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Article

Between Chronic Diseases and Geriatric Depression: Mediational Effects of Activities of Daily Living (ADLs) Disability Among Older Adults

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Abstract: This study is aimed to explore relations between chronic diseases, activities of daily living (ADLs) disability and depression among older adults, particularly ADLs disability mediational effects on the correlation between chronic diseases and geriatric depression. Records of 5931 participants at age 60 and above from China Health and Retirement Longitudinal Study (CHARLS) in 2015 were used as valid samples for data relating to their chronic diseases index, ADLs scale and Center for Epidemiologic Studies Depression (CES-D) scale. Our findings confirm that among older adults, 75.9% are afflicted with chronic diseases and 52.5% have ADLs difficulty or disability, and that there exists a significant positive correlation between the numbers of chronic diseases they suffer, these verity of ADLs disability they experience and the risks/level of depression they have or will have. Besides, for older adults, ADLs disability plays a partially mediational role in the correlation between the numbers of chronic diseases and the level/risks of geriatric depression. Mental health of the older adults with chronic diseases, therefore, should be taken seriously by caregivers and self-management support and ADLs exercises are supposed to be provided by them to help reduce the risk of geriatric depression.

Keywords: Older adults; chronic diseases; activities of daily living (ADLs); depression

1 Introduction

With the largest number of older adults in the world, China is experiencing a rapid ageing of the population. Studies show that the number of Chinese citizens at age 65 and surpasses 110 million in 2011 and will reach 400 million in 2050 [1]. The government has made a lot of sincere efforts to provide social support to its old people. However, as older adults experience a deterioration of their physiological functions and changes in their social roles, their mental health becomes an issue that cannot be neglected or overlooked. Among all the known mental disorders, geriatric depression has a rather high occurrence, which, according to the findings of a review research, though much lower than that found among the middle-aged, will increase if the interviewed older adults are afflicted with chronic diseases and/or

disabilities. The overall ratio of older adults at age 65 and above having depression or showing depressive symptoms is between 0.9% and 42%, but for members of the same age group who have been clinically diagnosed with some disabling diseases, this ratio is between 7.2% and 49% [2]. Depression reduces the quality of sleep and life among older adults [3], restricts their social functions and increases their risks of suicide and other untimely death [4]. It is vital to understand the risk factors of depression in older adults before any effective preventive and protective measures could be found or proposed. Influencing factors, such as age, gender, education level and marital status, have proven their liability to risks of geriatric depression [5]; community environments another influencing factor as poverty and homicide rates have been found positively correlated to geriatric depressive symptoms [6]; while older adults who have a lower level of social exclusion are found less likely to have a depression [7].

It is not easy for the geriatric to maintain physical health. The physical fitness status of older adults can be used to predict the likelihood of their emotional distress and depressive symptoms. The self-awareness of their actual health status is negatively correlated with the likelihood of geriatric depression while increase in type or quantity of the prescribed drugs for medication, and/or decrease of their sight and/or hearing, are positively correlated with depression [8]. As the population is ageing, the number of individuals with hypertension, diabetes, cardio-cerebrovascular and/or other chronic diseases increases. Surveys show that 64.9% of the elderly population in Sichuan province of China have at least one chronic disease while 18% have two chronic diseases and 11.5% have three or more [9]. Chronic diseases, closely connected with geriatric depression, have become a grave threat to the physical and mental health of older adults as well as their quality of life. Researchers have discovered that stroke, loss of hearing, loss of sight, heart disorders, chronic pulmonary diseases are the risk factors that contribute to aggravated depression among older adults [10,11]. Others reported that higher level of depression had positive correlation with more health care and chronic medical illness [12], and chronic non-specific lung diseases, cardiovascular diseases, musculoskeletal diseases, cancer burden were associated with a chronic course of depression [13].

Besides health factors, ADLs disability of older adults is also an influencing factor of geriatric depression. Activities of Daily Living (ADLs), an important indicator of healthy ageing, refer to a set of actions a person must do by themselves to engage independently in everyday life [14], which generally include basic activities of daily living (bADLs) and instrumental activities of daily living (iADLs) [15,16]. The bADLs cover most common daily self-care activities for survival, such as feeding oneself, bathing, putting on clothes, using toilets and functioning mobility, etc. The iADLs cover activities to maintain a social life or support from the community, such as using a telephone, shopping, preparing meals, housework, self-medication, money management, etc. ADLs disability may cause among older people a reduced sense of self-efficacy that will lead to geriatric depression [17], and weaken their social networking capacity as their activities are much restricted [18]. Previous studies have demonstrated that ADLs ability is negatively correlated with depressive symptoms. In other words, older adults with ADLs disability tend to have higher level of geriatric depression [19,20].

Older adults' ADLs disability might be caused by the chronic diseases they have. Previous studies have shown that an individual's physical fitness indicators, e.g., muscular endurance and cardiopulmonary functions, can be used to predict that person's ADLs disability when other variables, such as age and gender, are under control [21]. Furthermore, chronic diseases are closely related to the deterioration in bADLs and iADLs abilities [22]. Some scholars have pointed out that individuals with hearing and/or sight loss caused by chronic diseases have more ADLs disability, the social support they can get is further reduced and hence greater risks of depression [23]. Though the relation between geriatric chronic diseases and depression as well as that between ADLs disability and depression has been studied in previous researches [11,24], a comprehensive study on the relation among the three was missing, particularly that on the mediational effect of ADL disability on the relation between chronic diseases and geriatric depression.

The purpose of our research is to analyze the relationship between chronic diseases and geriatric depression in China and to examine the mediational effect of ADL disability on the relation of the two. Based on the previous studies of the relationship between chronic diseases, ADLs disability and geriatric depression, this research has three hypotheses as follows:

Hypothesis 1: Geriatric chronic diseases are positively correlated with ADLs disability and depression.

Hypothesis 2: ADLs disability among older adults is positively correlated with depression.

Hypothesis 3: ADLs disability plays a mediational role in the relation between geriatric chronic diseases and geriatric depression.

And the relation model of the three variables is demonstrated in Fig. 1.

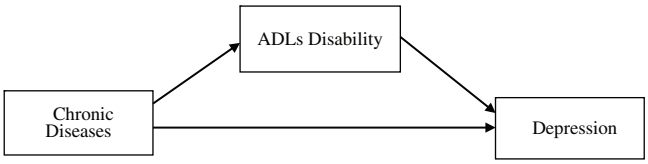

Figure 1: Mediational effect of ADLs ability on the relation between chronic diseases and geriatric depression: A hypothesized model

2 Methodology

2.1 Samples & Data

The data used in our research come from CHARLS 2015, a nationwide household survey by the National Institute of Development of Peking University in 2015. CHARLS 2015 aimed at collecting a high quality nationally representative sample of Chinese residents ages 45 and older to serve the needs of research on the elderly. Samples were selected through multistage probability sampling. The sample was stratified by region and within the region by urban districts or rural counties and *per capita* statistics on gross domestic product(GDP). Eventually, the researchers interviewed 17 thousand people at age 45 and above from 450 communities/villages in 150 counties/cities of 28 provinces, autonomous regions and municipalities in China. Records of CHARLS 2015 participants at age 60 and above without any missing values were selected as valid samples, the number of which reaches 5931. The sampled participants has an age range from 60 to 93 (M = 68.32, SD = 6.50), among whom, 44.7% are male and 55.3% female; 62.8% are sexagenarian (60–69), 30.5% are septuagenarians (70–79) and 6.6% octogenarians or older (80 and above).

2.2 Variants

2.2.1 Depression

CES-D 10, a most common screening instrument to determine whether a general public has depressive symptoms [25], is introduced in our research to evaluate the level of depression among the sampled participants, as it has good reliability and validity under China's cultural contexts [26]. CES-D 10 contains ten items, e.g., "I feel anxious because of some trifles", "I am in low mood", and etc., and has a grading scale from 0 to 3 (i.e., from "none or almost none" to "almost always there"). The total score range varies from 0 to 30 and anyone with a score of 10 and above is estimated to have depressive symptoms. The Cronbach's α coefficient for the CES-D 10 used in our research is 0.79.

2.2.2 Chronic Diseases Index (CDI)

CDI is used to measure the number of chronic diseases an older adult is afflicted with. The testees are required to answer whether or not they have been diagnosed with the following 14 common chronic diseases

such as hypertension, arthritis or rheumatism, digestive disorders, heart disorders, chronic pulmonary diseases, diabetes, stroke, etc. If one has a chronic disease on the list, a point will be added to his/her CDI. The more points one gets, the more chronic diseases one has. This research method is widely used to assess the chronic diseases older adults are afflicted with [27]. The Cronbach's α coefficient for the questionnaire used in our research is 0.65.

2.2.3 Activities of Daily Living (ADLs)

ADLs Scale is often used to measure a person's ability to conduct ADLs, which can be further divided into bADLs and iADLs [28,29]. The bADLs ability reflects whether an older adult is capable of taking care of himself/herself or managing to live by himself/herself, which includes six activities such as putting on clothes, bathing, feeding oneself, moving into/out of the bed, using the toilet, and having bladder and bowel control. The iADLs ability reflects whether an older adult is capable of using daily instruments and tools, which also includes six activities such as housework, meals preparation, shopping, money management, self-medication, and use of the telephone. The testees are required to use a 4.0 scale ranging from "without difficulty" (1 point) to "unable to conduct" (4 point) for each of the above-mentioned activities. Any activity they find difficult to conduct can be held as an ADLs disability: the higher their score is, the more difficult this activity is for them to conduct. The Cronbach's α coefficient for the ADLs scale used in our research is 0.81.

2.3 Data Analysis

All the data used in our research have been processed by SPSS23.0. First, the frequency and forms of chronic diseases and ADL disability reported by older adults have been put into descriptive statistics to record their scores in the three variables. Then, the correlation of CDI, ADLs disability and degree of depression has been calculated. In the end, the mediational effect of ADLs disability on the relation between chronic diseases and degree of depression is examined by Preacher and Hayes' SPSS bootstrap program [30].

3 Findings

3.1 Statistical Description of Chronic Diseases, ADLs Disability and Depression among Older Adults

The percentage of the tested older adults afflicted with specific chronic diseases and experiencing ADLs disability is demonstrated in Tab. 1. Generally speaking, about 75.9% older adults have chronic diseases, among which the most common ones are arthritis or rheumatism, hypertension, gastrosia or digestive disorders, and heart disorders; about 52.5% older adults are experiencing ADLs disability, among which the most complaints lie in using the telephone, using the toilet, doing housework or chores, managing cash and other properties, and preparing meals.

Descriptive statistics for the three variables are presented in Tab. 2.

3.2 Variations of Chronic Diseases, ADLs Disability and Depression among Older Adults in terms of Gender and Age Group

Analytical results of variation of chronic diseases, ADLs disability and depression in terms of gender and age group among older adults are shown in Tabs. 3 and 4 respectively. Our findings show that gender plays an insignificant role in the variations of numbers of chronic diseases, but demonstrates a significant variation as far as ADLs disability and scores of depression are concerned. Female older adults tend to have more ADLs disability and a higher level of depression than their male counterparts. For the convenience of study, we divided the participants into three age groups: Sexagenarians (60−69 years old), Septuagenarians (70–79 years old), and People over 80. Different age groups show a significant variation in numbers of chronic diseases, ADLs disability and scores of depression. Our *post hoc* tests discover that septuagenarians have more chronic diseases than people over 80; ADLs disability grows as people advance in ages; sexagenarians have a higher score of depression than the other two age groups.

Table 1: Percentage of older adults with specific forms of chronic diseases and ADLs disability

Chronic diseases	%	ADLs disability	%
Hypertension	30.8	Dressing	8.9
Dyslipidemia	12.7	Bathing	11.5
Diabetes or Hyperglycemia	8.3	Feeding	3.5
Cancer and Malignancies	1.2	Moving into/out of bed	10.8
Chronic pulmonary diseases	14.9	Using toilet	21.6
Hepatic disorders	4.8	Having bladder & bowels control	7.3
Heart disorders	17.6	Housework	19.8
Stroke	3.5	Meals preparation	14.2
Nephritic disorders	8.6	Shopping	12.3
Gastrosia or Digestive Disorders	27.0	Use of telephone	24.1
Emotional and Mental Disorders	1.6	Self-medication	6.2
Amnesia	2.6	Money management	14.3
Arthritis or Rheumatism	44.5		
Asthma	6.0		
Afflicted with Chronic Diseases	75.9	Experiencing ADLs disability	52.5

Table 2: Means and standard deviations of study variables (N = 5931)

Variable	Score range	Mean	SD
Chronic disease	0–10	1.84	1.64
ADLs disability	12–48	14.87	4.70
Depression	0–30	9.47	6.75

Table 3: Gender Variations in number of chronic diseases, ADLs disability and depression

Gender	Chronic diseases	ADLs disability	Depression
Male	1.80 ± 1.66	14.53 ± 4.73	8.49 ± 6.34
Female	1.88 ± 1.63	15.16 ± 4.67	10.30 ± 6.98
t	−1.78	−5.15**	−10.41**

Note: $^{**}p < 0.01$.

Table 4: Age Variations in number of chronic diseases, ADLs disability and depression

	①Sexagenarians	②Septuagenarians	③People over 80	*F*	
Chronic disease	1.83 ± 1.64	1.91 ± 1.65	1.71 ± 1.68	3.04*	②>③
ADLs disability	14.39 ± 4.19	15.42 ± 5.12	16.93 ± 6.28	71.45**	①<②<③
Depression	9.66 ± 6.80	9.27 ± 6.74	8.54 ± 6.30	5.94**	①>②; ①>③

Note: $^{*}p < 0.05$; $^{**}p < 0.01$.

3.3 Correlation Analysis of Chronic Diseases, ADLs Disability and Depression among Older Adults

The coefficients related to chronic diseases, ADLs disability and depression among older adults are shown in Tab. 5. The results of correlation analysis show that numbers of chronic diseases are positively related with ADLs disability and depression, which suggests that the more chronic diseases an older adult has, the more ADLs disability and depression he or she will experience. Besides, among older adults, ADLs disability has a significant positive correlation with depression, which means the more ADLs disability an older adults has, the more depressed he or she becomes. Therefore, the hypothesis 1 and 2 of this research have been validated.

Table 5: Descriptive statistics and correlations of study variables

	1	2	3
1. Chronic disease	1		
2. Activities of daily living disability	0.148**	1	
3. Depression	0.179**	0.348**	1

Note: $^{**}p < 0.01$.

3.4 ADLs Disability Mediational Effect on the Relation between Chronic Disease and Depression

We employed a recommended bootstrap approach by Preacher et al. to test the ADLs disability mediational effect on the relationship between chronic diseases and depression [28]. The indirect effect is measured by resampling (i.e., via random sampling with replacement of original samples) in terms of estimators and 95% confidence interval (CI). If that confidence interval excludes the null value (zero), the indirect effect should be regarded as a significant one when p is less than 0.05.

Tab. 6 presents the test results of our hypothesized mediational effect model. According to the bootstrap analysis, the partially mediational effect of ADLs disability (*ab* path) in our study is significantly different from zero when p is less than 0.05; the value of unstandardized mediational effect equals 0.1998 and the 95% CI is [0.1614,0.2432], which indicates the mediational effect accounts for 27.22% of all the effects. In other words, ADLs disability functions as a partial mediator in the relationship between chronic diseases and depression, and hence the validation of Hypothesis 3. All path coefficients of the mediational effect model are shown in Fig. 2.

Table 6: Test results of the hypothesized mediational effect model

Path	β	B	SE	p	CIs for indirect effect	
					Lower	Upper
Chronic disease–ADLs (*a* path)	0.148	0.424	0.037	0.000	0.3521	0.4962
ADLs–Depression (*b* path)	0.328	0.471	0.018	0.000	0.4368	0.5054
Total effect (*c* path)	0.179	0.734	0.052	0.000	0.6312	0.8370
Direct effect (*c'* path)	0.130	0.534	0.050	0.000	0.4361	0.6325
Indirect effect (*ab* path)					0.1614	0.2432

Note: Confidence intervals excluding zero indicate a statistically significant indirect effect when p is less than 0.01.

Figure 2: Path coefficients of the mediational effect model

4 Discussion

After having described the incidence rates of chronic diseases and ADLs disability among older adults in China and examined the correlation between chronic diseases, ADLs disability and depression, we proposed a mediational model to explain the potential mechanism of the correlation between chronic diseases and depression among older adults. Our research findings can be used to demonstrate how to positively anticipate geriatric depression via chronic diseases. Our findings also have validated our hypotheses, proving there exists a mediational effect of ADLs disability on the relation between chronic diseases and depression among older adults.

In our study, geriatric depression is significantly positively related with numbers of chronic diseases and severity of ADLs disability the older adults are experiencing. In other words, older adults with more chronic diseases and/or more severe ADLs disability are more likely to have a higher level of depression. This finding is in concert with previous cross-sectional studies [13,31]. Our finding indicates that care worker and caregivers need to realize the effect of chronic diseases and ADLs impairments on older people's moods and pay more attention to and provide supportive assistance for them so as to effectively reduce the risk of depression.

Our study has demonstrated a significant positive correlation between chronic diseases and ADLs disability among older adults, which is positively related to depression. This finding is also consistent with previous studies relating to the correlation between chronic diseases and ADLs disability, and that between ADLs disability and depression [32,33]. Previous studies have found that there were positive associations between chronic diseases and activity limitations [34]. Chronic diseases limit older adults' mobility and independence [35], so they will have more difficulty in engaging in the common daily self-care activities for survival and the activities to maintain a social life or support from the community. ADLs include a set of actions a person must do by themselves to engage independently in everyday life, which are important to their survival and social life. ADLs disability can cause tremendous changes in lifestyle, and may make it difficult to pursue the activities one enjoys and can diminish self-confidence and a sense of hope in the future [36]. Therefore, ADLs disability is positively linked to depression. Our findings prove that chronic diseases among older adults will increase their chances of ADLs disability and depression.

The focus of our study is to manifest the mediational effect of ADLs ability on the relationship between chronic diseases and depression among older adults, which suggests that older people with more chronic diseases are more prone to ADLs disability and therefore more likely to have or increase geriatric depression. Previous studies have discovered the connection of ADLs among older people with their sense of self-efficacy and social networking capacity [17,18]. As a reduced ADLs ability often leads to a damaged image of self-efficacy and changes in social networking capacity, chronic diseases, which can greatly compromise older adults' ADLs ability, make geriatric depression more likely to occur. Therefore, the influence of chronic diseases on geriatric depression is both direct and indirect (as via ADLs disability). Besides affected ADLs ability, other variables (such as the burden of medical care, cognitive damage, etc.) may also play a mediational role in the relationship between chronic diseases and

depression among older adults. Future researchers can focus on other variables that play a potential mediational role in the relation of the two.

Our study, however, has its own limitations. Firstly, the cross-section method used in our study cannot present an absolute causality among the variables (i.e., chronic diseases, ADLs disability, depression). Previous studies have discovered that depression can increase the risk of older adults to have chronic diseases and may reduce their ADLs ability [37,38]. It is quite possible that our cross-section study of these variables may just reflect the influence of depression on chronic diseases and ADLs disability. Therefore, our findings cannot be used conclusively to determine whether it is chronic diseases and ADLs disability that affect depression, or it is depression that affects ADLs disability. A longitudinal approach should be considered for the future research to clarify the causal relations of those variables. Secondly, data relating to those variables are collected from the reports of the participants, which, due to the possible influence of social desirability and difficulty among older people in understanding terms used in the questionnaire, might not be able to guarantee their objectivity and accuracy. In further studies, data collection should cover reports of caregivers, participants' health records, etc. Thirdly, this study only explored the relationship between the number of chronic diseases, the number of ADLs disability and depression, and did not examine the impact of the duration of chronic diseases and the severity of these diseases on depression. Studies have found that the cumulative somatic chronic disease burden is related to depression [13]. The future evaluation of chronic diseases can consider adding indicators such as severity and duration Lastly, our study did not examine other factors coexistent with chronic diseases, ADLs disability and depression among older adults and hence incapable of excluding the possible mixed effect of those factors. For example, a high level of distress that often leads to the risk of depression [39], and may cause chronic diseases like cardiovascular disorders [40]. A conclusion, however, can be drawn here that the correlation between chronic diseases, ADLs disability and depression may reflect the influence of other relevant factors like the pressure of life on those variables. Future studies should also focus on covariants that may affect both chronic diseases and depression among older adults.

Despite above-mentioned limitations, our findings can still help clinicians to further understand the role of ADLs disability in the relationship between chronic diseases and depression, and provide meaningful solutions for care workers to prevent or ameliorate geriatric depression. On one hand, an older adult with more chronic diseases are more likely exposed to a higher risk of depression, which requires care workers to pay more attention to older people with chronic diseases, to provide life and emotional support to them and to help them realize and accept the changes in their physiological functions and the effect of those changes on their life and mood so as to reduce related emotional distress. On the other hand, health care professionals, along with care workers, should provide self-management support programmes to older adults afflicted with chronic diseases to increase their ADLs capacity and reduce risk of depression. Self-management support programmes are the systematic and professional interventions with educational and supportive merits, the core elements of which include: health improvement and disease related information; knowledge required for disease management and difficulty solutions; education concerning skills and strategies; use of personal and individual plans or goals to guide changes in health-related behaviors; support via communication with peers or professionals; functional exercises and training; etc. [41]. By providing support to increase older adults' capability of self-management, care workers and other health care professionals can prevent ADLs dependence among older adults and prepare them for adaption and self-management of the consequences caused by chronic diseases. Previous studies have proven that self-management support programmes have a positive effect on the health-related aspect of older people's life such as the quality of life, self-efficacy and ADLs ability [42] as well as reducing the risk of depression among older adults with chronic diseases.

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