and stand three times? (8) able to take public transportation? Participants responded on a 3-point Likert scale, in the CLHLS survey, ranging from 1 (yes) to 3 (unable to do so). In our study, we made a reverse of the scores of these items. The overall score ranged from 8 to 24. With the higher the score, the better the ability to take care of themselves. The Cronbach's alpha coefficient was 0.95 in this study.

Data analysis

Data were analyzed by SPSS 21.0. Descriptive statistics were used to characterize participants' demographics. The relationships among chronic diseases, depression and IADLs were examined with Pearson correlation analysis.

Table 1 Means, standard deviations, and correlations among study variables

	$M \pm SD$	1	2	3
1 Chronic diseases	4.04 ± 3.30	1		
2 IADLs	19.35 ± 5.60	−0.167**	1	
3 Depression	22.42 ± 5.96	0.139**	−0.192**	1

** $p < .01$

The moderated mediation model was tested with the SPSS Marco PROCESS (Model 4 and Model 14) (Hayes, 2013). To obtain the standardized regression coefficients, all the raw scores were transformed to z-scores before testing the mediated moderation effect, and the area of residence was defined as a dummy variable.

Results

Bivariate analyses

We conducted the Pearson correlations to calculate the relationships among chronic diseases, depression and IADLs. Table 1 showed the results of the correlations as well as the means and standard deviations of the variables. The results showed that chronic diseases were negatively correlated with IADLs (r=-.167, $p < .01$) and positively correlated with depression ($r = .139$, $p < .01$). IADLs was negatively correlated with depression (r=-.192, $p < .01$).

Mediation analyses

Model 4 was used to test the mediating role of IADLs on the relation between chronic diseases and depression. The results were shown in Table 2. After controlling demographic variables (sex, age and co-residence), we found chronic diseases negatively predicted IADLs (β=-0.15, $p < .001$) and positively predicted depression ($\beta = 0.14$, $p < .001$), and IADLs negatively predicted depression (β=-0.20, $p < .001$). The result of bias-corrected bootstrapping showed that IADLs mediated the relation between chronic diseases and depression, and the standardized indirect effect was 0.054, 95% CI [0.033, 0.081], accounting for 22.04% of the total effect (total effect was 0.245). The direct effect of chronic diseases on depression was 0.191, 95% CI [0.102, 0.280], accounting for 77.96% of the total effect. We generated 5000 bootstrapping procedures as recommended in previous studies (Hayes, 2013).

Mediated moderation analyses

After the mediation model was verified, we conducted Model 14 in SPSS PROCESS Marco to examine the mediated

Table 2 Testing the moderated mediation effect

Dependent variable	Independent variables	R	β (SE)	LLCI	ULCI
IADLs		0.63 ***			
	Sex		−0.09 (0.22) ***	-1.397	−0.525
	Age		−0.60 (0.01) ***	−0.339	−0.298
	Co-residence		0.06 (0.24) **	0.204	1.158
	Chronic diseases		−0.15 (0.03) ***	−0.319	−0.188
Depression		0.19 ***			
	Sex		0.08 (0.30) **	0.310	1.487
	Age		0.06 (0.01) *	0.008	0.064
	Co-residence		0.06 (0.33) *	0.175	1.463
	Chronic diseases		0.14 (0.05) ***	0.156	0.333
Depression		0.24 ***			
	Sex		0.06 (0.30) *	0.109	1.278
	Age		−0.06 (0.02)	−0.067	0.003
	Co-residence		0.07 (0.33) **	0.326	1.603
	Chronic diseases		0.11 (0.05) ***	0.102	0.280
	IADLs		−0.20 (0.03) ***	−0.280	−0.147
Depression		0.34 ***			
	Sex		0.53 (0.29)	−0.040	1.098
	Age		−0.04 (02) *	−0.068	−0.001
	Co-residence		0.93 (0.32) **	0.304	1.545
	Chronic diseases		0.24 (0.04) ***	0.156	0.330
	IADLs		−0.01 (0.09)	−0.201	0.175
	Area of residence		3.05 (0.33) ***	2.399	3.691
	Int		−0.14 (0.05) *	−0.243	−0.029
Conditional indirect effect of IADLs on Depression at Area of residence			β (Boot SE)	BootLLCI	BootULCI
urban			−0.15 (0.048) **	−0.244	−0.054
rural			−0.28 (0.038) ***	−0.359	−0.210

*$p < .05$; ** $p < .01$; *** $p < .001$. Standardized regression coefficients appear above. Int = Area of residence×IADLs.

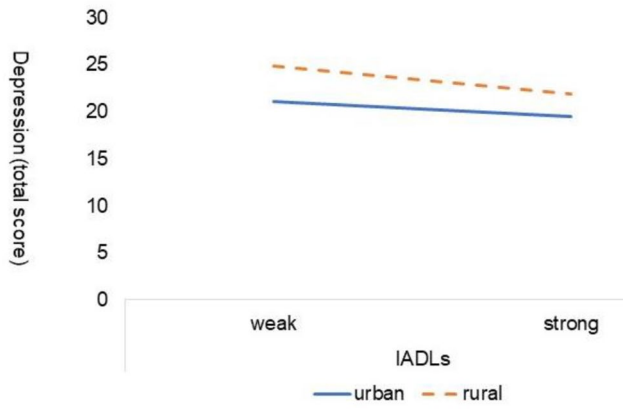

Fig. 2 Area of residence as a moderator between IADLs and depression

moderation model, and the results were shown in Table 2. The interaction of area of residence and IADLs negatively predicted depression (β=-0.136, $p < .05$). These results suggested that area of residence played a moderating role in the relation between IADLs and depression. Simple slope analyses revealed that, for rural elders, the negative prediction of IADLs on depression (b_{simple} =-0.28, $p < .001$) was stronger than that for urban elders (b_{simple} =-0.15, $p < .01$). The moderation effects were illustrated in Fig. 2.

4 Discussion

With the aging of the population, issues related to the elderly are receiving attention. Researchers have recognized the close relationship between physical and mental health in older adults (Petrova & Khvostikova, 2021). However, the mechanism of this relation has been less explored. In this study, we examined the mediating role of IADLs in the relation between chronic diseases and depression, and the moderating role of area of residence in this association. Resulted showed, as we hypothesized, IADLs mediated the relation between chronic diseases and depression, and area of residence moderated the relation between IADLs and depression. In addition, simple slope analysis showed that IADLs was a more negative predictor of depression in older adults in rural areas than in urban areas.

The mediating role of IADLS

Mediating model test showed that chronic diseases not only had a direct predictive effect on mental health of the elderly, but also had an indirect effect on depression through IADLs. These results are consistent with previous studies, which indicates that chronic diseases positively relate to depression (Pruchno et al., 2016; Sharpe et al., 2017) and negatively relate functional ability (the more severe the chronic diseases, the weaker the functional ability) (Bowling et al., 2011; Calderón-Larrañaga et al., 2018).

Older adults with chronic diseases are at increased risk of poorer quality of life and mental health (Leung et al., 2020). The disability model proposed by Verbrugge and Patrick's (1995) explains the mechanism of the relation between chronic diseases and mental disorders. The disability model describes the path from pathology (biological level) to disability (quality of life). On the biological level: Some chronic diseases and depression share a common biological substratum. On the impairments and functional limitations level: Chronic diseases have generic characteristics such as life threat and may themselves be considered as stressors. Moreover, disability and impairment caused by chronic diseases have stressful consequences that produce stress. The more stressful these consequences are, the greater the likelihood of developing a mental disorder, such as depression and anxiety. Furthermore, due to functional limitations, chronic diseases may have a social, relational or physical impact that can be stressful or cause mental distress (Verhaak et al., 2005). To be specific, chronic diseases such as heart and lung disease, arthritis, hypertension, and diabetes accompanied by a lot of pain and physical limitation, are significant risk factors for depressive symptoms. It is likely that elders with chronic diseases may have less IADLs capacity and become more dependence, making them feel stressed and ultimately lead to depression.

The moderating role of area of residence

In this study, we found the relation between depression and ability in IADLs was more negative in elders lived in rural area than that of in urban area. The predictive power of urban-rural differences is consistent with previous studies, and the likelihood of IADLs disability in rural elderly was significantly higher than that in urban elderly (Zhang et al., 2017). As we all know, adequate access to healthcare is particularly important for older adults who need higher levels of treatment and care to treat disease and prolong survival. There are significant urban-rural differences in access to and utilization of health services in China. Compared with urban elders, rural elders have less access to healthcare. When rural elderly people have health problems, they are often unable to receive timely treatment due to their distance from hospitals. Inadequate access to healthcare was significantly associated with higher rates of disability and mortality among older adults.

Studies also have showed that rural elders in China have higher levels of depression than urban elders (Dong & Simon, 2010; Li et al., 2011). This may be because on the one hand, urban residents are likely to have benefited more from recent economic developments than rural residents in terms of economic status, quality of life and improved medical services. On the other hand, rural elders have worse health status, faster decline in physical function compared with their urban peers. Physical limitation and disability are known to increase the risk of depression in older adults (Li et al., 2016).

Limitations and contributions

Several limitations of the present study should be mentioned. Frist, since the data were collected through self-report, there may be common-method biases, which may affect the validity of our conclusions. Second, due to the cross-sectional design adopted in this study, our findings can only be interpreted as correlation. Therefore, we should be careful in interpreting the findings. Future researchers can use longitudinal study to elucidate the causality of these variables. Third, the samples in this study were Chinese elderly people over 65 years old, as we know, the functional limitation may be more severe with age. Perhaps the relationship among chronic diseases, ADLs, depression and area of residence would be more pronounced if we can distinguish between different age groups. Last but not least, based on the available data, we cannot obtain the influence of post-COVID-19 syndrome on depression, which is a very complex problem and deserves to be studied (Renaud-Charest et al., 2021). Even with these limitations, this study contributes to growing efforts to understand the potential pathway from chronic diseases to depression. This is of great significance for the prevention and intervention of depression in the elderly. Additionally, as far as we know, CLHLS has the largest sample of elderly population in China. Therefore, the findings in this study are very representative.

Acknowledgements We thank the CLHLS and all the interviewees and their families for their voluntary participation in the CLHLS.

Funding This research was supported by Medical Science Foundation of Hebei University (2022X04), the Key Research and Development Program Project of Hebei Province (18277735D) and Intellectual Property Project of Hebei Province.

Data Availability Data can be obtained by emailing the corresponding author.

Declarations

Informed consent This study was carried out in accordance with the recommendations of the Research Ethics Committees of Peking University with written informed consent from all subjects.

Conflicts of interest/Competing interests No Conflicts of interest.

References

Ames, D., Chiu, E., Lindesay, J. L., & Shulman, K. I. (2010). *Guide to the psychiatry of old age*. Cambridge: Cambridge University Press.

Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *American Journal of Preventive Medicine*, *10*, 77–84.

Barlow, M. A., Liu, S. Y., & Wrosch, C. (2015). Chronic Illness and Loneliness in Older Adulthood: The Role of Self-Protective Control Strategies. *Health Psychology*, *34*, 870–879.

Barua, A., Ghosh, M. K., Kar, N., & Basilio, M. A. (2011). Prevalence of depressive disorders in the elderly. *Annals of Saudi Medicine*, *31*, 620–624.

Bowling, C. B., Sawyer, P., Campbell, R. C., Ahmed, A., & Allman, R. M. (2011). Impact of chronic kidney disease on activities of daily living in community-dwelling older adults. *Journal of Gerontology: Medical Sciences*, *66A*, 689–694.

Byers, A. L., Yaffe, K., Covinsky, K. E., Friedman, M. B., & Bruce, M. L. (2010). High occurrence of mood and anxiety disorders among older adults: the national comorbidity survey replication. *Archives of general psychiatry*, *67*, 489–496.

Calderón-Larrañaga, A., Santoni, G., Wang, H. X., Welmer, A. K., Rizzuto, D., Vetrano, D. L., Marengoni, A., & Fratiglioni, L. (2018). Rapidly developing multimorbidity and disability in older adults: does social background matter? *Journal of Internal Medicine*, *283*, 489–499.

Cao, W., Guo, C., Ping, W., Tan, Z., Guo, Y., & Zheng, J. (2015). A community-based study of quality of life and depression among older adults. *International Journal of Environmental Research and Public Health*, *13*, 693–702.

Cheng, C., Yang, C., Inder, K., & Chan, S. W. (2020). Urban–rural differences in mental health among Chinese patients with multiple chronic conditions. *International Journal of Mental Health Nursing*, *29*, 224–234.

Chou, K. L., & Chi, I. (2002). Chronic illness and depressive symptoms among Chinese older adults: A longitudinal study. *Aging and Human Development*, *54*, 159–171.

Dong, X., & Simon, M. (2010). Health and aging in a Chinese population: Urban and rural disparities. *Geriatrics & Gerontology International*, *10*, 85–93.

Elderkin-Thompson, V., Mintz, J., Haroon, E., Lavretsky, H., & Kumar, A. (2006). Executive dysfunction and memory in older patients with major and minor depression. *Archives of Clinical Neuropsychology*, *21*, 669–676.

Griffith, L., Raina, P., Wu, H., Zhu, B., & Stathokostas, L. (2010). Population attributable risk for functional disability associated with chronic conditions in Canadian older adults. *Age And Ageing*, *39*, 738–745.

Gulley, S. P., Rasch, E. K., Bethell, C. D., Carle, A. C., Druss, B. G., Houtrow, A. J., Reichard, A., & Chan, L. (2018). At the intersection of chronic disease, disability and health services research: A scoping literature review. *Disability and Health Journal*, *11*, 192–203.

Guo, L., An, L., Luo, F., & Yu, B. (2020). Social isolation, loneliness and functional disability in Chinese older women and men: a longitudinal study. *Age and Ageing*, *50*, 1222–1228.

Han, B. (2002). Depressive symptoms and self-rated health in community-dwelling older adults: A longitudinal study. *Journal of American Geriatrics Society*, *50*, 1549–1556.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Hegeman, J. M., de Waal, M. W. M., Comijs, H. C., Kok, R. M., & van der Mast, R. C. (2016). Depression in later life: a more somatic presentation? *Journal of Affective Disorders*, *170*, 196–202.

Hu, X., Huang, J., Lv, Y., Li, G., & Peng, X. (2015). Status of prevalence study on multimorbidity of chronic disease in China: systematic review. *Geriatrics Gerontology International*, *15*, 1–10.

Jiang, C., Zhu, F., & Qin, T. (2020). Relationships between chronic diseases and depression among middle-aged and elderly people in China: A prospective study from CHARLS. *Current Medical Science*, *40*, 858–870.

Lam, B. T., Cervantes, A. R., & Lee, W. K. (2014). Late-Life Depression, Social Support, Instrumental Activities of Daily Living, and Utilization of In-Home and Community-Based Services in Older Adults. *Journal of Human Behavior in the Social Environment*, *24*, 499–512.

Lawton, M. P., & Brody, E. M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist*, *9*, 179–186.

Leung, J., Fan, V. S., & Mahadevan, R. (2020). How do different chronic condition comorbidities affect changes in depressive symptoms of middle aged and older adults? *Journal of Affective Disorders*, *272*, 46–49.

Li, C. C., Jiang, S., Yang, T., Zheng, W. G., & Zhou, C. C. (2015). Depression status and its risk factors among single empty-nest elderly in Shandong province. *Chinese Journal of Public Health*, *31*, 1587–1589.

Li, L. W., Liu, J., Xu, H., & Zhang, Z. (2016). Understanding rural–urban differences in depressive symptoms among older adults in China. *Journal of Aging and Health*, *28*, 341.

Li, N., Pang, L., Chen, G., Song, X., Zhang, J., & Zheng, X. (2011). Risk factors for depression in older adults in Beijing. *Canadian Journal of Psychiatry*, *56*, 466–473.

Liu, L., & Kuang, L. (2012). Discrimination against Rural-to-Urban Migrants: The Role of the Hukou System in China. *Plos One*, *7*, e46932.

Kim, B. J., Liu, L., Nakaoka, S., Jang, S., & Browne, C. (2018). Depression among older Japanese Americans: The impact of functional (ADL & IADL) and cognitive status. *Social Work in Health Care*, *57*, 109–125.

Kiosses, D. N., & Alexopoulos, G. S. (2005). IADL Functions, Cognitive Deficits, and Severity of Depression: A Preliminary Study. *American Journal of Geriatric Psychiatry*, *13*, 244–249.

Ma, C. (2018). The prevalence of depressive symptoms and associated factors in countryside-dwelling older Chinese patients with hypertension. *Journal of clinical nursing*, *27*, 2933–2941.

Moussavi, S., Chatterji, S., Verdes, E., Tandon, A., Patel, V., & Ustun, B. (2007). Depression, chronic diseases, and decrements in health: results from the World Health Surveys. *Lancet*, *370*, 851–858.

Ng, C. Y. H., Tay, S. H., McIntyre, R. S., Ho, R., Tam, W. W. S., & Ho, C. S. H. (2022). Elucidating a bidirectional association between rheumatoid arthritis and depression: A systematic review and meta-analysis. *Journal of Affective Disorders*, *311*, 407–415.

Niti, M., Ng, T., Kua, E. H. K., Ho, R. C. M., & Tan, C. H. (2007). Depression and chronic medical illnesses in Asian older adults:

the role of subjective health and functional status. *International Journal of Geriatric Psychiatry*, *22*, 1087–1094.
Olvera, R. L., Fisher-Hoch, S. P., Williamson, D. E., Vatcheva, K. P., & McCormick, J. B. (2016). Depression in Mexican Americans with diagnosed and undiagnosed diabetes. *Psychological Medicine*, *46*, 637–646.
Petrova, N. N., & Khvostikova, D. A. (2021). Prevalence, structure, and risk factors for mental disorders in older people. *Advances in Gerontology*, *11*, 409–415.
Prina, A. M., Ferri, C. P., Guerra, M., Brayne, C., & Prince, M. (2011). Prevalence of anxiety and its correlates among older adults in Latin America, India and China: cross-cultural study. *British Journal of Psychiatry*, *199*, 485–491.
Pruchno, R. A., Wilson-Genderson, M., & Heid, A. R. (2016). Multiple chronic condition combinations and depression in community-dwelling older adults. *Journals of Gerontology: Medical Sciences*, *71*, 910–915.
Read, J. R., Sharpe, L., Modini, M., & Dear, B. F. (2017). Multimorbidity and depression: A systematic review and meta-analysis. *Journal of Affect Disorder*, *221*, 36–46.
Renaud-Charest, O., Lui, L. M. W., Eskander, S., Ceban, F., Ho, R., Vincenzo, J. D. D., Rosenblat, J. D., Lee, Y., Subramaniapillai, M., & McIntyre, R. S. (2021). Onset and frequency of depression in post-COVID-19 syndrome: A systematic review. *Journal of Psychiatric Research*, *144*, 129–137.
Rossom, R. C., Simon, G. E., Coleman, K. J., Beck, A., Oliver, M., Stewart, C., & Ahmedani, B. (2019). Are wishes for death or suicidal ideation symptoms of depression in older adults? *Aging & Mental Health*, *23*, 912–918.
Sharpe, L., McDonald, S., Correia, H., Raue, P. J., Meade, T., Nicholas, M., & Arean, P. (2017). Pain severity predicts depressive symptoms over and above individual illnesses and multimorbidity in older adults. *Bmc Psychiatry*, *17*, 166.
Sprangers, M. A. G., de Regt, E. B., Andries, F., van Agt, H. M. E., Bijl, R. V., de Boer, J. B., Foets, M., Hoeymans, N., Jacobs, A. E., Kempen, G. I. J. M., Miedema, H. S., Tijhuis, M. A. R., & de Haes, H. C. J. M. (2000). Which chronic conditions are associated with better or poorer quality of life? *Journal of Clinical Epidemiology*, *53*, 895–907.
Statistical Bulletin of the People's Republic of China on National Economic and Social Development in 2019. (In Chinese).
Su, D., Wu, X., Zhang, Y., Li, H., Wang, W., Zhang, J., & Zhou, L. (2012). Depression and social support between China' rural and urban empty-nest elderly. *Archives of Gerontology and Geriatrics*, *55*, 564–569.
Thompson, W. W., Zack, M. M., Krahn, G. L., Andresen, E. M., & Barile, J. P. (2012). Health-related quality of life among older adults with and without functional limitations. *American Journal of Public Health*, *102*, 496–502.
Tomás, J. M., Pinazo-Hernandis, S., Oliver, A., Donio-Bellegarde, M., & Tomás-Aguirre, F. (2019). Loneliness and social support: Differential predictive power on depression and satisfaction in senior citizens. *Journal of Community Psychology*, *47*, 1225–1234.
United Nations Department of Economic and Social Affairs. World Population Prospects: The 2019 Revision. Available online: https://population.un.org/wpp/Download/Standard/Population/ (In Chinese)
Vanderhorst, R. K., & Mclaren, S. (2005). Social relationships as predictors of depression and suicidal ideation in older adults. *Aging & Mental Health*, *9*, 517–525.
Verbrugge, L. M., & Patrick, D. (1995). Seven chronic conditions: Their impact on us adults' activity levels and use of medical services. *American Journal of Public Health*, *85*, 173–182.
Verhaak, P. F. M., Heijmans, M. J. W. M., Peters, L., & Rijken, M. (2005). Chronic disease and mental disorder. *Social Science & Medicine*, *60*, 789–797.
Vu, H. T. T., Nguyen, T. X., Nguyen, H. T. T., Le, T. A., Nguyen, T. N., Nguyen, A. T., Nguyen, T. T. H., Nguyen, H. L., Nguyen, C. T., Tran, B. X., Latkin, C. A., Pham, P. T., Zhang, M. W. B., & Ho, R. C. M. (2018). Depressive symptoms among elderly diabetic patients in Vietnam. *Diabetes Metabolic Syndrome and Obesity*, *11*, 659–665.
Vu, T. T. M., Le, T. V., Dang, A. K., Nguyen, L. H., Nguyen, B. C., Tran, B. X., Latkin, C. A., Ho, C. S. H., & Ho, R. C. M. (2019). Socioeconomic vulnerability to depressive symptoms in patients with chronic hepatitis B. *International Journal of Environmental Research and Public Health*, *16*, 255.
Wright, P. P., & Thorpe, C. W. (2016). Triple threat among the elderly: Depression, suicide risk, and handguns. *Journal of Emergency Nursing*, *42*, 14–18.
Wu, Y., Lei, P., Ye, R., Sunil, T. S., & Zhou, H. (2019). Prevalence and risk factors of depression in middle-aged and older adults in urban and rural areas in China: a cross-sectional study. *The Lancet*, *394*, S53.
Xiao, T., Qiu, H., Chen, Y., Zhou, X., Wu, K., Ruan, X., Wang, N., & Fu, C. (2018). Prevalence of anxiety and depression symptoms and their associated factors in mild COPD patients from community settings, Shanghai, China: a cross-sectional study. *Bmc Psychiatry*, *18*, 89.
Xue, J., Chen, S., Bogner, H. R., Tan, W., Li, L., & Conwell, Y. (2017). The prevalence of depressive symptoms among older patients with hypertension in rural China. *International Journal of Geriatric Psychiatry*, *32*, 1411–1417.
Yokota, R. T. C., Berger, N., Nusselder, W. J., Robine, J., Tafforeau, J., Deboosere, P., & Van Oyen, H. (2015). Contribution of chronic diseases to the disability burden in a population 15 years and older. *Bmc Public Health*, *15*, article 229.1997–2008.
Zhang, M. W. B., Ho, R. C. M., Cheung, M. W. L., Fu, E., & Mak, A. (2011). Prevalence of depressive symptoms in patients with chronic obstructive pulmonary disease: a systematic review, meta-analysis and meta-regression. *General Hospital Psychiatry*, *33*, 217–223.
Zhang, X., Dupre, M. E., Qiu, L., Zhou, W., Zhao, Y., & Gu, D. (2017). Urban-rural differences in the association between access to healthcare and health outcomes among older adults in China. *BMC Geriatrics*, *17*, 151.
Zhao, Y., He, L., Han, C., Oldenburg, B., Sum, G., Haregu, T. N., & Liu, X. (2021). Urban-rural differences in the impacts of multiple chronic disease on functional limitations and work productivity among Chinese adults. *Global Health Action*, *14*, 1975921.
Zimmer, Z., Kaneda, T., & Spess, L. (2007). An examination of urban versus rural mortality in China using community and individual data. *Journal of Gerontology: Social Sciences*, *62*, S349–S357.