Master's Thesis of Social Welfare

The Relationship Between Social Activities and Cognitive Functioning Among Chinese Older Adults

-Focusing on the Mediating Effect of Depressive Symptoms-

중국 노인의 사회적 활동과 인지 기능의 관계

- 우울한 증상의 매개 효과를 중심으로 -

August 2020

서울대학교 대학원
사회복지학과

LI WENXIN

The Relationship Between Social Activities and Cognitive Functioning Among Chinese Older Adults
-Focusing on the Mediating Effect of Depressive Symptoms-

지도교수 하정화

이 논문을 사회복지학과 석사 학위논문으로 제출함

2020년 05월

서울대학교 대학원
사회복지학과

이 문 형

이문형의 석사 학위논문을 인준함
2020 년 07 월

위 원 장   이봉주

부위원장   강상경

위   원   하정화

Abstract

The Relationship Between Social Activities and Cognitive Functioning Among Chinese Older Adults

- Focusing on the Mediating Effect of Depressive Symptoms -

LI WENXIN

Department of Social Welfare

The Graduate School

Seoul National University

With the increased life expectancy of the elderly in China, the country has gradually entered an aging society in 2000. In old age, the elderly gradually drop out of the labor market, and various social resources are lost. The cognitive functioning of the elderly shows progressive cognitive impairment or decline with age, along with changes in the above factors. In old age, if cognitive impairment is serious, daily living ability and the ability to take care of oneself cannot be realized. Activity theory requires the elderly to actively

participate in social activities to maintain their social networks, and thus, preserve good mental health and physiological functioning.

Although some existing studies focus on the relationship between social activity and cognitive functioning among Chinese older adults, there is still insufficient empirical research to verify the relationship between social activity and cognitive functioning. Most of the research is limited to a certain area, lacking a comprehensive grasp of the relationship between the social activities and cognitive functioning of the elderly in the country. In addition, there are few explorations on the internal mechanism of the relationship between social activity and cognitive function. Few studies about the effect of depressive symptoms in the relationship between social activity and cognitive function have been carried out.

The purposes of this study are as follows: 1) to verify the relationship between social activity and cognitive functioning among Chinese older adults; 2) to explore the relationship between social activity and depressive symptoms among Chinese older adults; and 3) to examine the mediating effect of depressive symptoms in the relationship between social activity and cognitive functioning among Chinese older adults. The study uses the fourth wave of the 2015 China Health and Retirement Longitudinal Study (CHARLS) data to study the relationship between social activity and cognitive functioning, with 9,112 elderly people aged 60 and over as the research subjects.

The main findings of this study are as follows: First, there is a significant positive correlation between social activity and cognitive function. The results of the study show that more participation in social activities can help improve the cognitive function of the elderly. Second, social activity is significantly negatively correlated with depressive symptoms. That is, participating in more social activities

has the benefit of reducing depressive symptoms among older adults. Third, depressive symptoms play a partial mediating role in the relationship between social activity and cognitive functioning. Specifically, social activity is not only directly related to cognitive functioning but also indirectly associated with cognitive functioning through the mediating effect of depressive symptoms, which is an internal mechanism between social activity and cognitive functioning.

The results of this study show that social activities can not only directly improve cognitive functioning among older adults but also improve the cognitive functioning of the elderly by reducing their depressive symptoms. Therefore, the government and the community should adopt valid measurements to support the elderly to actively participate in more social activities, and the children and grandchildren of elderly people should help them participate in social activities as much as possible; in this way, improving the cognitive function of elderly people directly or indirectly can improve their quality of life.

Table of Contents

Tables

Figures

Chapter 1.　　Introduction

1.1　　Problem Statement and Research Objectives

According to the National Bureau of Statistics in China, in 2000, 7% of the total population was aged 65 years and over, while 22.9% were 0-14 years old, and China started to enter the aging society in 2000 (Population Division of Chinese National Bureau of Statistics, 2019). At the end of 2019, there were 253.88 million adults aged 60 and over, accounting for 18.1% of the total Chinese population. At the same time, there were 176.03 million individuals aged 65 years and over, accounting for 12.6% of the population (Yi, 2020). At the same time, with the development of the Chinese social environment, people's living standards are improving, and medical and health services are developing step by step. The average life expectancy was prolonged by 20 years from 1957 to 2018 (Population Division of Chinese National Bureau of Statistics, 2019).

In old age, the elderly gradually drop out of the labor market, and various social resources are gradually lost. The decline of individual cognitive functioning, such as memory, calculation and executive ability, may also develop into mild cognitive impairment and even Alzheimer's disease (AD; Wang & Zhu, 2013; Xia et al., 2006). In old age, if cognitive impairment is serious, daily living ability and the ability to take care of oneself cannot be realized. In the aging population, 10% to 15% of people with cognitive impairment develop AD each year, and cognitive impairment is a significant risk factor for this disease (Zhang, Zhao, Zhang, Madengdai, & Wang, 2004). According to the World Health Organization, AD and other dementia

diseases, which are characterized by cognitive decline, have become the sixth leading cause of death for the elderly(Jia, 2015). In 2015, there were about 46.8 million elderly people with dementia all over the world (Liu, Wang, & Xiao, 2016), and the total number of dementia patients in China was nearly 10 million. Thus, the country has the largest number of dementia patients and the fastest growth rate in the world. More than 20 million people in China are predicted to develop dementia by 2050 (Ye, 2015). According to the 2017 Chinese National Epidemiological Survey on mental illness, the prevalence of dementia among people aged 65 years and over in China was 5.56% (China Center for Disease Control and Prevention, 2019).

At present, there is no effective treatment for dementia to restore cognitive functioning, but timely detection and correct intervention in the early stage of cognitive impairment is of great significance (Li, 2010; Ye, 2015; Zhao, Xue, & Wang, 2009); this can significantly improve the life quality and prolong the life of older adults. From the social point of view, the decline of cognitive functioning of the elderly not only means an increase of in−family nursing and care, which can negatively affect other family members, but also an increase of the scale of social medical treatment and social services. This also results in an increase in the share of social health resources, and even economic resources, needed by the patient with dementia. Therefore, how to better maintain the cognitive functioning of the elderly and slow down old adults' cognitive decline has become a widespread social concern.

According to activity theory, participating in social activities is not only a physical activity but also involves contact and interaction with others, which will bring emotional comfort to the elderly and indirectly stimulate cognitive functioning (Zhao & Yu, 2016). Active

individuals maintain frequent positive emotional states through frequent social interactions and high−quality social relationships (Fratiglioni, Paillard−Borg, & Winblad, 2004), which can benefit individuals' cognitive functioning (Seeman, Lusignolo, Albert, & Berkman, 2001).

Active participation in social activities can also help older adults achieve positive self−image, sense of satisfaction, and happiness. Participation in social activities is beneficial to older adults' physical and mental health (Folland, 2007). These positive mental health outcomes of social activities can be beneficial for cognitive functioning as well. That is, social activities are positively associated with an individual's cognitive functioning via better mental health.

In this dissertation, under the theoretical background of activity theory, I study the relationship between social activities and cognitive functioning among Chinese older adults through nationally representative samples. Moreover, I examine the extent to which depressive symptoms mediate the relationship between social activities and cognitive functioning.

First, I examine the relationship between social activities and cognitive functioning. Both Chinese and foreign studies show that cognitive functioning is positively related to social activities. James, Wilson, Barnes, and Bennett (2011) examined the relationship between social activities and cognitive functioning among older adults using longitudinal data, and the results showed that the rate of cognitive aging would decrease by 47% for each additional social activity. Research by Carlson et al. (2008) confirmed that the elderly could improve their cognitive functioning by increasing their participation in social activities, such as participating in volunteer activities. Berkman (2000) articulated that the social network formed during participating in social activities can provide social support for

the elderly and reduce loneliness, effectively protecting cognitive functioning. Bassuk, Glass, and Berkman's (1999) 12-year longitudinal survey showed that elderly people without social relationships are more prone to cognitive impairment than elderly people with multiple social relationships are.

There are few empirical studies on the association between social activities and cognitive functioning in China. Most scholars focus on the analysis of factors associated with cognitive functioning, and their conclusions are consistent with foreign research results. Zhu and Zeng's (2019) research showed that social activity participation could significantly improve cognitive functioning among Chinese older adults in rural communities. Abundant social activities are one of the favorable factors for cognitive functioning among older adults (Gu & Qiu, 2003). Communicating with family and friends and participating in social activities are related to cognitive functioning among older adults (Hao, Chen, Li, & Li, 2009). Yu, Chen, and Wang (2007) confirmed that living in the community and attending family and friends gatherings were positively associated with cognitive functioning among older adults.

Previous studies on the connection between social activities and cognitive functioning in China have only been carried out in limited areas, such as in a certain city or community, and most of the studies were conducted on older adults in rural areas (Yu et al., 2007; Zhang et al., 2001; Zhu & Zeng, 2019). In addition, domestic research mainly focuses on the correlation between social activity participation and cognitive functioning (Hao et al., 2009). Therefore, more specific empirical studies are necessary to verify the relationship between social activities and cognitive functioning.

Due to differences in regions and cultures, there are some differences in the measurement of social activities. For example,

travel often appears in foreign studies (Bassuk et al., 1999; Hao et al., 2009; James et al., 2011), while Chinese surveys of social engagement rarely include travel. Mahjong is an important and unique social entertainment activity in China, but it is rare in other countries. Therefore, although the research results all show that social activities are positively related to cognitive functioning, it is still necessary to research the relationship between social activities and cognition among older adults in China.

As a second step in this study, I examine the mediating effect of depressive symptoms in the relationship between social activities and cognitive functioning. Although a few studies on social activities and cognitive functioning in China have found a significant correlation between the two, it is unclear whether any internal mechanism is associated with this relationship. Understanding the internal mechanism that is related to the relationship between social activities and cognitive functioning will help to further improve the cognitive functioning of the elderly in the future. Therefore, it is necessary to explore whether there are internal mechanisms between social activities and cognitive functioning by introducing mediating variables to more effectively analyze the association between them.

Previous studies have shown that social activities are negatively related to the depressive symptoms of the elderly, which means that elderly people with more social activity participation have a lower CES-D score related to depressive symptoms (Chiao, Weng, & Botticello, 2011; Glass, De Leon, Bassuk, & Berkman, 2006; Isaac, Stewart, Artero, Ancelin, & Ritchie, 2009; Liu et al., 2012; Lu, 2014). Depressive symptoms are negatively related to the cognitive functioning of the elderly. That is, elderly people with lesser depressive symptoms have higher cognitive functioning than do those with greater depressive symptoms (Köhler et al., 2010; Liu, Lai, &

Zhang, 2015; McDermott & Ebmeier, 2009; Yan et al., 2003). Given the existence of these two relationships, elderly people with lower scores of depressive symptoms have a higher cognitive functioning, while elderly people with more social activity participation have a lower score of depressive symptoms, which can make elderly people have higher cognitive functioning. In other words, in addition to the direct relationship between social activities and cognitive functioning, social activities may also be associated with cognitive functioning indirectly through a negative association with depressive symptoms.

Wang and Fang (2019) took the Chinese elderly immigrant group living in Toronto as their research subject and tried to use depressive symptoms as a mediating factor to explore the indirect association between social activities and cognitive functioning. The results showed that the degree of depressive symptoms played a mediating role in the relationship between social activity participation and cognitive functioning.

Although Wang and Fang's (2019) research confirmed that depressive symptoms mediated the relationship between social activities and cognitive functioning, the data sample size was only 107 respondents, and the study targeted a Chinese elderly immigrant group living overseas (Wang & Fang, 2019). In addition, the measurement of cognitive functioning only included episodic memory and working memory, whereas measurement of orientation functioning and drawing (structural functioning) was lacking. Therefore, Wang and Fang's (2019) research is insufficient for the measurement of cognitive functioning. Different results may be caused by an insufficient sample size or different characteristics of specific elderly populations. Thus, it is still necessary to adopt the elderly living in native China as research subjects with a larger national sample to study the mediating roles of depressive symptoms

on social activities and cognitive functioning.

To address the identified gaps, the fourth wave of the China Health and Retirement Longitudinal Study (CHARLS) data is adopted in this study to examine the relationship between social activities and cognitive functioning and the mediating effect of depressive symptoms. The CHARLS data comprise a set of high-quality micro-data representing individuals aged 45 and over and families in China. It is a high-quality national representative dataset for analyzing the aging problem of the Chinese population and promoting interdisciplinary research on the aging problem. Overall, the data of the elderly aged 60 and over will be adopted in this study to verify whether and how social activities are related to cognitive functioning, as well as whether and how depressive symptoms mediate the relationship between social activities and cognitive functioning among Chinese older adults.

1.2   Research Questions

The purpose of this study is to investigate the relationship between social activities and cognitive functioning among older adults and the mediating effect of depressive symptoms in this relationship. The research questions are as follows:

Question 1: Are social activities related to better cognitive functioning among Chinese older adults?

Question 2: Are social activities related to less depressive symptoms among Chinese older adults?

Question 3: Is the relationship between social activities and cognitive functioning among older adults mediated by depressive symptoms?

Chapter 2. Literature Review

2.1 Theoretical Foundation

Activity theory guided this study. This theory was first proposed by Havighurst in 1961. It proposes that the successful aging of the elderly requires their active participation in various activities for avoiding the reduction of physical, social, and other activities. The reason why activity theory emphasizes social participation and activities is that the elderly replace the roles lost due to widowing or retirement with new roles through social participation and activities, thereby improving the depression and depressive symptoms caused by the interruption of social roles (Havighurst, 1963).

Activity theory can be used to explain the effect of social activities on cognitive functioning and the influence of social activities and depressive symptoms among older adults. The successful aging of the elderly's in terms of cognitive functioning and mental health also require the elderly to maintain active physical and social activities in their later years.

According to Rowe and Kahn's (1997) definition of successful aging, avoiding disease and disability, maintaining good physical and psychological functions, and sustained social participation represent the three elements of successful aging (Rowe & Kahn, 1997). Therefore, more emphasis is placed on the importance of participating in social activities and maintaining social interaction. At the same time, good mental status and cognitive functioning are keys to successful aging.

According to activity theory, the long-term normal activities of the elderly are the basis and key to the protection of self-esteem; the satisfaction of rational needs, health and longevity; and the

reduction of depressive symptoms and loneliness. At the same time, the theory also suggests that maintaining appropriate cognitive functioning and physical strength, as well as participating in certain social activities, represent needs of later life. Therefore, in activity theory, elderly people are encouraged to continue to participate in social activities in their old age, which is beneficial not only to their physical health but also their mental health (Folland, 2007). Activity theory refers to activities including a wide range of content, such as productive activities, volunteering, hobbies, social communication, and exercise (Li & Chen, 2009). Activity theory suggests that the elderly should gain social recognition and self-improvement through social participation as they did in the past for avoiding separation from society as much as possible.

There are many foreign studies showing that actively participating in social activities is positively correlated with the cognitive functioning of elderly people. Kruger et al. (2009) and James et al. (2011) found that the frequency of social activity participation was positively correlated with cognitive functioning in studies of the elderly (James et al., 2011a; Krueger et al., 2009). Through data from a 1982-1994 follow-up survey of the elderly in United States, Bassuk et al. (1999) found that cognitive decline was more likely to occur for older adults lacking social involvement. In addition, active social activity participation is related to depression and well-being. A longitudinal study in Korea included elderly people aged 60 years old and over as subjects and showed that the participation of the elderly in sport, social, and religious activities was conducive to reducing the risk of depression for the elderly (Roh et al., 2015).

Recently, some Chinese scholars have also studied the association between social activities and cognitive functioning in the context of activity theory. The active participation of older adults in

social activities can provide a high−quality environment for the social interaction of elderly people and help improve their cognitive functioning (Liu, 2019). People participate in social activities to alleviate the aging of cognitive functioning. Elderly people who are active, energetic, and more involved in activities perform better on cognitive functioning tests than those who are less active and alienated or separated from society (He & Chen, 2013).

Many studies have shown that social activities are significantly associated with depressive symptoms in China and abroad. Glass et al. (2006) verified the relationship between depressive symptoms and social activity participation. The results showed that social activities were negatively associated with depressive symptoms (Glass et al., 2006). Jang and Chiriboga (2011) took Korean Americans as the research object and examined the relationship between social activities and depressive symptoms, considering the conditioning role of acculturation. The results showed that active social activity participation was associated with fewer depressive symptoms. Under different acculturation levels, social activities affected depressive symptoms to varying degrees (Jang & Chiriboga, 2011). Zhang and Zhang (2016) used the CHARLS data from 2011 to explore the impact of social activity participation on daily living ability and depression, and the results showed that the more social activity participation they engage in, the less depression they experience and the healthier the elderly are (Zhang & Zhang, 2016). The participation of the elderly in the community through active social involvement can reduce the symptoms of depression and benefit the positive emotions of the elderly (Zhang & Xue, 1997).

Some scholars think that social activities will affect cognitive function through individuals' internal social−psychological factors (Glei et al., 2005). According to activity theory, the elderly can maintain the personal social network through vigorous activity

participation to reduce the occurrence of depression and depressive symptoms (Havighurst, 1963), which are also related to better cognitive function (Panza et al., 2009; Paterniti, Verdier－Taillefer, Dufouil, & Alp□rovitch, 2002). Therefore, activity theory is used to explain the relationship between social activities and cognitive functioning and the mediating role of depressive symptoms in the relationship between social activities and cognitive functioning in this study.

2.2   The Definition of Cognitive Functioning

Cognitive functioning is the mental functioning of the human brain to recognize and reflect objective things; it includes perception, learning and memory, attention, language, thinking, and executive functions (Tao & Li, 2002). For the elderly, cognitive functioning is extremely important to their daily lives. However, with aging, the cognitive functioning of the elderly, such as information processing speed, executive functioning, functioning of memory, attention, and reasoning, will show a gradual declining trend (Zhang & Tang, 2005).

The decline of cognitive functioning will produce many common diseases, such as AD, mild cognitive impairment (MCI), and other types of dementia in old age (Li, 2006). China is already the country with the largest number of older adults suffering from dementia. It is predicted that the number of patients with dementia in China will represent the sum of the number of dementia patients in all developed countries by 2040 (Wang, Wu, Huang, Lu, & Dong, 2008). In an aging society, dementia is one of the most common diseases. With the development of the disease, the patient's cognitive functioning continues to deteriorate, and the ability to engage in daily life activities declines progressively, accompanied by various nervous psychiatric symptoms and behavioral disorders. In this case, not only may the physical health of the nursing staff be influenced, but the psychological health of the staff may also be affected, influencing their care for patients with dementia and even bringing a huge economic burden to society (Hautzinger & Welz, 2004; KongFanzhen et al., 2011; Wu, Lin, & Jiang, 2001). Therefore, it is imperative to find the relevant factors for cognitive impairment and take active and effective intervention measures.

Clinically, the mini-mental state examination (MMSE) is mostly used for the detection of cognitive functioning, in both foreign

countries and China (Wu, Yan, & Huang, 2003). The MMSE is often used for dementia screening as well (Jin, Li, & Wei, 2009).

2.3   Definition of Social Activities

Social activities refer to the communication or shared activities between the elderly and other social members (relatives, friends, neighbors, etc.) or organizations (e.g., community, religion, and other non-governmental organizations; Berkman, Glass, Brissette, & Seeman, 2000). The activity theory mentioned above suggests that keeping an active lifestyle helps older people maintain physical and mental health. After entering the old age, the elderly end their work trajectories after decades, leaving a familiar working environment and employee status. This results in the loss of job-related social communication opportunities, shrinking of personal networks, and narrowing of living space (Wang, 2007).

The participation of social activities has a positive significance for individuals, communities, and even the entire society. From an individual perspective, personal social capabilities can be significantly improved when social activities are recognized by people (Chen, 2005). A certain level of social communication and participation can be beneficial to improve the life satisfaction of the elderly, which helps delay cognitive decline, reduce the incidence of cardiovascular disease, and prevent mental illnesses, such as AD and depression (Fratiglioni et al., 2004; Zhou, 2014). From a social perspective, participating in social activities has great significance and economic value for the community and society. During participation in social activities, the elderly are no longer the subject of care; they have become a highly valuable resource for families, communities, and society. Through participating in social activities, they can improve self-efficacy and make a difference (Morrow-Howell, Hinterlong, & Sherraden, 2001; Wang & Tan, 2009).

According to the China Pension Report published in 2019, which uses 2015 CHARLS data for the analysis, in China, elderly people

aged 60 and over are more inclined to take leisure and entertainment for social activities. As the range of activities of the elderly gradually becomes limited, the interaction with friends in the neighborhood becomes the best choice for the elderly participating in social activities. Women tend to participate in fitness and dance activities, and men tend to participate in chess and card activities. In China, the elderly who participate in voluntary services show the characteristics of high education and urban life background (Zhao et al., 2019).

2.4   Definition of Depressive Symptoms

The decline of physiological functions and the change of social roles, the decline of social interaction, the lack of social support, the reduction of economic income, disease, the loss of working ability, and the loss of activities of daily living among older adults will all lead to the occurrence of psychological disorders, such as negative emotion, depression, and anxiety. Depression and depressive symptoms are common psychological problems among older adults and an important indicator for evaluating the mental health of this population (Li & Guo, 2020). Previous studies have shown that depressive symptoms are associated with an increased likelihood of disability and decreased chances of recovery (Cronin-Stubbs et al., 2000). In addition, depressive symptoms are associated with impaired cognitive function (Köhler et al., 2010). Depression and depressive symptoms may be caused by social, psychological, and biological genetic factors (Lv et al., 2001).

The Center for Epidemiologic Studies Depression (CES-D) is often used to measure depressive symptoms, and the original CES-D was with 20-item version (Smarr & Keefer, 2011). Andresen et al. (1994) compared the 10-item short form of the Center for Epidemiologic Studies Depression (CES-D-10) with the 20-item CES-D (CES-D-20), the results of which showed that the CES-D-10 evaluation result was feasible for the elderly. If the CES-D-10 score is 10 or above, the respondent could be diagnosed with depression. (Andresen et al., 1994).

In Europe, about 12% of the elderly over 65 years old are affected by depressive symptoms, which is similar to the proportion in Finland (Forsman, Nyqvist, Schierenbeck, Gustafson, & Wahlbeck, 2012). In the United States, the incidence of depressive symptoms among older adults over 65 years of age is about 3.0-4.5% (Blazer,

Le, Maslow, & Eden, 2012). In low— and middle—income countries, the incidence of depressive symptoms among older adults age 65 and over is 5.8% (Andreasen, Lönnroos, & von Euler—Chelpin, 2014).

In China, Pei (2019) adopted CHARLS in 2015 to study depressive symptoms in the elderly. The overall incidence of depressive symptoms among the aging population was 31.74%. In addition, the proportion of women is higher than that of men; the incidence of depression in divorce, widowhood and unmarried is higher than that in marriage; and the incidence of depressive symptoms in the educational level with high school and above is higher than that of junior high school, which are the conclusions reached in Pei's (2019) study (Pei, 2019).

2.5   Social Activities and Cognitive Functioning

The relationship between social activities and cognitive functioning or cognitive decline is often used as an important factor in exploring cognitive function aging, and it has been extensively studied in cognitive functioning. Most studies show that social activities are positively related to social activities (Bourassa, Memel, Woolverton, & Sbarra, 2017; Lian et al., 2013).

Although the measurement methods for social activities are different, most of the current studies have obtained the same results that social activities are positively associated with cognitive functioning. In general, social activities are measured by the sum of the number of social activities (Glei et al., 2005), whether subjects participate in social activities (Zhu & Zeng, 2019), the frequency of social activities (Zhang & Zhang, 2016), the types of social activities (Hu, Lei, Smith, & Zhao, 2012), certain social activities (e.g. volunteer services; Proulx, Curl, & Ermer, 2018), and so on.

James et al. (2011) tracked the association between social activities in later life (e.g., visiting friends, participating in sports, traveling) and cognitive aging for 5 years. They found that the rate of cognitive aging dropped by 47% with every additional social activity, and the participants had less difficulty with coordination (James et al., 2011). Cognition declines with age, but cognitive functioning of older adults can be improved by increasing their participation in social activities, such as volunteering at the library or helping children with homework for 15 hours a week for a year (Carlson et al., 2008). The results of a longitudinal study conducted on the elderly in Korea by Choi, Park, Cho, Chun, and Park (2016) showed that the cognitive functioning of older adults who participated in all kinds of social activities was higher than that of older adults who did not participate in social activities.

The process of actively participating in social activities is also a process of forming a social network. In this process, the elderly receive social support and their loneliness is reduced, effectively protecting cognitive functioning and preventing the elderly from developing cognitive impairment. In contrast, with age, social isolation and a disengaged lifestyle accelerate cognitive decline (Berkman et al., 2000). Bassuk et al. (1999) tracked more than 2,000 non-social welfare elderly people for 12 years. Older people who did not have a social relationship were twice as likely as those who had five or six social relationships to develop cognitive impairment. Therefore, extensive and deep interpersonal communication can prevent cognitive impairment in the elderly to some extent (Bassuk et al., 1999).

At present, there are few empirical studies about the association between social activities and cognitive functioning in China. However, in those that do exist, most scholars focus on the analysis of factors associated with cognitive functioning, and the conclusions are consistent with the results of foreign studies.

Zhu and Zeng (2019) studied the association between participation and cognitive function by using CHARLS panel data, the results of which showed that participating in social activities could significantly improve cognitive functioning among Chinese older adults in rural areas. Xue (2018) verified the connection between social participation and cognitive functioning by using the number of social activities participated in as a reference index for social engagement. The results showed that the number of social activities participated in was positively related to cognitive functioning (Xue, 2018). Yang, Chen, Li, and Fan (2008) compared the relationship between older adults' participation in social activities and the incidence of elderly cognitive impairment through the chi-square test; the research subjects were elderly people from 22 provinces

and cities in China. The results showed that the elderly with no social activity participation were more likely to suffer from cognitive impairment.

Studies have verified the connection between certain social activities and cognitive functioning. Communicating with family and friends and participating in social activities are related to cognitive functioning in the elderly (Hao et al., 2009). Yu et al. (2007) found that attending gatherings of friends and relatives, which is a kind of social activity, showed a trend of significant influence on the cognitive functioning of elderly people. Playing mahjong, as a unique social activity in China, has a certain effect on cognitive functioning. The results of the simple mental state examination (MMSE) scores of 62 elderly people with an average age of 80 years or over with MCI were improved after playing mahjong 4 months (Cheng, Chan, & Yu, 2006).

Physical and social activities as important means of increasing cognitive reserves can provide effective external stimulation and maintain the activity level of the brain neural network. At the same time, these activities, as an important source of leisure and entertainment, can release pressure and keep the mood pleasant, which can effectively avoid the direct damage of pressure to the brain and contribute to the maintenance of cognitive functioning in the next few years (Qi, 2013).

Previous studies have presented results that are different from the above. Too much participation in social activities requires the elderly to use more social resources to maintain the social network (Kawachi & Berkman, 2001), and social networks generated by social activities may also have negative interaction effects (Cohen, 1988). Therefore, social activities may also be negatively associated with cognitive functioning.

Although there are some studies on the relationship between

social activities and cognitive functioning in China, most research has been conducted in a limited area (specific cities, specific communities, or just in rural areas), and there is a lack of large－scale research on the elderly from a national perspective. In addition, most of the research only studies the correlation between social activities and cognitive functioning or verifies this relationship using the chi－square test to compare the differences of cognitive functioning. In addition, some studies are based on a certain social activity or leisure activity as a reference index to explore the relationship between social activity and cognitive function. Therefore, it is necessary to conduct a sample survey of the elderly all over the country, adopt data that can represent the elderly in China, and consider multiple social activities to obtain results with higher validity. This study explores the internal mechanism between social activities and cognitive functioning by introducing mediating variables to further study the association between the two.

2.6   Social Activities and Depressive Symptoms

Many previous studies have shown that depressive symptoms are related to social activities. Generally, this relationship is negative. Glass et al. (2006) and Isaac et al. (2009) conducted follow-up surveys on older adults over the age of 65 to verify the association between depressive symptoms and social activity participation. The results showed that social activities were negatively related to depressive symptoms. (Glass et al., 2006; Isaac et al., 2009). A study by Chiao et al. (2011) reported the same results. Older adults who participate in social activities have lower depressive symptoms. In addition, compared with older adults who have never participated in social activities, participating in social activities is beneficial to improve the depression of the elderly (Chiao et al., 2011).

Aihara, Minai, Aoyama, and Shimanouchi (2011) included 1,029 older adults aged 65 years and over in a prefecture in Japan in their study, and a baseline survey was conducted to verify the association between social activities and depressive symptoms. The results showed that the level of social activities was associated with depressive symptoms, and people who liked to participate in social activities in middle age could prevent the occurrence of depressive symptoms in old age (Aihara et al., 2011).

Liu et al. (2012) conducted a survey about the influencing factors of depressive symptoms in retired older adults in four communities in Wuhan, China. The results showed that, if the elderly maintained a good level of participation in social activities, they could significantly regulate depression and anxiety (Liu et al., 2012).

Lu (2014) used the 2011 CHARLS data to examine depressive symptoms and the related factors among the rural elderly in China. The results showed that, compared with rural elderly who did social activities, rural elderly who did not engage in activities were more

prone to depressive symptoms (Lu, 2014).

The above research is consistent with some other previous research results (He, Luan, & Liu, 2010; Hsu & Wright, 2014; Kang & Kim, 2011; Zhang & Xue, 1997; Zhao & Pan, 2014). In addition, some previous studies have shown that education level, gender, and marital status are related to depressive symptoms (Li, Zhang, Shao, Qi, & Tian, 2014), and health status (Phifer & Murrell, 1986).

2.7 Social Activities, Depressive Symptoms, and A

ssociation with Cognitive Functioning

2.7.1　Depressive Symptoms and Cognitive Functioning

Many studies have been conducted on the association between depressive symptoms and cognitive functioning. Most of the results showed a negative correlation between the two.

Andersen, Lolk, Kragh-Sϕrensen, Petersen, and Green (2005) used cohort study data from 1994 to 1999 for studying depressive symptoms and the risk of AD. The results showed that AD was closely related to a history of depression (Andersen et al., 2005). In addition, Dotson, Beydoun, and Zonderman (2010) studied the association between depressive symptoms and dementia risk, and the results showed that, as the evaluated depressive symptoms increased, so did the risk of dementia. Köhler et al.' s (2010) study about depressive symptoms and cognitive decline among community-dwelling older adults showed the same results. Moreover, there have been many other previous studies showing that depressive symptoms are associated with cognitive functioning (Avila et al., 2009; Ganguli, Du, Dodge, Ratcliff, & Chang, 2006; Wilson, De Leon, Bennett, Bienias, & Evans, 2004; Yaffe et al., 1999).

Many scholars in China have explored the correlation between depressive symptoms and cognitive functioning. Yan et al. (2003) conducted a 2-year follow-up study on dementia and depressive symptoms of the elderly living in the community from 1997 to 1999. The follow-up results showed that depressive symptoms could reduce the cognitive functioning of the elderly (Yan et al., 2003). There is another study showing that, the more severe the depressive symptoms, the worse the cognitive functioning (Ai et al., 2019). Moreover, Liu et al. (2015) reached the same conclusion as the

above results; their study included elderly people going to the hospital for medical examination as the research subjects. Many scholars in China have explored the association between depression and cognitive functioning from the perspectives of psychology and medicine, and the results are consistent with the above studies (Chen & Zhao, 2018; Liang et al., 2015; Li, Yang, Huang, & Shang, 2013; Lu et al., 2001; Yan, Qu-wan, Jiang, Yang, & Fu, 2013).

2.7.2 The Mediating Effect of Depressive Symptoms in the Relationship Between Social Activities and Cognitive Functioning

Existing research provides indirect evidence for the mediating role of depressive symptoms in the relationship between social activities and cognitive functioning (Bassuk et al., 1999; Berkman, 2000; Gu & Qiu, 2003; Hao et al., 2009). On the one hand, social activities are closely related to depressive symptoms (Chiao et al., 2011; Glass et al., 2006; Isaac et al., 2009; Liu et al., 2012; Lu, 2014); on the other, depressive symptoms are also closely related to cognitive functioning (Andersen et al., 2005; K⬜hler et al., 2010; Yan et al., 2003).

Based on the results outlined above, older adults who actively participate in social activities have fewer depressive symptoms, and there is an association between fewer depressive symptoms and better cognitive functioning. This indirectly illustrates that there may be an internal influence mechanism between social activities and cognitive functioning, that is, depressive symptoms, which mediate the relationship between social activities and cognitive functioning. In some previous studies, it was also verified that depressive symptoms may be an internal mechanism related to social activities, affecting the relationship between social activities and other factors

(Katja et al., 2014).

Social activities reduce feelings of loneliness and depression through contact and interaction with others and bring emotional comfort to the elderly, which indirectly stimulates cognitive functioning (Zhao & Yu, 2016). Individuals can frequently interact with others through social activities and maintain high－quality social relationships, as well as positive emotional states (Fratiglioni et al., 2004), which can benefit individuals' cognitive functioning (Seeman et al., 2001). In general, social activities are not only directly associated with cognitive functioning but also indirectly associated via the negative association with depressive symptoms. In this process, depressive symptoms may mediate the relationship between social activities and cognitive functioning.

Wang and Fang (2019) discussed the relationship between social participation and cognitive functioning with 107 Chinese elderly people living in Toronto as the research subjects. The results showed that social participation had a positive effect on cognitive functioning among older adults. This effect was reflected not only in the direct impact of social participation on the cognitive functioning among older adults but also in the indirect effect of depressive symptoms mediating the association between social respondents and cognitive functioning. Participating in various social activities can be beneficial to improve the quality of life of the elderly, which has a positive influence on reducing depression and loneliness (Wang & Fang, 2019).

Another study verified the relationship between social activities and life satisfaction among older adults in rural China through 2011 CHARLS data (Liu, 2016). After stepwise regression, the relationship between social activities and life satisfaction of the elderly in rural areas was verified. The results showed that there were mediating variables that mediated the relationship between

social activity and life satisfaction. Specifically, social activities could significantly improve life satisfaction among older adults through depressive symptoms and timely medical treatment (Liu, 2016).

Although Wang and Fang's research confirmed the mediating effect of depressive symptoms on social activities and cognitive functioning, the sample size of the study was too small, and the subjects were not elderly people living in native China, but rather, elderly immigrants who had emigrated overseas (Wang & Fang, 2019). Furthermore, cognitive functioning was only examined through situational memory and working memory, which had certain deficiencies, so it is still necessary to adopt Chinese native elderly people as research subjects and to verify cognitive functioning more comprehensively. The relationship between social activities and functions can be discussed in detail to make up for the deficiencies of previous studies.

2.8 Other Factors Related to Cognitive Functioning Among Older Adults

There are many factors influencing the cognition of the elderly. Scholars have studied the influence of factors related to cognitive functioning by taking demographic factors, life history factors, chronic disease factors, and psychological factors into consideration.

In China, there is a summary of the data on cognitive functioning in the China Health and Retirement Report (Zhao et al., 2019). In this report, the authors analyzed cognitive functioning by dividing it into episodic memory functioning and mental functioning. The results showed that low education level, advanced age, and older adults who hold agricultural hukou had poor cognitive functioning in both aspects involved above. However, under the same conditions, women's episodic memory functioning was higher than men's, and men's mental functioning was higher than women's (Zhao et al., 2019). In addition, a study verified the association between sociodemographic factors and cognitive functioning. The results showed that advanced age, female sex, and lower educational levels may lead to lower cognitive functioning, and the cognitive functioning of married people was higher than those of other marital statuses (Wu, Lan, Chen, Chiu, & Lan, 2011).

Many studies have found that bad health behaviors, such as drinking and smoking, can lead to the decline of cognitive functioning in the elderly (Bo et al., 2018). In addition, a study has shown that living arrangements are associated with cognitive functioning. Compared with older adults who are living with their children, those living alone are more prone to cognitive decline (Zhang, Guo, & Bai, 2014).

Chronic disease and mental health levels are correlated with the

cognitive functioning of the elderly. Wang et al. (2008) found that hypertension may lead to cognitive decline in her research results (Wang et al., 2008). Qi, Li, Liang, and Lei (2013) also showed that the incidence of cognitive dysfunction in patients with type 2 diabetes was significantly higher than that in patients without diabetes. In addition, other chronic disease, coronary heart disease (Beeri et al., 2006), and respiratory diseases (Singh et al., 2014) are also associated with the cognitive functioning of the elderly.

2.9　　Limitations of Previous Research

　　Although there are many studies about the association between social activities and the cognitive functioning of the elderly in foreign countries, due to regional and cultural differences between China and foreign countries, the types of activities that the elderly participate in may be different. Therefore, it is necessary to conduct relevant research on older adults in China. Existing studies in China have only been carried out within limited areas, such as in a certain city or community, and most of the studies have been conducted on the elderly in rural regions. Therefore, to establish universally applicable findings, further in-depth discussion is needed. It is necessary to analyze the association between social activities and cognitive functioning based on national sample data to better grasp the overall characteristics of Chinese older adults. Moreover, the research on social activities and cognitive functioning among older adults mainly focuses on correlation analysis, and the more specific empirical studies are not comprehensive. Therefore, specific empirical research is needed to verify the detail of the relationship between social activities and cognitive functions. In addition, there are few studies on the mediating effects of depressive symptoms on social activities and cognitive functioning. Therefore, in this study, I verify the mediating effect of depressive symptoms in the connection between social activities and cognitive functioning. The findings will be useful in preventing cognitive decline in old age.

Chapter 3.   Conceptual Framework and Research Hypotheses

3.1   Conceptual Framework

Mediating Variable
Depressive Symptoms

Independent Variable	Dependent Variable
Social Activities	Cognitive

Control variable
The Elderly's Status: Sociodemographic Characteristics, Health Status, Health Behavior
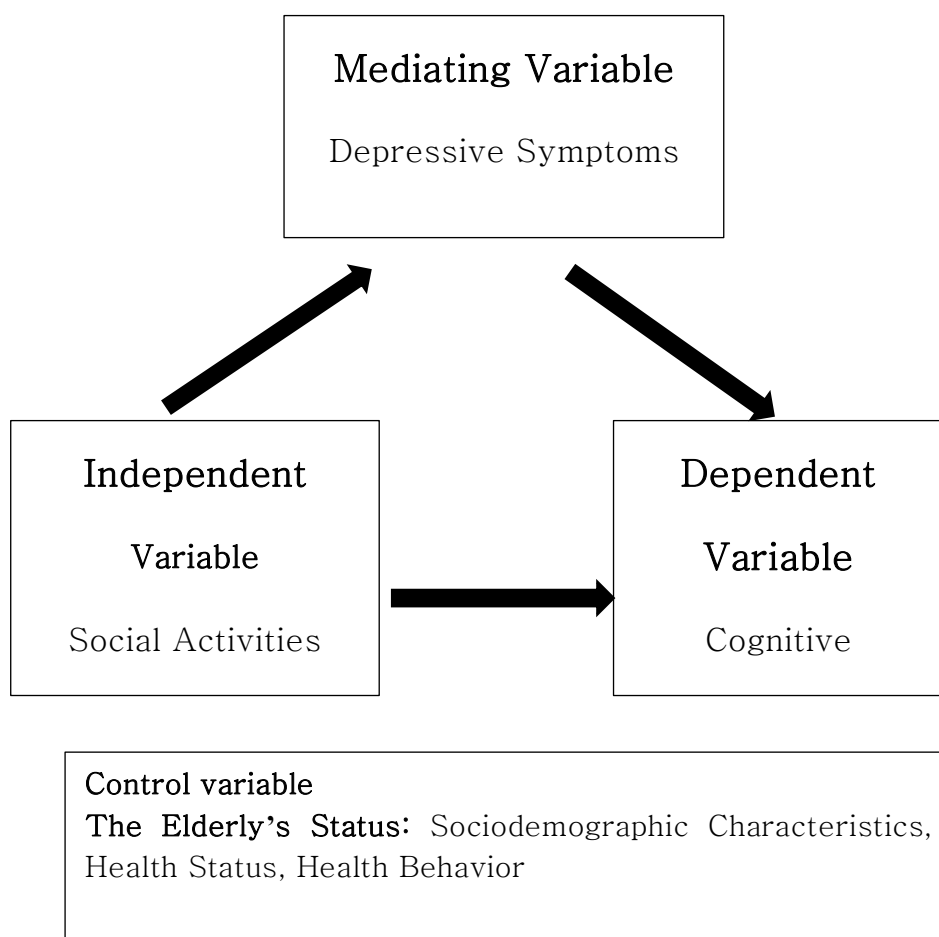
[Figure 3-1] Conceptual framework of this study.

3.2   Research Questions and Hypotheses

To test the main research questions, hypotheses are proposed as follows in this paper:

Question 1: Are social activities related to better cognitive functioning among Chinese older adults?

Hypothesis 1 Social activities are positively associated with cognitive functioning among Chinese older adults.

Question 2: Are social activities related to less depressive symptoms among Chinese older adults?

Hypothesis 2 Social activities are negatively related to depressive symptoms among Chinese older adults.

Question 3: Is the relationship between social activities and cognitive functioning among older adults mediated by depressive symptoms?

Hypothesis 3 The relationship between social activities and cognitive functioning is mediated by depressive symptoms.

Chapter 4.　　Research Methods

4.1　　Data Source and Research Subjects

CHARLS data from 2015 are adopted in this study. CHARLS is a large interdisciplinary research project jointly conducted by the National Development Research Institute of Peking University, the Chinese Academy of Social Sciences Research Center of Beijing University, and the Youth Corps Committee of Beijing University, as well as a major project funded by the National Natural Science Foundation of China. CHARLS aims to collect a set of high-quality data on behalf of Chinese senior citizens over the age of 45, as well as elderly households and individuals, to analyze the problem of population aging in China, promote interdisciplinary research on aging issues, and provide a more scientific basis for the formulation and improvement of Chinese policies.

In 2008, CHARLS conducted a preliminary survey in Zhejiang and Gansu provinces, which represented the typical national conditions in the east and west of China, respectively. The national baseline survey was first established in 2011. The survey was conducted in 150 counties/districts and 450 villages/resident communities in 2011, 2013, 2015, and 2018. By the time the nationwide follow-up survey was completed in 2018, the sample had covered 19,000 respondents in 12,400 households. In addition, CHARLS organized and carried out two national special visits, "Survey of Chinese Residents' Life Course" in 2014 and "Survey of Grassroots Economic History in the Early Years of the Republic" in 2016, which also fully covered the above sample areas. In 2017,

provincial representative sampling was conducted in Beijing and Tianjin, and the range of the respondents was expanded to include a full age sample of households. Although the follow-up survey of 2018 has been completed, the existing public CHARLS data were only updated to the fourth wave in 2015, so the fourth wave data are adopted in this study.

CHARLS is based on the Health and Retirement Study (HRS) and related aging surveys, such as the English Longitudinal Study of Aging (ELSA) and the Survey of Health, Aging and Retirement in Europe (SHARE). Multistage sampling was adopted in the survey, with PPS sampling in both village sampling and the county/district phases. The CHARLS questionnaire includes sections on demographics, health status and functioning, family structure/transfer, work, health care and insurance, income and consumption, retirement and pension, assets (individual and household), and community level information.

The analytic sample in this paper includes older adults aged 60 and above with valid data on cognitive functioning, social activity, and depressive symptoms. Out of 21,097 respondents who participated in the fourth wave of CHARLS data in 2015, 9,910 were aged 60 or over. Of these respondents, those who did not have valid data on cognitive functioning, depressive symptoms, and social activities were deleted ($n = 798$). The data of 9,112 respondents were finally adopted in this study. The selection process is illustrated in [Figure 4-1].

This study verifies the characteristics of the elderly with missing data through logistic regression. According to the results, it can be known that older respondents, those who have a higher income, those who are illiterate, and those with a marital status of "other" are more likely to be missing from the data.
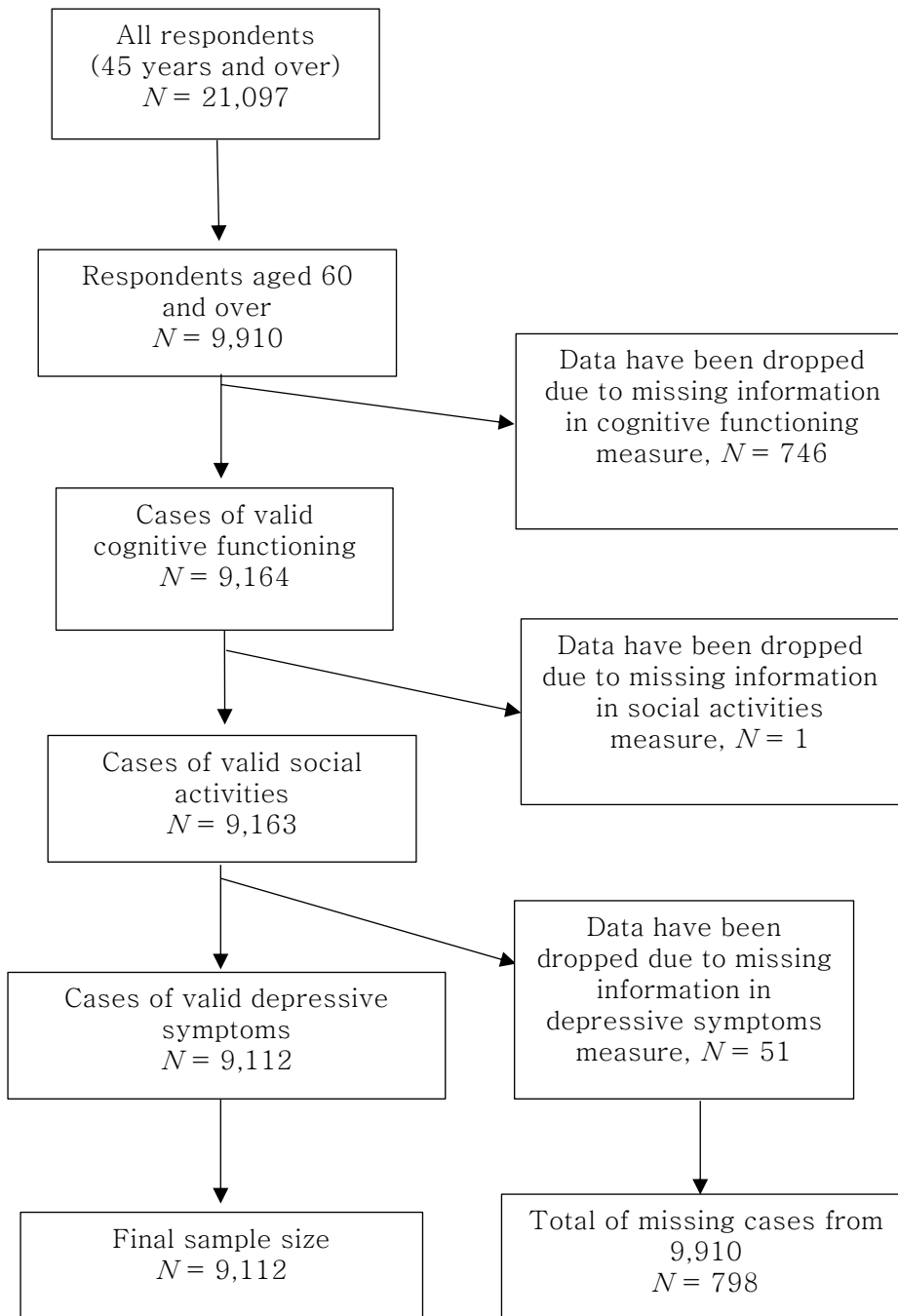
[Figure 4-1] Selection process for the data in this study.

4.2　　Measurement of Variables

4.2.1　　Dependent Variable: Cognitive Functioning

Most of the surveys about cognitive functioning are measured by scales, and many tools are available to test cognitive functioning at present. The "health status and functioning" part of the CHARLS questionnaire has almost the same test questions as the MMSE scale, which measures episodic memory functioning and mental functioning. Mental functioning includes orientational, computational, and drawing (structural) functioning. Orientational functioning indicates the orientation to the date, month, year, and day of the week, with 1 point scored for each correct answer. In terms of computing functioning, respondents are required to subtract 7 from the previous number, starting with 100 and repeating five times; 1 point is scored for each correct answer. In terms of drawing (structure) functioning, this indicates whether it is possible for the respondent to draw a specific picture of two pentagons overlapping; 1 point is scored for a correct drawing. The mental functioning score is the total of the scores through the above tests, and the full score is 10. Episodic memory functioning is the total score of the total words recalled. The interviewer reads 10 words to the interviewees and asked them to recall these words as much as possible. Four minutes later, the interviewees recall the 10 words again, with 1 point scored for each correct answer; the total possible score for episodic memory functioning is 20. The total possible score for cognitive functioning, which is used in this study, is 30.

4.2.2　　Independent Variable: Social Activities

In CHARLS, respondents are asked about social activities, including 10 activities. The items are as follows: 1 = interacted with

friends; 2 = played mahjong, chess, or cards, or went to the community club; 3 = provided help to family, friends, or neighbors who do not live with you; 4 = went to a sport, social, or other kind of club; 5 = took part in a community－related organization; 6 = did voluntary or charity work; 7 = cared for a sick or disabled adult who does not live with you; 8 = attended an educational or training course; 9 = invested in stocks; and 10 = used the Internet (Greysen, Garcia, Sudore, Cenzer, & Covinsky, 2014). Regarding trading stocks to make profits through stock trading and using internet, some studies exclude these measures from social activities because they do not involve social interactions (citation needed). However, given that these activities can be considered production activity, I included these measures in the index of social activity (Li & Chen, 2009).

In this study, the independent variable is measured in terms of how many social activities the respondent participated in last month. Thus, each item was recoded so that 1 indicates participating in a certain activity, while 0 indicates not participating in this activity. Because no respondent participated in nine or more kinds of activities delineated above, the value of the summary score in this study ranges from 0 to 8.

4.2.3   Mediating Variable: Depressive symptoms

In the *health status and functioning* part of the CHARLS questionnaire, a 10－item short form of the Center for Epidemiologic Studies Depression (CES－D－10) test was administered to individuals, mainly measuring the depressive symptoms of respondents. Following the codebook of CHARLS data, depressive symptoms are coded as follows: A code of 1 indicates that the respondent experienced the particular feeling rarely or never (less than one day). A code of 2 indicates the respondent experienced the

particular feeling some or a little of the time (1-2 days). A code of 3 indicates the respondent experienced the particular feeling occasionally or a moderate amount of time (3-4 days). Finally, a code of 4 indicates the respondent experienced the particular feeling most or all of the time (5-7 days). The scales for each of the 10 questions are adjusted so that the anchors are 0-3 rather than 1-4. Then, the sum of the 10 questions is taken after reverse coding two questions ("I felt hopeful about the future" and "I was happy"). Finally, the total score ranges from 0 to 30. Andresen et al. (1994) evaluated the feasibility of the CES-D-10 compared with the 20-item CES-D (CES-D-20). The results showed that the CES-D-10 evaluation result was feasible, and the cutoff score of CES-D-10 was ≥ 10, which means when the CES-D-10 score is 10 or above, the respondent can be diagnosed with depression. A higher CES-D-10 score means more severe depression (Andresen et al., 1994).

4.2.4   Control Variables

Based on the results of previous studies on factors related to the cognitive functioning of the elderly (Bo et al., 2018; Clarke et al., 1998; Li & Chen, 2009; Singh et al., 2014; Wu et al., 2011; Zhao et al., 2019), the relevant factors may be age, gender, marital status, health status, educational level, hukou status, whether they have children, whether they are co-residing with any children, smoking history, drinking history, and income may be related to the cognitive functioning of the elderly. Thus, these variables are taken as control variables in this paper.

1) Age

The age of the respondent in 2015 is based on the result of the respondent's birth year and month subtracted from the interview year and month.

2) Gender

According to the item "Interviewer records respondent's gender" on the questionnaire, gender is divided into 1 = Male and 0 = Female.

3) Hukou status

Hukou status is assessed according to the question, "What's your hukou type?," and the answers are 1 = agricultural hukou, 2 = non-agricultural hukou, 3 = unified residence hukou, and 4 = do not have hukou. Since the "unified residence hukou" is also a kind of non-agricultural hukou, and "do not have hukou" occurs in the rural areas, the hukou status is coded as follows: 0 = agricultural hukou (answers 1 and 4 in the survey), 1 = non-agricultural hukou (answers 2 and 3 in the survey).

4) Educational level

For the question, "Has your highest level of education changed? What is the highest level of education your spouse/partner has attained?," the answers are "1 = no formal education (illiterate), 2 = did not finish primary school but capable of reading and/or writing, 3 = sishu/home school, 4 = elementary school, 5 = middle school, 6 = high school, 7 = vocational school, 8 = 2-/3-year college/associate degree, 9 = 4-year college/bachelor's degree, 10 = master's degree, 11 = doctoral degree/PhD, 12 = no change". In this paper, educational level is coded as 0 = no formal education (illiterate) and 1 = has a record of formal education (answers of 2, 3, 4, 5, 6, 7, 8, 9, or 10 on the survey).

5) Marital status

The survey responds to the question, "Which marital status does your marriage apply to?," and the answers are as follows: "1 = married and living with your spouse, 2 = married but not staying with your spouse at the moment, 3 = separated (do not co-share as

a spouse), 4 = divorced, 5 = bereaved, 6 = no marriage, and 7 = living together". In this paper, marital status is coded as 1 = married (while the answer is 1 or 2 in the survey) and 0 = all the others (while the answer is 3, 4, 5, 6, or 7 in the survey) for analysis.

6) Health status

Health status is measured by subjective assessment of the elderly using the question, "Would you say your health is very good, good, fair, poor or very poor?" The answers are "1 = very good, 2 = good, 3 = fair, 4 = poor and 5 = very poor". In this study, health status is coded as 1 = very poor, 2 = poor, 3 = fair, 4 = good, and 5 = very good.

7) Smoking history

According to the question, "Have you ever chewed tobacco, smoked a pipe, smoked self-rolled cigarettes, or smoked cigarettes/cigars?" in the questionnaire, the answers are 1 = yes and 0 = no.

8) Drinking history

According to the question, "Did you drink any alcoholic beverages, such as beer, wine, or liquor, in the past year? How often?" in the questionnaire, the answers are as follows: 1 = yes, more than once a month, 2 = yes, but less than once a month, and 3 = none of these. In this study, drinking history will be coded as 1 = yes (1 or 2 in the survey) and 0 = no.

9) Income

Income is measured as gross income during the past year. Specifically, older adults' earned income, pension income, social security income, asset income, and other income are calculated as gross income. Because income measures are skewed, the natural logarithm is taken for income. In this study, the average value of the individual's overall income level in the previous year is 6,384.94

yuan, the standard deviation (SD) is 14,435.8, and the range is 0-36,4800 (yuan).

Since some elderly have an income of 0 yuan, before taking the logarithmic treatment in this study, 1 is added to each person's income and then the logarithm is taken. The specific formula is as follows:

$$\text{Income} = \ln{(income + 1)}.$$

10) Co-residence with child(ren)

Co-residence with child(ren) indicates whether the respondent co-resides with any of their children (which can include biological children, foster children, stepchildren, and adopted children). If the respondents reported co-residing with at least one child, these cases are coded as 1 = has at least one co-residing child. When the respondent has at least one child but does not co-reside with any child or has no child, the cases are coded as 0 = has no co-residing child.

[Table 4−1] Definition and Measurement of Variables

Variables		Variable definition and measurement
Dependent variable	Cognitive functioning	Includes mental functioning and episodic memory functioning; total possible score = 30
Independent variable	Social activities	Number of social activities participated in last month; score = 0-8
Mediating variable	Depressive symptoms	Scored according to CES−D−10, range = 0-30
Control variables	Gender	1 = Male, 0 = female
	Age	Real age based on 2015, range = 60-101
	Educational level	0 = No formal education (illiterate), 1 = has a record of formal education
	Marital Status	1 = Married, 0 = all others
	Hukou type	0 = Agricultural hukou, 1 = non−agricultural hukou
	Co−residence with child(ren)	1 = Has at least one co−residing child, 0 = has no co−residing child
	Health Status	Self−assessed health status 1 = very poor 2 = poor 3 = fair 4 = good 5 = very good
	Smoking history	Whether the respondent has ever chewed tobacco, smoked a pipe, smoked self−rolled cigarettes, or smoked cigarettes/cigars 1 = yes, 0 = no

	Drinking history	Whether the respondent has consumed any alcoholic beverages, such as beer, wine, or liquor, in the past year. 1 = yes, 0 = no
	Income	Total income last year (after taking a natural logarithm): Income= $\ln(income + 1)$ Range = 0-12.807

4.3　　Analysis Method

This study uses the STATA 15.1 statistical program for the analysis. First, I a descriptive statistical analysis (e.g., frequencies, percentages [%], mean [M], and SD) of all variables is performed. Second, correlation analysis is conducted to examine the pairwise relationships among all variables. Finally, the relationship between social activities and cognitive functioning, as well as the mediating effect of depressive symptoms in the relationship between social activities and cognitive functioning, is verified through multiple regression. Before performing multiple regression analysis, the independent－samples t－test and chi－square test, values of kurtosis and skewness, histograms, White test, and variance inflation factor are used to examine the independence, normality, heteroscedasticity, and multicollinearity of all the variables. Through this, whether all variables meet the basic assumptions of multiple regression can be examined.

Chapter 5.   Research Findings

The findings of the data analysis are explained in this chapter. The findings include descriptive analysis of the sociodemographic characteristics, health status and health behavior of all respondents, dependent variable, independent variable, mediating variable, and correlation between all variables. Furthermore, the results of the multiple regression analysis and hypothesis test for each research model are presented.

5.1   Descriptive Statistics of Control Variables

This section describes the sociodemographic characteristics, health status, and living habits of all respondents in this study. These included age, gender, marital status, education level, hukou status, health status, income (all income in the last year), co-residence with children, drinking history, and smoking history, which are tabulated in [Table 5-1] and expressed in terms of percentage, mean, and SD.

The average age of the respondents was 67.99 years (SD = 6.54). In terms of gender, the proportion of males accounts for 47.70% (n = 4,529) of the total, while the proportion of females was slightly greater than that of males, accounting for 50.30% (n = 4,583) of the total. As for marital status, 76.55% (n = 6,975) of all respondents were married, and 23.45% (n = 2,137) were in other situations. In terms of hukou status, about three quarters (76.16%) of the respondents (n=6,940) held agricultural hukou, while 23.84% (n = 2,172) held non-agricultural hukou. Of the respondents, 33.72% (n = 3,073) had "no formal education (illiterate)," while 66.28% (n = 6,039) had a record of formal education. In addition, 48.92% (n = 4,458) of all respondents co-resided with at least one child, while 51.08% (n = 4,654) had no co-residing child.

In terms of health status, the respondents had an average score of 2.99, and the SD was 0.97. Concerning health behaviors, 46.82% (n = 4,266) of the respondents had a history of smoking, and 53.18% (n = 4,846) had no history of smoking. While 32.28% (n = 2,941) reported drinking in the last year, 67.72% (n = 6,171) showed no drinking history. In addition, the average income of the respondents, which is the value after taking the natural logarithm year, was 5.07 (SD = 4.01) in the previous year.

The values of skewness and kurtosis were also examined in this study. The skewness values of the control variables (continuous variable) were all below 3 (age = 0.893, health status = 0.279, income = −0.254), while the kurtosis values were under 10 (age = 3.285, health status = 3.164, income = 1.499). We can regard these control variables as the normal distribution and proceed to the next analysis steps (Kline, 2010).

[Table 5-1] Sociodemographic Characteristics, Health Status, Health Behavior of All Respondents

Variables	Total ($N = 9,112$)
	Mean (SD)/Percent
Age (60-101)	67.99 (6.54)
Gender (1 = male, 0 = female)	49.70%
Hukou status (1 = non-agricultural hukou, 0 = agricultural hukou)	23.84%
Marital status (1 = married, 0 = other)	76.55%
Educational level (1 = has a record of formal education, 0 = no formal education [illiterate])	66.28%
Co-residence with child(ren) (1 = has at least one co-residing child, 0= has no co-residing child)	48.92%
Smoking history (1 = yes, 0 = no)	46.82%
Drinking history (1 = yes, 0 = no)	32.28%
Health status (1 = very poor, 5 = very good)	2.99 (0.97)
Income (0-12.807)	5.07 (4.01)

[Table 5-2] Descriptive Statistics of Continuous Control Variables

Variables	Mean	SD	Min.	Max.	Skew.	Kurt.
Age	67.992	6.535	60	101	0.893	3.285
Health status	2.993	0.971	1	5	0.279	3.164
Income	5.074	4.007	0	12.807	−0.254	1.499

5.1.1 Descriptive Statistics of the Dependent Variable, Independent Variable, and Mediating Variable

In this section, the descriptive statistical results for the dependent variable, independent variable, and mediating variable are presented, as listed in [Table 5-3]. In general, the cognitive functioning score ranged from 0 to 30, with a mean of 10.96 (SD = 5. 93). The mean of social activities, which ranged from 0 to 8, is 0.79 (SD = 0.98). The mean of depressive symptoms was 8.39 (SD = 6.54), and the score ranged from 0 to 30.

We can see that the value of skewness of the dependent variable, independent variable, and mediating variable were all below 3, while the value of kurtosis was smaller than 10. Then, we can regard the dependent variable, independent variable, and mediating variable as the normal distribution and proceed to the next analysis steps (Kline, 2010).

[Table 5-3] Descriptive Statistics of Dependent Variable, Independent Variable, and Mediating Variable

Variables		M	SD	Min	Max	Skew.	Kurt.
Dependent variable	Cognitive functioning	10.96	5.93	0	30	−0.03	2.22
Independent variable	Social activities	0.79	1.03	0	8	1.69	6.95
Mediating variable	Depressive symptoms	8.39	6.54	0	30	0.90	3.22
Total		$N = 9{,}112$					

This study conducted a descriptive analysis of whether respondents participated in each described activity; the results are shown in [Table 5-4]. It can be seen that the elderly people who interacted with friends were the largest group, with 2,917 people, accounting for 32.01% of the total respondents. The elderly who attended education or training courses formed the smallest group, with only 31 people, accounting for 0.34% of the total respondents. As for other activities, there were only two identified— "Played mahjong, chess, or cards, or went to the community club" and "provided help to family, friends, or neighbors who do not live with you and who did not pay you for the help," in which the number of older adults participating accounted for 10-20% of the total number of respondents. The number of older adults participating in the remaining activities was less than 10% of the total number of respondents. The number of people engaged in stock investment and attending education or training courses was less than 1% of the total number of respondents. Overall, the number of elderly people participating in each activity was not large, and 50.94% of the elderly did not participate in any activities.

[Table 5-4] Status of Participation in Each Activity

	Percent
1. Interacted with friends	32.01%
2 Played mahjong, chess, or cards, or went to the community club	18.02%
3 Provided help to family, friends, or neighbors who do not live with you and who did not pay you for the help	11.90%
4 Went to a sport, social, or other kind of club	7.35%
5 Took part in a community-related organization	2.44%
6 Done voluntary or charity work	1.16%
7 Cared for a sick or disabled adult who does not live with you and who did not pay you for the help	2.21%
8 Attended an educational or training course	0.34%
9 Invested in stocks	0.56%
10 Used the Internet	2.64%
None of the above	50.94%

5.2　Correlation Matrix of All Variables

In this part, the Pearson correlation coefficient was used to test the correlation between the main variables in this study, as shown in [Table 5-5]. The variables involved all variables in this study.

The correlation coefficient matrix is shown in the table below. From the correlation coefficient matrix table, we can see that the Pearson coefficients between all variables were no higher than 0.8; if the coefficient of the correlation between two variables was in excess of 0.8, there may be multicollinearity according to Gujarati (2009). In addition, the independent variable ($r = 0.258$, $p < .01$), mediating variable ($r = -0.236$, $p < .01$), and all the control variables were linearly correlated with the dependent variable at a significance level of. 01 (two-tailed).

[Table 5-5] Correlation Matrix of All Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1												
2	0.258**	1											
3	−0.236**	−0.125**	1										
4	−0.299**	−0.083**	0.007	1									
5	0.203**	0.040**	−0.176**	0.016	1								
6	0.307**	0.211**	−0.154**	0.050**	0.057**	1							
7	0.182**	0.007	−0.116**	−0.251**	0.144**	0.053**	1						
8	0.517**	0.163**	−0.141**	−0.140**	0.361**	0.253**	0.144**	1					
9	0.120**	0.038**	−0.092**	0.015	0.712**	0.007	0.069**	0.249**	1				
10	0.137**	0.105**	−0.101**	−0.073**	0.396**	0.029**	0.067**	0.178**	0.323**	1			
11	0.104**	0.086**	−0.380**	−0.028**	0.071**	0.068**	0.036**	0.043**	0.039**	0.107**	1		
12	0.220**	0.118**	−0.110**	−0.064**	0.133**	0.169**	0.078**	0.165**	0.077**	0.098**	0.070**	1	
13	−0.050**	−0.033**	0.035**	−0.043**	−0.031**	−0.071**	−0.063**	−0.039**	−0.024	−0.038**	−0.012	−0.029**	1

Note.

* <.05 , ** <.01 (two-tailed)

1 = Cognitive functioning, 2 = social activities, 3 = depressive symptoms, 4 = age, 5 = gender, 6 = hukou status, 7 = marital status, 8 = educational level, 9 = smoking history, 10 = drinking history, 11 = health status, 12 = income, 13 = co-residence with child(ren)

5.3　Test of Hypotheses

In this research, the research questions can be divided into two parts. The first part verifies the relationship between social activities and cognitive functioning among Chinese older adults. The second examines the mediating effect of depressive symptoms in the relationship between social activities and cognitive functioning among Chinese older adults.

Multiple regression models are used to verify the research questions and hypotheses in this study. First, the ordinary least squares (OLS) approach is used to predict the regression model. Second, the White test was used to test whether heteroscedasticity existed in the residual of each regression group. If it showed that heteroscedasticity existed in the residual, heteroskedasticity－consistent standard errors were used to regress and adjust the residuals to obtain an effective regression model (Chen, 2015). Finally, according to the first two steps, stepwise regression was used to verify the relationship between social activities and cognitive functioning and the mediating effect of depressive symptoms in the relationship between social activities and cognitive functioning.

Multicollinearity was verified by examining the variance inflation factor (VIF). According to the results, VIFs in [Model 1] and [Model 2] range from 1.02 to 2.39, while [Model 3] ranges from 1.03 to 2.42. All the VIFs are less than 2.5, which means that there are no multicollinearity problems in this study (Ma, 2008).

In this section, the relationships between social activities, depressive symptoms, and cognitive functioning among Chinese older adults are examined. The research questions and hypotheses are tested through [Model 1], [Model 2], and [Model 3]. It should be noted that, to accurately verify the mediating effect of depressive

symptoms, in this study, the independent variable (social activities) and mediating variable (depressive symptoms) are centered before regression (i.e., the mean value is 0).

[Model 1]   ① Social Activities ⟶ Cognitive Function

$$Y = b_0 + cX + \sum_{i=1}^{11} b_i C_i + \varepsilon_i$$

[Model 2]   ② Social Activities ⟶ Depressive Symptoms

$$M = b_0 + aX + \sum_{i=1}^{11} b_i C_i + \varepsilon_i$$

[Model 3]   ③ Social Activities ⟶ Cognitive Function with Depressive Symptoms as a Mediator

$$Y = b_0 + c'X + bM + \sum_{i=1}^{11} b_i C_i + \varepsilon_i$$

Y: Cognitive functioning (range = 0－30)

X: Number of social activities participate in last month (after centralization, range = (−0.79)–6.21)

M : Depressive symptoms (after centralization, range = (−8.39)–21.61)

C_1: Age (range = 60－101)

C_2: Gender (1 = male, 0 = female)

C_3: Hukou status (1 = non－agricultural hukou, 0 = agricultural hukou)

C_4: Marital status (1 = married, 0 = all other situations)

C_5: Health status (range = 1－5)

C_6: Smoking history (1 = yes, 0 = no)

C_7: Drinking history (1 = yes, 0 = no)

C_8: Educational level (1 = has a record of formal education, 0 = no formal education [illiterate])

C_9: Income (after taking logarithm, range 0－12.81)

C_{10}: Co－residence with child(ren) (1 = has at least one co－residing child, 0 = has no co－residing child)

[Figure 5－1] Relationship between social activities and cognitive functioning, and the mediating effect of depressive symptoms

[Table 5-6] Relationship Between Social Activities and Cognitive Functioning and the Mediating Effect of Depressive Symptoms in the Relationship Between Social Activities and Cognitive Functioning

	Social activities → cognitive functioning			Social activities → depressive symptoms			Social activities → cognitive functioning with depressive symptoms as a mediator		
	b	SE	*t*	*b*	SE	*t*	*b*	SE	*t*
Social activities (range (−0.79) − 6.21)	0.713∗∗∗	0.047	15.05	−0.400∗∗∗	0.058	−6.91	0.669∗∗∗	0.047	14.28
Depressive symptoms (range (−8.39)-21.61)	−	−	−	−	−	−	−0.110∗∗∗	0.008	−13.57
Age (range, 60-101)	−0.205∗∗∗	0.008	−26.57	−0.0285∗∗	0.01	−2.88	−0.208∗∗∗	0.008	−27.08
Gender (1 = Male)	0.564∗∗∗	0.147	3.84	−1.939∗∗∗	0.192	−10.07	0.351∗	0.147	2.38
Hukou status (1 = non−agricultural hukou)	2.368∗∗∗	0.122	19.36	−1.333∗∗∗	0.145	−9.21	2.221∗∗∗	0.121	18.33
Marital status (1 = married)	0.614∗∗∗	0.123	5	−1.207∗∗∗	0.163	−7.42	0.481∗∗∗	0.122	3.93
Educational level (1 = Has a record of formal education)	4.846∗∗∗	0.121	40.15	−0.538∗∗∗	0.154	−3.49	4.787∗∗∗	0.12	39.88

Health status (range, 1-5)	0.294***	0.051	5.72	−2.389***	0.065	−36.52	0.0305	0.054	0.56
Smoking history (1 = yes)	−0.319*	0.133	−2.4	0.631***	0.179	3.52	−0.249	0.132	−1.89
Drinking history (1 = yes)	0.0719	0.113	0.64	0.0499	0.141	0.35	0.0774	0.112	0.69
Income (range, 0-12.81)	0.128***	0.013	10.07	−0.0596***	0.015	−3.86	0.121***	0.013	9.65
Co−residence with child(ren) (1 = has at least one co−residing child)	−0.260**	0.098	−2.66	0.134	0.124	1.08	−0.245*	0.097	−2.53
Constant	19.07***	0.602	31.67	11.58***	0.773	14.97	20.35***	0.608	33.5
R−squared	0.392			0.196			0.404		
F−test	645.842			205.946			622.201		
Prob > F	0.000			0.000			0.000		

Note.

Standard errors have been adjusted by heteroskedasticity−consistent standard errors, and he t−statistic is the robust t−statistic.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two−tailed)

5.3.1 Relationship Between Social Activities and Cognitive Functioning

In this part, hypothesis 1 is examined using [Model 1], and the results can be seen in [Table 5-6].

Question 1: Are social activities related to better cognitive functioning among Chinese older adults?

Hypothesis 1 Social activities are positively related to cognitive functioning among Chinese older adults.

First, 39.2% of the variance of cognitive functioning can be explained in [Model 1] at a significance level of .001. Second, the relationships between social activities and cognitive functioning among older adults are illustrated below.

It can be seen that social activities $(b = 0.713, p < 0.001)$ are related to the cognitive functioning among older adults in a positive way, as illustrated in [Table 5-6]. The more types of social activities elderly people participate in, the higher their cognitive functioning will be. The conclusions from previous studies showed the same results (Hu et al., 2012; Xue, 2018). In addition, gender $(b = 0.564, p < .001)$, hukou status $(b = 2.368, p < .001)$, marital status $(b = 0.614, p < .001)$, educational level $(b = 4.846, p < .001)$, health status $(b = 0.294, p < .001)$, and income $(b = 0.128, p < .001)$ were positively related to cognition ability among older adults. In contrast, age $(b = -0.205, p < .001)$, smoking history $(b = -0.319, p < .05)$, and co-residence with child(ren) $(b = -0.260, p < .001)$ showed negative associations with cognition ability among older adults. In summary, elderly people who are younger, male, married, with better health status, without smoking history, and who have non-agricultural hukou, a record of formal education, higher income, and no co-residing children have higher cognitive functioning, These results are consistent with previous studies (Bo et al., 2018; Wu et al., 2011;

Zhang et al., 2014).

Finally, drinking history had no statistically significant effect on cognition ability. This result is not consistent with previous studies, which have suggested that having a drinking history and having no children can lead to cognitive decline (Bo et al., 2018).

5.3.2 The Relationship Between Social Activities and Depressive Symptoms

In this part, the results of the testing of hypothesis 2 are explained, as presented in [Table 5-6].

Question 2: Are social activities related to less depressive symptoms among Chinese older adults?

Hypothesis 2 Social activities are negatively related to depressive symptoms among Chinese older adults.

This research question is also a key step for examining the mediating effect of depressive symptoms, which verifies the relationship between social activities and depressive symptoms. First, social activities ($b = -0.400, p < 0.001$) show a negative relationship to depressive symptoms, which means that the more social activities elderly people participate in, the lower the depressive symptoms score becomes. Based on this result, the second step of the test procedure of the mediating effect was completed.

Second, except for drinking history and co-residence with child(ren), the control variables are significantly related to depressive symptoms. Specifically, according to [Table 5-6], we can see that age ($b = -0.0285, p < 0.01$), gender ($b = -1.939, p < 0.001$), hukou status ($b = -1.333, p < 0.001$), marital status ($b = -1.207, p < 0.001$), education level ($b = -0.538, p < 0.001$), health status ($b = -2.389, p < 0.001$), and income ($b = -0.0596, p < 0.001$) are negatively associated with depressive symptoms, while smoking history ($b = 0.0.631, p < 0.001$) is positively associated with depressive symptoms.

In general, elderly adults who are older, male, married, with non-agricultural hukou, better health status, no smoking history, and who have a record of formal education and higher income show fewer depressive symptoms. According to the regression results of the second step, we can also know that 19.6% of the depressive symptoms can be explained by [Model 2], and it is statistically significant at the significance level of $p < .001$.

5.3.3 The Mediating Effect of Depressive Symptoms in the Relationship Between Social Activities and Cognitive Functioning

In this part, the results of testing for hypothesis 3 are explained, as presented in [Table 5-6].

Question 3: Is the relationship between social activities and cognitive functioning among older adults mediated by depressive symptoms?

Hypothesis 3 The relationship between social activities and cognitive functioning is mediated by depressive symptoms.

To confirm the mediating effect of depressive symptoms in the relationship between social activities and cognitive functioning, this paper uses a mediating effect verification process to verify the mediating effects of depressive symptoms and answer question 3 and hypothesis 3. According to Baron and Kenny (1986) and Wen, Zhang, Hou, and Liu (2004), the test procedures for verifying the mediating effect can be carried out by testing the significance of regression coefficients through stepwise regression. Specifically, this can be divided into the following three steps: 1) Regress the dependent variable and independent variable to verify whether the independent variable has a significant effect, which includes a direct effect, on the dependent variable; 2) regress the mediating variable and independent variable to verify whether the independent variable has

a significant effect on the mediating variable; and 3) regress the dependent variable, independent variable, and mediating variable to verify the significance of the mediating variable and verify the change of the relationship between the independent variable and the dependent variable while controlling the mediating variable.

The three models in Figure 5-1 are based on the three steps delineated above. According to the coefficients and significance of a, b, c, and c' shown in the figure, it can be judged whether the mediating effect is full or partial. When $a, b, c,$ and c' are all significant, if "$c = ab + c'$," then there is a partial mediating effect. When $a, b,$ and c are significant, and c' equals 0 (or is not significant), there may be a full mediating effect (Baron & Kenny, 1986; Wen, Zhang, Hou, & Liu, 2004). In addition, according to Wen et al. (2004), to verify the mediating effect more accurately, the independent variable and mediating variable can be centralized.

The influence of control variables, such as some social-demographic variables (age, sex, household registration status, marital status, education level, income) and lifestyle habits (drinking history and smoking history), and health status are considered. The specific regression equation is shown in [Figure 5-1], and the results of the three steps of the regression are shown in [Table 5-6] The overall results are explained based on the above three steps.

First, according to the results of the first step, social activities are significantly related to cognitive functioning, which satisfies the assumption of the first step. Second, according to the results of the second step, social activities are significantly related to depressive symptoms, which satisfies the assumption of the second step.

The results of the third step can be clarified in this section. First, we can see that depressive symptoms ($b = -0.111, p < 0.001$) are negatively related to cognitive functioning, which means that the

higher the depressive symptoms score, the lower the cognitive functioning. Second, with the control of depressive symptoms, social activities $(b = 0.641, p < 0.001)$ still show a significant positive correlation with cognitive functioning. At the same time, it can be known that "c = $c' + ab$," which shows that depressive symptoms can play a mediating role in the relationship between social activities and cognitive functioning. The mediating effect is partial because social activities are still significantly related to cognitive functioning in [Model 3] (Baron & Kenny, 1986; Wen et al., 2004). In addition, according to the results in [Table 5-6], 40.4% (1.2% rising from [Model 1]) of the cognitive functioning can be explained by [Model 3], which has remarkable statistical significance at a level of $p < .001$.

Finally, the Sobel test is used to verify whether the intermediary effect is statistically significant. The results of the Sobel test are shown in [Table 5-7]. The statistical value for the mediating effect of depressive symptoms is $z = 6.165$, and the significance level is $p < .000$, which means that depressive symptoms play a statistically significant (partially) mediating role in the association between social activities and cognitive functioning.

[Table 5-7] Statistically Significant Verification of the Mediating Effect of Depressive Symptoms in the Relationship between Social Activities and Cognitive Functioning

a	S_a	b	S_b	Sobel Test	
				Test Statistics	p-value
−0.400	0.058	−0.110	0.008	6.165 ***	0.000

Note.

$a =$ Coefficient of social activities in [Model 2],

$S_a =$ Standard error of social activities in [Model 2],

$b =$ Coefficient of depressive symptoms in [Model 3],

$S_a =$ Standard of depressive symptoms in [Model 3].

* $p < .05$, ** $p < .001$, *** $p < .000$ (two-tailed)

Chapter 6.　Conclusion

6.1　Summary of Findings

With the improvement of life expectancy, population aging has become a hot issue in society. In the early 21st century, China entered the aging society. The implementation of the one－child policy, which lasted for nearly 40 years, from 1978 to 2015, has increased the burden of caring for the elderly. Therefore, home－based care services for the elderly dwelling in the community have begun to formally enter Chinese society. The care for the elderly comes not only from the family but also increasing social support. This obviously requires the elderly's active social engagement and interaction. In addition, with the increase of age, the cognitive ability of the elderly gradually declines, which puts a certain burden not only on elderly people and their families but also society as a whole. Therefore, it is necessary to explore the association between social factors and cognitive functioning and the related mechanisms of this association.

This research investigated the relationship between social activities and cognitive functioning among older adults and the mediating effect of depressive symptoms in the relationship between social activities and cognitive functioning of the elderly. This was done by considering 9,112 respondents aged 60 years and over in terms of their results from the fourth wave of CHARLS in 2015. To achieve the purpose of the study, three research questions and hypotheses were proposed, and the results are summarized below.

For question 1, "Are social activities related to better cognitive functioning among Chinese older adults?," the results showed that social activities are positively related to cognitive functioning, so hypothesis 1 was supported. For question 2, "Are social activities related to less depressive symptoms among Chinese older adults?," the results show that social activities are negatively related to depressive symptoms, so hypothesis 2 is supported. For question 3, "Is the relationship between social activities and the cognitive functioning among older adults mediated by depressive symptoms?," the results show that depressive symptoms mediate the relationship between social activities and cognitive functioning. Therefore, hypothesis 3 is supported.

6.2   Discussion of Major Findings

6.2.1   The Relationship Between Social Activities and Co－gnitive Functioning

The results of this study indicated that social activities are positively related to the cognitive functioning of the elderly, which is consistent with previous research results (Hu et al., 2012; Xue, 2018). Choi et al. (2016) used longitudinal data from the Korean Longitudinal Study on Aging (KLoSA) from 2006 to 2012 for tracking the influence of social activities on cognitive functioning. The results for 2010 and 2012 showed that older adults who participated in all kinds of social activities had higher cognitive functioning on average than did elderly people who did not participate in social activities (Choi et al., 2016). Glei et al.'s (2005) results, based on data from Taiwan, also suggested that the elderly participating in social activities had a lower probability of failure in cognitive tasks than those who did not participate in social activities. The elderly who participate in multiple social activities have a lower probability of failure in cognitive tasks than those participating in fewer social activities (Glei et al., 2005). In other words, participating in more social activities contributes to the cognitive functioning of the elderly.

In some studies, different conclusions were established. For some older adults, participation in social activities may require more resource investment, which may have a negative effect on them (Kawachi & Berkman, 2001). This may be because the elderly engage in a variety of social networks by participating in different social activities, but negative interactions may also form in their social networks, which then have some negative effects on the elderly (Cohen, 1988).

The positive relationship between social activities and cognitive functioning among older adults in this study may be explained as follows: First, according to activity theory, after the elderly enter old age, maintaining active participation in the social network can make them self−satisfied in terms of achieving the purpose of successful aging. Through social activities, the elderly can obtain more resources and larger social networks. At the same time, they can feel a sense of involvement and satisfaction in the process of participation, which reduces anxiety and pressure and contributes to cognitive functioning (Berkman et al., 2000; Fratiglioni et al., 2004; Moen, Dempster−McClain, & Williams, 1992). Second, when the elderly participate in social activities, they need to generate complex interpersonal communication and new cognitive stimulation with people, which can improve or rebuild cognitive reserves to a certain extent and help the brain resist cognitive impairment (Scarmeas & Stern, 2003).

Some sociodemographic factors may affect the participation of the elderly in social activities. For example, people with higher socioeconomic status and higher education levels may have more opportunities to participate in various social activities than those with weaker attributes, while these factors are also related to better cognitive functioning to some extent (Hsu, 2007).

Not only can social activities be related to cognitive functions, but cognitive functions are also related to social activities. For elderly stroke patients in the community, cognitive dysfunction is negatively correlated with the level of participation in social activities. Cognitive impairment is a major factor affecting the decline in social participation. People with cognitive impairment have a lower level of participation in social activities (Tian, Hu, Zhu, & Shi, 2017). In a study using data from 2006‑2012 of KLoSA, which examines the

changes in social activity brought about by the decline of cognitive function, the results show that the decline in cognitive function is associated with a decline in activity participation level (Ha, Chung, & Jeong, 2015).

Because this study used cross－sectional data, it could not verify the causal relationship between social activities and cognitive functions. However, it did verify the positive relationship between social activities and cognitive functioning. In future research, longitudinal data should be used to further explore the causal relationship between social activities and cognitive functions.

6.2.2 The Relationship Between Social Activities and Depressive Symptoms and the Mediating Effect of Depressive Symptoms in the Relationship Between Social Activities and Cognitive Functioning

The results for research question 2 showed that social activities are negatively related to depressive symptoms, which is consistent with previous studies (Aihara et al., 2011; Chiao et al., 2011). The results of research question 3 showed that depressive symptoms mediate the relationship between social activities and cognitive functioning.

According to activity theory, the elderly maintain a good mental state and psychological and physiological functioning through active social activities (Havighurst, 1963). According to the results in this study, it can be seen that elderly people who participate in more social activities have fewer depressive symptoms and higher cognitive functioning; this is consistent with previous studies (He et al., 2010; Hsu & Wright, 2014; Kang & Kim, 2011; Xue, 2018; Zhang & Xue, 1997; Zhao & Pan, 2014). In addition, the results of this study demonstrate that elderly people with fewer depressive symptoms have higher cognitive functioning, which is consistent with previous studies (Avila et al., 2009; Ganguli et al., 2006; Lu et al., 2001; Wilson et al., 2004; Yaffe et al., 1999; Yan et al., 2003).

Based on the above results, the mediating effect of depressive symptoms between social activity and cognitive functioning was examined. The significant mediating effect of depressive symptoms found in this study can be explained as follows: Social activities are not only directly related to cognitive functioning but also indirectly related to it through the mediating effect of depressive symptoms. In other words, being more active in social activities may directly improve cognitive functioning, and at the same time, social activities

improve cognitive functioning by reducing the impact of depressive symptoms. The view of Glass et al. (1999) can also be confirmed by this result, in that there may be psychological social pathways mediating the relationship between activity participation and cognitive functioning (Glass, De Leon, Marottoli, & Berkman, 1999).

Another previous study showed that the relationship between social activity and cognitive function is related to the mediating effect of other factors, which means that the relationship between social activity and cognitive function may be mediated by internal mechanisms other than depressive symptoms. The results of McHugh Power Tang, Lawlor, Kenny, and Kee (2018) showed that perceived stress mediates the relationship between social and leisure activities and cognitive functioning, and participation in social and leisure activities improves cognitive functioning by reducing the effect of the level of perceived stress. This also confirms that social activities can affect cognitive functioning through the internal mechanism of social activities. Moreover, it supports the existence of psychological social paths that may mediate the relationship between social activities and cognitive functioning.

6.2.3 The Relationship Between Control Variables and Cognitive Functioning

In this study, age, gender, hukou status, marital status, health status, education level, and income were significantly associated with cognitive functioning, while co-residence with child(ren) was negatively related with cognitive functioning. Specifically, older adults who are male, married, with a formal education record, holding a non-agricultural hukou, with higher income, and not co-residing with any child may have better cognitive functioning. There was a positive association between health status and cognitive functioning and a negative association between smoking history and cognitive

functioning, without controlling for depressive symptoms. These results are consistent with the findings examined in the preceding studies (Clarke et al., 1998; Li & Chen, 2009; Qi et al., 2013; Singh et al., 2014; Wu et al., 2011; Zhao et al., 2019).

6.3   Implications

Based on the above results and conclusions, we propose the following theoretical and practical points. First, this study is the first to use national large sample data to verify the relationship between social activity and cognitive functioning, focusing on the mediating effect of depressive symptoms. Second, it explained the relationship between social activity and cognitive function with the mediating effect of depressive symptoms based on activity theory. According to activity theory, the elderly maintain a better mental state and better physical functioning by participating in more social activities. In addition, depressive symptoms are negatively correlated with cognitive functioning.

Overall, social activities not only directly improve cognitive functioning but do so indirectly by reducing depressive symptoms. Thus, to improve the cognitive functioning of the elderly, it is necessary to consider not only the direct relationship between social activities and cognitive functioning but also the mediating effect of depressive symptoms as the internal mechanism in the relationship between the two. In addition, most previous studies have verified the direct association between social activities and cognitive functioning through cross-sectional or longitudinal data, and little research has introduced the mediating variables to discuss the internal mechanism of the relationship between social activities and cognitive functioning. Especially in China, there are few studies on the association between social activities and cognitive functioning through national sample data, and there are few studies on mediating variables, which can be supplemented to a certain extent in this study.

The practical implications of this study are as follows: The elderly should be actively involved in social activities from the

personal, family, and social perspectives to reduce the elderly's depressive symptoms, thereby directly or indirectly improving elderly people's cognitive function. First, from the individual perspective, social workers should assess the physical and psychological status of elderly people and encourage them to actively participate in appropriate social activities. Second, from the family perspective, the children and grandchildren of elderly people should help them participate in various types of social activities. Considering that elderly people have a relatively narrow way to receive information about social activities, this may require family members to pay more attention to the information related to the social activities organized by the community and the government so that the elderly will have more ways to participate in social activities. The family of elderly people should also provide them with convenient services related to participation in social activities, such as transporting them to social activity areas and accompanying them to participate in social activities. In addition, social activities can improve the cognitive functioning of the elderly by weakening depressive symptoms. Therefore, the family members of the elderly people should try to help them release depressive symptoms through participating in social activities as much as possible, thereby improving their cognitive function. Finally, from the social perspective, appropriate measures, regulations, and policies can be formulated at the community and government levels to encourage elderly people to actively participate in social activities and provide certain economic guarantees so that they can do so.

At the community level, social workers should assess the physical and psychological status of elderly people, formulate scientific and feasible social activities for them, and encourage them to actively participate in appropriate social activities. At the

government level, as far as Chinese existing policies are concerned, government has vigorously supported the participation of the elderly in social activities. In terms of existing policy, the Chinese State Council General Office on the Opinions of the Formulation and Implementation of the Elderly Care Services was issued on June 6, 2017. The key tasks in articles 18, 19, and 20, are encouraging the reduction of tuition fees for poor elderly people to study in universities (schools) for older adults and support the elderly in entertainment, spiritual comfort, helping each other, and other activities to promote elderly people's participation in social activities. The establishment of senior television (Internet) universities is encouraged to optimize the community learning network for the elderly. In articles 9 and 10, it is pointed out that preferential and convenient public transport services should be provided to the elderly ("Chinese State Council General Office on the Opinions of the Formulation and Implementation of the Elderly Care Services," 2017).

Although measures that involve the construction of elderly service facilities and travel convenience for the elderly to move could encourage elderly people to participate in social activities to a certain extent, it may also be a good measure if the policy were encourage the follow-up support projects to be completed. Social activities need some financial support. Therefore, some of the funds allocated by the government to the grassroots level each year should be used for the social activities of the elderly and special funds, avoiding borrowing by other projects. At the same time, the government should strengthen the relevant publicity about the social participation of the elderly, promote the concept of caring for and respecting the elderly, and create a good atmosphere and comfortable environment for older adults to participate in social activities. In this way, the

elderly can experience social support and care, allowing them to participate actively in social activities. Moreover, it might be better to encourage point-to-point convenience services, such as universities for the elderly, integrated services facilities for the elderly and their families and communities, or pension facilities for the elderly (e.g., providing shuttlebuses or cars for the elderly or fuel allowances for those taking the elderly to social activity areas).

6.4   Limitations and Future Research Directions

In this study, some limitations should be noted. First, this study only focused on the cross-sectional data of the 2015 CHARLS. However, social activities, depressive symptoms, and cognitive functioning are dynamic elements. Predicting the causal relationship between social activities and cognitive functioning through cross-sectional data is inadequate. Therefore, future studies should verify the association between social activities and cognitive functioning and examine the internal influence mechanism in this relationship among older adults through longitudinal data.

Second, although depressive symptoms can mediate the relationship between social activities and cognitive functioning according to this study, there may be other mediating factors associated with the relationship between social activities and cognitive functioning. In future research, more mediating factors should be explored to examine other internal mechanisms that mediate the relationship between social activities and cognitive functioning.

Third, although the CHARLS is a sample survey of the population over 45 years old in China, for the elderly respondents aged 60 years and over, 76.16 percent of whom hold agricultural hukou, which may lead to this study to reflect the characteristics of older adults in rural areas.

Forth, this study conducted a holistic study on samples of all elderly groups in China, and lacks comparative analysis of specific samples such as the differences between urban and rural samples, in order to examine the differences between different groups, and to verify the differences between specific groups and the whole. Therefore, future research should further analyze the characteristics

of specific groups and make more targeted policy recommendations based on the differences.

Fifth, there may be a reverse causal relationship between social activities and cognitive functioning. Therefore, in future research, not only should we clarify the causal relationship between social activities and cognitive functioning, but also the direction of the causal relationship between social activities and cognitive functioning. This will be more conducive to studying the successful aging of cognition.

Bibliography

Ai, Y., Hu, H., Wang, L., Ren, H., Gao, X., Wang, Z., & Chen, F. (2019). Correlation between cognitive function and depression level among the community dwelling elderly. *Journal of Nursing Science*, *34*(16), 33.

Aihara, Y., Minai, J., Aoyama, A., & Shimanouchi, S. (2011). Depressive symptoms and past lifestyle among Japanese elderly people. *Community Mental Health Journal*, *47*(2), 186-193.

Andersen, K., Lolk, A., Kragh-Sørensen, P., Petersen, N. E., & Green, A. (2005). Depression and the risk of Alzheimer disease. *Epidemiology*, 233-238.

Andreasen, P., Lönnroos, E., & von Euler-Chelpin, M. C. (2014). Prevalence of depression among older adults with dementia living in low-and middle-income countries: a cross-sectional study. *The European Journal of Public Health*, *24*(1), 40-44.

Avila, R., Moscoso, M. A. A., Ribeiz, S., Arrais, J., Jaluul, O., & Bottino, C. M. (2009). Influence of education and depressive symptoms on cognitive function in the elderly. *International Psychogeriatrics*, *21*(3), 560-567.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173-1182.

Bassuk, S. S., Glass, T. A., & Berkman, L. F. (1999). Social disengagement and incident cognitive decline in community-dwelling elderly persons. *Annals of Internal Medicine*, *131*(3), 165-173.

Beeri, M., Rapp, M., Silverman, J., Schmeidler, J., Grossman, H., Fallon, J., . . . Lesser, G. (2006). Coronary artery disease is associated with Alzheimer disease neuropathology in APOE4 carriers. *Neurology*, *66*(9), 1399-1404.

Berkman, L. F. (2000). Which influences cognitive function: Living alone or being alone? *Lancet (London, England)*, *355*(9212), 1291-1292.

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine*, *51*(6), 843-857.

Blazer, D., Le, M., Maslow, K., & Eden, J. (2012). *The mental health and substance use workforce for older adults: In whose hands?* Washington, DC: National Academies Press.

Bo, Z.-Y., Kuang, W.-H., Wang, Y., Chen, G., Xiong, Q.-R., & Qiu, P.-Y. (2018). Cognitive impairments and associated factors in community-dwelling elderly in Chengdu, Sichuan. *Journal of Sichuan University (Medical Science Edition)*, *49*(5), 759-764.

Bourassa, K. J., Memel, M., Woolverton, C., & Sbarra, D. A. (2017). Social participation predicts cognitive functioning in aging adults over time: Comparisons with physical health, depression, and physical activity. *Aging & Mental Health*, 21(2), 133-146.

Carlson, M. C., Saczynski, J. S., Rebok, G. W., Seeman, T., Glass, T. A., McGill, S., . . . Fried, L. P. (2008). Exploring the effects of an "everyday" activity program on executive function and memory in older adults: Experience Corps. *The Gerontologist*, *48*(6), 793-801.

Chen, Q. (2005). *Research on the social support of the elderly in the community of Nanjing*. (Doctoral dissertation, Nanjing University of Science & Technology).

Chen, Q. (2015). *Econometrics and Stata applications* (Vol. 7). Beijing: Higher Education Press.

Chen, X., & Zhao, H. (2018). Correlation between depression and cognitive function in middle-aged and elderly people in Chinese communities. *Chinese Journal of Gerontology*, *38*(4), 971-973.

Cheng, S. T., Chan, A. C., & Yu, E. C. (2006). An exploratory study of the effect of mahjong on the cognitive functioning of persons with dementia. *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences*, *21*(7), 611-617.

Chiao, C., Weng, L.-J., & Botticello, A. L. (2011). Social participation reduces depressive symptoms among older adults: An 18-year longitudinal analysis in Taiwan. *BMC Public Health*, *11*(1), 292-300.

China Center for Disease Control and Prevention (2019). World Alzheimer's Day | Caring for the elderly, please pay attention to Alzheimer's disease. Retrieved from http://www.chinacdc.cn/yyrdgz/201909/t20190921_205709.html

Chinese State Council General Office on the Opinions of the Formulation and Implementation of the Elderly Care Services. (2017). Retrieved from http://www.gov.cn/zhengce/content/2017-06/16/content_5203088.htm

Choi, Y., Park, S., Cho, K. H., Chun, S. Y., & Park, E. C. (2016). A change in social activity affect cognitive function in middle-aged and older Koreans: Analysis of a Korean longitudinal study on aging (2006-2012). *International Journal of Geriatric Psychiatry*, *31*(8), 912-919.

Clarke, R., Smith, A. D., Jobst, K. A., Refsum, H., Sutton, L., & Ueland, P. M. (1998). Folate, vitamin B12, and serum total homocysteine levels in confirmed Alzheimer disease. *Archives of Neurology*, *55*(11), 1449-1455.

Cohen, S. (1988). Psychosocial models of the role of social support in the etiology of physical disease. *Health Psychology*, *7*(3), 269.

Cronin-Stubbs, D., De Leon, C. F. M., Beckett, L. A., Field, T. S., Glynn, R. J., & Evans, D. A. (2000). Six-year effect of depressive symptoms on the course of physical disability in community-living older adults. *Archives of Internal Medicine*, *160*(20), 3074-3080.

Dotson, V. M., Beydoun, M. A., & Zonderman, A. B. (2010). Recurrent depressive symptoms and the incidence of dementia and mild cognitive impairment. *Neurology*, *75*(1), 27-34.

Folland, S. (2007). Does "community social capital" contribute to population health? *Social Science & Medicine*, *64*(11), 2342-2354.

Forsman, A. K., Nyqvist, F., Schierenbeck, I., Gustafson, Y., & Wahlbeck, K. (2012). Structural and cognitive social capital and depression among older adults in two Nordic regions. *Aging & Mental Health*, *16*(6), 771-779.

Fratiglioni, L., Paillard-Borg, S., & Winblad, B. (2004). An active and

socially integrated lifestyle in late life might protect against dementia. *The Lancet Neurology*, *3*(6), 343-353. doi:10.1016/s1474-4422(04)00767-7

Ganguli, M., Du, Y., Dodge, H. H., Ratcliff, G. G., & Chang, C.-C. H. (2006). Depressive symptoms and cognitive decline in late life: a prospective epidemiological study. *Archives of General Psychiatry*, *63*(2), 153-160.

Glass, T. A., De Leon, C. F. M., Bassuk, S. S., & Berkman, L. F. (2006). Social engagement and depressive symptoms in late life: Longitudinal findings. *Journal of Aging and Health*, *18*(4), 604-628.

Glass, T. A., De Leon, C. M., Marottoli, R. A., & Berkman, L. F. (1999). Population based study of social and productive activities as predictors of survival among elderly Americans. *BMJ*, *319*(7208), 478-483.

Glei, D. A., Landau, D. A., Goldman, N., Chuang, Y.-L., Rodríguez, G., & Weinstein, M. (2005). Participating in social activities helps preserve cognitive function: an analysis of a longitudinal, population-based study of the elderly. *International Journal of Epidemiology*, *34*(4), 864-871.

Greysen, S. R., Garcia, C. C., Sudore, R. L., Cenzer, I. S., & Covinsky, K. E. (2014). Functional impairment and Internet use among older adults: Implications for meaningful use of patient portals. *JAMA Internal Medicine*, *174*(7), 1188-1190.

Gu, D., & Qiu, L. (2003). Cognitive functioning and its determinants among the oldest old in China. *Journal of Nanjing College for Population Programme Management, 19*(2), 3-9.

Gujarati, D. N. (2009). *Basic econometrics*. London: Tata McGraw-Hill Education.

Hao, X., Chen, C., Li, J., & Li, S. (2009). Investigation and analysis of cognitive functions and influencing factors of the elderly in 22 provinces (cities). *Chinese Journal of Gerontology*, *29*(3), 3095-3097.

Hautzinger, M., & Welz, S. (2004). Cognitive behavioral therapy for depressed older outpatients-A controlled, randomized trial. *Zeitschrift fur Gerontologie und Geriatrie*, *37*(6), 427-435.

Havighurst, R. J. (1963). Successful aging. *Processes of Aging: Social and Psychological Perspectives*, *1*, 299-320.

He, C., & Chen, C. (2013). The delaying effect of activities engagement on the cognitive impairment. *Advances in Psychological Science*, *21*(3), 506-516.

He, X., Luan, X., & Liu, L. (2010). Investigation of the depression in the elderly widows living alone and the correlation factors. *Chinese Journal of Modern Nursing*, *16*(2), 142-144.

Hsu, H. (2007). Does social participation by the elderly reduce mortality and cognitive impairment? *Aging & Mental Health*, *11*(6), 699-707.

Hsu, Y.-C., & Wright, C. L. (2014). The association between participation in social activity and depressive symptoms in institutionalized elders in Taiwan. *Geriatric Nursing*, *35*(1), 31-36.

Hu, Y., Lei, X., Smith, J. P., & Zhao, Y. (2012). Effects of social activities on cognitive functions: Evidence from CHARLS. C*ognitive Social Science Journal.*

Isaac, V., Stewart, R., Artero, S., Ancelin, M.-L., & Ritchie, K. (2009). Social activity and improvement in depressive symptoms in older people: A prospective community cohort study. *The American Journal of Geriatric Psychiatry*, *17*(8), 688-696.

James, B. D., Wilson, R. S., Barnes, L. L., & Bennett, D. A. (2011). Late-life social activity and cognitive decline in old age. *Journal of the International Neuropsychological Society*, *17*(6), 998-1005. doi:10.1017/S1355617711000531

Jang, Y., & Chiriboga, D. A. (2011). Social activity and depressive symptoms in Korean American older adults: The conditioning role of acculturation. *Journal of Aging and Health*, *23*(5), 767-781. doi:10.1177/0898264310396214

Jia, J. (2015). Research on Chinese familial Alzheimer's disease. *China Medical News*, (12)*, 12-12.*

Jin, Y., Li, R., & Wei, L. (2009). Exploratory development of MMSE for senile dementia patients. *Chinese Journal of Geriatric Care*, *7*(4), 46-47.

Kang, S. K., & Kim, H. J. (2011). A study of impact of social activities and religion/spirituality on depression and life satisfaction among the Korean elderly. 한국인구학, *34*(2), 163-190.

Katja, P., Timo, T., Taina, R., & Tiina-Mari, L. (2014). Do mobility, cognitive functioning, and depressive symptoms mediate the

association between social activity and mortality risk among older men and women? *European Journal of Ageing*, *11*(2), 121-130.

Kawachi, I., & Berkman, L. F. (2001). Social ties and mental health. *Journal of Urban Health*, *78*(3), 458-467.

Kline, R. B. (2010). *Promise and pitfalls of structural equation modeling in gifted research.* Washington, DC, US: American Psychological Association

Kong, F., Wu, G., Huang, L., Li, W., Lu, P., Du, X., & Xue, Y. (2011). To evaluate the efficacy of cognitive behavioral therapy in the treatment of old depression. *Journal of Community Medicine*, *9*(14), 13-14.

Kⵁhler, S., van Boxtel, M. P., van Os, J., Thomas, A. J., O'Brien, J. T., Jolles, J., . . . Allardyce, J. (2010). Depressive symptoms and cognitive decline in community-dwelling older adults. *Journal of the American Geriatrics Society*, *58*(5), 873-879.

Krueger, K. R., Wilson, R. S., Kamenetsky, J. M., Barnes, L. L., Bienias, J. L., & Bennett, D. A. (2009). Social engagement and cognitive function in old age. *Experimental Aging Research*, *35*(1), 45-60.

Li, D., Zhang, D.-J., Shao, J.-J., Qi, X.-D., & Tian, L. (2014). A meta-analysis of the prevalence of depressive symptoms in Chinese older adults. *Archives of Gerontology and Geriatrics*, *58*(1), 1-9.

Li, H.-F., & Chen, T.-Y. (2009). Social functioning and subjective well-being in the elderly. *Advances in Psychological Science*, *17*(4), 759-765.

Li, L. (2010). Common nursing problems and nursing measures for patients with senile dementia. *China Modern Medicine*, *17*(13), 119-120.

Li, S., & Guo, H. (2020). Research progress on the correlation between cognitive function, depression and social capital among the elderly in nursing institutions. *Journal of Shenyang Medical College*, *22*(1), 77-82.

Li, S., Yang, X., Huang, P., & Shang, S. (2013). Correlation among cognitive function and activities of daily living, anxiety and depression in hospitalized older patients. *Journal of Nursing Science*, *28*(9), 68-69.

Li, Y. (2006). Expert consensus on prevention and treatment of cognitive dysfunction in China. Chinese Journal of Geriatrics, *25*(7), 485-487.

Lian, G., Zhu, W., Zhou, D., Liu, W., Xu, Y., & Chen, Z. (2013). Correlation between lifestyle factors and mild cognitive impairment in old adults. *Chinese Journal of Rehabilitation Theory and Practice*, *19*(5), 465-468.

Liang, X., Ding, J., Luo, J., Zhao, Q., Guo, Q., Zhou, Y., . . . Hong, Z. (2015). The association between anxiety and depression symptoms and cognitive impairment in elderly. *Chinese Journal of Clinical Neurosciences*, *23*(6), 635-641.

Liu, B, Wang, J., & Xiao, Y. (2016). Prevalence of senile dementia in people aged ≥60 years in China: A meta－analysis. *Chinese Journal of Epidemiology*, *37*(11), 1541-1545.

Liu, F., Liang, X., Luo, H., Hu, S., Gao, S., & Wang, Z. (2012). The analysis of influence factors of geriatric depressive symptoms among retired people. *Chinese Journal Of Social Medicine*, *29*(2), 121-124.

Liu, J., Lai, Y., & Zhang, X. (2015). Functional status in elderly depressed people cognitive. *Journal of International Psychiatry*, *42*(5), 29-32.

Liu, S. (2019). *Degeneration and reconstruction of cognitive and social communication function: Study on the effective of group work in the elderly with mild dementia.* (Master's thesis, Shandong University).

Liu, X. (2016). How does social activities affect the rural elderly life satisfaction? *Population & Economics*, *2*, 40-47.

Lu, Y. (2014). *Study on depression status and its influence factors of rural elderly in china.* (Doctoral dissertation, Shandong University),

Lu, Z., Wu, W., Cai, J., Li, Y., Li, C., Liu, M., . . . Guo, Z. (2001). Depressive symptoms and the relationship with cognitive function for elderly patients in general hospital. *Shanghai Archives of Psychiatry*, *13*(3),124－126.

Lv, T., Ma, M., Cao, Y., Yang, Y., Yuan, H., Wu, S., & Li, Z. (2001). Study on depression of the old people in communities and the influencing factors. *Journal of Nursing Science*, *16*(7), 387-389.

Ma, X.-W. (2008). Diagnosis and empirical analysis on multicollinearity in linear regression model. *Journal of Huazhong Agricultural University (Social Sciences Edition)*, *2*, 78-81.

McDermott, L. M., & Ebmeier, K. P. (2009). A meta-analysis of depression severity and cognitive function. *Journal of Affective Disorders*, *119*(1-3), 1-8.

McHugh Power, J., Tang, J., Lawlor, B., Kenny, R. A., & Kee, F. (2018). Mediators of the relationship between social activities and cognitive function among older Irish adults: Results from the Irish longitudinal study on ageing. *Aging & Mental Health*, *22*(1), 129-134.

Meng, C., Tang, Z., & Chen, B. (2000). Longitudinal study on the influencing factors of cognitive decline in the elderly. *Chinese Journal Of Geriatrics*, *19*(3), 211-214.

Moen, P., Dempster-McClain, D., & Williams, R. M., Jr. (1992). Successful aging: A life-course perspective on women's multiple roles and health. *American Journal of Sociology*, *97*(6), 1612-1638.

Morrow-Howell, N., Hinterlong, J., & Sherraden, M. (Eds.) (2001). *Productive aging: Concepts and challenges*. Baltimore, MD: John Hopkins University Press.

Panza, F., D'Introno, A., Colacicco, A. M., Capurso, C., Del Parigi, A., Caselli, R. J., . . . Scafato, E. (2009). Temporal relationship between depressive symptoms and cognitive impairment: The Italian Longitudinal Study on Aging. *Journal of Alzheimer's Disease*, *17*(4), 899-911.

Paterniti, S., Verdier-Taillefer, M.-H., Dufouil, C., & Alpérovitch, A. (2002). Depressive symptoms and cognitive decline in elderly people: Longitudinal study. *The British Journal of Psychiatry*, *181*(5), 406-410.

Pei, Q. (2019). *Analysis of depression symptoms and influencing factors in Chinese elderly*. (Doctoral dissertation, Zhengzhou University).

Phifer, J. F., & Murrell, S. A. (1986). Etiologic factors in the onset of depressive symptoms in older adults. *Journal of Abnormal Psychology*, *95*(3), 282.

Population Division of Chinese National Bureau of Statistics (2019).

人口总量平稳增长 人口素质显著提升——新中国成立 70 周年经济社会发展成就系列报告之二十. Retrieved from http://www.stats.gov.cn/tjsj/zxfb/201908/t20190822_1692898.html

Proulx, C. M., Curl, A. L., & Ermer, A. E. (2018). Longitudinal associations between formal volunteering and cognitive functioning. *The Journals of Gerontology: Series B*, *73*(3), 522-531.

Qi, S. H. (2013). *The relationship study among personality, leisure activities and cognitive function of older individuals*. Southwest University.

Qi, Z.-H., Li, S., Liang, Z.-H., & Lei, Y. (2013). Clinical relevance analysis and risk factors screening between cognitive impairment and diabetes. *Journal of China Medical University*, *42*(8), 702-705.

Roh, H. W., Hong, C. H., Lee, Y., Oh, B. H., Lee, K. S., Chang, K. J., . . . Back, J. H. (2015). Participation in physical, social, and religious activity and risk of depression in the elderly: A community-based three-year longitudinal study in Korea. *PloS One*, *10*(7), e0132838.

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The gerontologist, 37*(4), 433-440.

Scarmeas, N., & Stern, Y. (2003). Cognitive reserve and lifestyle. *Journal of Clinical and Experimental Neuropsychology*, *25*(5), 625-633.

Seeman, T. E., Lusignolo, T. M., Albert, M., & Berkman, L. (2001). Social relationships, social support, and patterns of cognitive aging in healthy, high-functioning older adults: MacArthur studies of successful aging. *Health Psychology*, *20*(4), 243-255.

Singh, B., Mielke, M. M., Parsaik, A. K., Cha, R. H., Roberts, R. O., Scanlon, P. D., . . . Petersen, R. C. (2014). A prospective study of chronic obstructive pulmonary disease and the risk for mild cognitive impairment. *JAMA Neurology*, *71*(5), 581-588.

Smarr, K. L., & Keefer, A. L. (2011). Measures of depression and depressive symptoms: beck depression inventory-II (BDI-II), Center

for Epidemiologic Studies Depression Scale (CES-D), geriatric depression scale (GDS), hospital anxiety and depression scale (HADS), and patient health Questionnaire-9 (PHQ-9). *Arthritis care & research, 63*(S11), S454–S466.

Tao, S., & Li, B. (2002). Implicit cognition: A new window of exploring human cognition and learning. *Journal of Beijing Normal University (Humanities and Social Sciences)*, (*4*), 12–19.

Wang, F., Wu, H., Huang, C., Lu, Z., & Dong, B. (2008). Psychotherapy for depression in older patients: A systematic review. *Chinese Journal of Evidence–Based Medicine*, *8*(12), 1079-1085.

Wang, L., & Fang, D. (2019). The relationship between social participation and cognitive function of old Chinese immigrants. *Chinese Journal of Gerontology*, *39*(23), 67–70.

Wang, L., & Zhu, M. (2013). Research progress in the pathogenesis of Alzheimer's disease. *Jilin Medical Journal*, *34*(3), 531-532.

Wang, M. (2007). Profiling retirees in the retirement transition and adjustment process: Examining the longitudinal change patterns of retirees' psychological well–being. *Journal of Applied Psychology*, *92*(2), 455–474.

Wang, X., Wang, L., Liu, D., Li, J., Sun, J., & Wang, B. (2008). Analysis on hypertension KAP and influence factors in rural population. *Chinese Journal of Public Health*, *24*(3), 269-270.

Wang, Y., & Tan, L. (2009). "Informal" old–age education and social participation of the elderly. *Population Journal*, *4*, 41-46.

Wen, Z., Zhang, L., Hou, J., & Liu, H. (2004). Testing and application of the mediating effects. *Acta Psychologica Sinica*, *36*(5), 614-620.

Wilson, R., De Leon, C. M., Bennett, D., Bienias, J., & Evans, D. (2004). Depressive symptoms and cognitive decline in a community population of older persons. *Journal of Neurology, Neurosurgery & Psychiatry*, *75*(1), 126-129.

Wu, J., Lin, D., & Jiang, G. (2001). *Medical psychology*. Beijing: Higher Education Press.

Wu, M.–S., Lan, T.–H., Chen, C.–M., Chiu, H.–C., & Lan, T.–Y. (2011). Socio–demographic and health–related factors associated with cognitive impairment in the elderly in Taiwan.

BMC Public Health, *11*(1), 22−29.

Wu, R., Yu, Y. S., Chen, H. Z., & Song, L. X. (2005). Analysis on Influencing Factors in Depression of the Elderly in Dunyun Community. *Journal of Nursing Science, 20*(20).

Wu, S., Yan, T., & Huang, L. (2003). The validity and reliability of the abbreviated Mental Test Scale. *Chinese Journal of Physical Medicine and Rehabilitation*, *25*(3), 140−142.

Xia, Y., Binhua, C., Xueqian, S., Yuqing, N., Changwang, J., Xiurong, L., & Ying, M. (2006). Cognitive functioning in community− dwelled aged: A comparison of baseline and 4−year follow− up. *Chinese Journal of Psychiatry*, *39*(1), 29-32.

Xue, X.−D. (2018). The effect of social participation on the cognitive functioning of middle−aged and elderly people in China. *Chinese Journal of Health Policy*, *11*(5), 1-9.

Yaffe, K., Blackwell, T., Gore, R., Sands, L., Reus, V., & Browner, W. S. (1999). Depressive symptoms and cognitive decline in nondemented elderly women: a prospective study. *Archives of General Psychiatry*, *56*(5), 425-430.

Yan, F., Li, S., Liu, J., Zhang, W., Chen, C., Liu, M., . . . Wu, H. (2003). 2 Years follow−up of the elderly with dementia or depression. *Chinese Mental Health Journal*, *17*(11), 745−748.

Yang, F., Chen, C., Li, J., & Fan, Y. (2008). Research on the influence of sports and social activities on the occurrence of cognitive impairment in the elderly. *Chinese Journal of Modern Nursing*, *14*(22), 2383-2384.

Ye, Y. (2015). Scientifically understand and prevent Alzheimer's disease. *Health Guide*, *9*, 22-23.

Yi, Z. (2020). 人口总量增速放缓 城镇化水平继续提升. Retrieved from http://www.stats.gov.cn/tjsj/zxfb/202001/t20200119_172376 7.html

Yu, H., Chen, J., & Wang, J. (2007). The influence of the lifestyle of the elderly in the community on their cognitive function. *Journal of Heilongjiang College Of Education*, *26*(23), 70−71.

Yuan, J., Qu, Z.−W., Jiang, Q., Yang, Z.−D., & Fu, W.−Z. (2013). The epidemiological survey of depression disorder and cognitive disorder of the elderly in Shanghai Pudong community. *Journal of Clinical Psychiatry*, *23*(2), 86−88.

Zhang, C., & Zhang, D. (2016). The influences of social activities on

urban elderly people's health: Based on CHARLS 2011. Population & Economics, *5*, 55-63.

Zhang, D., Guo, X., & Bai, B. (2014). Mild cognitive impairment of the elderly from the urban community in Beijing. *China Journal of Health Psychology*, *22*(10), 1460-1462.

Zhang, W., & Xue, X. (1997). Analysis of depression and related factors of the elderly in the community. *Health Psychology Journal*, *4*, 270-271.

Zhang, W, Zhao, G, Liu, X, Madendai, Wang, G., & Li, C. (2001). Cognitive function and related factors of urban elderly: A cross-sectional study. *Chinese Mental Health Journal*, *15*(5), 327-330.

Zhang, Y, & Tang, Z. (2005). Elderly hypertension and cognitive functioning. *Chinese Journal of Hypertension*, *13*(7), 399-402.

Zhang, Y., Zhao, G., Zhang, W., Madengdai, & Wang, G. (2004). An investigation of cognitive function and related factors of the urban elderly people. *Shandong Archives of Psychiatry*, *17*(4).

Zhao, D., & Yu, L. (2016). Influence of social interaction on cognitive functions in the elderly. *Advances in Psychological Science*, *24*(1), 46-54.

Zhao, X.-Y., & Pan, J.-T. (2014). Social participation and depression of the urban widowed women elders from a gender perspective. *Collection of Women's Studies*, *2*, 25-33.

Zhao, Y., Wang, Y., Chen, X., Meng, Q., Tang, Y., Zhang, T., . . . Bo. (2019). China health and retirement report. Retrieved from http://charls.pku.edu.cn/Public/ashelf/public/uploads/documen t/public_documents/application/china-health-retirement-report.pdf

Zhao, Y., Xue, J., & Wang, Y. (2009). Analysis of the effect of psychological nursing intervention on improving anxiety and depression of family members of patients with dementia. Journal of Psychiatry, *22*(5), 377-378.

Zhou, A. (2014). An empirical study of rural aged social participation. *Journal of Jixi University*, *14*(2), 59-62.

Zhu, H.-L., & Zeng, X.-Q. (2019). Social activities and the cognition of rural older adults-Evidence from 2011-2015 CHARLS data. *China Labour*, *9*, 25-39.

국문초록

중국 노인의 사회적 활동과 인지 기능의 관계
- 우울한 증상의 매개 효과를 중심으로 -

서울대학교대학원

사회복지학과

이문형

　중국 노인의 기대 수명이 증가함에 따라 중국은 점차 고령화 사회에 진입했다. 노인들은 노후 생활에 들어가면서 점차 노동 시장에서 빠져 나가고 다양한 사회적 자원이 상실된다. 또한 인지 장애와 인지 기능 저하 등 문제가 나타난다. 노년기에 인지 장애가 심각하면 일상 생활 능력과 스스로를 돌보는 능력을 상실할 수 있다. 활동 이론은 노인이 사회적 활동에 적극적으로 참여하여 소셜 네트워크를 유지하며 나아가 정신건강과 생리적 기능을 유지하도록 요구한다.

　중국의 기존의 일부 연구는 노인들 사이에서 사회적 활동과 인지 기능의 관계에 초점을 맞추고 있지만, 사회적 활동과 인지 기능의 관계를 검증하기 위한 실증적 연구는 아직 충분하지 않다. 그리고 대부분의 연구는 특정 지역으로 한정되어 있으며, 사회적 활동과 인지 기능의 관계에 대한 포괄적인 이해가 부족하다. 또한 사회적 활동과 인지 기능의 관계에 대한 내부 메커니즘의 탐색은 거의 없다. 사회적

활동과 인지 기능의 관계에서 우울 증상의 매개 효과에 대한 연구는 부족하다. 그러므로 본 연구의 목적은 다음과 같다:

1) 중국 노인의 사회적 활동과 인지 기능의 관계를 검증한다. 2) 중국 노인의 사회적 활동과 우울 증상의 관계를 탐색한다. 3) 중국 노인의 사회적 활동과 인지 기능의 관계에서 우울 증상의 매개 효과를 검토한다.

본 연구는 2015 년 제 4 차 China Health and Retirement Longitudinal Study (CHARLS) 데이터를 사용하여 9,112 명의 60 세 이상 노인을 대상으로 사회적 활동과 인지 기능의 관계를 연구하였고 연구의 주요 결과는 다음과 같다:

첫째, 사회적 활동과 인지 기능에는 유의미한 정적 상관 관계가 있다. 즉 사회적 활동에 적극적으로 참여하는 것이 노인의 인지 기능을 향상시키는 데 도움이 된다고 볼 수 있다.

둘째, 사회적 활동은 우울 증상과 유의미한 부정적인 상관 관계가 있다. 즉, 사회적 활동에 많이 참여할 수록 노인들의 우울 증상을 줄일 수 있다.

셋째, 우울은 사회적 활동과 인지 기능의 관계에서 부분 매개 효과가 있다. 구체적으로 보면, 사회적 활동은 인지 기능과 직접 관련이 될 뿐만 아니라 우울 증상의 매개 효과를 통해 인지 기능과 간접적으로 관련이 되어 있다.

본 연구의 결과에 따르면 사회적 활동이 노인의 인지 기능을 직접적으로 개선 할 뿐만 아니라 우울 증상을 감소시킴으로써 노인의 인지 기능을 향상시킬 수 있다. 따라서 정부와 지역 사회는 노인들이 더 많은 사회적 활동에 적극적으로 참여할 수 있도록 올바른 정책을 제정해야 하며, 노인의 자녀와 가족들은 노인이 더 많은 사회적 활동에 참여하도록 도움으로써 직접 또는 간접적으로 노인의 인지 기능을 향상시킨다.

키워드 : 노인; 사회적 활동; 우울 증상; 인지 기능
학번 : 2017−26738