# Health Services Utilization of Older Adults with Depression and Comorbid Chronic Health Conditions: Evidence from China

By

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Abstract

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This study examines the health services utilization of older adults in China with depressive symptoms and chronic health conditions. In older adults with chronic conditions, depression has shown to be associated with greater severity of medical illness, poorer health status and quality of life, and increased mortality. Studies in western industrialized societies have shown that individuals with depression use a higher number of physical health services. However, there have been no studies identified to date that have looked at this question for China, including for Chinese older adults in particular. The healthcare utilization patterns of Chinese residents with depression may show differential patterns from those of individuals living in western industrialized countries due to differences in culture, available forms of help, existing service systems, and policy contexts, including the rapid expansion of healthcare coverage in China in recent years due to healthcare reform.

This study employs logistic regression to analyze the relationships between depression, chronic health conditions, and health services utilization among Chinese older adults. It uses nationally representative survey data from the 2011-2012 China Health and Retirement and Longitudinal Study (CHARLS) (n=17,708). The study also presents a profile of service users based on a cluster analysis of health conditions and health services used.

After controlling for sociodemographic and health characteristics, depression was found to be positively associated with outpatient service utilization but not significantly associated with inpatient service utilization for the general sample of older adults in China. Among the sample of older adults with chronic conditions, also having depression was significantly associated with greater outpatient service use. Those with both chronic conditions and depression were 1.53 times more likely to use outpatient services than those who only had chronic conditions with no depression. There was no significant relationship between chronic conditions and depression with inpatient service use.

Results of a cluster analysis indicate that depression levels and levels of ADLs and IADLs appear to be positively associated with both outpatient and inpatient service utilization. High utilizers of outpatient services tend to be less uninsured and to have the most Urban

Employee and New Cooperative insurance, and the least Urban Resident and Government insurance relative to moderate and low users of outpatient services. High users of outpatient services are more likely to be female and rural residents. High users of inpatient services tend to be more rural and to have lower levels of social support than both moderate and low users. Findings on the healthcare usage patterns of this population have implications for improving health policy and interventions related to the treatment and prevention of depression among this population of vulnerable older adults.

***To my parents,***
***Anne and Chu-Shun Peng***
***and my husband,***
***Matt Fitzpatrick***
***with much love and gratitude for their continuous support.***

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# CHAPTER 1. INTRODUCTION

China, the most populous country in the world, also has the largest older adult population of any country, numbering over 168 million (United Nations, Department of Economic and Social Affairs, Population Division, 2013). The older adult population is growing rapidly, with projections of rising to more than 400 million by 2050 (United Nations Population Division, 2009). The growth of the aging population in China has been accompanied by an increase in the burden of chronic or non-communicable disease (Chatterji et al., 2008; Wang, Kong, Wu, Bai, Burton, 2005). Chronic diseases are the leading cause of death and disability around the world, comprising 38 million or 68% of the world's 56 million deaths in 2012 (World Health Organization, 2014a). In recent decades, the fast pace of growth of China's economy has contributed to an accelerated shift in the contributing causes of mortality from infectious diseases and perinatal conditions to chronic diseases and injuries (Yang et al., 2008; Yang, Yang, Zhu, & Qiu 2011). According to China's Ministry of Health, more than 160 million people are chronically ill patients (Ministry of Health People's Republic of China, 2004; Zhang, Ye, Huang, Li, & Yang, 2008). By 2030, the burden of disease of chronic conditions is estimated to increase by 40% overall (Wu et al., 2013), and older Chinese adults are expected to bear an estimated 66% of total Chinese health burden (Chatterji et al., 2008; Wu et al., 2013).

### *Rise in mental health needs*

Alongside rapid economic growth and social change in recent decades, China has witnessed a significant increase in the incidence of mental disorders (Chang & Kleinman, 2002). A study by Phillips et al. (2009) estimated that 173 million Chinese citizens suffer from diagnosable mental disorders, and approximately 16 million are affected by severe mental illness. Furthermore, according to World Health Organization estimates in 2000, neuropsychiatric disorders ranked first among all diseases in China in terms of disease burden, at 31.3 million disability adjusted life years[1] (Hu, He, Zhang, & Chen, 2007; Phillips et al., 2009). Phillips, Li, & Zhang (2002) estimated a mean annual suicide rate of 23 per 100,000 or 287,000 deaths due to suicide annually in China for 1995-1999. For 2000, the Global Burden of Disease study estimated a suicide mortality rate of 31.0 per 100,000 for China (Murray & Lopez, 1996). In contrast, the 2010 rate for the United States was 12.4 per 100,000 (Murphy, Xu, & Kochanek, 2013). For older adults age 55 and over, Phillips, et al. (2009) found that the one-month prevalence rate of any mental disorder was 24.04% (95% CI: 22.25-25.92), and the prevalence rate for any mood disorder, including depression, was 10.6% (9.49-11.74).

Despite the existence of effective treatments for mental disorders, approximately 90% of Chinese with a common mental disorder have not received formal mental health services (Phillips et al., 2009). Those who do access services tend to be hospitalized for severe mental

[1]The World Health Organization (WHO) global burden of disease (GBD) measures burden of disease using the disability-adjusted-life-year (DALY). This time-based measure combines years of life lost due to premature mortality and years of life lost due to time lived in states of less than full health. (WHO: accessed online: www.who.int/topics/global_burden_of_disease/en/).

disorders (Phillips et al., 2009; Yip, 2007). This is consistent with the literature on Asians in western industrialized countries like the U.S., who, if they are aware of such services, tend to use these services as a last resort, after other options have failed (Snowden and Cheung, 1990). In U.S. studies, Asians with inpatient stays have tended to have longer lengths of stay in comparison to other racial groups (Rosenstein, Milazzo-Sayre, MacAskill, & Manderscheid 1987).

Both cultural and structural barriers have been reviewed in the literature on Asian populations living in western countries (Leong & Lau, 2001). These include lack of knowledge of mental health services (Loo, Tong, & True, 1989; Sue & Morishima, 1982); shortage of mental health services (United States Department of Health and Human Services, 2001); and cultural stigma associated with having mental illness (Leong & Lau, 2001; Lin, Innui, Kleinman, & Womack, 1982; Sue & Sue, 1977).

## I. SPECIFIC AIMS

The proposed study seeks to investigate the health services utilization of older adults in China with depressive symptoms and comorbid chronic health conditions. The literature in Western countries documents a high prevalence of depression in individuals with chronic diseases (Egede, 2007; Katon, 2003; Katon et al., 2010; Stein, Cox, Afifi, Belik, & Sareen, 2006). In China, one of the few studies published in the English language literature about depression and chronic disease, conducted by Zhang, Ye, Huang, Li, Yang (2008), found a very high prevalence rate of depression, 78.9%, among inpatients with pulmonary heart disease, diabetes, hypertension, or coronary heart disease. Among older adults with chronic medical conditions, depression can severely impair social and physical functioning (Rovner et al., 1991). Depression is associated with greater severity of medical illness and increased risk of mortality in the population of individuals with chronic diseases (Himelhoch, Weller, Wu, Anderson, & Cooper, 2004). Poorer health status has been demonstrated in patients with depression compared to those without depression (Moussavi et al., 2007). The presence of chronic physical diseases has been associated with lower health-related quality of life scores. (Moussavi et al., 2007)

Specifically, this study will examine the rates of health services use of older adults with depressive symptoms and co-occurring chronic physical health conditions. The study questions are significant in light of the issue of disease burden. Depression often goes untreated, at high cost to individuals and health systems (Hu, 2004). In addition to the physical and emotional costs to the individual, other cost factors include economic impacts on the health system, impacts on the larger economy related to workforce productivity, and public service costs associated with depression.

**The specific aims of the study are to:**

1. **Assess the independent and combined impact of depression symptoms and co-occurring health conditions on health services utilization;**
2. **Identify a profile of health services users on the basis of health and sociodemographic characteristics.**

## II. HYPOTHESES

With respect to the first study aim, the study hypotheses are:

1. Controlling for sociodemographic factors, there is a positive relationship between depression symptoms and physical health services utilization.

2. Controlling for sociodemographic factors, the odds of health services utilization will be greater for individuals with depression symptoms in combination with a co-occurring chronic health condition(s) as compared to individuals with the health condition(s) alone.

The second aim is exploratory in nature, and thus not hypothesis-driven.

There are very few studies in the English language literature about depression and chronic disease in China, and none that could be identified about the health services utilization of older adults in particular. To the author's knowledge, this is the first study to examine the issue of health services utilization in China amongst the older adult population with depression and comorbid chronic health conditions. This age demographic is an important one in China due to its size and its vulnerability to serious health challenges. Studies of depression in China are important because depression has unique cultural characteristics in this country that can make it difficult to identify and treat. Findings from this study can provide a better understanding of the contribution of depression to healthcare utilization, which can have implications for health system planning and policy in both Asian and non-Asian countries globally. Successfully identifying and treating depression can not only alleviate human suffering but also potentially reduce or offset non-essential healthcare costs (Pearson et al., 1999).

# CHAPTER 2. LITERATURE REVIEW

## I. OLDER ADULTS IN CHINA: DEMOGRAPHIC CHALLENGES

Home to over 1.3 billion people, or one-fifth of the world's population, China is the most populous country and also has the world's largest aging population (Poston & Duan, 2000). In 2010, China's older adult population numbered over 168 million (United Nations, Department of Economic and Social Affairs, Population Division, 2013). In a relatively short span of time, the population has grown remarkably quickly. In 1950, individuals 60 years of age and over comprised 7.5% of the population; in 2005, this figure was 10.9%; and it is estimated to rise to over 35%, or more than 400 million by 2050, according to United Nations' estimates (United Nations Population Division, 2009). By 2050, China is projected to have only 14% of the world's people but will still have 21% of the world's older adults, as its currently large working-age population ages (Poston & Duan, 2000). The major forces behind population aging include the country's one-child policy, increased life expectancy, and reduced mortality (Gao et al., 2007; Lloyd-Sherlock, 2000; Restrepo & Rozental, 1994; United Nations Dept. of Economic and Social Affairs, 2006; Yang et al., 2008). As a result of the one-child policy and increasing levels of socioeconomic development (Poston & Duan, 2000; Poston & Gu, 1987), the total fertility rate has decreased dramatically, from levels of greater than six children per woman in the early 1950s to 1.8 births per childbearing woman in 2000. This trend is expected to remain stable through 2050 (Gao et al., 2007: United Nations Population Division, 2004). Life expectancy has risen dramatically, from 46 in the 1950s to approximately 74 in 2009 (Lei et al., 2014b; World Health Organization, 2012). Underpinning this shift, the mortality rates for children under age 5 have reduced substantially, from 225 per 1000 births in 1960 to 48 in 1990 and 14 in 2012 (Lei et al., 2014b; Wagstaff, Yip, Lindelow, & Hsiao 2009, UNICEF, 2013). Much of the reduction in mortality rates and increase in life expectancy can be attributed to improved living standards and advances in public health services (Yang et al., 2008), which have increased control over infectious diseases (Lei et al., 2014b).

China's elderly population is growing within a context of rapid urbanization and industrialization, all of which are affecting traditional family support systems for seniors (Gu, Dupre, & Liu 2007; Li, Liang, Toler, & Gu 2005; Population Reference Bureau, 2010). Social and economic problems can potentially arise in the context of a high ratio of elderly dependents to workers (Gavrilov & Hueveline, 2003; Lei et al., 2014b; Peng, 2011). The older adult support ratio (the number of working-age adults aged 25 to 64 divided by the number of adults aged 65 and above) will drop from about 13:1 in 2000 to approximately 2:1 in 2050 (Zhao, Strauss, Park, & Sun, 2009). By 2050, this ratio is set to exceed that of the United States: for every 100 workers in China, there will be 59 aged dependents, or less than two workers for every one elderly dependent, versus 46 dependents for every 100 workers in the United States (Poston & Duan, 2000). The speed of the change in age structure in China has provided little time for the evolution of a non-familial elder support system to replace the traditional family (Poston & Duan, 2000). Thus, the changes in China's age structure are associated with social challenges such as supporting the large number of elderly people (Poston & Duan, 2000), the

relative decrease in the working age population (Poston & Duan, 2000), increasing healthcare costs (Zimmer & Kwong, 2004) and added stress on health infrastructures, which until recently have been focused on treating diseases at younger ages and on infectious as opposed to chronic diseases (Lei et al., 2014b). Addressing the need for support of the well-being of older adults is one of the biggest challenges China will face in the coming decades (Zhao, Strauss, Park, Sun, 2009).

## II. DEPRESSION IN OLDER ADULTS

In China, neuropsychiatric disorders are the leading cause of disease burden, and of these disorders, depression is the most common (Phillips et al., 2009). According to the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems, or ICD-10, the diagnostic criteria for depression include the presence of at least one of the following ten key symptoms most days, most of the time, for at least two weeks: persistent sadness or low mood; loss of interest or pleasure; fatigue or low energy; disturbed sleep; poor concentration or indecisiveness; low self-confidence; poor or increased appetite; suicidal thoughts or acts; agitation or slowing of movements; and guilt or self-blame[2] (World Health Organization, 2010).

### *The burden of depression*

Amongst older adults, studies in the West have found depression to be associated with increased disability (Barry, Soulos, Murphy, Kasl, & Gill, 2013; Broadhead, Blazer, George, & Tse, 1990; Egede, 2007; Schillerstrom, Royall, & Palmer, 2008), increased health services utilization (Egede, 2007), decreased productivity (Broadhead, Blazer, George, & Tse, 1990; Egede, 2007), increased mortality (Blazer, Hybels, & Pieper, 2001; Krishnan, 2000; Lett et al., 2004; Persad et al., 2003; Rozzini, Sabatini, Frisoni, & Trabucci, 2001; Sun, Schooling, Chan, Ho, & Lam, 2011; Whooley et al., 2008), and increased suicide risk in later life (Chen, Conwell et al., 2012; Sun, Schooling, Chan, Ho, & Lam, 2011).

Globally, depression is attributable to approximately 12% of total years lived with disability and represents the greatest proportion of disease burden attributable to non-fatal health outcomes (Moussavi, Chatterji, Verdes, Tandon, Patel, & Ustun, 2007). In an eight-year longitudinal cohort study of 1828 elderly in Beijing who were free of any physical disability at baseline, disability in activities of daily living were significantly greater at follow-up intervals among depressed than non-depressed individuals, with a relative risk of 2.20 for basic activities of daily living (BADL) and a relative risk of 4.29 for instrumental activities of daily living (Jiang, Tang, Futatsuka, & Zhang, 2004). Depression is also associated with increased mortality and diminished quality of life; in a 4-year study of 2588 primary care patients age 65 and older in the U.S., it was found that individuals with depression had significantly lower quality adjusted

[2] The number of symptoms defines the degree of depression, and management is based on the particular degree. Fewer than four symptoms is categorized as not depressed, four symptoms as mildly depressed; five to six symptoms as moderately depressed; and severe depression is seven or more symptoms, with or without psychotic symptoms.

life years (QALYs) than those without depression, even after adjusting for chronic medical conditions and some demographic characteristics (Unützer, Patrick, Diehr, Simon, Grembowski, & Katon, 2000).

Individuals with depression can also be difficult to treat, and both the direct and indirect costs of the disorder are high. In a meta-analysis of studies correlating patients' treatment noncompliance with their depression and anxiety, Dimatteo, Lepper, and Croghan (2000) found that depressed patients had three times greater odds of not complying with medical treatment recommendations compared to non-depressed patients. In a study of the economic consequences of depression in China, Hu, He, Zhang, and Chen (2007) estimated the 1) direct costs of depression in the form of depression-related outpatient and inpatient stays and 2) indirect costs of depression in the form of morbidity (e.g., lost productivity) and mortality (e.g., suicide) costs at a total of 51,370 million RMB ($6,242 million). Indirect costs comprised the bulk of this total, at 84%.

### *Prevalence*

In China, studies conducted prior to the 1990s found a low prevalence rate of depression at less than four percent (Parker, Gladstone, & Chee, 2001), which was significantly lower than the rate in Western Europe, at 12% (Lei, Sun, Strauss, Zhang, & Zhao, 2014a). One explanation for this trend was the existence of filial culture and the high levels of social support for older adults in China at the time of the studies, when the vast majority of older adults lived with at least two generations in the same household (Lei, Sun, Strauss, Zhang, & Zhao, 2014a). Since the 1990s, studies have shown increasing prevalence of depression, ranging from 6.3% to 53.6%; however, most of these surveys are regional rather than national studies and use different depression measures, making comparisons difficult (Lei, Sun, Strauss, Zhang, & Zhao, 2014a).

In a recent study of four provinces in China, Phillips, et al. (2009) found that the one-month prevalence rate of any mental disorder was 24.04% (95% CI: 22.25-25.92) for older adults age 55 and over, and the prevalence rate for any mood disorder, including depression, was 10.6% (9.49-11.74). These rates were considerably higher than those for the general population, which had a one-month prevalence rate of 17.5% (16.6-18.5) for any mental disorder and a 6.1% (5.7-6.6) prevalence rate for any mood disorder.

In one of the few national studies exclusively examining depression in China in the older adult population, using the China Health and Retirement Longitudinal Study (CHARLS), Lei, Sun, Strauss, Zhang, and Zhao (2014a) found significant depressive symptom levels in 34.2% of the men and 49.4% of the women age 60 and older, as indicated by a CES-D 10[3] score of 10 or higher.

### *Risk and protective factors and sociocultural correlates*

Studies have widely reported a strong socioeconomic status gradient in depression symptoms (Lorant, Deliege, Eaton, Robert, Philippot, & Ansseau, 2003). Risk factors for depression identified in Chinese studies do not differ significantly from those in Western

[3] The CES-D 10 scale is described further in the Methodology section.

countries, and include increased age (Chen, Pan, Yu, & Gao 1994; Gao, Yan, Fan 1992; Fan, Chen, Lu, Lu, & Zhou 1994), female gender (Chen, Pan, Yu, & Gao 1994; Gao, Yan, Fan 1992; Jiang, Tang, Futatsuka, & Zhang, 2004), low educational attainment (Chen, Pan, Yu, & Gao 1994; Gao, Yan, Fan 1992; Fan, Chen, Lu, Lu, & Zhou, 1994; Jiang, Tang, Futatsuka, & Zhang, 2004); low family income (Chen et al., 2005), lack of social support (Chen et al., 2005), and poor health status (Chen et al., 2005), including poor health in childhood (Lei, Sun, Strauss, Zhang, & Zhou, 2014a).

Explanations for female gender as a risk factor include a higher risk of depression onset, longer life expectancy, higher widowhood rate, lower levels of income, educational attainment, and overall social status (Lei, Sun, Strauss, Zhang, & Zhou, 2014a; Li, Zhang, Shao, Qi, & Tian 2014). In the Lei et al. (2014a) study, rural residents were found to have a significantly higher level of depression as compared to urban residents, with effects greater than those reported for the relationship between household expenditure/income and depression. They also found that once health status was controlled for, many of the effects of SES on depression decreased, suggesting that a large part of the pathways through which SES is significantly related to depression is through current health status.

In addition, stressful or adverse life events (Chen et al., 2005), such as serious physical illness and injuries, financial problems, relationship problems with spouse or family members (Chen et al., 2005), and serious illness or death of spouse (Lei et al., 2014a), were found to be risk factors for depression (Fan, Chen, Lu, Lu, & Zhao 1994). Recent death of a spouse is an especially strong factor. Lei et al. (2014a) found that the death of a spouse within the previous two years was strongly and positively associated with higher depressive symptom scores. The effects of a recent death of a spouse on depression were substantially larger than those for all of the socioeconomic variables on depression.

Researchers assert that changes in the traditional familial structures and dynamics resulting from the rapid socioeconomic transition and modernization of China influence depression levels in the older adult population (Yu, Li, Cuijpers, Wu, & Wu, 2012). As the number of multi-generational households decreases and those with nuclear families increase, it is argued that filial piety may be eroding (Cheung & Kwan, 2009). The maintenance of filial piety for elderly family members and similar cultural norms may influence the psychological well-being of older adults (Zhang, Yu, Yuan, Tong, Yang, & Foreman, 1997). Cheng and Chan (2006) surveyed 164 Hong Kong seniors about perceived filial behaviors of their children and the extent to which these behaviors were discrepant with their expectations. They found that whether the children were showing respect and whether they were providing care when the parent was ill or distressed were both predictive of influencing a sense of discrepancy with expectations. Showing respect for parents was the most consistent predictor of psychological well-being among these older adults.

### *The cultural meaning of depression in China*

Definitions of distress, illness, and disease are created and shaped by the social environments and systems to which individuals are tied. Culture, in particular, has a profound influence on the manner in which psychological distress is expressed, as well as how it is interpreted and its associated coping methods (Kleinman 1986; Parker, Gladstone, and Chee,

2001). Varying "explanatory models" exist in different cultures for psychological distress conditions (Kleinman, 1986). These views or beliefs mold the ways in which psychological conditions are manifested; distress takes shape within the context of social structures, norms, and systems (Kleinman, 1986). Such structures include cultural traditions and belief systems (Kleinman, 1986), the modern health care system and its diagnostic nosology, and concepts and content propagated in the mass media and through social and community networks (Watters, 2010), all of which have become increasingly more globalized.

In Chinese culture, as with other collectivistic societies, interpersonal relationships, and particularly family relationships, are paramount. For the Chinese in particular, mental well-being and equilibrium are said to arise from maintaining harmonious relations with others, and from the matching of one's own behaviors to standards upheld by society and the larger culture (Hsiao, Klimidis, Minas, & Tan, 2006). Confucianism is the most significant influence in defining norms and rules for relationships between individuals, and personal identity is based on how one relates to others in the group and fulfills group-oriented duties and obligations. Thus, failure to behave according to group norms and standards can become a significant source of personal distress, shame, and guilt. For the Chinese context in particular, much has been written in the literature about personal psychological distress arising from the social stress of family or intergenerational relationships or failure to meet family duties and obligations (Hsiao, Klimidis, Minas, & Tan, 2006; Kleinman, 1980).

Confucian philosophy also espouses inhibition of emotions, which influences the ways in which psychological distress is expressed in Chinese culture (Ots, 1990). This emphasis on emotional inhibition is thought to lead to somatization, or the physical manifestation of emotions (Kleinman, Eisenberg, and Good, 1978).

For the Chinese, somatization has been described as an idiom of distress, in which somatic symptoms are outwardly manifested in lieu of emotional symptoms. Such physical expressions may be culturally-sanctioned ways of expressing discomfort or a lack of well-being. Kleinman (1986) asserts that the Confucian principles of valuing harmonious social relations over potentially disruptive and ego-centered, emotional expressions, as well as the general preference for subtle or indirect expression of emotion as opposed to direct verbal expression of emotion, which is viewed as uncultivated and uncouth, are the cultural factors that lend to somatization. Further, there is a strong stigma attached to families with members who are mentally ill, and in that vein, the expression or conveyance of what may be perceived as weak or shameful to those outside of the immediate family circle is discouraged. According to Kleinman (1986), traditional Chinese medicine equates health with emotional balance, and illness with emotional excesses. Help-seeking for physical problems - and not emotional problems - is traditionally sanctioned.

The low reported prevalence of depression in China prior to the 1990s likely also has cultural origins related to the limited use of the diagnosis itself and its later spread in more recent decades. Globalization may be a significant factor in the cultural importation of depression as a construct in China and elsewhere (Watters, 2010). Since the early 1900s until relatively recently in China, neurasthenia was widely used as a diagnosis, one that was notably non-stigmatizing and commonly accepted by the general public (Parker, Gladstone, & Chee, 2001). Known as *shenjing shuairuo*, which literally means "neurological weakness," its symptoms include emotional disturbance, fatigue, nervous pain, and insomnia (Kleinman, 1986).

By the 1980s, neurasthenia was the most common mental diagnosis, with approximately 80% of psychiatric outpatients in China diagnosed with the condition in China (Parker, Gladstone, & Chee, 2001). *Shenjing shuairuo* was thought to develop from the interaction between a genetic predisposition toward neuroticism and environmental stressors, and generally carried somatic implications, which disguised mental illnesses that, according to Kleinman (1986: 15), "otherwise raise embarrassing issues of moral culpability and social stigma." Neurasthenia was preferred as a label over "depression," which can be translated as *yi* ("repress" or "restrain"), *yu* ("gloomy" or "depressed") or *zheng* ("disorder"), which did not have popular appeal (Lee, 1998).

In recent decades, Western influences on the Chinese medical system as well as Western cultural influences on society as a whole may contribute to the increased reporting of depression. The dramatic economic and sociopolitical changes in China would likely also affect not only the true prevalence of depression but also its identification and reporting (Parker, Gladstone, and Chee, 2001).

## III. CHRONIC HEALTH CONDITIONS

The growth of the aging population in China has been accompanied by an increase in the burden of chronic or non-communicable diseases (Chatterji et al., 2008; Wang, Kong, Wu, Bai, & Burton 2005). The World Health Organization (WHO) defines chronic, non-communicable diseases as diseases that are not passed from person to person, are of long duration, and generally slow progression (WHO website, http://www.who.int/topics/noncommunicable_diseases/en/, 2015). Another common definition is "conditions that last a year or more and require ongoing medical attention and/or limit the activities of daily living" (Anderson & Horvath, 2004; Hwang, Weller, Ireys, & Anderson 2001). The four main types of non-communicable diseases are cardiovascular diseases, such as heart attack and stroke; cancers; chronic respiratory diseases, such as chronic obstructed pulmonary disease and asthma; and diabetes (WHO website, http://www.who.int/topics/noncommunicable_diseases/en/ 2015). Chronic diseases are the leading cause of death and disability around the world, comprising 38 million or 68% of the world's 56 million deaths in 2012 (World Health Organization, 2014a). In recent decades, the fast pace of growth of China's economy has contributed to an accelerated shift in the contributing causes of mortality (Yang et al., 2008; Yang, Yang, Zhu, & Qiu 2011).

China has followed the trajectory of other industrialized countries in its leading causes of mortality shifting from infectious diseases and perinatal conditions to chronic diseases and injuries (Yang et al., 2008). The proportion of deaths caused by chronic non-communicable diseases is now twice that of all infectious diseases (Yang, Yang, Zhu, & Qiu 2011). Factors responsible for this shift include increased vaccination coverage, better hygiene, sanitation, and water quality, improved access to medical care; and advanced social and living standards, such as universal education, higher incomes, and better nutrition and housing (Yang et al., 2008). At the same time that these advances have controlled the prevalence of infectious diseases, forces such as urbanization have contributed to the increase in non-communicable diseases. Urban lifestyle factors such as unhealthy diets and physical inactivity contribute to overweight and obesity, as well as increases in chronic diseases such as diabetes (Wang, Kong, Wu, Bai, & Burton 2005; Wang, Du, Zhai, & Popkin 2007). The presence of chronic conditions predisposes

individuals to the highest use of health care; in the U.S., individuals with chronic conditions use 96% of home health care, 88% of prescriptions, 72% of physical visits, and 76% of inpatient hospital stays (Anderson & Horvath, 2004). Similar patterns of health care use are beginning to emerge in China.

### *Prevalence*

According to China's Ministry of Health, more than 160 million people are chronically ill patients (Ministry of Health People's Republic of China, 2004; Zhang, Ye, Huang, Li, & Yang 2008). By 2030, the burden of disease of chronic conditions is estimated to increase by 40% overall (Wu et al., 2013), and older Chinese adults are expected to bear an estimated 66% of total Chinese health burden (Chatterji et al., 2008; Wu et al., 2013). In China, chronic, non-communicable diseases accounted for an estimated 87% of the total 9,846,000 deaths in 2014 (World Health Organization, 2014b). Forty-five percent of all deaths were due to cardiovascular diseases, 23% of all deaths were due to cancer, 11% were due to chronic respiratory diseases, 2% were due to diabetes, and 6% were due to other non-communicable diseases (World Health Organization, 2014b). For the four leading chronic diseases, the premature mortality rate, or probability of dying between the ages of 30-70 was 19% in China, as compared to 14% in the U.S (World Health Organization, 2014b & c). According to the Study on Global AGEing and Adult Health (SAGE), one of the few nationally representative epidemiological studies with a large sample of older adults in China, the estimated prevalence of angina was 8%; arthritis was 22%; stroke, 3%; diabetes, 7%; depression, 0.3%; chronic lung disease, 8%; and hypertension, 27%. Fifty percent of respondents reported having one chronic condition, 18.9% reported two conditions, 5.8% three conditions, and 1.4% reported having four or more chronic conditions (Wu et al., 2013). Between 2000 and 2040, an estimated 200 percent increase in deaths due to cardiovascular disease is expected (Chatterji et al. 2008). And, between 2000 and 2030, the number of individuals with diabetes is projected to grow from 20.8 million to 42.3 million (Chatterji et al., 2008).

### *Risk Factors*

As mentioned, rapid social change and urbanization have considerably increased the risk factors for chronic diseases in recent decades (Yang et al., 2008). The patterns of lifestyle change and concomitant health risks follow the trajectories of other industrialized countries, but the rate of change is happening much more quickly in China due to the speed of growth of its economy (Yang et al., 2008). According to the World Health Organization, a few key risk factors are responsible for most of the major chronic diseases around the world: unhealthy diets, physical inactivity, and tobacco use (Waxman, 2005). Heavy alcohol consumption (Bazzano et al., 2007; Bazzano et al., 2009; Yang, Yang, Zhu, & Qiu, 2011), automobile use (Yang et al., 2008), high blood pressure (He et al., 2005), and obesity (Bazzano et al., 2010; Gu et al., 2006) are also common risk factors for chronic conditions.

In 2011, one-quarter of all adults in China smoked (World Health Organization, 2014b), with China's smokers making up one-third of the total number of smokers in the world (Yang et

al., 2008; Yang, Hammond, Driezen, Fong, and Jiang, 2009). In addition, an estimated 530 million people in China are exposed to second-hand smoke (Yang et al., 2008). Smokers are overwhelmingly male; nearly half, or 47%, of all men in China smoke, while the same is true for only 2% of all women. Moreover, there is a high prevalence of smoking among older adults in China, particularly in lower-income groups (Chatterji et al., 2008). Men in China are also disproportionately greater consumers of alcohol compared to women, with a total per capita consumption of 11 liters of pure alcohol for men versus 2.2 liters for women (World Health Organization, 2014b).

In 2008, high blood pressure affected over 27% of the population in China, as compared to 18% of the population in the United States. While overweight and obesity are increasing in China, they are still much lower in comparison to the United States. In China, the prevalence of obesity was 5.7%, as compared to 33% in the United States in 2008 (World Health Organization, 2014b & c; Yang et al., 2008). The level of physical inactivity is also high, particularly among urban residents; in an analysis of data from the World Health Organization's (WHO) World Health Survey (WHS), ten percent of older adult respondents demonstrated low levels of physical activity, with a higher percentage of inactive urban residents (15.6%) as compared to inactive rural residents (7.1%) (Chatterji et al., 2008).

### *Depression and Comorbid Chronic Conditions*

The literature in Western countries documents a high prevalence of depression in individuals with chronic diseases (Egede, 2007; Katon, 2003; Katon et al., 2010). Using U.S. data on a nationally representative sample, Egede (2007) estimated that the prevalence of major depression by chronic conditions in the general population was as follows: congestive heart failure, 7.9%; hypertension, 8.0%; diabetes mellitus, 9.3%; coronary artery disease, 9.3%; stroke or cerebrovascular accident, 11.4%; chronic obstructive pulmonary disease, 15.4%; end-stage renal disease, 17.0%; and any chronic disease, 8.8%. In a Canadian study of 115, 071 subjects from the general adult population, Patten et al. (2005) discovered strong associations between major depression and several long-term medical conditions, namely chronic fatigue syndrome (adjusted odds ratio [AOR] 7.2) and fibromyalgia (AOR 3.4). The associations were less strong for major depression and hypertension (AOR 1.2) as well as diabetes, heart disease, and thyroid disease (1.4 for each). In the WHO World Health Study, a study of 60 countries, Moussavi et al. (2007) found that an average of between 9.3% and 23.0% of participants with one or more chronic diseases had depression. Depression also demonstrated having the worst effect on mean health scores compared with other chronic conditions. Those with depression and chronic health conditions were found to be in the worst health compared to those with any of the chronic health conditions alone or those with depression alone.

In China, one of the few studies published in the English language literature about depression and chronic disease, conducted by Zhang, Ye, Huang, Li, Yang (2008), found a very high prevalence rate of depression, 78.9%, among inpatients with pulmonary heart disease, diabetes, hypertension, or coronary heart disease. Compared to other studies of inpatients in western settings, this rate is dramatically higher. The researchers postulated that the much higher prevalence rate in China compared to the west may be due to socioeconomic factors that restrict their healthcare access, namely, the high cost of healthcare relative to the very low incomes of

most Chinese, and their low levels of educational attainment, which may affect their health literacy.

According to Katon (2003), the increased prevalence of major depression may be due to the following: 1) depression is a risk factor for the development of certain diseases; 2) depression is a secondary psychological reaction to the development of a disease; 3) depression is secondary to the complications or aversive symptoms of that disease; 4) depression is secondary to the side effects from medication used to treat those illnesses; 5) the chronic medical illness has a direct pathophysiologic effect on the brain (e.g., stroke or multiple sclerosis) or indirect physiological effects (e.g., increasing inflammatory factors affecting the brain).

Among older adults with chronic medical conditions, depression can severely impair social and physical functioning (Rovner et al., 1991). Depression is associated with greater severity of medical illness and increased risk of mortality in the population of individuals with chronic diseases (Himelhoch, Weller, Wu, Anderson, & Cooper, 2004; Yan et al., 2013). Poorer health status has been demonstrated in patients with depression compared to those without depression (Moussavi et al., 2007). The presence of chronic physical diseases has been associated with lower health-related quality of life scores. (Moussavi et al., 2007; Yan et al., 2013).

Depression may either cause or stem from disability (Gurland, Wilder, & Berkman, 1988; Rovner et al., 1991); the conditions may be reciprocally related (Gayman, Turner, & Cui, 2008). Comorbid depression can exacerbate the illness experiences from chronic disease by increasing the duration of the physical disease (Katon, 2003) or worsening the prognosis for certain diseases. In a meta-analysis of studies correlating patients' treatment noncompliance with their depression and anxiety, Dimatteo, Lepper, and Croghan (2000) found that depressed patients had three times greater odds of not complying with medical treatment recommendations compared to non-depressed patients. For inpatients, depression can increase the risk of death by suicide (Yan et al., 2013).

Further, depression in patients with chronic diseases is significantly under-detected, and especially so in China (Xu et al., 2004). The concept of "competing demands" has been described in the western literature to explain how treatment of depression among older adults with chronic conditions could be hindered or delayed (Himelhoch, Weller, Wu, Anderson, & Cooper, 2004). In the Zhang, Ye, Huang, Li, & Yang (2008) China-based study, 16% or fewer of cases had their depression detected by medical doctors. Doctors in this study acknowledged that since they were not specialists in the area of psychological disorders, they would tend to miss the symptoms of depression. They also emphasized the priority placed on the treatment of physical disease and the assumption that once physical conditions were treated, the mental disorder would be relieved.

## IV. HEALTH SERVICES UTILIZATION

The management of chronic diseases is a particular challenge for a country with a population the size of China's (Yang et al., 2008) and with a health system that has historically developed to respond primarily to communicable diseases (Lei et al., 2014b). The older adult population in China carries the majority of the burden of chronic disease (Chatterji et al., 2008) and has demonstrated higher levels of utilization of health services in general, and higher use of

hospital services in particular (Chen, Lucas, Gong, 2004; Gao, Raven & Tang, 2007). Further, for this population, meeting the high costs of chronic and inpatient care is a significant challenge (Chen, Lucas, Gong, 2004; Gao, Raven & Tang, 2007), one that both individual patients and the government are struggling to manage within the structures and constraints of the current health system.

### *Under-utilization of Mental Health Services*

As is the case elsewhere in the world, people in China are much more likely to seek treatment for physical illnesses and disorders as opposed to mental disorders. The vast majority of people in China who need mental health services do not receive them. Phillips et al. (2009) found that more than 88% of individuals with non-psychotic mental disorders had never received any type of professional help for psychological problems. Ten percent of patients who had never received professional help had obtained help from family, friends, or, in rare instances, from local monks and shamans. Forty-one percent of individuals who had received professional help had only been treated by non-mental health professionals, mainly physicians who practice western medicine or traditional Chinese medicine. Seventy percent of patients treated by mental health professionals at some time in the past had at least one psychiatric hospital admission, with 45% having been treated in the previous 6 months. This suggests that the majority of those treated by mental health professionals had serious mental health conditions warranting hospitalization.

There are approximately 20,000 psychiatrists in China, or 1.5 psychiatrists for every 100, 000 people (Cyranoski, 2010; Xiang, Yu, Sartorius, Ungvari, & Chiu, 2012). This is only one-tenth of the same ratio for the United States. In China, fewer than 4000, or one-fifth of these psychiatrists have a college or post-graduate education (Ng et al., 2009). Most psychiatrists and mental health services are located in urban areas, whereas a substantial proportion of the population lives in rural areas (Xiang, Yu, Sartorius, Ungvari, & Chiu, 2012). Given the low rate of mental health services utilization documented in the literature, the health services utilization rates covered by this review and later in the analyses for this study largely reflect service utilization for physical rather than mental health conditions.

### *Health Services Utilization: Western Studies*

Western studies in primary care settings generally demonstrate a positive association between depression and use of physical health services. Higher medical costs have been observed in patients with depression and depressive symptoms in comparison to those without depressive symptoms across all health service settings (Katon, 2003). Himelhoch, Weller, Wu, Anderson, & Cooper (2004) examined the relationship between comorbid depressive syndrome with utilization of emergency room services and preventable inpatient stays among older adult Medicare beneficiaries with chronic medical conditions. They found that older adults with a depressive syndrome were at least twice as likely to use inpatient services (range of adjusted ORs: 1.72-2.68; $p<.001$) and the emergency room (range of adjusted ORs: 2.12-3.16; $p<.0001$) than those without a depressive syndrome. In a study of primary care patients in six countries

(Israel, Brazil, Australia, Spain, Russia, and the U.S.), Herrman et al. (2002) found that patients with higher depression scores had worse health, functional status, quality of life, and greater use of health services across all sites. Similar findings with respect to increased costs associated with depression are demonstrated in earlier studies of elderly patients in primary care. In a prospective cohort study of 5012 Medicare enrollees, Unützer et al. (1997) found that compared to patients without depressive symptoms, patients with significant depressive symptoms at baseline had higher use of services in all categories of medical care, including inpatient admissions, outpatient services, laboratory tests, emergency department visits, number of prescriptions, and number of ancillary visits, as well as higher median costs in the first year following baseline ($2147 vs. $1461). In a study of 8894 elderly primary care patients, Katon, Lin, Russo, and Unützer (2003) found that total ambulatory and inpatient costs were 47% to 51% higher in depressed compared with non-depressed elderly patients after controlling for chronic illnesses. Simon, Von Korff, and Barlow (1995) analyzed data on primary care patients in a large American HMO and found that patients with depression had higher annual healthcare costs ($4246 vs. $2371, $p<.001$) and higher costs for every category of healthcare (primary care, inpatient, pharmacy, specialty services, and laboratory services) as compared to those without depression. In a study of individuals with diabetes, those with depression had total health care expenditures that were 4.5 times higher as compared to those without depression (Egede, Zheng and Simpson, 2002).

Studies of the general population in Western countries also show similar trends. Egede (2007) analyzed data on 30,801 American adults from the 1999 National Health Interview Survey. Controlling for covariates, he determined that adults with chronic conditions[4] and major depression had greater odds of using ambulatory services (OR=1.50; 95% CI: 1.28-1.77) and emergency services (OR=1.94; 95% CI=1.55 -2.45), had more days in bed due to illness (OR=1.60; 95% CI=1.28-2.00) and more functional disability (OR=2.48; 95% CI=1.96-3.15). In a study of a random sample of Medicare beneficiaries in the U.S., stratified on the presence of at least one chronic health condition[5], Stein, Cox, Afifi, Belik, & Sareen (2006) examined the relative and combined impact of depressive and chronic physical conditions on health care utilization in the general population in Canada (n=133,880). After adjusting for covariates, the researchers found that those with major depressive disorder had a significantly higher likelihood of using health care in the previous 12 months (AOR 2.74, 99.5% CI: 2.07-3.64, $p<.005$).

### *Health Services Utilization Rates: Chinese Studies*

Few studies in China have focused on the health services utilization of patients with depression and chronic health conditions in particular. This section reviews Chinese studies of health services utilization by the general population. Studies show that overall, health services utilization is increasing over time, likely due to improved insurance coverage, and that sociodemographic factors, such as income and urban/rural residence, are significant factors in these patterns.

[4] Seven chronic medical conditions for inclusion in the study were selected on the basis of high prevalence and public health burden: hypertension, diabetes mellitus, coronary artery disease, congestive heart failure, stroke or cerebrovascular accident, chronic obstructive pulmonary disease and end stage renal disease.

[5] Patients were stratified on the basis of the presence of at least one of the following conditions: coronary artery disease, diabetes mellitus, congestive heart failure, hypertension, prostate cancer, breast cancer, lung cancer, or colon cancer.

Using a multistage cluster sampling method, Meng et al. (2012) examined nationally-representative health services utilization rates within 94 counties in China using data from the 2003, 2008, and 2011 waves of the National Health Services Survey (NHSS). In 2003, the rate of use of outpatient services was 13.4% across all regions, and this figure rose moderately to 14.5% in 2008, and rose slightly again 14.8% in 2011. The rates of outpatient service use in rural areas were higher than in urban areas, at 13.9% vs. 11.8% in 2003; 15.2% vs. 12.7% in 2008; and 15.3% vs. 13.7% in 2011. The rate of hospital admissions also increased, beginning at 3.6% in 2003, rising to 6.8% in 2008, and rising again to 8.8% in 2011. With hospital admissions, urban residents exhibited a higher rate of use compared to rural residents across all three years; at 4.2% vs. 3.4% in 2003; 7.1% vs. 6.8% in 2008; and 10.1 vs. 8.4% in 2011.

Liu, Zhang, Lu, Kwon, & Quan (2007) also analyzed data from the 2003 National Health Services Survey, but they examined utilization specifically amongst those who reported illness in the two weeks before the survey. Similar to the Meng et al. (2012) findings, rural residents tended to use physician services more than urban residents, and they tended to use hospital services less. Among rural residents, 52.0% had a physician visit in the prior two weeks, while the same was true for 43.0% of urban residents. The researchers also studied subpopulation trends for adults age 65 and older who reported illness in the two weeks before the survey: 48.9% of rural residents, and 44.0% of urban residents had a physician visit, while 7.5% of rural and 16.3% of urban residents were hospitalized. In the general population of adults with insurance, rural residents were less likely than urban residents to report a physician visit (RR: 0.99; CI: 0.93-1.05) and less likely to report a hospitalization (RR: 0.83; CI: 0.69-0.99). Among those in the general population of adults without insurance, rural residents were more likely to report a physician visit than urban residents (RR: 1.38; CI: 1.30-1.46) and more likely to report a hospitalization (RR: 1.07; CI: 0.91-1.25).

Health services capacity is an important factor affecting services utilization. In urban areas, there are 27.77 hospitals per million people, and 70.57 doctors and 4.05 hospital beds per 1000 people. In rural areas, there are 8.13 hospitals per million people, and 21.35 doctors and 1.78 hospital beds per 1000 people (Jian, Chan, Reidpath, & Xu, 2010). In the rural, inland western provinces, the numbers are even lower (Jian, Chan, Reidpath, & Xu, 2010).

Another study to use the National Health Services Survey (NHSS) to examine health services utilization in rural China was conducted by Zhou et al. (2013). The researchers used Probit regression models to estimate health care utilization in four waves: 1993, 1998, 2003, and 2008. Among their main findings was that, with the exception of utilization of outpatient services in 2008, outpatient and inpatient services from 1993 to 2008 tended to be used more by higher-income individuals. Higher-income rural residents used more healthcare than poor rural residents with the same level of healthcare need. They also observed that inequity of utilization of outpatient services declined from 1993 to 2008. For inpatient services, the inequity of utilization was seen to increase substantially from 1993 to 2003 and then to decrease afterward. The authors speculate that these changes were due to improved insurance coverage and primary care initiatives.

Gao, Raven, and Tang (2007) analyzed data on hospitalizations from a stratified, randomized sample of approximately 16,000 urban households in China with older adults followed for 3 years, 1993, 1998, and 2003. They found that financial difficulty was the primary deterrent to accessing inpatient care; older adults with insurance were nearly twice as likely to use services as those without insurance. Hospital admission rates were significantly higher

among men than among women, with 15.2% of elderly men and only 9.8% of elderly women using inpatient services in 2003. The researchers also examined the issue of non-hospitalization, which is defined as not using the inpatient services to which one is referred for admission. It is understood as a possible indicator of unmet health care need. This rate was significantly higher among women (31.9%) than men (20.2%), and among the non-insured (40.2%) as compared to the insured (19.2%).

### *Factors associated with health care access*

In a study of middle-aged and older adults aged 45 and over, Jiang et al. (2013) found that access to healthcare was associated with a number of demographic characteristics. For inpatient treatment, the utilization of grade III hospitals[6], the class of hospitals providing the highest quality of care, was positively associated with higher income, age, being married, and urban residence. For outpatient treatment, the utilization of grade III hospitals was positively associated with age, being married, working in enterprises, urban residence, living in central and western regions, and higher income. Outpatient treatment was negatively associated with the occupational status of farmers, who as residents of rural areas, must travel further to access grade III hospitals, which tend to be located in urban areas.

In a study of healthcare use in poor rural areas, Qian, Pong, Yin, Nagarajan, and Meng (2009) studied factors that influenced health care decisions and found that price and distance were important determinants of health care use. The level of services used was more responsive to changes in price for low-income residents than it was for high-income residents. And, when provider quality or reputation was of particular concern, or respondents had poor health status, they were more willing to travel to seek health care at higher quality service facilities. Insurance was also a factor; enrollment in the New Cooperative Medical Scheme (NCMS), the insurance program for rural residents, increased the likelihood of use of public village clinics over self-treatment. Notably, poor, rural older adults were more likely to use lower level health service providers or opt for self-treatment than they were to access higher levels of care. These studies serve to highlight the disparities in access to the higher quality hospitals in the urban areas versus the lower quality of facilities available to rural residents in China.

### *Healthcare system origins*

Many of the health system challenges that China currently faces arose as a result of the rapid transition from a centrally planned economy to a market-based economy (Popkin, 2008; Yip & Mahal, 2008). After the establishment of the Communist Party in China in 1949 and prior to the liberalization of China's economy in 1978, all social services, including health services, were planned by the central government. Both central and local government owned all health services and physicians were employees of the state. In the rural areas, the commune was the economic unit of agricultural production and became the foundation for the rural health care

[6] China's public hospital system is comprised of facilities classified on the basis of three grades, with grade III hospitals being the largest and providing the highest level of care. Utilization of grade III hospitals is viewed as an indicator of healthcare access (Jiang et al., 2013). The hospital system is discussed further below in this section.

system, providing basic health care through the Cooperative Medical System (CMS), a network of primary care centers staffed by "barefoot doctors" or community health workers. In the urban areas, the state-owned-enterprises (SOE) established clinics for employees and their families (Yip & Hsiao, 2015). Work-unit-based health insurance through the Labor Insurance System or the Government Insurance System was available to the working urban population (Eggleston, 2012). Those outside of the SOE sector could access public clinics and hospitals funded by local governments (Yip & Hsiao, 2015).

Between the 1950s and 1980s, the public health infrastructure developed rapidly and the incidence of infectious diseases decreased dramatically through improved surveillance, immunization, and sanitation (Yip & Hsiao, 2015). During this time, China's rural and urban populations were nearly universally insured (Yip & Mahal, 2008). While access was good, however, the quality of services and technology in the health centers at this time was very low due to lack of funding and a shortage of trained clinicians (Yip & Hsiao, 2015).

With the liberalization of China's economy in 1978, transitioning from a centralized economy to a socialized market economy, the government, in order to develop a privatized agricultural system, completely dismantled the communes, including the commune's health systems, leaving 900 million rural residents uninsured. In the urban areas, reforms of the SOEs led to severe downsizing and many workers were laid-off and became uninsured. So, while the transition during the 1980s to the market system improved living standards overall, the decentralization of the healthcare system was associated with a neglect of health services on the part of government (Popkin, 2008). Decentralization was characterized by decreased central government funding for public health programs and an increased emphasis on local funding from the private sector (Popkin, 2008).

In 1994, the government introduced a pilot program, the Urban Employee Basic Medical Insurance scheme (UEBMI), which was scaled up to the national level in 1998. This scheme covered only urban employees, but not their dependents, workers in the informal sectors, nor the unemployed (Strauss et al., 2012). Meanwhile, the government deferred responsibility for service funding and delivery to laissez faire market forces. This resulted in a de-emphasis on prevention and primary care services and led to severe health system and health outcome inequalities between urban and rural populations and high and low income populations. Due to high costs, most people could not afford health care (Yip & Hsiao, 2015).

Starting in 2003, in response to sustained public outcry over exorbitant healthcare costs, the government introduced the New Cooperative Medical Scheme (NCMS), to cover the 900 million rural residents who were uninsured at the time, providing them with a partial subsidy to cover large hospital expenses. This initiative was shaped by a new ideology shifting responsibility from the market to government. At the time, three-quarters of the population, comprised primarily of rural residents and urban residents in the informal sectors, were uninsured. In 2007, the third major insurance program, the Urban Resident Basic Medical Insurance program (URBMI) was established to cover the groups not already covered under the UEBMI (Tang, 2014; Yip & Hsiao, 2015).

### *China's contemporary health care system*

China's healthcare system is comprised primarily of hospitals, with supplementary primary care providers based in the "grassroots" settings of village clinics, township health centers, and urban community health centers (Eggleston, 2012). There are no healthcare "gatekeepers" or a formal referral system in China; individuals are able to self-refer to any medical provider, although insurance coverage of providers is limited outside the patient's locality (Eggleston, 2012).

The government operates nearly all of the country's hospitals as well as the majority of the grassroots primary care centers (Eggleston, 2012). Public hospitals have designated classifications of grades I, II, or III; grade III hospitals are generally larger and have the capacity to provide comprehensive healthcare to patients across cities and provinces (Jiang, Wang, Zhang, Li, Wang, & Ma, 2013). They also serve as educational and research institutions. Grades I and II hospitals are smaller, serve a more regional population, and tend to provide lower quality of care (Jiang, Wang, Zhang, Li, Wang, & Ma, 2013). While the authors do not specifically define what constitutes lower quality of care in this study, other studies have cited the low educational attainment of rural doctors (Anand et al., 2008) as well as the workforce shortage of village doctors (Li, et al., 2014; Liu, Yuan, Liu, Jayasinghe, & Harris, 2014) as indicators of poor or inadequate care in rural areas. Sylvia et al. (2014) studied interactions between incognito standardized patients and village doctors in rural China and found that the clinicians largely tended to not follow recommended treatment guidelines, mostly gave incorrect diagnoses, and provided unnecessary or harmful medications in a majority of the cases. The researchers found educational attainment and medical training/qualifications to be the most strongly correlated factors with quality of care provided. Quality of care in township health centers, while better than that in villages, was also determined to be low. The lack of public trust in the quality of smaller hospitals in China has been documented in the literature (Liu, Wang, Kong, & Cheng, 2011).

In urban areas, community health centers (CHCs) serve as the core, grassroots institutions in China offering primary care and public health services (Pan, Dib, Wang, & Zhang, 2006). Their main functions are 1) disease prevention, surveillance, and control; 2) implementation of healthcare surveys; 3) promotion of health education; 4) implementation of family planning policy; 5) provision of basic medical care, including for chronic diseases; and 6) provision of community rehabilitation treatment for the disabled and those with chronic illness (Pan, Dib, Wang, & Zhang, 2006). As central as the CHCs are to providing basic healthcare, they are also largely distrusted by the public on the basis of the inexperience and low educational attainment of the health workers staffing these sites (Dib, Sun, Minmin, Wei, & Li, 2010; Pan, Dib, Wang, & Zhang, 2006). Improving the quality of care of CHCs and establishing a referral or gatekeeping system between these centers and hospitals are central features of China's recent healthcare reform efforts, to be discussed further below.

In rural areas, village clinics and township centers are the major health service facilities. County-level institutions make up the healthcare landscape as well. The health services network operates along these three tiers in rural areas (Sylvia et al., 2014). At the village level, there is one health station staffed by one or more health workers providing basic and preventive care. At the township level, a health center will oversee the activities of the village level, provide referrals for more serious health conditions, and generally provide services to the regional population (Gu,

Tang, & Cao, 1995). The county-level institutions usually include a general hospital, maternal and child health clinic, and an anti-epidemic center (Gu, Tang, & Cao, 1995). In a study of healthcare preferences of rural residents, Wang, He, Zheng, and Ji (2014) found that the majority of their survey respondents preferred county hospitals for treatment of more significant illnesses and diseases, due to the presence of more highly skilled staff and better medical technology and equipment. However, village clinics and township centers were viewed as adequate for the treatment of minor conditions and were utilized for their convenience.

Health spending has increased rapidly alongside the growth of China's economy (Eggleston, 2012). Currently, pubic spending makes up approximately half of China's total health spending, which is comparable to the U.S., and consumer out-of-pocket spending comprised 35.2% in 2010 (Eggleston, 2012). Government spending has shifted from direct subsidies of government-operated healthcare providers to subsidies to consumers to enroll in health insurance, with much of this transition happening in rural areas (Eggleston, 2012).

In April 2009, the Chinese government, along with the Central Committee of the Communist Party, announced a major comprehensive healthcare reform initiative, which would guarantee a basic universal level of health security while allowing the market to meet additional demands (Ho, 2011). The aim of the reform – with a total cost of 850 billion CNY or about 133.5 billion US dollars – was to achieve universal healthcare coverage for the entire population by 2020 (Ho, 2011). The reform initiative featured five priority areas: 1) expanding insurance coverage for at least 95% of the population; 2) improving public health services access and equity; 3) improving the primary care delivery system to provide basic health care universally; 4) establishing an essential medicine system; and 5) piloting public hospital reforms in 17 cities for better models of governance, organization, and management, leading to improved efficiency and quality of services (Yip & Hsiao, 2015). Reform is needed for public hospitals, which are seen to be inefficient and lacking in quality of care (Yip & Hsiao, 2015).

By 2012, substantial progress had been made on the first four goals, with 95% of the population covered by health insurance; significant improvements in health services access and equity between higher and lower income groups; rebuilding and upgrading of thousands of primary care centers and increased training of providers; and the establishment of a National Essential Drug List. The fifth goal of reforming public hospitals is the target of the most recent wave of health care reforms begun in 2013, aimed at promoting private investment in public hospitals, including privatizing hospitals (Yip & Hsiao, 2015). Privatization is meant to spur competition and to motivate public hospital reform efforts (Yip & Hsiao, 2015). Other pro-market features characterize this latest wave of reforms, including that private insurance companies are increasingly encouraged to supplement the basic forms of public health insurance, including long-term care (Yip & Hsiao, 2015). According to Yip and Mahal (2008), while these changes have been beneficial, the full benefits of the reform efforts can only be realized with improved regulatory processes on the part of government.

### *Major forms of health insurance*

One of the most significant barriers to health service access is financial – both the lack of health insurance and overall cost of healthcare are highly prohibitive factors (Cheung & Snowden, 1990). In the early 2000s, health insurance coverage in China was mainly for urban

dwellers working for organized employers (Blumenthal & Hsiao, 2005). In only a decade, China has expanded health insurance coverage from one-quarter of the population to over 95% (Tang, 2014). Premiums and reimbursements rates depend on the plan and on the parameters, both of which are set at the county or district level (Strauss et al., 2012). They vary greatly across counties depending on a multitude of factors, such as total medical expenditures, type of service facility, and treatment received (Strauss et al., 2012). In general, premiums paid by residents of rural areas are low and those paid by residents of urban areas are higher, reflecting the higher degree of subsidization in rural areas (Strauss, et al., 2012). The three major health insurance programs and their sources of financing are described by Barber & Yao (2010) as follows:

1. New Cooperative Medical Scheme (NCMS): The NCMS program is a voluntary rural program for households that is administered at the county level and targets 840 million people[7]. It has expanded rapidly from 333 participating counties in 2004 to 2176 counties in 2009. Between 2003 and 2009, insurance coverage increased from 13% to 94%, with 90% of coverage coming from NCMS and 4% from other social health insurance programs. For the NCMS, premiums are subsidized by both the central and local governments. In 2010, the annual premium was 120 yuan (US $17.60) per year (with 50 yuan each from central and local governments and 20 yuan from individuals from poor regions). Poor households are eligible for support to cover the individual portion of the NCMS contribution. In wealthier regions, the local government is responsible for financing a larger part of the government share (Barber & Yao, 2010). The NCMS has four models of reimbursement, a major one of which is household medical savings accounts. Household members make contributions to this account and spend from it, and there is a deductible and reimbursement cap (Strauss et al., 2012).

2. Urban Employees Basic Medical Insurance (UEBMI): The UEBMI is a mandatory insurance program for individuals administered at the municipal level and targets approximately 300 million urban employed individuals. In 2008, it was estimated to cover 200 million, or 67% of all urban employees. Financing is derived from eight percent of employee wages, with six percent an employer payroll tax and two percent an employee contribution. Premiums are derived from social pooled funds and medical savings accounts, of which the employee share of 2% plus 30% of the employer share comprise the medical savings account and the remaining 70% from employers are paid into a pooled account (Barber & Yao, 2010). The percentage of expenses reimbursed by Urban Employee insurance is higher, at 65%, than that for Urban Residents Basic Medical Insurance (described below), at 45% (Meng & Teng, 2010; Sun, Deng, Xiong, & Teng, 2014).

3. Urban Residents Basic Medical Insurance (URBMI): The URBMI is a voluntary program for households that is administered at the municipal level and targets approximately 200 million urban children, students, elderly, disabled, and non-working urban residents. In 2008, it covered 60.4% of the target population. The URBMI financing scheme is similar to that of the NCMS. Benefit packages for URBHI vary due to differences in financial contributions by locality (Tang, 2014). However, the average premium was 245 yuan (US $36.00) for adults and 113 yuan (US $16.10) for children. As of 2010, the government share of the premium was 120 yuan (US $17.60) per person. As with the NCMS, poor households are eligible for support to cover the individual contribution. The poor and disabled receive an additional 60 yuan (US $8.20) per year, with 50% of that covered by the central government (Barber & Yao, 2010).

[7] NCMS targets people with a rural hukou, not necessarily those living only in rural areas (Strauss et al., 2012).

***Uneven access***

According to Tang (2014), despite the success of these national programs in expanding health insurance coverage, challenges still remain in equity of healthcare access. Due to uneven economic development in different parts of China, many local governments struggle to meet the matching funds to support the NCMS and URBMI schemes. The per-capita funding levels in wealthy, eastern, coastal, urban areas are frequently several times higher than those for poorer inland, western provinces.

In a study of 2093 middle-aged and elderly subjects in China, Wang, Jiang, Li, Wang, Ma, and Ma (2013) found that health insurance was not utilized for 12.6% of inpatient visits, 53.3% of outpatient visits, and 72.6% of self-treatment episodes. In a multivariate analysis of outpatient treatment expenditure, insurance utilization was significantly associated with higher treatment cost, lost income, and gross total cost. They also found that certain groups tended to use less insurance: rural residents and individuals with lower income and lower educational attainment.

For the over 250 million rural-to-urban migrants covered by NCMS, very few have been able to participate in UEBMI in the urban areas where they live. The vast majority are unable to use their NCMS insurance and must pay entirely out-of-pocket for health care because they live too far away from their rural home counties to use the services that they are eligible for there (Tang, 2014).

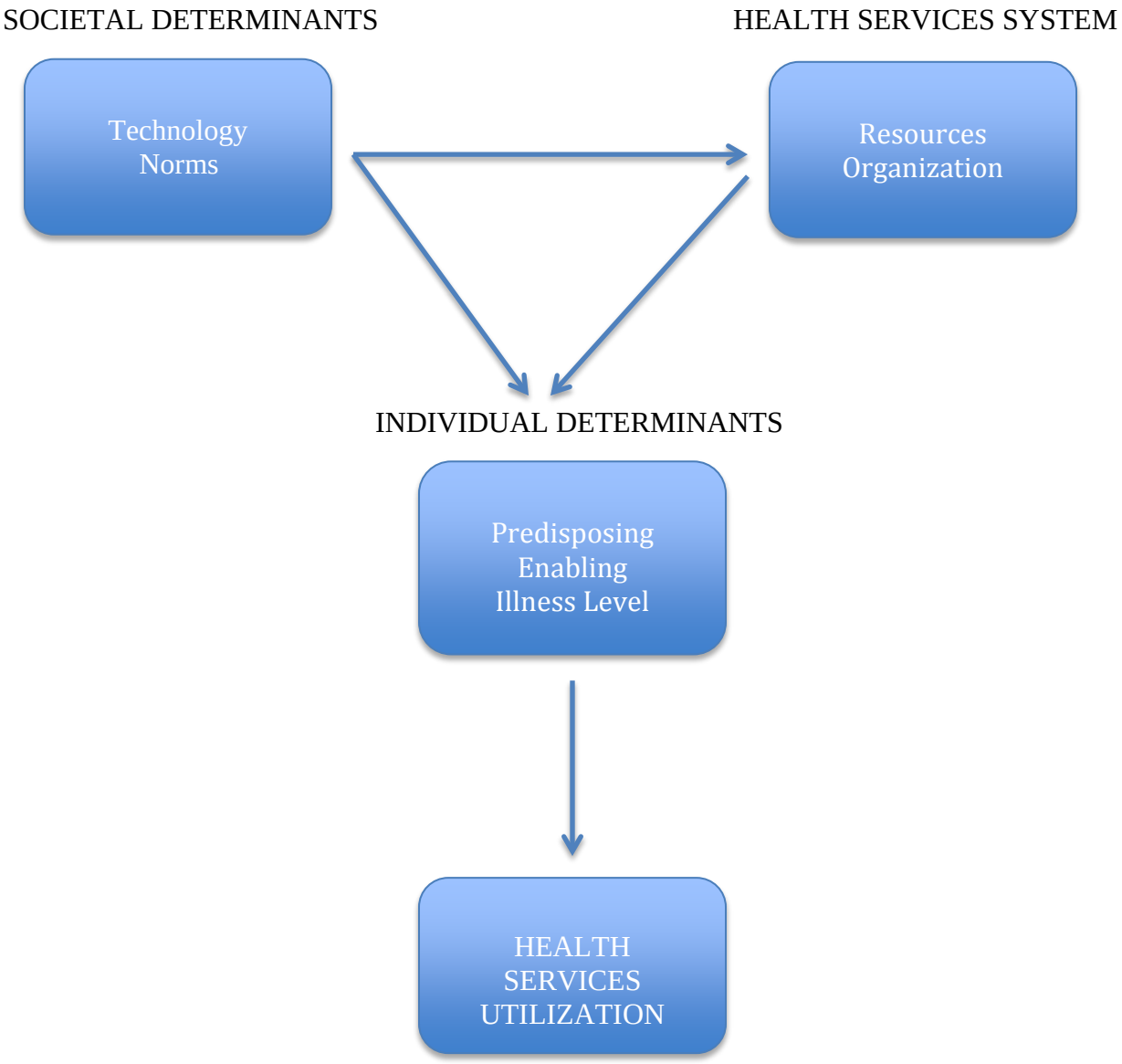
Liu and Zhao (2014) found that while Urban Resident Insurance and New Cooperative Medical Insurance have generally increased utilization of both outpatient and inpatient health services, they have not reduced out-of-pocket expenses. For the NCMS, several studies have not found any reduction in out-of-pocket expenses (Cheng, Liu, Zhang, Shen, & Zeng 2014; Lei & Lin, 2009; Wagstaff, Lindelow, Jun, Ling, & Juncheng 2009). However, despite the lingering financial challenges, there is some preliminary evidence that low-income older adults benefit from NCMS participation in terms of health outcomes and perceived access to healthcare (Cheng, Liu, Zhang, Shen, & Zeng 2014). Cheng, Liu, Zhang, Shen, & Zeng (2014) found that enrollment in the NCMS among lower-income older adults in rural China had significant positive effects on activities of daily living (ADLs) and on cognitive functioning. The researchers also found an association between NCMS enrollment and reduced mortality, particularly in the eastern regions of China.

## V. THEORETICAL FRAMEWORK:

### ANDERSEN & NEWMAN'S HEALTHCARE UTILIZATION MODEL

This study will draw upon Andersen and Newman's (1973) theory of health services utilization. Andersen and Newman's framework takes into account both societal and individual determinants and is ecological in its approach. This framework emphasizes the importance of the (1) characteristics of the health services delivery system, (2) societal determinants of utilization, and (3) individual determinants of utilization.

**FIGURE 1. Framework for viewing health services utilization**



### *Characteristics of the health services system*

According to Andersen and Newman (1973), a national healthcare system consists of two major dimensions, resources, and organization, which structure the provision of health services to individuals.

System resources include the labor and capital allocated to health care, including health personnel, structures in which health care is provided, and the equipment and materials used in providing services. Two important features of resources are the volume of resources relative to the population served and the geographical distribution of resources.

Organization describes the manner in which the system manages its resources and is comprised of factors called *access* and *structure*. *Access* is defined as the means through which the patient gains entry to the healthcare system. It defines the requirements for entry and the barriers to obtaining medical care. Factors that influence access include out-of-pocket costs for medical care, wait-times for various kinds of treatment, and definitions of conditions which qualify the patient for treatment. Access tends to increase as the proportion of medical care expenditures paid for by third-party payers increases; as waiting times for medical care decreases; and as the range of conditions accepted for treatment increases. *Structure* pertains to characteristics of the system that determine the patient experience following system entry. Some examples of this include the hospital admissions process, the referral process to other sources of care, and characteristics of hospital care (Andersen & Newman, 1973).

### *Societal determinants*

Societal determinants are comprised of changes in medical technology and social norms relating to illness and its treatment. The general definition of technology used by Andersen is "a set of principles and techniques useful to bring about change toward desired ends." Andersen asserts that the societal norms that have possibly the greatest effect on health services utilization relate to the financing of medical care. Varying approaches for financing different kinds of health services suggest that societal values assigned to these services are substantially different. The extent of government financing of medical care can reflect the importance attached to such services because third-party payments significantly reduce financial burden. Figure 1 depicts the way in which societal determinants affect the individual determinants both directly and through the health services system. Various individual determinants then influence health services used by the individual (Andersen & Newman, 1973).

### *Individual Determinants*

Individual determinants include (1) the predisposition of the individual to use services; 2) his/her ability to secure services; and 3) his/her illness level. Predisposing characteristics include demographic, social structural and attitudinal-belief variables. Age and sex are among the demographic variables closely related to illness. The social structural variables reflect social status as measured by characteristics such as education and occupation. Such characteristics

impact lifestyle and health behaviors. Attitudes or beliefs about medical care, physicians, and disease may influence health behavior.

Enabling conditions make health service resources available to the individual and include family resources such as income and health insurance coverage. Enabling characteristics are also found in the community and include such characteristics as the amount of health facilities and personnel in a community. Geographic location and cost of medical care can also be considered community-level enabling conditions.

The most immediate cause of health services utilization is illness. In addition to perception of illness by the individual and/or his/her family, a clinical evaluation is also part of the framework as, once care is initiated in the formal system, the nature and extent of that care is partly determined by the providers. Measures include number of disability days that an individual experiences, symptoms the individual experiences in a given time period, and self-reported health level (Andersen & Newman, 1973).

This framework informs our understanding of the multi-level factors that influence health services utilization and can guide us in interpreting patterns we observe of healthcare utilization in China.

# CHAPTER 3. METHODOLOGY

## I. SOURCE OF DATA

This study analyzes survey data from the China Health and Retirement Longitudinal Study (CHARLS), a biennial, nationally representative social science and health survey of Chinese residents age 45 and older. The survey is directed by researchers from the China Center for Economic Research (CCER), National School of Development at Peking University, the University of Southern California, and Oxford University. CHARLS is based on the U.S.-based 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) (Zhao, Strauss, Park, & Sun, 2009). The study was designed to be comparable with these studies for inter-country comparisons, while maintaining sensitivity to the specific conditions of China (Zhao et al., 2013). The survey covers the following topics: (a) Demographic Background, (b) Family, (c) Health Status and Functioning, (d) Health Care and Insurance, (e) Work, Retirement and Pension, (f and g) Income, Expenditure and Assets. All data collected in the CHARLS are maintained at the CCER, and are publicly available at the CHARLS project website: http://charls.ccer.edu.cn.

## II. SAMPLING

2011-12 survey. Based on experiences from its pilot survey conducted in 2008, CHARLS conducted its national baseline survey from May 2011 to March 2012. This survey covered 28 provinces, 150 counties/districts, and 450 villages/urban communities across the country. The survey interviewed 17,708 people in 10, 257 households, reflecting the Chinese middle-aged and older adult population collectively (Zhao et al., 2013). One of the major strengths of the dataset is that the sample is representative of Chinese people aged 45 and over, living in households. Institutionalized mid-aged and older adults are not sampled, but Wave 1 respondents who later enter into an institution are followed (Zhao, Strauss, Park, & Sun, 2009).

The study employed a multi-stage, randomized, and stratified study design. All samples were drawn in four stages: county, neighborhood, household, and respondent. All data were collected in face-to-face computer-assisted personal interviews (CAPI). A full description of the sampling design is featured in Appendix A.

## III. STUDY POPULATION

The population of interest is individuals age 60 and over (n=7684) living in households in China. Analyses are focused on the groups of individuals with and without one or more chronic physical conditions in combination with depression or depression symptoms. These health conditions will be described further below.

## IV. ANALYSIS

Data analysis was conducted in four phases using the statistical software packages, STATA 12 and SPSS 21. First, all data were analyzed descriptively via univariate analysis. Descriptive statistics, including frequencies, means, standard deviations, medians, and sample distributions were employed to provide summary information about the demographics of the sample. Variables were assessed for the possibility of carrying response bias (e.g., Likert scales) or a wide distribution. Scores were standardized for those items. The values for the following variables were transformed to standardized scores: annual household expenditure, number of chronic health conditions, depression score/CES-D score, ADL score, and IADL score. Descriptions of these variables follow below.

Second, the relationship between the dependent variables for health services utilization - outpatient service use and inpatient service use – and the independent variables *Depression* and *Chronic Health Conditions and Depression* and covariate variables were examined using bivariate analysis. Pearson chi-square tests were employed to test the relationships between categorical predictor variables and the categorical dependent variables, and t-tests were used to test the relationships between continuous predictor variables and the categorical dependent variables.

Third, binary logistic regression models were used to model the dependent variables as a function of all predictor variables included in the multivariate model. Step-wise logistic regression models were employed. In the first step, demographic variables were included in the model. These variables were age, gender, urban/rural residence, household expenditure, education (less than high school, more than high school), marital status, and social support. In the second step, insurance variables were added to the model (Urban Employee insurance, Urban Resident insurance, New Cooperative insurance, and Government insurance). In the third step, disability variables were added to the model (ADLs, IADLs). The health variables – chronic health conditions and depression – were added to the model in the fourth step. In the fifth step, the interaction term for chronic health conditions and depression was added to the model.

Prior to data analysis, an examination of test assumptions indicated multicollinearity would not present a significant problem in analysis. Pairwise correlations and variance inflation factor (VIF) estimates were performed (See Appendix B for results of multicollinearity tests). Also, results were weighted to represent the population of non-institutionalized adults age 60 and over living in households in China. A probability survey weight was applied to adjust for the complex survey design characteristics. The sampling weight corrects for the disproportionality of the sample with respect to the target population, reflecting unequal inclusion probabilities and compensating for differential non-response and frame under-coverage (Pffefermann, 1993). The probability weight used in this study is an individual weight that adjusts for household and individual non-response. This weight was created by the CHARLS study team and included in the dataset. This sampling weight is used as the number of subjects in the population that each observation represents when computing estimates such as proportions, means, and regression parameters. A robust variance estimation technique is automatically used in STATA to adjust for the features of study design features so that variances, standard errors, and confidence intervals are correct (University of North Carolina at Chapel Hill, Carolina Population Center, 2015).

The study used listwise deletion to exclude missing cases, in accordance with procedures used in other published studies using the CHARLS datasets (Lei et al., 2014a, 2014b; Li &

Zhang, 2013; Strauss et al., 2012). The issue of missing data is covered further in the Discussion section.

Fourth, a K-means cluster analysis was performed to build a typology of health services utilization. The K-Means cluster analysis is a method of assigning cases to a fixed number of groups (clusters) whose characteristics are not yet known but are based on a set of specified variables. Three clusters were selected to represent 3, or *k*, well-spaced observations for the cluster centers. Initial cluster centers were constructed. After obtaining initial cluster centers, the procedure assigned cases to clusters based on Euclidean distance from the cluster centers. The locations of cluster centers were updated based on the mean values of cases in each cluster (IBM, 2011).

In this study, three cluster centers were defined on the basis of attempting to profile respondents with low, moderate, and high-levels of service use for both outpatient and inpatient health services. Predictor variables that demonstrated a significant relationship ($p<.05$) with the dependent variables in bivariate analysis were included as input variables into the K-means cluster model.

The aim of this analysis was to present the underlying structure of health services utilization in Chinese older adults with depressive symptoms by identifying homogenous clusters of individuals based on service utilization profiles (Hybels, Blazer, Pieper, Landerman, & Steffens, 2009). This application of the cluster analysis method attempts to confirm that the demographic, socioeconomic, and treatment backgrounds of the clusters are distinct from each other and reflect the expected characteristics associated with membership in a given cluster (Kuhn & Culhane, 1998). The cluster analysis allows for examination of patterns of health services utilization (low, moderate, and high) that are not observable through the regression analyses.

## V. SPECIFICATION OF DEPENDENT VARIABLES

1.**Use of outpatient health services.** This dichotomous categorical variable measures the use of one or more outpatient health services visits in a one-month period (the month prior to the survey). Outpatient service types or settings are described in the survey as general hospitals, specialized hospitals, Chinese medicine hospitals, community healthcare centers, township hospitals, health care posts, village clinics/private clinics, health worker practices, doctor practices, and visits made by a health worker or doctor to the patient. The specific survey question used in the analyses was " *In the last month have you visited a public hospital, private hospital, public health center, clinic, or health worker's or doctor's practice, or been visited by a health worker or doctor for outpatient care?"* A value of 1 was assigned for the response of "Yes" and a value of 0 was assigned to the response of "No."

2. **Use of inpatient health services**. This dichotomous categorical variable measures the use of one or more inpatient health services visits in a one-year period (the year prior to the survey). Inpatient hospitalization is described in the survey as care received upon hospital admission to the following facilities: general hospitals, specialized hospitals, Chinese medicine hospitals, community healthcare centers, and township healthcare clinics. The specific survey question used in the analyses was *"Have you received inpatient care in the past year?"* A

value of 1 was assigned for the response of "Yes" and a value of 0 was assigned to the response of "No."

## VI. SPECIFICATION OF INDEPENDENT VARIABLES

1. **Depression**. Depression was measured as both a categorical and continuous variable in analyses. The dichotomous categorical variable measures whether the respondent meets a threshold level of symptoms to indicate the presence of significant depression symptoms. The survey used the 10-item Center for Epidemiologic Studies Depression Scale (CES-D-10), a short self-report scale designed to measure depressive symptomatology, with emphasis on the affective component, depressed mood, in the general population (Radloff, 1977). The symptoms are among those on which a diagnosis of clinical depression is based but which may also accompany other diagnoses (Radloff, 1977). The scale has been validated for use with older Chinese adult populations (Cheng & Chan, 2005). The possible range of scores for the 10-item scale is 0 through 30. A threshold score of 12 was used to categorize the group with significant depression symptoms (Cheng & Chan, 2005). A value of 1 was assigned to those with a score greater than or equal to 12, and a value of 0 was assigned to those with a score less than 12. Please see Appendix C for a list of the scale items. With respect to the continuous variable for depression, the values reflect the possible range of scores for the 10-item CES-D scale: 0-30.

2. **Chronic Health Conditions**. This continuous variable was defined as the number of chronic health conditions reported by the respondent. Those with the condition are defined as having been diagnosed with the condition by a doctor, nurse, paramedic, or doctor of traditional Chinese medicine. The health conditions of focus in this study encompass the four major types of non-communicable diseases in China, which are cardiovascular disease, diabetes, chronic obstructive pulmonary disease (subsumed under "chronic respiratory disease"), and lung cancer (subsumed under "cancer") (Wang, Marquez, & Langenbrunner, 2011). Two additional categories covered by the CHARLS are digestive and liver disorders, and arthritis and other conditions.

Specifically, the categories of chronic conditions comprising this variable are: 1) cardiovascular problems, 2) diabetes/chronic diabetes, 3) chronic respiratory diseases, 4) cancer, 5) digestive and liver disorders, and 6) arthritis and other conditions. Thus, the minimum value for this variable is zero and the maximum value is six.

Subsumed under each disease category are specific diagnoses as follows:

1. Cardiovascular disease

This category includes:

i. Hypertension
ii. Dyslipidemia
iii. Heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems
iv. Stroke

2. Diabetes and complications of chronic diabetes

This category includes:

i. Diabetes or high blood sugar
ii. Kidney disease (except for tumor or cancer)

3. Chronic respiratory diseases

This category includes:

i. Chronic lung diseases, such as chronic bronchitis, emphysema (excluding tumors or cancer)
ii. Asthma

4. Cancer

This category includes:

i. Cancer or malignant tumor (excluding minor skin cancers)

5: Digestive and liver disorders

This category includes:

i. Stomach or other digestive disease (except for tumor or cancer)
ii. Liver disease (except fatty liver, tumors, and cancer)

6: Arthritis and other conditions

This category includes:

i. Arthritis or rheumatism
ii. Memory-related disease

3. **Chronic Health Conditions and Depression.** This categorical variable classified respondents who indicated having been diagnosed with at least one chronic condition into two groups: those with and those without depression. A value of 1 was assigned to respondents who were diagnosed with at least one chronic health condition and also scored 12 or higher on the CES-D-10 scale. A value of 0 was assigned to those who were diagnosed with at least one chronic health condition but scored under 12 on the CES-D-10 scale.

## VII. COVARIATES

The control variables include a broad range of demographic factors, which are assumed to relate to services utilization. These include such variables as age, gender, annual household expenditure, educational attainment, marital status, and urban vs. rural residence. Other variables included in this study that have support in the literature for associations with health services utilization include health insurance status, social support, limitations in performing activities of daily living, and limitations in performing instrumental activities of daily living. The variables are described further below, including a brief rationale for the inclusion of each in the study.

### 1. Age

*Measure*: Age was coded into five dummy variables: i. age 60-64 (reference group); ii. age 65-69; iii. age 70-74; iv. age 75-79; v. age 80 and over

*Rationale:* Older age has been shown to be a risk factor for depression in Chinese studies (Chen, Hu, Qin, Xu, & Copeland, 2004; Chen et al., 2012; Woo et al., 1994). And age has also been shown to be related to specific healthcare choices or patterns of health services utilization (Qian, Pong, Yin, Nagarajan, and Meng, 2009).

### 2. Gender

*Measure:* Gender was coded as a dummy variable, with female assigned a value of 0 and male assigned a value of 1.

*Rationale:* Gender is also a factor both in terms of depression, with most studies showing women to both have more depression (Chen et al., 2005; Chen et al., 2012; Jiang, Tang, Futatsuka, & Zhang, 2004; Woo et al., 1994) and to use more outpatient health services (Bertakis, Azari, Helms, Callahan, & Robbins, 2000; Kouzis & Eaton, 1998).

### 3. Annual Household Expenditure (Income Proxy)

*Measure:* Due to a limited number of observations in actual reported household and individual income, annual household expenditure was used as a proxy. Annual household expenditure is a continuous variable and was tabulated by summing the totals for household expenditures on the following: food, eating out, alcohol and tobacco, communication fees, utilities, fuels, housekeepers, local transportation, household items and personal toiletries, entertainment, clothing and bedding, long distance travel, heating, furniture and consumption of durable goods/appliances/instruments, education and training, medical

expenditures, fitness expenditures, beauty, maintenance and repair of appliances/electronics/automobiles, taxes and fees paid to government, automobiles, electronics, property management fees, and donations to society. This variable was log transformed to better meet the underlying assumptions of regression.

*Rationale:* Low income has been found to be an independent and significant predictor of depression in Chinese studies (Chen et al., 2005). Chen, Hu, Qin, Xu, & Copeland (2004) found a dose-response relationship between measures of socioeconomic deprivation such as low education and low income and depression. Income tends to be positively related to health services utilization in China (Jiang et al., 2013; Qian, Pong, Yin, Nagarajan, and Meng, 2009; Sun, Deng, Xiong, & Tang, 2014).

## 4. Educational Attainment

*Measure:* Educational attainment was coded into three dummy variables: i. no formal education (reference group); ii. less than high school education; iii. high school degree or higher.

*Rationale:* The relationship between socioeconomic status, of which educational attainment is a major factor, and health status has long been recognized (Lynch & Kaplan, 2000). Educational attainment has shown in studies to be negatively related to depression (Chen, Hu, Qin, Xu, & Copeland, 2004; Jiang, Tang, Futatsuka, & Zhang, 2004).

## 5. Marital Status

*Measure:* Marital status was coded as a dummy variable, with married assigned a value of 1 and unmarried/unpartnered assigned a value of 0.

*Rationale:* A meta-analysis of 24 cross-sectional and eight longitudinal studies demonstrated that being unmarried was a significant risk factor for depression among elderly age 55 and older; unmarried elderly people are more likely to suffer from loneliness and lack of social support, which are risk factors for depression (Yan, Huang, Huang, Wu, & Qin, 2011). Jiang et al. (2013) found that marital status was related to increased health service use for both outpatient and inpatient services.

## 6. Urban/Rural Residence

*Measure:* Urban/rural residence was coded as a dummy variable, with urban assigned a value of 1 and rural coded as 0. The designation was based on China National Bureau of Statistics (NBS) area classifications.

*Rationale:* Disparities in access between urban and rural residence have been documented in numerous studies. They are attributable at the systems level to the structure of the healthcare system and health insurance, and are related to sociodemographic factors at the individual level (Liu, Zhang, Lu, Kwon, Quan, 2007; Yu et al., 2010). Rural residence is also associated with a higher likelihood of depression; in a meta-analysis of ten cross-sectional studies, Chen, Copeland, & Wei (1999) found that the risk of depression and depressed mood was significantly higher in rural communities as compared to urban ones.

## 7. Health Insurance

*Measure*: Health insurance was coded into five dummy variables: i. No insurance, ii. Urban Employee (UEBMI) insurance only, iii. Urban Resident (URBMI) insurance only, iv. New Cooperative (NCMS) insurance only; and v. Government insurance only. Respondents with multiple forms of insurance were excluded.

*Rationale:* According to Andersen and Newman (2005), health insurance is categorized as an enabling characteristic; it is a resource that facilitates access to health services. There is some preliminary evidence that low-income older adults benefit from insurance participation in terms of perceived access to health care (Cheng, Liu, Zhang, Shen, & Zeng 2015). Liu and Zhao (2014) found that two of the major forms of public health insurance, Urban Resident Insurance and New Cooperative Medical Insurance, have generally increased utilization of both outpatient and inpatient health services. The topic of health insurance in China is covered in greater depth in the literature review.

## 8. Social Support

*Measure*: This variable measures whether the respondent had contact with friends in the last month or not. It was coded as a dummy variable, with a value of 1 assigned to respondents indicating some interaction with friends in the last month and a value of 0 assigned to respondents who did not indicate at least some interaction with friends in the last month.

*Rationale*: Low levels of social support have been demonstrated in Chinese studies to be associated with depression (Chou & Chi, 2003; Hou, Cerulli, Wittink, Caine, & Qiu, 2015; Wang & Zhao, 2012). Social factors also influence pathways to health care utilization (Pescosolido, 1992). There is a substantial body of literature on the roles of social support in health services utilization; social support can both improve health by mitigating the negative effects of stress and by encouraging or facilitating healthy behaviors, help-seeking, and access to health knowledge and health resources (Lee, Arozullah, & Cho, 2004). Conversely, a lack of sufficient social support can also lead to increased health services utilization (Kouzis & Eaton, 1998).

9. **ADLs**

*Measure:* This continuous variable measures functional disability or limitations in performing activities of daily living (ADLs), or basic activities of personal care and hygiene (Spector & Fleishman, 1998). Respondents were asked to rate their degree of difficulty with each of six ADLs: difficulty with dressing, difficulty with bathing, difficulty with eating, difficulty with getting into/out of bed, difficulty with using the toilet, and difficulty controlling urination. For each of these items, 0 was assigned to the response "No, I don't have any difficulty"; 1 was assigned to "I have difficulty but can still do it;" 2 was assigned to "Yes, I have difficulty and need help;" and 3 was assigned to "I cannot do it." Scores for the six ADL items were summed for the final ADL score, which had a range of 0 to 18.

*Rationale:* Associations between functional ability in activities of daily living (ADLs and IADLs) and self-rated health status have been demonstrated in studies, with activities related to mobility being strongly predictive of self-rated health among seniors (Gama et al., 2000). The relationship between increased physical disability and health services utilization is also documented in the literature (Chen et al., 2014). The association of depression and disability has also been demonstrated in many studies, most of which were conducted in western countries (Beekman et al., 2002; Gayman, Turner, & Cui, 2008; Ormel, Rijsdijk, Sullivan, van Sonderen, and Kempen 2002; Von Korff, Ormel, Katon, & Lin, 1992). One of the few studies to look at this relationship in China, by Jiang, Tang, Futatsuka, & Zhang (2004), analyzed the influence of depression symptoms on the prevalence of physical disability in elderly living in Beijing. Individuals with depression had higher functional impairment than those without depression, leading the authors to conclude that depression may increase the risk for prevalent disability.

### 10. IADLs

*Measure:* This continuous variable measures functional disability or limitations in performing instrumental activities of daily living (ADLs), or basic activities necessary to reside in the community (Spector & Fleishman, 1998). Respondents were asked to rate their degree of difficulty with each of five IADLs: difficulty with household chores, difficulty with preparing hot meals, difficulty with shopping for groceries, difficulty with managing your money, difficulty with taking medication. For each of these items, 0 was assigned to the response "No, I don't have any difficulty"; 1 was assigned to "I have difficulty but can still do it;" 2 was assigned to "Yes, I have difficulty and need help;" and 3 was assigned to "I cannot do it." Scores for the five IADL items were summed for the final IADL score, which had a range of 0 to 15.

*Rationale:* The same justification for including ADLs applies to IADLs. Both variables measure functional disability, albeit significantly different dimensions of it. Both are important measures for understanding relationships between depression, chronic health conditions, and health services utilization.

## VIII. HUMAN SUBJECTS REVIEW

The study protocol was submitted to the UC Berkeley Committee on the Protection of Human Subjects/ Office for the Protection of Human Subjects for review by the Institutional Review Board. The decision from this office was that the study protocol did not constitute human subjects research.

All study data used are publicly-available secondary data and are retrievable from the China Health and Retirement Longitudinal Study (CHARLS) website, which is hosted by the National School of Development at Peking University and located at http://charls.ccer.edu.cn/en.

# CHAPTER 4. RESULTS

## I. DESCRIPTIVE STATISTICS

The study sample was comprised of 7,689 adults age 60 and over, with a mean age of 68.5 (*SD*=7.1; MIN/MAX=60-101). The sample was nearly evenly split, with 3,849 men (50.1%) and 3,835 women (49.9%). The age subgroup breakdown was as follows: 37.7% were age 60 to 64, 24.1% were age 65 to 69, 17.9% were age 70 to 74, 11.6% were age 75 to 79, and 8.7% were age 80 and over. In terms of residence, 60.2% of the sample lived in rural areas and 39.8% lived in urban areas. The mean annual household expenditure was 19,532.37 yuan (*SD*=29,108.33; MIN/MAX=0-1,083,200). The vast majority of the sample had less than a high school education, with 37.1% having no formal education and 55.8% having less than a high school education. Five percent earned a high school degree and only 2.1% had a greater than high school level of educational attainment. The majority, 77.9%, were currently married, while 19.9% were widowed, 1.3% were divorced or separated, and only 0.9% had never married. Table 1 presents a summary of sociodemographic statistics. In terms of social support, less than one-third, 30.6 %, indicated that they had at least some interaction with friends in the past month. More women (33.4%) than men (28.0%) indicated at least some interaction with friends in the past month. Table 1 provides a breakdown of these findings by gender.

**Table 1: Sociodemographics by Gender**[8]

| | Total | | | Men | | | Women | | |
|---|---|---|---|---|---|---|---|---|---|
| | **n** | **M** | **%** | **n** | **M** | **%** | **n** | **M** | **%** |
| **Age** | 7689 | 68.5 | | 3849 | 68.33 | | 3835 | 68.63 | |
| *60-64* | 2904 | | 37.7 | 1448 | | 37.6 | 1452 | | 37.9 |
| *65-69* | 1853 | | 24.1 | 950 | | 24.7 | 903 | | 23.5 |
| *70-74* | 1375 | | 17.9 | 719 | | 18.7 | 656 | | 17.1 |
| *75-79* | 892 | | 11.6 | 441 | | 11.5 | 450 | | 11.7 |
| *80+* | 665 | | 8.7 | 291 | | 7.6 | 374 | | 9.8 |
| **Gender** | 7684 | | | 3849 | | 50.1 | 3835 | | 49.9 |
| **Residence** | 7689 | | | 3849 | | | 3835 | | |
| *Urban* | 3058 | | 39.8 | 1477 | | 38.4 | 1578 | | 41.1 |
| *Rural* | 4631 | | 60.2 | 2372 | | 61.6 | 2257 | | 58.9 |
| **Mean Annual Household Expenditure** (Yuan) (Income Proxy) | 6356 | 19,532.37 | | | 20,066.63 | | | 19,003.28 | |
| **Education** | 7672 | | | 3841 | | | 3826 | | |
| *No formal education* | 2849 | | 37.1 | 778 | | 20.3 | 2070 | | 54.1 |
| *Less than high school* | 4277 | | 55.8 | 2669 | | 69.5 | 1605 | | 41.9 |
| *High school/ vocational* | 385 | | 5.0 | 271 | | 7.1 | 113 | | 3.0 |
| *More than high school* | 161 | | 2.1 | 123 | | 3.2 | 38 | | 1.0 |
| **Marital Status** | 7679 | | | 3849 | | | 3830 | | |
| *Married* | 5979 | | 77.9 | 3313 | | 86.1 | 2666 | | 69.6 |
| *Divorced/ Separated* | 100 | | 1.3 | 64 | | 1.7 | 36 | | 0.9 |
| *Widowed* | 1528 | | 19.9 | 405 | | 10.5 | 1123 | | 29.3 |
| *Never Married* | 72 | | 0.9 | 67 | | 1.7 | 5 | | 0.1 |
| **Social Support** | 7689 | | | 3849 | | | 3835 | | |
| *Social Support – YES* | 2355 | | 30.6 | 1076 | | 28.0 | 1279 | | 33.4 |
| *Social Support – NO* | 5329 | | 69.4 | 2773 | | 72.0 | 2556 | | 66.6 |

Table 2 provides summary statistics broken down by urban/rural residence. Mean annual household expenditure was notably lower among rural residents, at 15,661.29 yuan, versus 25,790.82 yuan for urban residents. Nearly all rural residents had below a high school education, at 97.9%, while the same was true for 85.3% for urban residents. In particular, 44.6% of rural residents had no formal education, while the same was true for 25.8% of urban residents. In terms of social support, 32.3% of rural residents reported at least some interaction with friends in the past month, while the same was true for 28.1% of urban residents.

[8] The sum of gender subgroup counts may differ from overall totals due to missing data for those variables.

**Table 2: Sociodemographics by Residence**[9]

| | Total | | | Urban | | | Rural | | |
|---|---|---|---|---|---|---|---|---|---|
| | **n** | **M** | **%** | **n** | **M** | **%** | **n** | **M** | **%** |
| **Age** | 7689 | 68.5 | | 3058 | 68.7 | | 4631 | 68.3 | |
| *60-64* | 2904 | | 37.7 | 1150 | | 37.6 | 1754 | | 37.9 |
| *65-69* | 1853 | | 24.1 | 679 | | 22.2 | 1174 | | 25.4 |
| *70-74* | 1375 | | 17.9 | 570 | | 18.6 | 805 | | 17.4 |
| *75-79* | 892 | | 11.6 | 391 | | 12.8 | 501 | | 10.8 |
| *80+* | 665 | | 8.7 | 268 | | 8.8 | 397 | | 8.6 |
| **Gender** | 7684 | | | 3055 | | | 4629 | | |
| *Male* | 3849 | | 50.1 | 1477 | | 48.3 | 2372 | | 51.2 |
| *Female* | 3835 | | 49.9 | 1578 | | 51.7 | 2257 | | 48.8 |
| **Residence** | 7689 | | | 3058 | | 39.8 | 4631 | | 60.2 |
| **Mean Annual Household Expenditure** (Yuan) (Income Proxy) | 6356 | 19,532.37 | | | 25,790.82 | | | 15,661.29 | |
| **Education** | 7672 | | | 3048 | | | 4624 | | |
| *No formal education* | 2849 | | 37.1 | 787 | | 25.8 | 2062 | | 44.6 |
| *Less than high school* | 4277 | | 55.8 | 1813 | | 59.5 | 2464 | | 53.3 |
| *High school/ vocational* | 385 | | 5.0 | 296 | | 9.7 | 89 | | 1.9 |
| *More than high school* | 161 | | 2.1 | 152 | | 5.0 | 9 | | 0.2 |
| **Marital Status** | 7679 | | | 3053 | | | 4631 | | |
| *Married* | 5979 | | 77.9 | 2407 | | 78.8 | 3577 | | 77.2 |
| *Divorced/ Separated* | 100 | | 1.3 | 38 | | 1.2 | 62 | | 1.3 |
| *Widowed* | 1528 | | 19.9 | 594 | | 19.5 | 934 | | 20.2 |
| *Never Married* | 72 | | 0.9 | 14 | | 0.5 | 58 | | 1.3 |
| **Social Support** | 7689 | | | 3058 | | | 4631 | | |
| *Social Support – YES* | 2355 | | 30.6 | 860 | | 28.1 | 1496 | | 32.3 |
| *Social Support – NO* | 5329 | | 69.4 | 2198 | | 71.9 | 3135 | | 67.7 |

As shown in Table 3, univariate analyses were also performed on variables related to health and health insurance. Of those reporting fewer than two kinds of health insurance, 11.1% had no insurance, while 71.4% reported having New Cooperative insurance, 11.3% reported having Urban Employee insurance, 4.7% had Urban Resident insurance, and 1.6% had Government insurance. The mean score on the measure of limitations with activities of daily living (ADLs) was relatively low at 1.2 (*SD*=2.7; MIN/MAX=0-18). For the measure of limitations with instrumental activities of daily living (IADLs), the mean score was 1.6 (*SD*=3.3; MIN/MAX=0-15). The mean CES-D-10 score, measuring depressive symptoms, was 9.1

[9] The sum of urban/rural residence subgroup counts may differ from overall totals due to missing data for those variables.

(*SD*=6.5; MIN/MAX=0-30). Women demonstrated a higher mean CES-D-10 score, of 10.2 (*SD*=0.1), as compared to 8.0 (*SD*=0.1) for men.

Nearly one-third of the sample, 32.7%, met the threshold score for significant depression symptoms. About a quarter of all male respondents (25.9%) and well over one-third (39.7%) of female respondents met the threshold score.

**Table 3. Health and Functional Status and Health Insurance by Gender[10]**

| | Total | | | Men | | | Women | | |
|---|---|---|---|---|---|---|---|---|---|
| | **n** | **M** | **%** | **n** | **M** | **%** | **n** | **M** | **%** |
| **Insurance** | 7325 | | | 3659 | | | 3661 | | |
| *No insurance* | 811 | | 11.1 | 407 | | 11.1 | 403 | | 11.0 |
| *Urban Employee only* | 827 | | 11.3 | 402 | | 11.0 | 425 | | 11.6 |
| *Urban Resident only* | 341 | | 4.7 | 169 | | 4.6 | 172 | | 4.7 |
| *New Cooperative only* | 5230 | | 71.4 | 2621 | | 71.6 | 2605 | | 71.2 |
| *Government only* | 116 | | 1.6 | 60 | | 1.6 | 56 | | 1.5 |
| **ADLs** | 5914 | 1.2 | | 2691 | 1.1 | | 3218 | 1.2 | |
| **IADLs** | 7569 | 1.6 | | 3796 | 1.3 | | 3768 | 1.8 | |
| **CES-D-10 score** | 6609 | 9.1 | | 3358 | 8.0 | | 3248 | 10.2 | |
| **Depression** | 6609 | | | 3358 | | 50.8 | 3248 | | 49.2 |
| *Depression – YES* | 2161 | | 32.7 | 870 | | 25.9 | 1290 | | 39.7 |
| *Depression – NO* | 4448 | | 67.3 | 2488 | | 74.1 | 1958 | | 60.3 |
| **Number of chronic health conditions** | 7410 | 1.4 | | 3716 | 1.3 | | 3689 | 1.4 | |

Table 4 shows that New Cooperative health insurance was the most prevalent form of insurance in both urban and rural areas, at 71.7% and 71.2%, respectively. Mean CES-D scores were higher among rural residents as compared to urban residents, at 10.0% and 7.8%, respectively. Among rural residents, 37.9% met the threshold for significant depression symptoms, as compared to 24.9% of urban residents.

[10] The sum of gender subgroup counts may differ from overall totals due to missing data for those variables.

**Table 4. Health and Functional Status and Health Insurance by Residence[11]**

| | Total | | | Urban | | | Rural | | |
|---|---|---|---|---|---|---|---|---|---|
| | **n** | **M** | **%** | **n** | **M** | **%** | **n** | **M** | **%** |
| **Insurance** | 7325 | | | 2913 | | | 4412 | | |
| *No insurance* | 811 | | 11.1 | 339 | | 11.6 | 472 | | 10.7 |
| *Urban Employee only* | 827 | | 11.3 | 320 | | 11.0 | 507 | | 11.5 |
| *Urban Resident only* | 341 | | 4.7 | 110 | | 3.8 | 231 | | 5.2 |
| *New Cooperative only* | 5230 | | 71.4 | 2090 | | 71.7 | 3140 | | 71.2 |
| *Government only* | 116 | | 1.6 | 54 | | 1.9 | 62 | | 1.4 |
| **ADLs** | 5914 | 1.2 | | 2215 | 1.1 | | 3699 | 1.2 | |
| **IADLs** | 7569 | 1.6 | | 2995 | 1.4 | | 4574 | 1.7 | |
| **CES-D 10 score** | 6609 | 9.1 | | | 7.8 | | | 10.0 | |
| **Depression** | 6609 | | | 2642 | | | 3967 | | |
| *Depression – YES* | 2161 | | 32.7 | 657 | | 24.9 | 1504 | | 37.9 |
| *Depression – NO* | 4448 | | 67.3 | 1985 | | 75.1 | 2463 | | 62.1 |
| **Number of chronic health conditions** | 7410 | 1.4 | | | 1.4 | | | 1.3 | |

With regard to chronic health conditions, the mean number of chronic health conditions reported was 1.4 (*SD*=1.1; MIN/MAX=0-6). Table 5 shows that cardiovascular disease was reported most frequently by respondents at 43.6%. Arthritis and other conditions were reported by 38.4%; digestive and liver disorders by 24.7%; chronic respiratory disease by 16.1%; diabetes/chronic diabetes by 13.0%; and cancer by 1.0%.

Among those with a chronic health condition, the rate of depression was very high. Individuals with cancer and arthritis and other conditions met the threshold for significant depressive symptoms most frequently at 45.2% and 45.0%, respectively. Nearly all the other conditions had rates over 40% as well, with digestive and liver disorders at 44.3%, and diabetes/chronic diabetes and chronic respiratory disease at 43.0% each. Among those with cardiovascular disease, 35.4% met the threshold level for significant depression.

[11] The sum of urban/rural residence subgroup counts may differ from overall totals due to missing data for those variables.

**Table 5. Chronic Health Conditions**

| | Total | | With Depression[12] | |
|---|---|---|---|---|
| | **n** | **%** | **n** | **%** |
| **Cardiovascular Disease** | 3278 | 43.6 | 1007 | 35.4 |
| **Diabetes/Chronic Diabetes** | 977 | 13.0 | 368 | 43.0 |
| **Chronic Respiratory Disease** | 1221 | 16.1 | 450 | 43.0 |
| **Cancer** | 75 | 1.0 | 28 | 45.2 |
| **Digestive and Liver Disorders** | 1874 | 24.7 | 732 | 44.3 |
| **Arthritis and other conditions** | 2921 | 38.4 | 1134 | 45.0 |

Tables 6 and 7 show that over one-third of the sample, 36.8%, had at least one chronic health condition and depression. Notably, more than half were women, at 60.6%, versus 39.4% of men. Approximately one-fifth, 21.4%, reported utilizing outpatient health services in the past month. Women used outpatient services more frequently, at 53.3% versus 46.7% for men. Twelve percent (12.6%) of respondents reported having used inpatient services in the past year. Men were more frequent users of inpatient services, at 52.4%, versus 47.6% for women. As seen in Table 8, rural residents were more than twice as likely as urban residents to report at least one chronic health condition and depression, at 68.8% versus 31.2% respectively. Rural residents used outpatient health services at a much higher rate than urban residents, at 62.9% versus 37.1%. The same was true for inpatient services, with rural residents at 56.3% versus 43.8% for urban residents.

[12] Denominator is the number of respondents who answered questions for *both* the respective chronic health condition *and* depression and may thus not match the denominator for the "Total" column, which is the number of respondents answering the question for the chronic health condition.

**Table 6. Chronic Health Conditions, Depression & Health Services Utilization**

| | Total | |
|---|---|---|
| | **n** | **%** |
| **Chronic Health Status** | 4792 | |
| *At least one chronic health condition with depression - YES* | 1762 | 36.8 |
| *At least one chronic health condition with depression - NO* | 3030 | 63.2 |
| **Health Services Utilization: Outpatient** | 7590 | |
| *Visited outpatient services in the last month – YES* | 1626 | 21.4 |
| *Visited outpatient services in the last month – NO* | 5964 | 78.6 |
| **Health Services Utilization: Inpatient** | 7613 | |
| *Received inpatient care in the last year - YES* | 960 | 12.6 |
| *Received inpatient care in the last year - NO* | 6653 | 87.3 |

**Table 7. Chronic Health Conditions, Depression & Health Services Utilization by Gender[13]**

| | Men | | Women | | Total | |
|---|---|---|---|---|---|---|
| | **n** | **%** | **n** | **%** | **n** | **%** |
| **Chronic Health Status** | 2373 | | 2416 | | 4789 | |
| *At least one chronic health condition with depression - YES* | 693 | 39.4 | 1068 | 60.6 | 1761 | 100.0 |
| *At least one chronic health condition with depression - NO* | 1680 | 55.5 | 1348 | 44.5 | 3028 | 100.0 |
| **Health Services Utilization: Outpatient** | 3804 | | 3781 | | 7585 | |
| *Visited outpatient services in the last month – YES* | 760 | 46.7 | 866 | 53.3 | 1626 | 100.0 |
| *Visited outpatient services in the last month – NO* | 3044 | 51.1 | 2915 | 48.9 | 5959 | 100.0 |
| **Health Services Utilization: Inpatient** | 3816 | | 3792 | | 7608 | |
| *Received inpatient care in the last year - YES* | 503 | 52.4 | 457 | 47.6 | 960 | 100.0 |
| *Received inpatient care in the last year - NO* | 3313 | 49.8 | 3335 | 50.2 | 6648 | 100.0 |

[13] The sum of gender and residence subgroup counts may differ from overall totals due to missing data for those variables.

**Table 8. Chronic Health Conditions, Depression & Health Services Utilization by Residence[13]**

| | Rural | | Urban | | Total | |
|---|---|---|---|---|---|---|
| | **n** | **%** | **n** | **%** | **n** | **%** |
| **Chronic Health Status** | 1959 | | 2833 | | 4792 | |
| *At least one chronic health condition with depression - YES* | 1213 | 68.8 | 549 | 31.2 | 1762 | 100.0 |
| *At least one chronic health condition with depression - NO* | 1620 | 53.5 | 1410 | 46.5 | 3030 | 100.0 |
| **Health Services Utilization: Outpatient** | 4590 | | 3000 | | 7590 | |
| *Visited outpatient services in the last month – YES* | 1022 | 62.9 | 604 | 37.1 | 1626 | 100.0 |
| *Visited outpatient services in the last month – NO* | 3568 | 59.8 | 2396 | 40.2 | 5964 | 100.0 |
| **Health Services Utilization: Inpatient** | 4606 | | 3007 | | 7613 | |
| *Received inpatient care in the last year - YES* | 540 | 56.3 | 420 | 43.8 | 960 | 100.1 |
| *Received inpatient care in the last year - NO* | 4066 | 61.1 | 2587 | 38.9 | 6653 | 100.0 |

Table 9 presents a breakdown of service use and sociodemographic characteristics of the sample by depression states (i.e., number of individuals with depression versus without depression). For both outpatient and inpatient service use, over forty percent of the sample demonstrated CES-D scores above the threshold level for depression (44.0% and 42.7%, respectively). The proportion of individuals with depression showed a slightly increasing trend by age group, with the largest proportion of the depressed amongst the oldest age group, age 80 and over (38.2%). A larger proportion of women (39.7%) and rural residents (37.9%) were depressed in comparison, respectively, to men (25.9%) and urban residents (24.9%). The depressed group had a lower mean annual household expenditure in comparison to the non-depressed group (16,555.14 yuan versus 21,073.70 yuan). There was a decreasing trend in the proportion of depressed individuals by educational attainment level, with the highest proportion of depressed people amongst those with no formal education (41.0%). With respect to marital status, the smallest proportion of depressed individuals was found in the married group (30.4%), and the largest proportion of depressed individuals was found in the divorced/separated group (48.1%). With respect to social support, the group that indicated some contact with friends in the past month had a slightly lower proportion of depressed individuals (31.9%) than the group that did not indicate this contact (33.1%).

**Table 9. Service Use and Sociodemographic Characteristics of Sample by Depression States**

| | With Depression | % | Without Depression | % | Total |
|---|---|---|---|---|---|
| **Outpatient Service Use (yes)** | 619 | 44.0 | 789 | 56.0 | 1408 |
| **Inpatient Service Use (yes)** | 337 | 42.7 | 453 | 57.3 | 790 |
| **Age** | | | | | |
| *60-64* | 801 | 31.2 | 1770 | 68.8 | 2571 |
| *65-69* | 547 | 33.3 | 1096 | 66.7 | 1643 |
| *70-74* | 383 | 31.7 | 827 | 68.3 | 1210 |
| *75-79* | 254 | 35.1 | 470 | 64.9 | 724 |
| *80+* | 176 | 38.2 | 285 | 61.8 | 461 |
| **Gender** | | | | | |
| *Male* | 870 | 25.9 | 2488 | 74.1 | 3358 |
| *Female* | 1290 | 39.7 | 1958 | 60.3 | 3248 |
| **Residence** | | | | | |
| *Urban* | 657 | 24.9 | 1985 | 75.1 | 2642 |
| *Rural* | 1504 | 37.9 | 2463 | 62.1 | 3967 |
| **Mean Annual Household Expenditure** (Yuan) (Income Proxy) | 16,555.14 | | 21,073.70 | | 19,592.18 |
| **Education** | | | | | |
| *No formal education* | 953 | 41.0 | 1373 | 59.0 | 2326 |
| *Less than high school* | 1138 | 30.1 | 2646 | 69.9 | 3784 |
| *High school/ vocational* | 56 | 16.1 | 291 | 83.9 | 347 |
| *More than high school* | 14 | 9.4 | 135 | 90.6 | 149 |
| **Marital Status** | | | | | |
| *Married* | 1592 | 30.4 | 3644 | 69.6 | 5236 |
| *Divorced/ Separated* | 39 | 48.1 | 42 | 51.9 | 81 |
| *Widowed* | 509 | 41.3 | 724 | 58.7 | 1233 |
| *Never Married* | 21 | 35.6 | 38 | 64.4 | 59 |
| **Social Support** | | | | | |
| *Social Support – YES* | 704 | 31.9 | 1505 | 68.1 | 2209 |
| *Social Support – NO* | 1457 | 33.1 | 2943 | 66.9 | 4400 |

Table 10 presents a breakdown of service use and sociodemographic characteristics of the sample by chronic health condition states (i.e., number of individuals with one or more chronic health conditions versus those with no chronic health conditions). For both outpatient and inpatient service use, the vast majority of service users had one or more chronic health condition (85.6% and 89.1%, respectively). The proportion of individuals with a chronic health condition was relatively even across age groups, in the range of 71.9-75.9%. A slightly larger proportion of women (75.9%) and urban residents (75.3%) had a chronic health condition(s) in comparison, respectively, to men (72.3%) and rural residents (73.4%). The group with chronic health condition(s) had a higher mean annual household expenditure in comparison to the group with no chronic health conditions (20,280.14 yuan versus 17,629.03 yuan). With respect to educational attainment level, the greatest proportion of those with a chronic health condition(s) was amongst the most educated (82.4%). In terms of marital status, 74.4% of married and widowed individuals, respectively, had a chronic health condition(s), with lower proportions for the divorced/separated (62.4%) and never married (63.6%). With respect to social support, both the group that indicated some contact with friends in the past month and the group that did not indicate this contact had similar proportions of individuals with one or more chronic health conditions (74.0% and 74.2%, respectively).

**Table 10. Service Use and Sociodemographic Characteristics of Sample by Chronic Health Condition States**

| | With Chronic Health Condition | % | Without Chronic Health Condition | % | Total |
|---|---|---|---|---|---|
| **Outpatient Service Use (yes)** | 1358 | 85.6 | 228 | 14.4 | 1586 |
| **Inpatient Service Use (yes)** | 830 | 89.1 | 102 | 10.9 | 932 |
| **Age** | | | | | |
| *60-64* | 2057 | 73.0 | 759 | 27.0 | 2816 |
| *65-69* | 1353 | 75.9 | 430 | 24.1 | 1783 |
| *70-74* | 1006 | 75.4 | 328 | 24.6 | 1334 |
| *75-79* | 624 | 73.8 | 222 | 26.2 | 846 |
| *80+* | 454 | 71.9 | 177 | 28.1 | 631 |
| **Gender** | | | | | |
| *Male* | 2688 | 72.3 | 1028 | 27.7 | 3716 |
| *Female* | 2801 | 75.9 | 888 | 24.1 | 3689 |
| **Residence** | | | | | |
| *Urban* | 2221 | 75.3 | 730 | 24.7 | 2951 |
| *Rural* | 3273 | 73.4 | 1186 | 26.6 | 4459 |
| **Mean Annual Household Expenditure** (Yuan) (Income Proxy) | 20,280.14 | | 17,629.03 | | 19,604.19 |
| **Education** | | | | | |
| *No formal education* | 2006 | 73.2 | 733 | 26.8 | 2739 |
| *Less than high school* | 3071 | 74.4 | 1055 | 25.6 | 4126 |
| *High school/ vocational* | 278 | 74.3 | 96 | 25.7 | 374 |
| *More than high school* | 131 | 82.4 | 28 | 17.6 | 159 |
| **Marital Status** | | | | | |
| *Married* | 4319 | 74.4 | 1488 | 25.6 | 5807 |
| *Divorced/ Separated* | 58 | 62.4 | 35 | 37.6 | 93 |
| *Widowed* | 1075 | 74.4 | 369 | 25.6 | 1444 |
| *Never Married* | 42 | 63.6 | 24 | 36.4 | 66 |
| **Social Support** | | | | | |
| *Social Support – YES* | 1696 | 74.0 | 597 | 26.0 | 2293 |
| *Social Support – NO* | 3798 | 74.2 | 1319 | 25.8 | 5117 |

Table 11 presents a breakdown of service use and sociodemographic characteristics of the sample by chronic health condition and depression states (i.e., number of individuals with one or more chronic health conditions and depression versus those with one or more chronic health conditions and no depression). For outpatient service use, 46.8% of service users had one or more chronic health conditions and depression, while for inpatient service use, 44.7% of service users had one or more chronic health conditions and no depression. The proportion of individuals with a chronic health condition(s) and depression was relatively even across age groups, in the range of 35.5-38.7%, with the exception of the oldest group, age 80 and over, at 43.7%. A larger proportion of women (44.2%) and rural residents (42.8%) had a chronic health condition(s) and depression in comparison, respectively, to men (29.2%) and urban residents (28.0%). The group with chronic health condition(s) and depression had a lower mean annual household expenditure in comparison to the group with chronic health conditions and no depression (16,780.62 yuan versus 22,350.94 yuan). With respect to educational attainment level, there was a decreasing trend in the proportion of individuals with a chronic health condition(s) and depression, with the highest proportion amongst those with no formal education (45.8%). In terms of marital status, greater proportions of those with a chronic health condition(s) and depression were found in the divorced/separated (53.2%) and widowed (46.2%) groups, as compared to the married (34.4%) and never married groups (38.9%). With respect to social support, the group that indicated some contact with friends in the past month had a slightly lower proportion of individuals with a chronic health condition(s) and depression (35.6%), as compared to the group that did not indicate this contact (37.4%).

**Table 11. Service Use and Sociodemographic Characteristics of Sample by Chronic Health Condition and Depression States**

| | With Chronic Health Condition and Depression | % | With Chronic Health Condition and No Depression | % | Total |
|---|---|---|---|---|---|
| **Outpatient Service Use (yes)** | 552 | 46.8 | 627 | 53.2 | 1179 |
| **Inpatient Service Use (yes)** | 309 | 44.7 | 383 | 55.3 | 692 |
| **Age** | | | | | |
| *60-64* | 653 | 35.5 | 1187 | 64.5 | 1840 |
| *65-69* | 453 | 36.9 | 775 | 63.1 | 1228 |
| *70-74* | 318 | 35.7 | 574 | 64.3 | 892 |
| *75-79* | 199 | 38.7 | 315 | 61.3 | 514 |
| *80+* | 139 | 43.7 | 179 | 56.3 | 318 |
| **Gender** | | | | | |
| *Male* | 693 | 29.2 | 1680 | 70.8 | 2373 |
| *Female* | 1068 | 44.2 | 1348 | 55.8 | 2416 |
| **Residence** | | | | | |
| *Urban* | 549 | 28.0 | 1410 | 72.0 | 1959 |
| *Rural* | 1213 | 42.8 | 1620 | 57.2 | 2833 |
| **Mean Annual Household Expenditure** (Yuan) (Income Proxy) | 16,780.62 | | 22,350.94 | | 20,307.23 |
| **Education** | | | | | |
| *No formal education* | 761 | 45.8 | 899 | 54.2 | 1660 |
| *Less than high school* | 942 | 34.3 | 1808 | 65.7 | 2750 |
| *High school/ vocational* | 47 | 18.2 | 211 | 81.8 | 258 |
| *More than high school* | 12 | 9.8 | 110 | 90.2 | 122 |
| **Marital Status** | | | | | |
| *Married* | 1312 | 34.4 | 2507 | 65.6 | 3819 |
| *Divorced/ Separated* | 25 | 53.2 | 22 | 46.8 | 47 |
| *Widowed* | 411 | 46.2 | 479 | 53.8 | 890 |
| *Never Married* | 14 | 38.9 | 22 | 61.1 | 36 |
| **Social Support** | | | | | |
| *Social Support – YES* | 566 | 35.6 | 1025 | 64.4 | 1591 |
| *Social Support – NO* | 1196 | 37.4 | 2005 | 62.6 | 3201 |

## II. BIVARIATE ANALYSES

Table 12 presents a series of bivariate analyses of independent variables and covariates by the dependent variable *Outpatient Service Utilization*. An independent samples t-test applying Bonferroni corrections showed that the mean CES-D score, reflecting depression, was significantly higher among study respondents who indicated having had an outpatient visit in the past month ($M$ = 10.82, $SD$ = 6.71), as compared to those who indicated not having had an outpatient visit in the past month ($M$ = 8.65, $SD$ = 6.36), ($t$(6592)=11.232, $p$<.0038). The mean number of chronic health conditions was significantly higher for study respondents who indicated having had an outpatient visit in the past month ($M$ = 1.76, $SD$ = 1.18), as compared to those who indicated not having had an outpatient visit in the past month ($M$ = 1.24, $SD$ = 1.09), ($t$(7363)=16.61, $p$<.0038). Likewise, the mean number of IADLs was significantly higher for study respondents who indicated having had an outpatient visit in the past month ($M$ =1.91, $SD$ = 3.50), as compared to those who indicated not having had an outpatient visit in the past month ($M$ = 1.47, $SD$ = 3.25), ($t$(7527)=4.651, $p$<.0038).

**Table 12. Bivariate Analyses: Outpatient Service Utilization (DV) (*t*-tests)**

| | **M (*SD*)** | ***t* (*df*)** | ***p*** |
|---|---|---|---|
| **Depression** | | 11.232 (6592) | **.000*** |
| *Outpatient – YES* | 10.82 (6.713) | | |
| *Outpatient – NO* | 8.65 (6.362) | | |
| **Chronic Health Conditions** | | 16.606 (7363) | **.000*** |
| *Outpatient – YES* | 1.76 (1.178) | | |
| *Outpatient – NO* | 1.24 (1.093) | | |
| **Annual Household Expenditure** | | 1.963 (6331) | .039 |
| *Outpatient – YES* | 20,869 (27,047) | | |
| *Outpatient – NO* | 19,120 (29,584) | | |
| **ADLs** | | 2.260 (5881) | .021 |
| *Outpatient – YES* | 1.31(2.636) | | |
| *Outpatient – NO* | 1.12(2.734) | | |
| **IADLs** | | 4.651 (7527) | **.000*** |
| *Outpatient – YES* | 1.91(3.504) | | |
| *Outpatient – NO* | 1.47(3.249) | | |
| **Age** | | 0.590 (7588) | .555 |
| *Outpatient – YES* | 68.56 (7.05) | | |
| *Outpatient – NO* | 68.44 (7.06) | | |

***Applied Bonferroni correction, p< .003846 (=.05/13)***

Table 13 presents a series of bivariate analyses of independent variables and covariates by the dependent variable *Outpatient Service Utilization,* employing Pearson chi-square tests with Bonferroni corrections. The presence of chronic health conditions and depression was associated with more outpatient service utilization ($X^2(1) = 68.072$, $p<.0038$). Specifically, 31.4% of those with chronic health conditions and depression used outpatient health services in the past month. In comparison, 20.7% of those with chronic health conditions and no depression used outpatient health services in the past month. Chi-square analysis also indicated that women (22.9%) used more outpatient services than men (20.0%) ($X^2(1) =9.633$, $p<.0038$).

**Table 13. Bivariate Analyses: Outpatient Service Utilization (DV) (Chi-square tests)**

| | **Outpatient Service Use** | $X^2$ **(*df*)** | ***p*** |
|---|---|---|---|
| | Yes | | |
| **Chronic Health Condition(s) and Depression** | | 68.072(1) | **.000*** |
| *Yes* | 31.4% | | |
| *No* | 20.7% | | |
| **Gender** | | 9.633(1) | **.002*** |
| *Female* | 22.9% | | |
| *Male* | 20.0% | | |
| **Insurance** | | 10.363(4) | .035 |
| *No insurance* | 19.7% | | |
| *Urban Employee only* | 22.8% | | |
| *Urban Resident only* | 27.4% | | |
| *New Cooperative only* | 21.1% | | |
| *Government Insurance only* | 24.6% | | |
| **Residence** | | 4.901(1) | .027 |
| *Urban* | 20.1% | | |
| *Rural* | 22.3% | | |
| **Education** | | 2.962(2) | .227 |
| *No formal education* | 22.4% | | |
| *Less than high school* | 20.8% | | |
| *High school degree or higher* | 20.7% | | |
| **Marital Status** | | .683(1) | .409 |
| Married/Partnered | 21.2% | | |
| Not married/partnered | 22.2% | | |
| **Social Support** | | 1.737(1) | .188 |
| Indicated social interaction | 22.3% | | |
| Did not indicate social interaction | 21.0% | | |

***Applied Bonferroni correction, p< .003846 (=.05/13)***

Table 14 presents a series of bivariate analyses of independent variables and covariates with the dependent variable *Inpatient Service Utilization*. An independent samples t-test applying Bonferroni corrections showed that the mean score reflecting depression was significantly higher among study respondents who indicated having had an inpatient visit in the past year ($M$ = 10.78, $SD$ = 6.84), as compared to those who indicated not having had an inpatient visit in the past month ($M$ = 8.88, $SD$ = 6.42), ($t$(6598)=7.750, $p$<.0038). The mean number of chronic health conditions was significantly higher for study respondents who indicated having had an inpatient visit in the past year ($M$ = 1.90, $SD$ = 1.67), as compared to those who indicated not having had an inpatient visit in the past month ($M$ = 1.27, $SD$ = 1.10), ($t$(7383)=16.17, $p$<.0038).

Similarly, the mean annual household expenditure was significantly higher for those indicating an inpatient visit in the past year ($M$ = 25,440 (yuan), $SD$ = 46,318), as compared to those who indicated not having had an inpatient visit in the past year ($M$ = 18,657, $SD$ = 25,556), ($t$(6346)=6.17, $p$<.0038). The mean number of ADLs was significantly higher for study respondents who indicated having had an inpatient visit in the past year ($M$ = 1.91, $SD$ = 3.592), as compared to those who indicated not having had an inpatient visit in the past year ($M$ = 1.04, $SD$ = 2.510), ($t$(5898)=8.70, $p$<.0038). Likewise, the mean number of IADLs was significantly higher for study respondents who indicated having had an inpatient visit in the past month ($M$ = 2.86, $SD$ = 4.35), as compared to those who indicated not having had an inpatient visit in the past year ($M$ = 1.38, $SD$ = 3.09), $t$(7548)=13.045, $p$<.0038.

**Table 14. Bivariate Analyses: Inpatient Service Utilization (DV) (*t*-tests)**

| | **M (*SD*)** | ***t* (*df*)** | ***p*** |
|---|---|---|---|
| **Depression** | | 7.750 (6598) | **.008**** |
| *Inpatient – YES* | 10.78(6.843) | | |
| *Inpatient – NO* | 8.88(6.416) | | |
| **Chronic Health Conditions** | | 16.171 (7383) | **.000***** |
| *Inpatient – YES* | 1.90(1.666) | | |
| *Inpatient – NO* | 1.27(1.104) | | |
| **Annual Household Expenditure** | | 6.173 (6346) | **.000***** |
| *Inpatient – YES* | 25,440 (46,318) | | |
| *Inpatient – NO* | 18,657 (25,556) | | |
| **ADLs** | | 8.704 (5898) | **.000***** |
| *Inpatient – YES* | 1.91 (3.592) | | |
| *Inpatient – NO* | 1.04 (2.510) | | |
| **IADLs** | | 13.045 (7548) | **.000***** |
| *Inpatient – YES* | 2.86 (4.345) | | |
| *Inpatient – NO* | 1.38 (3.085) | | |

***Applied Bonferroni correction, p< .003846 (=.05/13)***

Table 15 presents a series of bivariate analyses of independent variables and covariates by the dependent variable *Inpatient Service Utilization*, employing Pearson chi-square tests with Bonferroni corrections. The presence of chronic health conditions and depression was associated with more outpatient service utilization ($X^2$(1) = 21.961, $p$<.0038). Specifically, 17.6% of those with chronic health conditions and depression used inpatient health services in the past year. In comparison, 12.6% of those with chronic health conditions and no depression used inpatient health services in the past year. Chi-square analysis also showed that those who indicated having social interaction with friends in the past month (10.6%) used more inpatient services than those who did not indicate social interaction with friends in the past month (13.5%), ($X^2$(1) =11.868, $p$<.0038).

**Table 15. Bivariate Analyses: Inpatient Service Utilization (DV) (Chi-square tests)**

| | **Inpatient Service Use** | $X^2$ **(*df*)** | ***p*** |
|---|---|---|---|
| | Yes | | |
| **Chronic Health Condition(s) and Depression** | | 21.961 (1) | **.000*** |
| *Yes* | 17.6% | | |
| *No* | 12.6% | | |
| **Gender** | | 2.201(1) | .138 |
| *Female* | 12.1% | | |
| *Male* | 13.2% | | |
| **Insurance** | | 6.881(4) | .142 |
| *No insurance* | 12.6% | | |
| *Urban Employee only* | 11.1% | | |
| *Urban Resident only* | 9.1% | | |
| *New Cooperative only* | 13.1% | | |
| *Government Insurance only* | 13.9% | | |
| **Residence** | | 8.310(1) | .004 |
| *Urban* | 14.0% | | |
| *Rural* | 11.7% | | |
| **Education** | | 5.149(2) | .076 |
| *No formal education* | 11.9% | | |
| *Less than high school* | 12.6% | | |
| *High school degree or higher* | 15.5% | | |
| **Marital Status** | | 2.336(1) | .126 |
| Married/Partnered | 12.9% | | |
| Not married/partnered | 11.5% | | |
| **Social Support** | | 11.868(1) | **.001*** |
| Indicated social interaction | 10.6% | | |
| Did not indicate social interaction | 13.5% | | |

***Applied Bonferroni correction, p< .003846 (=.05/13)***

## III. REGRESSION ANALYSES

A stepwise logistic regression model (Model I, Table 16) was conducted to analyze the relationships between the predictor variables and the dependent variable of outpatient service utilization, to address the question, *Is depression associated with health services utilization among the general population of older adults in China?*

In the step 1 model (*N*=6,312), when outpatient service utilization was regressed onto the demographic variables, gender (B=-.242) and urban/rural residence (B=-.249) were both negatively associated with outpatient service utilization. Women were 1.27 times more likely than men to use services (OR=.785, CI=.656-.938), and rural residents were 1.28 times more likely than urban residents to use services (OR=.780, CI=.660-.922). Household expenditure was significantly positively associated (B=.176) with outpatient service utilization (OR=1.192, CI=1.095-1.298).

In the step 2 model (*N*=6,021), insurance variables were added to the step 1 model. Gender, urban/rural residence, and household expenditure remained significant predictors. Urban Employee Insurance and Government Insurance were positively associated with outpatient service use. Specifically, individuals with Urban Employee Insurance were 1.18 times more likely than those without insurance to use outpatient services (OR=1.177, CI=.869-1.593). Those with Government Insurance were 1.25 times more likely than those without insurance to use outpatient services (OR=1.246, CI=.716-2.171).

In the step 3 model (*N*=4,661), disability variables were added to the step 2 model. Once disability was controlled for, gender and urban/rural residence were no longer significant predictors. Household expenditure remained significantly associated. Age was negatively associated with outpatient service use (B=-.0170), with younger people being more likely to use outpatient services (OR=.983, CI=-.970-.996). Once disability was controlled for, Urban Employee Insurance and Government Insurance were no longer significant, but Urban Resident Insurance was. Those with Urban Resident Insurance were 1.88 times more likely than those without insurance to use outpatient services (OR=1.882, CI=1.214-2.919). IADLs were positively associated with outpatient service use (B=.119) (OR=1.126, CI=1.015-1.250).

In the step 4 model (*N*=4,022), chronic health conditions and depression were added to the step 3 model. Once these health variables were added into the model, age and IADLs were no longer significant predictors. Household expenditures and Urban Resident Insurance remained significantly associated. Chronic health conditions was significantly associated with outpatient service use (B=.403) (OR=1.496, CI=1.357-1.649). Depression was also significantly associated with outpatient service use (B=.208) (OR=1.232, CI=1.115-1.361).

In the step 5 model (*N*=4,022), the interaction term for chronic health conditions and depression was included. The interaction was not significant, but household expenditures and Urban Resident Insurance remained significant predictors.

## Table 16. Regression Analyses: MODEL I. Outpatient Service Use

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | | Step 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** |
| Age | .998 (.986-1.010) | .781 | .998 (.986-1.010) | .697 | .983 (.970-.996) | **.012*** | .996 (.982-1.011) | .634 | .996 (.982-1.011) | .629 |
| Gender | .785 (.656-.938) | **.008*** | .761 (.633-.914) | **.004*** | .896 (.736-1.092) | .278 | .986 (.803-1.210) | .891 | .984 (.802-1.208) | .877 |
| Urban/rural | .780 (.660-.922) | **.004*** | .771 (.649-.916) | **.003*** | .894 (.741-1.079) | .243 | .868 (.707-1.066) | .178 | .866 (.705-1.064) | .171 |
| Household Expenditure | 1.192 (1.095-1.298) | **.000*** | 1.194 (1.093-1.304) | **.000*** | 1.217 (1.105-1.340) | **.000*** | 1.229 (1.109-1.362) | **.000*** | 1.226 (1.107-1.357) | **.000*** |
| Education < high school | .942 (.785-1.131) | .524 | .967 (.803-1.165) | .723 | .964 (.788-1.180) | .724 | .955 (.773-1.178) | .665 | .955 (.774-1.179) | .670 |
| Education > high school | 1.052 (.762-1.453) | .758 | 1.074 (.769-1.499) | .677 | .961 (.649-1.421) | .840 | .814 (.536-1.236) | .333 | .810 (.533-1.231) | .324 |
| Marital status | .930 (.758-1.142) | .490 | .906 (.734-1.118) | .357 | .892 (.712-1.117) | .317 | .855 (.672-1.089) | .205 | .856 (.673-1.090) | .207 |
| Social support | 1.177 (.985-1.406) | .072 | 1.178 (.980-1.417) | .082 | 1.192 (.970-1.464) | .094 | 1.180 (.962-1.446) | .112 | 1.183 (.966-1.450) | .104 |
| cons | .364 (.146-.907) | .030 | | | | | | | | |
| | | | | | | | | | | |
| Insurance_ Urban Employee | | | 1.177 (.869-1.593) | **.002*** | 1.145 (.822-1.596) | .423 | 1.356 (.943-1.950) | .101 | 1.348 (.937-1.938) | .108 |
| Insurance_ Urban Resident | | | 1.945 (1.289-2.936) | .356 | 1.882 (1.214-2.919) | **.005*** | 1.758 (1.101-2.808) | **.018*** | 1.748 (1.096-2.789) | **.019*** |
| Insurance_ New Cooperative | | | 1.122 (.878-1.433) | .436 | 1.114 (.853-1.455) | .429 | 1.232 (.912-1.665) | .174 | 1.228 (.909-1.658) | .180 |
| Insurance_ Government | | | 1.246 (.716-2.171) | **.030*** | 1.311 (.718-2.393) | .378 | 1.413 (.711-2.805) | .323 | 1.389 (.699-2.761) | .348 |
| cons | | | .339 (.128-.903) | .030 | | | | | | |
| | | | | | | | | | | |
| ADLs | | | | | .971 (.870-1.083) | .595 | .939 (.816-1.080) | .378 | .941 (.818-1.082) | .393 |
| IADLs | | | | | 1.126 (1.015-1.250) | **.025*** | 1.054 (.940-1.182) | .367 | 1.053 (.939-1.181) | .376 |

***TABLE CONTINUED ON NEXT PAGE**

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | | Step 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** |
| cons | | | | | .962 (.330-2.803) | .943 | | | | |
| | | | | | | | | | | |
| # Chronic health conditions | | | | | | | 1.496 (1.357-1.649) | **.000*** | 1.516 (1.370-1.678) | **.000*** |
| Depression score | | | | | | | 1.232 (1.115-1.361) | **.000*** | 1.248 (1.127-1.382) | **.000*** |
| cons | | | | | | | .310 (.095-1.008) | .052 | | |
| | | | | | | | | | | |
| CHC*dep | | | | | | | | | .964 (.885-1.050) | .398 |
| _cons | | | | | | | | | .313 (.096-1.014) | .053 |

Next, another stepwise logistic regression model (Model II, Table 17) was conducted to analyze the relationships between the predictor variables and the dependent variable of inpatient service utilization, to address the question, *Is depression associated with health services utilization among the general population of older adults in China?*

In the step 1 model (*N*=6,327), when inpatient service utilization was regressed onto the demographic variables, age (B=.028) (OR=1.029, CI=1.014-1.044) and household expenditure (B=.446) (OR=1.562, CI=1.403-1.740) were both positively associated with inpatient service utilization.

In the step 2 model (*N*=6,035), insurance variables were added to the step 1 model. Age and household expenditure remained significant predictors. No other variables were significantly related to inpatient service use.

In the step 3 model (*N*=4,672), disability variables were added to the step 2 model. Once disability was controlled for, age was no longer a significant predictor. Household expenditure remained significantly associated. Gender was positively associated with inpatient service use (B=.241), with men being 1.27 times more likely to use inpatient services than women (OR=1.272, CI=1.032-1.568). IADLs were positively associated with outpatient service use (B=.257) (OR=1.293, CI=1.143-1.461).

In the step 4 model (*N*=4,025), chronic health conditions and depression were added to the step 3 model. Once these health variables were added into the model, gender, household expenditures and IADLs remained significant predictors. Chronic health conditions was significantly associated with inpatient service use (B=.344) (OR=1.410, CI=1.262-1.575). Depression was not significantly associated with inpatient service use.

In the step 5 model (*N*=4,025), the interaction term for chronic health conditions and depression was included. The interaction was not significant, but gender, household expenditures, and IADLs remained significant predictors.

## Table 17. Regression Analyses: MODEL II. Inpatient Service Use

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | | Step 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** |
| Age | 1.029 (1.014-1.044) | **.000*** | 1.028 (1.013-1.044) | **.000*** | 1.006 (.989-1.024) | .466 | 1.016 (.997-1.036) | .104 | 1.016 (.997-1.036) | .104 |
| Gender | 1.141 (.937-1.390) | .190 | 1.134 (.929-1.384) | .218 | 1.272 (1.032-1.568) | **.024*** | 1.284 (1.014-1.626) | **.038*** | 1.279 (1.011-1.618) | **.040*** |
| Urban/rural | .980 (.802-1.199) | .848 | .967 (.787-1.190) | .754 | 1.096 (.877-1.371) | .421 | 1.058 (.820-1.365) | .667 | 1.052 (.816-1.356) | .697 |
| Household Expenditure | 1.562 (1.403-1.740) | **.000*** | 1.560 (1.394-1.745) | **.000*** | 1.542 (1.365-1.742) | **.000*** | 1.494 (1.305-1.709) | **.000*** | 1.487 (1.302-1.698) | **.000*** |
| Education < high school | .987 (.786-1.241) | .912 | .990 (.785-1.250) | .935 | 1.086 (.850-1.388) | .509 | 1.059 (.803-1.397) | .684 | 1.061 (.805-1.398) | .675 |
| Education > high school | 1.092 (.751-1.588) | .644 | 1.103 (.754-1.613) | .615 | 1.174 (.759-1.817) | .471 | 1.307 (.822-2.080) | .258 | 1.301 (.816-2.075) | .269 |
| Marital status | 1.003 (.773-1.301) | .984 | 1.013 (.775-1.325) | .923 | .990 (.740-1.324) | .943 | .891 (.649-1.225) | .479 | .893 (.650-1.227) | .484 |
| Social support | .845 (.689-1.035) | .104 | .849 (.689-1.046) | .125 | .949 (.754-1.196) | .660 | .926 (.717-1.196) | .556 | .932 (.723-1.201) | .584 |
| cons | .017 (.005-.055) | .000 | | | | | | | | |
| | | | | | | | | | | |
| Insurance_ Urban Employee | | | .894 (.598-1.336) | .585 | .887 (.565-1.392) | .602 | .834 (.516-1.349) | .460 | .827 (.511-1.337) | .438 |
| Insurance_ Urban Resident | | | .840 (.464-1.518) | .563 | .770 (.402-1.473) | .430 | .912 (.463-1.797) | .791 | .905 (.460-1.784) | .774 |
| Insurance_ New Cooperative | | | 1.122 (.829-1.520) | .455 | 1.178 (.842-1.648) | .339 | 1.203 (.834-1.735) | .323 | 1.196 (.830-1.724) | .337 |
| Insurance_ Government | | | 1.048 (.500-2.196) | .901 | 1.541 (.741-3.206) | .247 | 1.580 (.276-3.438) | .248 | 1.541 (.708-3.35) | .276 |
| cons | | | .017 (.005-.059) | .000 | | | | | | |
| | | | | | | | | | | |
| ADLs | | | | | .989 (.875-1.119) | .864 | 1.019 (.854-1.217) | .834 | 1.021 (.857-1.217) | .815 |
| IADLs | | | | | 1.293 (1.143-1.461) | **.000*** | 1.232 (1.076-1.411) | **.003*** | 1.229 (1.074-1.407) | **.003*** |

***TABLE CONTINUED ON NEXT PAGE**

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | | Step 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** |
| cons | | | | | .069 (.017-.272) | .000 | | | | |
| | | | | | | | | | | |
| # Chronic health conditions | | | | | | | 1.410 (1.262-1.575) | **.000*** | 1.440 (1.281-1.619) | **.000*** |
| Depression score | | | | | | | 1.121 (.992-1.268) | .067 | 1.152 (1.014-1.308) | **.030*** |
| _cons | | | | | | | .034 (.007-.163) | .000 | | |
| | | | | | | | | | | |
| CHC*dep | | | | | | | | | .942 (.849-1.045) | .257 |
| _cons | | | | | | | | | .034 (.007-.164) | .000 |

Next, a stepwise logistic regression model (Model III, Table 18) was conducted to analyze the relationships between the predictor variables and the dependent variable of outpatient service utilization, to address the question, *Among older adults with chronic health conditions, does also having depression increase the likelihood of health services utilization?*

The first three steps were the same as those for the earlier model, Model I. In the step 4 model (*N*=3,233), the continuous variable for chronic health conditions and the categorical composite variable of chronic health conditions and depression were added to the step 3 model. Once these variables were added, age was no longer a significant predictor. Household expenditures and Urban Resident Insurance remained significantly associated with outpatient service use. Social support was significantly associated with outpatient service use (B=.228); those who indicated that they had some interaction with friends in the past month were 1.26 times more likely than those who did not indicate interaction with friends in the past month (OR=1.257, CI=1.013-1.559). The number of chronic health conditions was significantly associated with outpatient service use (B=.360) (OR=1.433, CI=1.271-1.617). The independent variable of chronic health conditions and depression was significantly associated with outpatient service use (B=.427); specifically, those with both chronic conditions and depression were 1.53 times more likely to use outpatient services than those who only had chronic conditions and did not have depression (OR=1.533; CI=1.236-1.901).

## Table 18. Regression Analyses: MODEL III. Outpatient Service Use

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | |
|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** |
| Age | .998 (.986-1.010) | .781 | .998 (.986-1.010) | .697 | .983 (.970-.996) | **.012*** | .995 (.979-1.011) | .505 |
| Gender | .785 (.656-.938) | **.008*** | .761 (.633-.914) | **.004*** | .896 (.736-1.092) | .278 | .975 (.784-1.212) | .817 |
| Urban/rural | .780 (.660-.922) | **.004*** | .771 (.649-.916) | **.003*** | .894 (.741-1.079) | .243 | .873 (.701-1.087) | .225 |
| Household Expenditure | 1.192 (1.095-1.298) | **.000*** | 1.194 (1.093-1.304) | **.000*** | 1.217 (1.105-1.340) | **.000*** | 1.261 (1.127-1.412) | **.000*** |
| Education < high school | .942 (.785-1.131) | .524 | .967 (.803-1.165) | .723 | .964 (.788-1.180) | .724 | .942 (.755-1.176) | .598 |
| Education > high school | 1.052 (.762-1.453) | .758 | 1.074 (.769-1.499) | .677 | .961 (.649-1.421) | .840 | .735 (.474-1.141) | .170 |
| Marital status | .930 (.758-1.142) | .490 | .906 (.734-1.118) | .357 | .892 (.712-1.117) | .317 | .815 (.629-1.057) | .123 |
| Social support | 1.177 (.985-1.406) | .072 | 1.178 (.980-1.417) | .082 | 1.192 (.970-1.464) | .094 | 1.257 (1.013-1.559) | **.038*** |
| cons | .364 (.146-.907) | .030 | | | | | | |
| | | | | | | | | |
| Insurance_ Urban Employee | | | 1.177 (.869-1.593) | **.002*** | 1.145 (.822-1.596) | .423 | 1.285 (.872-1.892) | .205 |
| Insurance_ Urban Resident | | | 1.945 (1.289-2.936) | .356 | 1.882 (1.214-2.919) | **.005*** | 1.767 (1.072-2.913) | **.026*** |
| Insurance_ New Cooperative | | | 1.122 (.878-1.433) | .436 | 1.114 (.853-1.455) | .429 | 1.181 (.863-1.616) | .297 |
| Insurance_ Government | | | 1.246 (.716-2.171) | **.030*** | 1.311 (.718-2.393) | .378 | 1.245 (.583-2.661) | .571 |
| cons | | | .339 (.128-.903) | **.**030 | | | | |
| | | | | | | | | |
| ADLs | | | | | .971 (.870-1.083) | .595 | .922 (.797-1.066) | .272 |
| IADLs | | | | | 1.126 (1.015-1.250) | **.025*** | 1.062 (.943-1.195) | .320 |

***TABLE CONTINUED ON NEXT PAGE**

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | |
|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** | **OR (95% CI)** | ***P*>\|*t*\|** |
| cons | | | | | .962 (.330-2.803) | .943 | | |
| | | | | | | | | |
| # Chronic health conditions | | | | | | | 1.433 (1.271-1.617) | **.000*** |
| Chronic Health Conditions and Depression | | | | | | | 1.533 (1.236-1.901) | **.000*** |
| cons | | | | | | | .346 (.095-1.259) | .107 |

Finally, a stepwise logistic regression model (Model IV, Table 19) was conducted to analyze the relationships between the predictor variables and the dependent variable of inpatient service utilization, to address the question, *Among older adults with chronic health conditions, does also having depression increase the likelihood of health services utilization?*

The first three steps were the same as those for the earlier model, Model II. In the step 4 model (*N*=3,235), the continuous variable for chronic health conditions and the categorical composite variable of chronic health conditions and depression were added to the step 3 model. Once these variables were added, gender was no longer a significant predictor. Household expenditures and IADLs remained significantly associated with inpatient service use. The number of chronic health conditions was significantly associated with inpatient service use (B=.313) (OR=1.368, CI=1.195-1.566). The independent variable of chronic health conditions and depression was not a significant predictor of inpatient service use.

## Table 19. Regression Analyses: MODEL IV. Inpatient Service Use

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | |
|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** |
| Age | 1.029 (1.014-1.044) | **.000*** | 1.028 (1.013-1.044) | **.000*** | 1.006 (.989-1.024) | .466 | 1.014 (.993-1.035) | .192 |
| Gender | 1.141 (.937-1.390) | .190 | 1.134 (.929-1.384) | .218 | 1.272 (1.032-1.568) | **.024*** | 1.256 (.979-1.610) | .073 |
| Urban/rural | .980 (.802-1.199) | .848 | .967 (.787-1.190) | .754 | 1.096 (.877-1.371) | .421 | 1.096 (.836-1.436) | .509 |
| Household Expenditure | 1.562 (1.403-1.740) | **.000*** | 1.560 (1.394-1.745) | **.000*** | 1.542 (1.365-1.742) | **.000*** | 1.439 (1.244-1.663) | **.000*** |
| Education < high school | .987 (.786-1.241) | .912 | .990 (.785-1.250) | .935 | 1.086 (.850-1.388) | .509 | .994 (.743-1.331) | .970 |
| Education > high school | 1.092 (.751-1.588) | .644 | 1.103 (.754-1.613) | .615 | 1.174 (.759-1.817) | .471 | 1.292 (.788-2.118) | .309 |
| Marital status | 1.003 (.773-1.301) | .984 | 1.013 (.775-1.325) | .923 | .990 (.740-1.324) | .943 | .910 (.646-1.283) | .592 |
| Social support | .845 (.689-1.035) | .104 | .849 (.689-1.046) | .125 | .949 (.754-1.196) | .660 | .859 (.651-1.131) | .279 |
| cons | .017 (.005-.055) | .000 | | | | | | |
| | | | | | | | | |
| Insurance_ Urban Employee | | | .894 (.598-1.336) | .585 | .887 (.565-1.392) | .602 | .805 (.493-1.312) | .384 |
| Insurance_ Urban Resident | | | .840 (.464-1.518) | .563 | .770 (.402-1.473) | .430 | .776 (.399-1.509) | .454 |
| Insurance_ New Cooperative | | | 1.122 (.829-1.520) | .455 | 1.178 (.842-1.648) | .339 | 1.190 (.814-1.742) | .369 |
| Insurance_ Government | | | 1.048 (.500-2.196) | .901 | 1.541 (.741-3.206) | .247 | 1.594 (.696-3.651) | .270 |
| cons | | | .017 (.005-.059) | .000 | | | | |
| | | | | | | | | |
| ADLs | | | | | .989 (.875-1.119) | .864 | 1.004 (.833-1.209) | .969 |
| IADLs | | | | | 1.293 (1.143-1.461) | **.000*** | 1.286 (1.118-1.479) | **.000*** |

***TABLE CONTINUED ON NEXT PAGE**

| | Model - Step 1 | | Step 2 | | Step 3 | | Step 4 | |
|---|---|---|---|---|---|---|---|---|
| | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** | **OR (95% CI)** | ***P>\|t\|*** |
| cons | | | | | .069 (.017-.272) | .000 | | |
| | | | | | | | | |
| # Chronic health conditions | | | | | | | 1.368 (1.195-1.566) | **.000*** |
| Chronic Health Conditions and Depression | | | | | | | 1.223 (.944-1.586) | .128 |
| cons | | | | | | | .042 (.008-.223) | .000 |

## IV. CLUSTER ANALYSES

### *I. Cluster Analysis 1: Outpatient Service Utilization*

Three distinct clusters were generated using k-means cluster analysis. Besides the variable for outpatient service use, the variables for analysis were those found to be significantly related to outpatient service use ($p<.05$) in bivariate analysis. The input variables were: Chronic Health Conditions, Depression, Insurance, Household Expenditure, Gender, Urban/Rural Residence, ADLs, and IADLs.

High service utilization cluster (group 1): This group made up the smallest proportion of the sample, at 10.59%. In the high service utilization group, a **moderate level of chronic health conditions** was found compared to the other two groups. Relative to the other two groups, the high utilization group had the **highest levels of depression**, tended to be **less uninsured**, to have the **most Urban Employee and New Cooperative**, and the **least Urban Resident and Government Insurance**. Household expenditure level was mid-range between that of the other two groups. Respondents tended to be **female** and to live in **rural** areas, and these trends were stronger in the high-utilization group than in the other two groups. The level of **ADLs and IADLs was also the highest** among the three groups.

Moderate service utilization cluster (group 2): This group comprised 40.56% of the sample, and was the second largest sample. Moderate service utilizers had the **highest level of chronic health conditions**, and a **moderate level of depression,** relative to the other two groups. They had the **highest levels of no insurance, moderate levels of Urban Resident Insurance, New Cooperative insurance, and Government insurance** and the **least Urban Employee insurance**. This group had the **highest annual household expenditure** and respondents tended to be **female**, but there were more men in this group than in the high service utilization group.

This group also tended to be the **most urban**. This group had a **moderate level of ADLs and IADLs** relative to the other two groups.

Low service utilization cluster (group 3): This group made up the largest proportion of the sample, at 48.86%. This group had the **lowest level of chronic health conditions, and the lowest levels of depression**. It had **moderate levels of no insurance** and **moderate levels of Urban Employee insurance**. It had the most **Urban Resident insurance** and **Government insurance**. This group also had the **lowest level of annual household expenditure**. There were **more males** in this group than in the other two groups. This group also tended to be **more urban than the highest service utilization** group. This group had the **lowest levels of ADLs and IADLs.**

In sum, the depression level and levels of ADLs and IADLs appear to be positively associated with the level of outpatient health services utilization. While high service utilizers have a moderate amount of chronic health conditions, they have the most depression, ADLs and IADLs. High service utilizers tend to be less uninsured, have the most Urban Employee and New Cooperative insurance, and have the least Urban Resident and Government insurance relative to the other two groups. High service utilizers are more likely to be female and to live in rural areas.

**Table 20. Cluster Analysis 1: Outpatient Service Users**

| | Frequency | Percent |
|---|---|---|
| 1 | 426 | 10.59 |
| 2 | 1632 | 40.56 |
| 3 | 1966 | 48.86 |
| Total | 4024 | 100.00 |

**Table 21. Cluster Analysis 1 Means by Categories**

| | Outpatient | CHC | CESD | No Insurance | Insurance_Urb Employee | Insurance_ Urb Resident |
|---|---|---|---|---|---|---|
| 1 | .3169 | 1.8333 | 1.1062 | .1009 | .1315 | .0423 |
| 2 | .3009 | 2.5594 | .2245 | .1072 | .1134 | .0527 |
| 3 | .1765 | .6200 | -.1019 | .1068 | .1205 | .0539 |
| Total | .2418 | 1.5350 | .1584 | .1064 | .1188 | .0522 |

| | Insurance_ New Cooperative | Insurance_ Government | Household Expenditure | Gender | Urban/rural | ADL | IADL |
|---|---|---|---|---|---|---|---|
| 1 | .7207 | .0047 | -.0082 | .4131 | .3052 | 1.4380 | 2.2046 |
| 2 | .7102 | .0165 | .1008 | .4436 | .3885 | -.2108 | -.2035 |
| 3 | .7004 | .0183 | -.1356 | .4893 | .3555 | -.3191 | -.2978 |
| Total | .7065 | .0162 | -.0262 | .4627 | .3636 | -.0891 | .0054 |

*II. Cluster 2: Inpatient Service Utilization*

Three distinct clusters were generated using k-means cluster analysis. Besides the variable for inpatient service use, the variables for analysis were those found to be significantly related to inpatient service use ($p<.05$) in bivariate analysis. The input variables were: Chronic Health Conditions, Depression, Age, Household Expenditure, Urban/Rural Residence, ADLs, IADLs, and Social Support.

High service utilization cluster (group 3): This group made up the smallest proportion of the sample, at 10.47%. This group had a **moderate level of chronic health conditions** and the **highest level of depression**. The **household expenditure** level for this group fell between the other two groups. Relative to the other two groups, this group tended to be the **oldest,** to be comprised of the **most rural residents**, had the **highest level of ADLs and IADLs**, and **the lowest level of social support**.

Moderate service utilization cluster (group 1): This group comprised 40.70% of the sample and was the second largest cluster. This group had the **highest level of chronic health conditions** and a **moderate level of depression, ADLs, and IADLs**. Relative to the other two groups, this group was the **youngest,** had the **highest annual household expenditure**, tended to be the **most urban**, and exhibited the **most social support**.

Low service utilization (group 2): This group was the largest cluster, comprising 48.83% of the sample. This group exhibited the **lowest level of chronic health conditions**, and the **lowest levels of depression**. The group fell in between the other two groups in terms of age. The group exhibited the **lowest level of annual household expenditure,** and was **more likely to be urban than those in the high service utilization** group. This group had **the lowest levels of ADL and IADLs** relative to the other two groups. This group fell in between the two other groups in terms of social support.

In sum, depression level and levels of ADLs and IADLs appear to be positively associated with the level of inpatient health services utilization. High service utilizers fell between the other two groups in terms of chronic health conditions and household expenditure level. This cluster had the most rural residents and the lowest levels of social support.

**Table 22: Cluster Analysis 2: Inpatient Service Users**

| | Frequency | Percent |
|---|---|---|
| 1 | 1718 | 40.70 |
| 2 | 2061 | 48.83 |
| 3 | 442 | 10.47 |
| Total | 4221 | 100.00 |

**Table 23: Cluster Analysis 2 Means by Categories**

| | Inpatient | CHC | CESD | Age | Household Expenditure |
|---|---|---|---|---|---|
| 1 | .1787 | 2.5547 | .2353 | 1.1391 | .0966 |
| 2 | .0854 | .6128 | -.0996 | 1.3173 | -.1493 |
| 3 | .2398 | 1.7896 | 1.1108 | 1.9299 | -.0153 |
| Total | .1395 | 1.5264 | .1635 | 1.3089 | -.0352 |

| | Urban/ rural | ADL | IADL | Social Support |
|---|---|---|---|---|
| 1 | .3877 | -.2070 | -.1936 | .3527 |
| 2 | .3561 | -.3205 | -.3027 | .3411 |
| 3 | .3303 | 1.4663 | 2.2296 | .2489 |
| Total | .3663 | -.0872 | .0069 | .3362 |

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# CHAPTER 5. DISCUSSION AND CONCLUSION

## I. DISCUSSION

This study aimed to assess the independent and combined impact of depression and comorbid chronic health conditions on health services utilization. The research questions were: 1) Is depression associated with health services utilization among the general population of older adults in China?; 2) Among the sub-population of older adults in China with chronic health conditions, does also having depression increase the likelihood of health services utilization?; and 3) What is the health and sociodemographic profile of health service users?

It was hypothesized that, controlling for sociodemographic factors, there is a positive relationship between depression symptoms and health services utilization. This hypothesis was partially supported; controlling for sociodemographic factors, insurance, disability, and chronic health conditions, higher depression scores were associated with higher levels of outpatient service use, but they were not associated with inpatient service use.

The second study hypothesis was that, controlling for sociodemographic factors, the odds of health services utilization will be greater for individuals with depression symptoms in combination with a co-occurring health condition(s) as compared to individuals with the health condition(s) alone. This study similarly found that, controlling for sociodemographic factors, insurance, disability, and chronic health conditions, those with chronic health conditions and depression used significantly more outpatient services than those with just chronic health conditions alone. However, those with chronic health conditions and depression did not use significantly more inpatient services than those with just chronic health conditions alone.

The results for outpatient service utilization correspond with findings from earlier studies in western countries looking at the relationship between depression, chronic health conditions and health services utilization among older adults (Callahan, Hui, Nienaber, & Musick 1994; Unützer et al., 1997) and in the general population (Simon, VonKorff, and Barlow 1995). To date, the topic of depression and its relationship to health services utilization in China has not been adequately addressed. This study is among the very first to look at this relationship, particularly among older adults with chronic conditions in this country. The patterns of healthcare utilization observed in this study are embedded in the context of Chinese culture and the particular structure of the Chinese healthcare system. As referenced in earlier sections of this dissertation, there are cultural and social attributes of depression in China that may affect its relationship with health services utilization, such as stigma and/or the lack of understanding or recognition of the disorder itself. At the same time, the sociodemographics of the Chinese elder population and the unique structure of the healthcare system are important factors underpinning these healthcare utilization trends.

Depression may lead to increased outpatient health utilization among Chinese older adults as its symptoms may be mistaken for other conditions since it is often unrecognized by the patient themselves as well as undetected by medical professionals (Yeung, Yu, Fung, Vorono, & Fava, 2006). Somatic symptoms stemming from depression may be incorrectly attributed to physical illness by the patient. In a clinical encounter, somatic symptoms related to depression can be difficult for the provider to distinguish from somatic symptoms related to chronic medical conditions (Himelhoch, Weller, Wu, Anderson, and Cooper, 2004). A patient's focus on physical

complaints during medical visits could lead to increased referral to diagnostic tests and utilization of other services to treat those complaints (Himelhoch, Weller, Wu, Anderson, and Cooper, 2004). Sometimes such additional services are warranted, and other times they are not (Himelhoch, Weller, Wu, Anderson, and Cooper, 2004).

The course of chronic medical conditions tends to worsen in the presence of depression, thereby leading to potentially more health services utilization. Individuals with depression tend to have difficulty in coping with the requirements of day-to-day living (Rogers, May & Oliver, 2001), which extends into the ability to practice adequate self-care (Katon, 2011). The sense of helplessness and hopelessness associated with depression can make it difficult for individuals to follow treatment guidelines, thereby diminishing their health status (Katon, 2011). The deleterious effects of such associated behaviors as improper diet, lack of exercise, and lack of adherence to medications can lead to worsened health states (Katon, 2011). DiMatteo, Lepper, & Croghan (2000) found that individuals with depression were more than three times more likely to not comply with treatment recommendations compared to those without depression. Furthermore, according to Katon (2011), depression also has direct pathophysiological effects on the body, which relate to worsening of chronic physical conditions. There is growing evidence that depression can have pro-inflammatory effects within the body (Dowlati et al., 2010; Miller, Maletic, & Raison, 2009) that can exacerbate certain chronic conditions (Kiecolt-Glaser & Glaser, 2002).

Other psychological factors may influence the healthcare utilization patterns of individuals with depression. Patients with depression frequently also suffer from comorbid anxiety (Stavrakaki & Vargo, 1986). Symptoms of anxiety or worry about physical health status can lead them to seek an increased level of contact with the healthcare system (Katon, 2011) that would otherwise not exist in the absence of these conditions. The relationship between maladaptive attachment style and depression also has implications for health services utilization patterns (Katon, 2011). Those with insecure attachment stemming from early childhood have been shown to be at increased risk of depression in adulthood (Katon, 2011). Ciechanowski, Walker, Katon, and Russo (2002) studied the relationships between attachment style and 1) symptom reporting and 2) health services utilization among primary care patients. They found that primary care patients with two major types of insecure attachment styles - preoccupied and fearful attachment - were more likely to report a higher level of physical symptoms as compared to those with secure attachment styles. Those with preoccupied attachment had the highest primary care costs and service utilization, while those with fearful attachment had the lowest costs and utilization. Preoccupied attachment style is characterized by inconsistently responsive parenting experienced in childhood, leading in adulthood to emotional dependence on others, low self-esteem, and more psychological distress (Ciechanowski, Walker, Katon, and Russo, 2002). Such individuals have a positive concept of others and a negative view of themselves; in a health service context, their dependency on others can lead to increased use of services. Fearful attachment is characterized by harsh or rejecting parenting in childhood, and adults with this attachment style tend to be fearful of rejection and intimacy. They have a negative view of self and others. Their hesitation to rely on others may lend to lower service utilization patterns (Ciechanowski, Walker, Katon, and Russo, 2002). Both insecure attachment styles are associated with higher symptom reporting, so those with fearful attachment may delay help-seeking until conditions worsen, after which point they may require higher levels of care.

In the current study, the lack of significant relationships between 1) depression and inpatient service utilization and 2) chronic health conditions and depression and inpatient service utilization was contrary to expectation. Indeed, most large studies in the west that have compared health care utilization in medical inpatients with and without comorbid psychopathology have found that patients with both medical and psychiatric diagnoses had significantly longer mean lengths of stay in the hospital than those without psychopathology (Fulop, Strain, Fahs, Schmeidler, & Snyder, 1998; Saravay & Lavin, 1994; Wallen, Pincus, Goldman, & Marcus, 1987). In China, Zhong et al. (2010) found a high prevalence of depressive disorders (16.2%) and major depression (9.4%) among inpatients of general hospitals in the city of Wuhan. However, there are exceptions to this trend; for example, assessing the relationship between diabetes, depression, and health care use, Egede, Zheng, and Simpson (2002) found no relationship between depression and inpatient service use, a conclusion similar to that of the current study.

This study's findings may be explained by the fact that, compared with inpatient services, outpatient services are comparably easier and less costly to obtain. Specifically with respect to the Chinese context, while the health system in China is currently working toward more of a primary care gatekeeping system through recent health reforms (Liu, Wang, Kong & Cheng, 2011), managed care as it is known in the U.S. does not exist in this country (Eggleston, 2012). Outpatient services are generally obtainable in China if the patient has the resources to access them; thus, as is the case with the U.S., a certain amount of services rendered may not be necessary. On the other hand, patients must be admitted to the hospital for inpatient care, so a higher level of medical necessity is required. Among patients with depression, there may be a certain proportion of people who, for reasons mentioned earlier, such as associated anxiety and worry about health conditions, are accessing outpatient services that are unnecessary. Outpatient services are accessible without a doctor's referral or any admissions process, however, the same is not true for inpatient services, thus making them less utilized.

A lack of significance between depression and inpatient service utilization may also be seen because any depressive symptomatology that might be present among the inpatient sample may be mild or moderate relative to the severity of the physical conditions for which health services are being sought. Again, based on the literature, we can assume that most patients in China seek care for physical concerns but do not seek psychiatric and other mental health services directly to treat their depression. This is due to the lack of awareness and recognition of the disorder as well as its pervasive cultural stigma. The inpatient mental health services that do exist treat mental illnesses at a severe and persistent level. Thus, depression and depressive symptomatology generally goes untreated in China as, in addition, primary care and other doctors treating chronic conditions largely lack the necessary training to screen for and treat comorbid depression (Zhong et al., 2010).

Cost is likely also a significant factor in explaining both this finding on inpatient service use as well as the finding that household expenditure was significantly positively related to health service use in all four regression models. Broadly, cost is one of the most significant barriers to health services access (Ensor & Cooper, 2004). The degree of access to healthcare often depends on the amount of out-of-pocket expenses required, and access is assumed to increase with increased coverage of costs by government, insurance companies, and other third-party providers (Andersen & Newman, 2005). Inpatient services are generally expensive in China, as in most other countries (Gao, Tang, Tolhurst, & Rao, 2001). While health insurance

coverage has expanded in recent years, out-of-pocket payments are still high (Liu & Zhao, 2014). The rates of non-use of inpatient services, that is, the circumstances in which patients are referred by doctors for hospital admission, but were not admitted, are particularly high among the lowest income groups in China (Gao, Tang, Tolhurst, & Rao, 2001), suggesting that cost may be a reason for non-utilization. Financial difficulty is cited by a majority of individuals in studies of inpatient services as the major obstacle to accessing such services (Gao, Raven, Tang, 2007; Gao, Tang, Tolhurst, & Rao, 2001).

The fact that cost is a highly significant factor in health care utilization can also be inferred from the finding that household expenditure was one of the only variables that was consistently significant in all four models. Families with greater levels of household expenditure, which was used as a proxy for household income in this study, simply have more resources with which to access them. This finding is consistent with other studies in which income, per capita expenditure, or household expenditure was significantly associated with service use among older adults in China (Gao, Raven, & Tang, 2007; Sun, Deng, Xiong, Tang, 2014; Strauss et al., 2012). In China, the phrase, "*kan bing nan, kan bing gui*," meaning "obtaining medical care is difficult and expensive," is pervasive in the media and among the general public (Eggleston, 2010). The exorbitant costs of health care have been cited as a major national problem in public opinion polls across China (Eggleston, 2010).

The number of chronic health conditions was found to be a consistently very strong predictor ($p<.001$) of service use in each of the four models. This finding is in line with a well-established relationship between health status and health service use in the western literature (Broemeling, Watson, & Prebtani, 2007; Hulka & Wheat, 1985; Johnson & Wolinsky, 1993; Wolinsky & Arnold, 1988). According to Andersen and Newman (2005), illness level is one of the major individual determinants of health services utilization. Illness level is regarded as the most direct cause of health services utilization; individuals or their families must recognize an illness, or the potential for illness, in order for health service use to occur (Andersen & Newman, 2005). Individuals and their families are more likely to recognize and react to a higher number of chronic health conditions, thereby leading to a greater likelihood of health services utilization. Those with poor health status tend to use health services to a greater degree than healthier individuals. Their greater need for services is reflected in a higher rate of service utilization (Broemeling, Watson, & Prebtani, 2007).

Insurance was associated with outpatient but not inpatient service use in the final regression models (Step 4 models). Older adults with Urban Resident insurance were significantly more likely than those with no insurance to use outpatient health services. Urban Resident insurance targets non-working urban residents including children, students, and older adults who do not qualify for Urban Employee insurance. Urban Resident insurance tends to benefit poorer and more vulnerable populations to a greater extent (Lin, Liu, & Chen 2009; Liu & Zhao, 2014; Sun, Deng, Xiong, & Teng, 2014). The average level of total financial contributions, including premiums, per person was 269 yuan for Urban Resident insurance, while that for Urban Employee insurance was 1960 yuan (Sun, Deng, Xiong, & Teng, 2014); thus, the lower cost of Urban Resident insurance is a possible explanation for its significant relationship with outpatient service use. It would be expected that given the expansion of health insurance in China due to recent health care reforms, we would observe more relationships between the various types of insurance and service utilization. The lack of significance of insurance in relation to inpatient service use may reflect the fact that although overall health insurance

coverage has been increasing over the years both in terms of scope and percentage of expense reimbursement, co-pays and deductibles are high and insurance remains generally insufficient to cover medical expenses (Wang et al., 2013). Also, according to Wang et al. (2013), the reimbursement process for insurance can be lengthy and complicated, thereby further precluding its use and potentially impacting service utilization patterns.

The study found that those with greater difficulty in performing instrumental activities of daily living (IADLs) were more likely to use inpatient services, with IADLs being a strong predictor ($p<.01$, $p<.001$) in both inpatient models. The level of functional impairment may be related to the presence of disease, disability, chronic health conditions, or other health problems, and health status is an important predictor of health services utilization (Johnson & Wolinsky, 1993). Again, according to Andersen and Newman (2005), a greater illness level (or impairment level, in this case), would contribute to increased health services utilization. In this study, interestingly, no associations were observed between basic activities of daily living (ADLs) and health services utilization; that is, those with more basic functional impairments did not use more services. Further, depression was not significant in either of the two models (Models II and IV) for inpatient service use in which IADLs was found to be significant. Future studies could assess the way in which depression and ADLs/IADLs interact to affect service utilization in the Chinese context. According to Lenze, Martire, Rollman, and Schulz (2001), depression is thought to cause or to heighten disability through two major mechanisms: 1) the depressed state is disabling in and of itself and/or 2) depression increases the disability that arises from other medical conditions. In the latter case, depression can directly increase the risk for other medical conditions, or the poorer health behaviors associated with depression can lead to or exacerbate disability. Once disability is present, it essentially functions as the illness level (Andersen and Newman, 2005) that predisposes the individual to use services.

Social support and gender were two other variables that were found to be significant predictors of outpatient and inpatient service utilization, respectively. With respect to social support, in the sample of those with chronic health conditions (as seen in Model III), individuals who indicated interacting with friends in the last month were 1.26 times more likely to use outpatient services ($p< .05$) than those who did not indicate interacting with friends in the last month. Social factors influence pathways to health services utilization; medical care decision-making is often affected by those in an individual's social network (Pescosolido, 1992). There is a substantial body of literature on the roles of social support in health services utilization; social support can both improve health by mitigating the negative effects of stress and by encouraging or facilitating healthy behaviors, help-seeking, and access to health knowledge and health resources (Lee, Arozullah, & Cho, 2004). This finding is consistent with other studies that have shown that those having recent contact with friends are more likely to use health services (Kuo and Torres-Gil, 2001). Friends can provide information about specific health conditions, healthcare providers and other resources in the community, encourage individuals to obtain health care when needed, and provide emotional and physical support in managing illness (Lee, Arozullah, & Cho, 2004). On the other hand, studies of adult populations have shown that more socially-isolated individuals could also have a greater need for services and thereby use more of them (Kouzis and Eaton, 1998). Depression and social isolation have been shown to be predictive of mortality in patients with chronic illness (Chesney, 1993; Friedmann et al., 2006). The greater susceptibility to illness on the part of those with little social support could lead to higher need for and use of healthcare.

With respect to gender in this study (as seen in Model II), among the general population of older adults, men were 1.28 times more likely than women to use inpatient services ($p<.05$), and there were no significant gender relationships in the other models. The higher inpatient service use rate for men may be accounted for by the fact that age-specific mortality rates for older men are higher than for older women (Mustard, Kaufert, Kozyrskyj, & Mayer, 1998). End-of-life care is expensive; a significant proportion of lifetime medical expenses is used in the final year of life (Mustard, Kaufert, Kozyrskyj, & Mayer, 1998). Further, social constructionist theories of gender may be useful to understand differential patterns of service use among men and women. Varying social constructions of illness, in terms of attitudes, beliefs, behaviors, and gender roles, may affect service utilization patterns on the basis of gender (Redondo-Sendino, Guallar-Castillon, Banegas, Rodriguez-Artalejo, 2006). Social roles, attitudes, and beliefs of men may preclude them from seeking more routine or preventive care that may increase the likelihood of illness progressing to more advanced states or stages requiring higher levels of care, thereby necessitating higher rates of inpatient service use. In general, men are more likely to delay treatment-seeking (Noone & Stephens, 2008) and use fewer outpatient services than women (Bertakis, Azari, Helms, Callahan, & Robbins, 2000; Kouzis & Eaton, 1998). Their reluctance to seek the more routine or preventive medical care that might reduce inpatient rates may originate in socially constructed masculine identities stipulating that men not appear vulnerable or weak by asking for help (Noone & Stephens, 2008).

The final aim of the study was to present the demographic and health characteristics of high service utilizers. The cluster analyses allow for a distinctive profile of this group to emerge. High utilizers of services are of interest not only to inform health treatment and interventions but also to develop health policy (Henk et al., 1996). The majority of health care services are consumed by a relatively small group of patients, and these trends are related to psychological distress, particularly depression (Henk et al., 1996). Research in primary care has demonstrated that patients with major depression use health services at a disproportionate rate. Katon et al. (1990) found that 10% of patients use more outpatient services, specialty medical services, and inpatient services than the 50% of lowest service utilizers in these clinics.

The cluster analyses demonstrated that the overwhelming majority of older adults were low and moderate service utilizers. For both outpatient and inpatient services, the high service utilization group comprised just over 10% of each respective sample, and low service utilizers made up nearly half of each sample. While significant relationships between depression and inpatient service utilization were not demonstrated in the regression models, a clear trend of depression is observed among high service utilizers in the cluster analyses. In both outpatient and inpatient services, the high service utilization group had the highest levels of depression. Similarly, only limited associations between functional disability, as measured by ADLs, and IADLs, were observed in the regression models, with IADLs only being significantly related to inpatient service use. In the cluster analyses, however, high levels of ADLs and IADLs were associated with high service utilization. These findings corroborate prior studies demonstrating positive associations between depression and service utilization (Himelhoch, Weller, Wu, Anderson, & Cooper 2004; Katon, Lin, Russo, & Unützer, 2003) and between disability and service utilization (Chen et al., 2014). In both models, there appears to be a direct correlation between the levels of depression, ADLs, and IADLs with the level of service utilization. Those with the highest levels of depression/ADLs/IADLs had the highest service utilization, and those with the lowest levels of depression/ADLs/IADLs had the lowest service utilization. Using

Andersen and Newman's (2005) theoretical framework, depression, ADLs, and IADLs are health variables that relate to the individual determinant of illness level. As previously mentioned, illness level is regarded as the most direct cause of health services utilization (Andersen & Newman, 2005). High levels of illness are more recognizable by the individual and family members and thus more likely to lead to health services utilization. Given that the high service utilizers are a relatively small group among both outpatient and inpatient users, this finding supports trends from other studies showing that those with major depression are disproportionately represented among high service users (Katon et al., 1990).

The importance of insurance for the high service utilization group was also illustrated, with the high service utilization group for outpatient services being also the most insured. Interestingly, the high service utilizers had the most Urban Employee Insurance and the most New Cooperative Insurance. In the case of Urban Employee Insurance, this may be due to its relatively higher level of reimbursement as compared to Urban Resident Insurance (Meng & Teng, 2010; Sun, Deng, Xiong, & Teng, 2014). With regard to New Cooperative Insurance, both the central and local governments subsidize it, and its premiums are relatively low compared to the other forms of insurance (Barber & Yao, 2010).

For both outpatient and inpatient services, the high service utilization group was the most rural. This is an unexpected finding as prior studies have tended to find less utilization and lower medical costs associated with rural residents in the general population (Chau, 2010; Chen, 2013). For example, in 2003, 13% of urban residents and 19% of rural residents did not seek outpatient services as a result of exorbitant costs (Chen, 2013; Ling, Liu, Lu, & Wang 2011). There are also fewer health facilities (Hougaard, Osterdal, & Yu, 2011), and thus less health care access exists in rural areas. The high service utilization rate observed in this study may be due to a combination of more illness and thus greater need for service (Fang et al., 2014), as well as the relatively high level of insurance coverage among the rural older adult population that is observed in this analysis.

For outpatient services, the high service utilizer group was also the most female. This finding is as expected and consistent with an extensive literature showing that women disproportionately seek outpatient care (Bertakis, Azari, Helms, Callahan, & Robbins, 2000; Kouzis & Eaton, 1998). As previously mentioned, varying social constructions of illness, in terms of attitudes, beliefs, behaviors, and gender roles, may affect service utilization patterns on the basis of gender (Redondo-Sendino, Guallar-Castillon, Banegas, Rodriguez-Artalejo, 2006). The social roles, attitudes, and beliefs of women may encourage them to seek external help whenever a need becomes apparent to them or to their families. In contrast, as mentioned earlier, masculine social identities may dissuade men from external help-seeking or actions suggestive of weakness or vulnerability (Noone & Stephens, 2008).

Within inpatient services, the high service utilization group tended to be the oldest and also had the least social support. These findings are expected in light of the fact that, in the elderly years, health status tends to deteriorate with increasing age. Also, more socially-isolated individuals could have a greater need for services and thereby use more of them (Kouzis and Eaton, 1998). As referenced previously, depression and social isolation have been shown to be predictive of mortality in patients with chronic illness (Chesney, 1993; Friedmann et al., 2006). The greater susceptibility to illness on the part of those with little social support could lead to higher need for and use of healthcare.

## II. STUDY LIMITATIONS

Limitations of the study include the self-reported nature of the data and cross-sectional study design. As such, causality cannot be inferred, and the results should be interpreted with caution. Data are subject to possible recall bias and other limitations of self-reporting. Although significant levels of depression are observed in outpatient populations in this study, the face-to-face nature of the interviews could potentially bias towards under-reporting on sensitive topics of depression and other chronic illnesses. Also, the fact that illness patterns and health services utilization patterns can vary from year to year, particularly for inpatient service use, cannot be captured in this cross-sectional study.

Another limitation of the study is that it does not account for the reason for the indicated health service visit, so although the respondents' chronic condition diagnoses and their depressive symptoms are known, it is not known specifically for which conditions or illnesses individuals actively sought help when they indicated they had an outpatient visit or hospital stay. From the literature, it is known that the vast majority of those with depression do not seek services to directly treat their depression. Thus, those with depression may be using more outpatient services, but depression is likely not being treated in these services.

The dataset also has a substantial amount of missing data. The final regression models for the general population of older adults were based on the data for 4,022 cases, or approximately 52% of the total sample. While it is not unusual for large datasets of this size to have a significant amount of missing data, it is noteworthy that the patterns of nonresponse in this study potentially bias parameter estimates. The study used listwise deletion to exclude missing cases, in accordance with procedures used in other published studies using the CHARLS datasets (Lei et al., 2014a, 2014b; Li & Zhang, 2013; Strauss et al., 2012).

To better understand the patterns of missing data, demographic comparisons were conducted of the group that was excluded from the final regression model ("missing group") and the included ("non-missing group") group. Independent samples *t*-tests demonstrated significant differences by household expenditure, with higher expenditure respondents being over-represented in the missing group ($t$ =-2.79, $p$<.01) for outpatient services. Chi-square tests revealed that males ($X^2$ = 48.64, $p$<.001), urban ($X^2$ =41.81, $p$<.001), and more highly educated individuals ($X^2$ = 19.01, $p$<.001) were over-represented in the missing group. No differences were found for age or marital status. Similar trends were observed for the inpatient group. Results are reported in Appendix D.

Related to the issue of missing data, another limitation is that, with respect to the outcome variable of service use, the study only analyzes data on outpatient/inpatient service use versus non-use; analyses of amount or degree of service use are not included. Amount/degree of service use is a common feature of health service utilization studies, and such questions were asked in the CHARLS survey. However, there was a large number of missing data for these questions, which precluded these items from inclusion in the analyses.

Another limitation is that, while the study controls for the number of chronic health conditions co-occurring with depression, it does not control for the nature or the severity of those conditions. The study did not examine relationships between specific chronic conditions and depression. So, it is not known if the patterns of health care utilization are attributable to certain physical health conditions to a greater extent than others.

An additional limitation is that the study only measured depression and did not consider the effects of comorbid mental illness. Depression is frequently comorbid with anxiety and other mental health conditions (Scott et al., 2007), which adds to the burden of disability. The CES-D is the only validated instrument used in the CHARLS for mental health. Since other mental health conditions are unmeasured, it was not possible to assess their effects.

Overall, the results of the study confirm that the findings from studies in western countries looking at the relationship between depression and health services utilization also hold true for China in terms of outpatient service use. These findings point to the importance of implementing and evaluating programs and services to more effectively address the specific needs of older adults with depression and comorbid chronic physical conditions.

## III. IMPLICATIONS FOR PRACTICE, POLICY, AND RESEARCH

Measures to improve the health of older adults with depression and comorbid chronic health conditions should utilize a multi-pronged strategy that includes increasing public awareness of depression; improving screening and treatment of depression in general health settings where patients with chronic conditions access services, namely in primary care and in the course of care for chronic physical conditions; making health services more accessible through improvements to insurance; and building capacity in the existing mental health service system for assessment and treatment of depression and other common mental disorders; and improving policy practices related to mental health treatment and prevention.

Andersen's theory of healthcare utilization is a useful organizing framework not only for understanding the relationship between depression, chronic health condition and health services utilization among older adults in China but also the implications of the research. The following is a set of implications for practice, policy, and research organized according to Andersen's model under the primary components: Societal Determinants, Health Service System, and Individual Determinants.

### Societal Determinants: Public Education

Given the association between depression and healthcare use in the general population of older adults and the under-treatment of depression documented in the literature, practice implications include the importance of public education to build awareness about depression and its treatment and to combat the stigma associated with mental illness. In a critical review of published studies of 15 public education programs in eight countries, including Hong Kong, about depression and suicide, Dumesnil & Verger (2009) determined that public education programs contributed to improvement in public knowledge and attitudes toward these conditions, at least in the short term. They concluded that simultaneous application of several strategies, such as a media campaign, distribution of educational material, and training of health care professionals and other "gatekeepers" would be more effective than the often-implemented single strategy of distributing educational materials alone, and that implementing programs at a local level to target more homogenous populations is often more effective than a national, more broadly-focused program. More research is needed into methods and interventions to effectively

spread knowledge and reduce the stigma associated with depression and other mental disorders (Collins et al., 2011)

Health Service System: Integration of Care

The findings point to the need for the integration of mental health care into chronic disease care. The high level of depression in outpatient settings among the general older adult population as well as among the subpopulation of those with chronic conditions identified in the study suggests that depression screening in chronic disease management programs could potentially lead to improved recognition and treatment of depression. And treated depression could then potentially lead to less associated disability and improved health status overall. More attention should be directed towards implementing and evaluating the effectiveness of routine depression screening and management techniques specifically within chronic disease management programs (Stein, Cox, Afifi, Belik, & Sareen 2006).

Integration of mental health into primary care is another priority and a long-standing recommendation of the World Health Organization and other institutions (World Health Organization, 2008). In 2006, the Chinese central government established policies to encourage primary care providers to implement chronic disease management and treatment guidelines (Chen et al., 2012; Wang, Kushner, Frey, Du, & Qian 2007). More primary care physicians and other health service gatekeepers will require training in depression screening and assessment (Chen et al., 2012). In terms of implications for social work practice, the collaborative care model has shown to be efficacious in studies by Unützer, et al. (2002) & Katon et al. (2010). Collaborative care integrates behavioral health workers into the medical treatment team, and behavioral screening and treatment into medical treatment plans. Collaborative care is an evidence-based model of care for chronic conditions, with the following key components outlined by Unützer et al., (2002): “collaboration among primary care practitioners, patients, and specialists on a common definition of the problem, development of a therapeutic alliance, a personalized treatment plan that includes patient preferences, proactive follow-up and outcomes monitoring by a depression care manager, targeted use of specialty consultation, and protocols for stepped care.” To further explore the burden of depression on healthcare service use, future studies could examine the potential cost savings of treating depression in the presence of chronic medical conditions. Successfully treated depression could potentially reduce other medical costs by reducing use of non-essential medical services (Pearson et al.,1999). More research is needed to understand the specific individual- and system-level burdens associated with depression among high-service utilizing patients (Pearson et al., 1999).

Health Service System: Insurance

Future studies should further explore the relationship between insurance and health services utilization among those with depression and chronic health conditions. Out-of-pocket payments are still the dominant form of payment for health care in China (Chau, 2010). According to Hu (2004), most insurance schemes in the Asia-Pacific region, with the exception of Taiwan, do not have reimbursement schedules specifically for depression. In Taiwan, patients

with depression are considered chronic patients and are exempt from outpatient and inpatient co-payments (Hu, 2004), but this is not the case in China. Besides for Urban Resident Insurance, no other significant effects of other forms of insurance were observed. To encourage the use of insurance for needed care, the government could increase subsidies and the reimbursement level, lower premiums and co-payments, as well as lower other out-of-pocket costs for the patient. Liu and Zhao (2014) found that Urban Resident Insurance and New Cooperative Medical Insurance have essentially increased health services utilization for formal medical services, including both outpatient and inpatient care, and total health expenses, but they have not reduced out-of-pocket expenses. For the NCMS, a number of studies have not found any reduction in out-of-pocket expenses (Cheng et al., 2015; Lei & Lin, 2009).

The central government should also address the issue of urban-rural inequity of payments. Dong et al. (2014) found that compensation ratios for both outpatient and inpatient care are not adjusted to compensate for rural counties' levels of economic development or per capita GDP. Consequently, residents living in poor rural regions bear a disproportionate financial burden for healthcare (Dong et al., 2014).

Other researchers recommend policy interventions in the form of education and outreach programs to encourage insurance utilization in this group (Wang et al., 2013). Such programs could increase awareness about the existence of health insurance among the population that remains uninsured; spread knowledge about the benefits provided through health insurance and how to enroll; educate individuals and households about reimbursement processes and medical savings accounts. Outreach is important not only to enroll those who are currently uninsured, but also to educate and encourage those with insurance on maximizing the available benefits. China can look to models of insurance outreach and enrollment in Western countries such as the U.S. that have implemented both large scale and more targeted or tailored public insurance outreach programs (Plaza, 2012).

### Health Service System: Capacity-Building

There are few mental health service facilities in rural areas (Hu, Higgins, & Higgins, 2006), and the disparity in resources and skills between the wealthy, coastal, urban areas and the inland, western, and ethnic regions is dramatic (Liu, Ma et al., 2011). A major policy issue relates to national level mandates; it is the responsibility of the local governments to pay for the implementation of the mandates, which creates financial hardship for poorer regions.

Another critical issue is the shortage of specially trained mental health professionals. In 2004, China had 1.24 psychiatrists and psychiatric registrars per 100,000 population and 1.91 licensed psychiatric nurses per 100,000 population, while the global average is 4.15 psychiatrists and 12.97 psychiatric nurses per 100,000 population (Liu, Ma et al., 2011). There are very few clinical psychologists and social workers practicing in mental health. According to Liu, Ma et al. (2011), psychiatry is not a popular field to enter among medical students, and psychiatric hospitals have difficulty retaining professionals with advanced levels of education and expertise. Increasing funding for scholarships and raising salaries for mental health professionals may improve the outlook for the field. Sustainable models for training and increasing the number of lay and specialist care providers in evidence-based service delivery (Collins et al., 2011) is needed, and such models need to be tailored to the Chinese context.

Health Service System: Evaluation of mental health policies

China has been devising and enacting mental health policy since 1987, with the goal of developing the mental health system (Wong, Zhuang, Pan, & He 2013). Its policies emphasize the importance of attending to mental health for the sake of maintaining social stability. They also recognize the role of mental health care in safeguarding economic and social development (Ministry of Health, 2008).

In 2012, China passed its first major policy initiative pertaining to mental health at the national level. While it is laudable that the country has passed its first nationwide initiative, the effects of the implementation have yet to be documented in the literature (Wong, Zhuang, Pan, & He, 2013).

One of the major policy documents with particular relevance to the mental health of older adults is the 2008 Guidelines for the Development of (the) National Mental Health System (2008-2015), promulgated by the Ministry of Health. In these guidelines, a priority has been set for elderly mental health, specifically with regard to research, prevention work, counseling for elders, their families, and their caregivers, and publicizing information about dementia, depression and other illnesses in old age. The language is broad and fairly comprehensive in scope. However, it is unclear from the English-language literature what the impact of this policy has been. Scholars have commented that mental health policy goals have in general largely not been achieved (Shao, Xie, Good, & Good, 2010; Wong, Zhuang, Pan, & He 2013). Formal evaluations of individual policy goals should be conducted and their results should be published to be of most value to policy makers, program planners, and researchers.

Most recently, as of June 2015, several ministries of the Chinese government, including the National Health and Family Planning Commission have promulgated an extensive work plan with laudable goals to address mental health concerns nationally. Specific goals of the plan, by 2020, include: 1) improvement of a mental health management and coordination mechanism across three administrative levels – province, city, and county - and 70% of villages and towns; 2) establishment of mental health institutes in the three administrative districts, and a requirement for a mental health department in at least one general hospital at the village and town level; 3) increasing the psychiatrist workforce by 40,000; 4) more effective treatment and monitoring for the seriously mentally ill, with a target of monitoring of 80% of such patients; 5) increasing public awareness of common mental disorders, including depression; and 6) establishment of a rehabilitation network comprised of medical institutes, community-based rehabilitation centers, social organizations, and families. The plan noted that the depression treatment rate should increase by 50% by 2020 as a result of these measures (China Daily News, July 8, 2015; Xinhua News, June 18, 2015). Details about the implementation plan were not found in a search of the related English language news and other coverage at the time of this writing. As with other Chinese mental health policies, program evaluations should be administered and results widely disseminated to inform policy stakeholders.

Individual Determinants: Prevention-oriented research and interventions

In a systematic review and meta-analysis of 30 controlled trials, Forsman, Schierenbeck, and Wahlbeck (2010) evaluated a number of psychosocial interventions for the prevention of depression in older adults and found a small effect for such interventions, defined as any intervention that emphasizes psychological or social factors, in reducing depression. Studies included for analysis evaluated physical activity, social activities, skills-training, group support, and various forms of life reviewing or recall of past events. Of these, the only type of intervention with a statistically significant effect on reducing depression was social activities. Based on this meta-analysis, more studies need to be conducted, particularly within the Chinese context, on the types of interventions that can prevent the onset of depression in the older adult population. And based on this evidence, policies can be developed to promote prevention of both depression and chronic physical diseases. Examples could include healthcare system policies to increase routine physical exams and screenings (Spalding & Sebesta, 2008) for conditions such as hypertension and diabetes, promoting guidelines on diet, nutrition, exercise, and tobacco and alcohol use, as well as urban planning policies to promote environments that encourage physical activity (Jackson, 2003). Such policies need to be tailored to the Chinese context.

## IV. CONCLUSION

This study examines the important issue of depression and its relationship to health services utilization in China, a topic that has previously not been adequately addressed despite its far-reaching implications for human suffering and costs to the health system. Andersen's theory of healthcare utilization is a useful organizing framework for understanding the relationship between depression, chronic health conditions, and health services utilization among older adults in China and the related implications of the study's findings. From the cluster analysis, it is apparent that the enabling factor of insurance as well as a number of predisposing characteristics, namely, having higher levels of depression, higher levels of ADLs and IADLs, age, gender, urban/rural residence and social support factor into the health care patterns of high service utilizers. The cluster analysis allows us to examine patterns at the varying levels of health services utilization (low, moderate, and high) that are not observable through the regression analyses. These analyses demonstrate that rural residents and those with the highest levels of depression and functional disability are among the highest-level utilizers of both outpatient and inpatient services.

The findings from the regression analyses confirm that the findings of studies conducted in western countries - of a positive association between depression, chronic health conditions and health services utilization - also hold true for China, specifically with regard to outpatient health services. Depression is positively associated with outpatient service use, as we would expect, but not associated with inpatient service use, which was unexpected. Depression may be driving people to seek more outpatient services for a number of reasons, including the fact that depression can mimic or exacerbate the suffering from physical illness; its associated conditions of anxiety and worry may drive people to seek more services; and the associated decreased levels of self-care and non-adherence to treatment can worsen physical health conditions. All of these possible explanations could apply to inpatient services as well, but because inpatient services are

very costly to obtain in China, with insurance not providing adequate coverage, they may be more difficult to access. Patients must also be admitted to the hospital, which is a higher level of medical necessity required for access as compared to outpatient services. Some outpatient service use associated with the presence of depression may be considered to be medically unnecessary.

Illness level, as measured by number of chronic conditions, and ability to pay for service, as measured by household expenditure, appear to be extremely important factors in determining health services utilization patterns. Indeed, cost of service appears to be a major factor as household expenditure was one of the strongest and most consistent predictors of health service use across all of the regression models. Relatedly, we also do not observe as strong a trend with respect to the different types of insurance as might be expected given the expansion of health insurance in recent years due to health care reforms. Conceivably, more significant relationships with inpatient service use would be observed if the various types of available insurance were more beneficial to this particular population. However, the cluster analysis demonstrates that insurance is indeed important for the small group of highest service utilizers. Also, we see in the regression models that Urban Resident insurance, which targets the poorer, non-working and more vulnerable populations, including the elderly, makes a difference to health services utilization among the sample. Future studies should further explore the relationship between insurance and health services utilization among those with depression and chronic health conditions. Besides cost, the other major factor demonstrating a strong relationship to health services utilization in all four regression models was the number of chronic health conditions. As per Andersen and Newman's (2005) model, illness level is an important individual determinant of health service use.

Although the study was limited by the fact that the reason for the service visit is unknown, it is known from the literature that the vast majority of Chinese with mental disorders do not seek treatment. This may be due to aforementioned cultural reasons of stigma, shame, and lack of recognition and understanding of what depression and other mental disorders are. What this suggests for this study is that the types of services that were sought in this study likely tended to be health services to treat physical health conditions rather than mental health services to treat depression and other mental disorders. Given the link between depression, chronic health conditions, and disability, one implication of the findings is that treating depression in chronic care management settings or in primary care provides a potential opportunity to reduce the negative health outcomes associated with chronic health conditions and to reduce health service costs overall to the system. Future research can assess the potential cost savings to treating depression in the presence of chronic conditions. More research is also needed to test the effectiveness of specific interventions that can promote broader public awareness of depression and knowledge about treatment options; evaluate the efficacy of depression screening and management techniques in chronic care management settings; and evaluate implementation of mental health policy goals. The Chinese government has made great strides in expanding insurance coverage; to increase access to services, more efforts toward improving the utility of insurance and in bolstering mental health workforce capacity are urgently needed to meet the needs of this vulnerable and rapidly growing older adult population.

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# APPENDICES

## Appendix A. Description of CHARLS Multi-Stage Sampling Design

The following description is excerpted from Zhao, et al., (2013):

*County-level sampling*

At the first stage, all county-level units with the exception of Tibet were stratified by region, within region by urban district or rural county, and by GDP per capita. Region was a categorical variable based on the National Bureau of Statistics (NBS) division of province area. After this sorting (stratification), the population of each county was listed, along with the cumulative population (populations of each county plus all the counties higher on the list). If *N* is the total population of all the county-level units and 150 is the number of counties to be sampled, then an interval of n=*N*/150 was defined. The first county was selected by choosing a random number r from 0 to 1, and selecting the first neighborhood with cumulative population greater than r*n. Then the interval n was added to this starting point, and the second county was the first county on the list with a cumulative population greater than r*n+n. The third county was chosen once again adding the interval n, and picking the first county on the list with cumulative population greater than r*n+n+n.

*Neighborhood-level sampling*

The sample used administrative villages (*cun*) in rural areas and neighborhoods (*shequ*) in urban areas, which comprise one or more former resident committees (*juweihui*), as primary sampling units (PSUs). Three PSUs were selected within each county-level unit, using PPS (probabilities proportional to size) sampling. Note that rural counties contain both rural villages and urban neighborhoods and it is also possible for urban districts to contain rural administrative villages. For each county-level unit, the list of all PSUs was randomly sorted. Then the population of each PSU was listed, along with the cumulative population (populations of each PSU plus all the PSUs higher on the list). If *N* is the total population of the county-level unit and 3 is the number of PSUs to be sampled, then an interval of n=*N*/3 was defined. The first PSU is selected by choosing a random number r from 0 to 1, and selecting the first neighborhood with cumulative population greater than r*n. Then the interval n is added to this starting point, and the second PSU is the first PSU on the list with cumulative population greater than r*n+n. The third PSU is chosen by once again adding the interval n, and picking the first PSU on the list with cumulative population greater than r*n+n+n. This procedure was implemented using the STATA command *samplepps*.

In neighborhoods with very large populations (over 2000 households), given the high costs of preparing map-based sampling frames, supervisors were permitted to select a geographic

subset of the neighborhood as the PSU, for example, one or more former neighborhood committees (*juweihu*) in the community (*shequ*). Enough sub-neighborhoods were to be sampled to ensure there were a sufficient number of eligible sample respondents. Sub-neighborhoods would then be selected based on the estimated population of each sub-neighborhood. There were 30 communities that had to be split this way.

Due to mistakes in the original sampling frame, of the 450 communities originally chosen, six had to be replaced for the following reasons: two villages disappeared due to resettlement, one urban community was expanded to becoming a county-level urban district, two communities were nearly entirely collective dwelling residents, one being university dormitories and the other being prison, which were not supposed to be part of the samples. The choice of replacement communities followed the exact procedure outlined above. In six counties, the administrative boundaries changed so that the chosen communities fell within the two counties. These communities were not replaced. As a result, the final number of counties became 156.

*Household-level sampling*

In each PSU, a sample of dwellings from the frame was selected. This was constructed based on maps prepared by mappers/listers with support of local informants. In order to get accurate sample frames in each village or community, a mapping/listing software program named CHARLS-GIS was developed. For each PSU, a mapper was first sent to the community with a GPS unit to collect the boundary, then the CHARLS office used the boundary information to capture Google Earth map images, which were used as the basis for the mapping and listing. Then, all buildings in each PSU were enumerated with photos and GPS readings, and dwellings within each building were listed. Collective living dwellings such as military bases, schools, dormitories or nursing homes, were excluded.

Then each PSU sampling frame was checked by the CHARLS headquarters to ensure that all buildings within the community boundary were enumerated. After verification, the supervisors used CHARLS-GIS software to randomly sample 80 households, which were marked on the map and sent back to mappers/listers in the field to collect information for these households including age of the oldest person, name of the household head, telephone number, and whether the dwelling unit was empty or not. The number of households sampled was greater than the targeted sample size of 24 households per PSU in anticipation of sampled households not having any members aged 45 or older, the possibility of an empty house and household non-response. Based on this information, the supervisor randomly sampled a specific number of households for each community/village using the CHARLS/GIS software. The initial sampling was a random sample from the 80 households. From these households, the fraction of households that were age-eligible and the number of empty dwellings was computed. From this, neighborhood/village-specific sampling proportions were derived and then the sample from the entire sampling frame was chosen.

After final sampling work in the PSU was completed, the information on sampled households was sent back to the mappers/listers, who loaded this information in the CHARLS-GIS software on their computer. The mappers/listers then sent “A letter to the respondent.” Simultaneously, the IT in the CHARLS project office transferred the sampled household lists and addresses for a given PSU to the interviewer’s CAPI system.

All age-eligible sample households in each PSU who were found and willing to participate in the survey were interviewed. Some dwellings had multiple households living in them. In these cases, one household that had an age-eligible member was chosen. Thus, variation in the share of sampled households that could be found, had an age-eligible member, or were willing to participate in the survey led to different numbers of completed household surveys in each PSU. This is corrected for in the sampling weights.

*Respondent-level sampling*

In each sampled household, a short screening form was used to identify whether the household had a member meeting the age-eligibility requirements. If a household had persons older than 40 and meeting the residence criterion, one of them was randomly selected. If the chosen person was 45 or older, then s/he became the main respondent, and that person's spouse was also interviewed. If the chosen person was between the ages of 40 and 44, s/he was reserved for a refresher sample, for future rounds of the survey. If an age-eligible person was too frail to answer questions, a proxy respondent was identified to help answer questions. This person was usually a spouse or knowledgeable adult child, if there was one in the house. Households without members 45 or older were not interviewed.

Questions concerning household roster, household organization, and financial transfers were answered by the "Family Respondent," who could be either the main respondent or the spouse of the main respondent. Whenever possible, the person chosen was the individual most able to answer the questions in these sections accurately.

Similarly, a "Financial Respondent" was chosen to answer questions on family income, expenditures, and assets. In this case, any household member age 18 or above could be selected as the "Financial Respondent" (including the main respondent and the main respondent's spouse), with the main criteria again being which person is most knowledgeable about these matters.

# Appendix B. Collinearity Statistics

## Outpatient Service Use

| Variable | Tolerance | VIF |
|---|---|---|
| CES-D score | .812 | 1.231 |
| Number of physical health conditions | .926 | 1.080 |
| ADLs | .572 | 1.748 |
| IADLs | .553 | 1.808 |
| Insurance | .998 | 1.002 |
| Urban/rural residence | .879 | 1.137 |
| Annual household expenditure | .944 | 1.060 |
| Gender | .829 | 1.206 |
| Social support | .982 | 1.018 |
| Age | .842 | 1.187 |
| Marital status | .861 | 1.162 |
| Highest level of education | .761 | 1.314 |

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| Marital status | .861 | 1.162 |
| Highest level of education | .761 | 1.314 |

# Pairwise Correlation Matrices

## Outpatient Service Use

| | Outpatient | Age | Gender | Urban/Rural | Expenditure | Educ_None | Educ_<HS | Educ>HS | Married |
|---|---|---|---|---|---|---|---|---|---|
| Outpatient | 1.0000 | | | | | | | | |
| Age | 0.0068 | 1.0000 | | | | | | | |
| Gender | -0.0356 | -.0212 | 1.0000 | | | | | | |
| Urban/Rural | -0.0254 | .0260 | -.0283 | 1.0000 | | | | | |
| Expenditure | 0.0451 | -.1469 | .0448 | .2592 | 1.0000 | | | | |
| Educ_None | 0.0198 | .2476 | -.3503 | -.1901 | -.1896 | 1.0000 | | | |
| Educ<HS | -.0170 | -.2359 | .2772 | .0610 | .0740 | -.8627 | 1.0000 | | |
| Educ>HS | -.0043 | -.0095 | .1228 | .2390 | .2137 | -.2127 | -.3107 | 1.0000 | |
| Married | -.0095 | -.3275 | .1983 | .0189 | .1764 | -.1912 | .1440 | .0813 | 1.0000 |
| Social Support | .0151 | -.0256 | -.0585 | -.0444 | -.0222 | -.0032 | -.0016 | .0092 | -.0372 |
| Insur_None | -.0152 | .0058 | .0018 | .0147 | .0163 | -.0342 | .0299 | .0065 | -.0037 |
| Insur_UrbEmp | .0116 | -.0019 | -.0098 | -.0078 | -.0097 | .0118 | -.0145 | .0058 | .0052 |
| Insur_UrbRes | .0317 | .0026 | -.0019 | -.0339 | -.0302 | .0117 | -.0133 | .0038 | -.0060 |
| Insur_NewCoop | -.0151 | -.0024 | .0053 | .0063 | .0026 | .0124 | -.0032 | -.0170 | -.0016 |
| Insur_GovtOnly | .0094 | -.0056 | .0044 | .0176 | .0251 | -.0085 | -.0042 | .0239 | .0120 |
| ADLs | .0295 | .2023 | -.0129 | -.0182 | .0055 | .1048 | -.0813 | .0480 | -.0656 |
| IADLs | .0535 | .2938 | -.0703 | -.0362 | -.0069 | .1856 | -.1441 | -.0704 | -.1166 |
| CHC | .1900 | -.0057 | -.0554 | .0104 | .0824 | -.0106 | .0115 | -.0023 | .0092 |
| CHC_Depression | .1193 | .0348 | -.1556 | -.1508 | -.1208 | .1368 | -.0609 | -.1294 | -.0992 |

# Outpatient Service Use – continued

| | Social Support | Insur_ None | Insur UrbEmp | Insur_ UrbRes | Insur NewCoop | Insur GovtOnly | ADLs | IADLs | CHC | CHC Depression |
|---|---|---|---|---|---|---|---|---|---|---|
| Social Support | 1.0000 | | | | | | | | | |
| Insur_None | .0166 | 1.0000 | | | | | | | | |
| Insur_UrbEmp | -.0031 | -.1259 | 1.0000 | | | | | | | |
| Insur_UrbRes | -.0021 | -.0780 | -.0788 | 1.0000 | | | | | | |
| Insur_NewCoop | -.0034 | -.5575 | -.5637 | -.3491 | 1.0000 | | | | | |
| Insur_GovtOnly | -.0179 | -.0448 | -.0453 | -.0280 | -.2004 | 1.0000 | | | | |
| ADLs | -.1036 | -.0141 | .0133 | -.0020 | -.0037 | -.0082 | 1.0000 | | | |
| IADLs | -.1005 | -.0147 | .0229 | -.0041 | -.0001 | -.0139 | .7105 | 1.0000 | | |
| CHC | .0119 | .0185 | -.0003 | .0010 | -.0119 | -.0039 | .1199 | .1551 | 1.0000 | |
| CHC_Depression | -.0175 | -.0097 | .0147 | .0140 | -.0027 | -.0281 | .2307 | .2687 | .1928 | 1.0000 |

# Inpatient Service Use

| | Inpatient | Age | Gender | Urban/Rural | Expenditure | Educ_None | Educ_<HS | Educ>HS | Married |
|---|---|---|---|---|---|---|---|---|---|
| Inpatient | 1.0000 | | | | | | | | |
| Age | .0572 | 1.0000 | | | | | | | |
| Gender | .0170 | -.0212 | 1.0000 | | | | | | |
| Urban/Rural | .0330 | .0260 | -.0283 | 1.0000 | | | | | |
| Expenditure | .1128 | -.1469 | .0448 | .2592 | 1.0000 | | | | |
| Educ_None | -.0144 | .2476 | -.3503 | -.1901 | -.1896 | 1.0000 | | | |
| Educ<HS | .0015 | -.2359 | .2772 | .0610 | -.0740 | -.8627 | 1.0000 | | |
| Educ>HS | .0243 | -.0095 | .1228 | .2394 | .2137 | -.2127 | -.3107 | 1.0000 | |
| Married | .0175 | -.3275 | .1983 | .0189 | .1764 | -.1912 | -.1440 | .0813 | 1.0000 |
| Social Support | -.0395 | -.0256 | -.0585 | -.0444 | -.0222 | -.0032 | -.0016 | .0092 | -.0372 |
| Insur_None | -.0004 | .0058 | .0018 | .0147 | .0163 | -.0342 | .0299 | .0065 | -.0037 |
| Insur_UrbEmp | -.0169 | -.0019 | -.0098 | -.0078 | -.0097 | .0118 | -.0145 | .0058 | .0052 |
| Insur_UrbRes | -.0237 | .0026 | -.0019 | -.0339 | -.0302 | .0117 | -.0133 | .0038 | -.0060 |
| Insur_NewCoop | .0219 | -.0024 | .0053 | .0063 | .0026 | .0124 | -.0032 | -.0170 | -.0016 |
| Insur_GovtOnly | .0047 | -.0056 | .0044 | .0176 | .0251 | -.0085 | -.0042 | .0239 | .0120 |
| ADLs | .1126 | .2023 | -.0129 | -.0182 | .0055 | .1048 | -.0183 | -.0480 | -.0656 |
| IADLs | .1485 | .2938 | -.0703 | -.0362 | -.0069 | .1856 | -.1441 | -.0704 | -.1166 |
| CHC | .1850 | -.0057 | -.0554 | .0104 | .0824 | -.0106 | .0115 | -.0023 | .0092 |
| CHC_Depression | .0677 | .0348 | -.1556 | -.1508 | -.1208 | .1368 | -.0609 | -.1294 | -.0992 |

# Inpatient Service Use – continued

| | Social Support | Insur_ None | Insur UrbEmp | Insur_ UrbRes | Insur NewCoop | Insur GovtOnly | ADLs | IADLs | CHC | CHC Depression |
|---|---|---|---|---|---|---|---|---|---|---|
| Social Support | 1.0000 | | | | | | | | | |
| Insur_None | .0166 | 1.0000 | | | | | | | | |
| Insur_UrbEmp | -.0031 | .1259 | 1.0000 | | | | | | | |
| Insur_UrbRes | -.0021 | .0780 | -.0788 | 1.0000 | | | | | | |
| Insur_NewCoop | -.0034 | -.5575 | -.5637 | -.3491 | 1.0000 | | | | | |
| Insur_GovtOnly | -.0179 | -.0448 | -.0453 | -.0280 | -.2004 | 1.0000 | | | | |
| ADLs | -.1036 | -.0141 | .0133 | -.0020 | .0037 | -.0082 | 1.0000 | | | |
| IADLs | -.1055 | -.0147 | .0229 | -.0041 | -.0001 | -.0139 | .7105 | 1.0000 | | |
| CHC | .0119 | .0185 | -.0003 | .0010 | -.0119 | -.0039 | .1199 | .1551 | 1.0000 | |
| CHC_Depression | -.0175 | -.0097 | .0147 | .0140 | -.0027 | -.0281 | .2307 | .2687 | .1928 | 1.0000 |

# Appendix C. Center for Epidemiologic Studies Short Depression Scale (CES-D 10)

Below is a list of some of the ways you may have felt or behaved. Please indicate how often you have felt this way ***during the past week***.

0= Rarely or none (less than one day)
1= Some or a little of the time (1-2 days)
2= Occasionally or a moderate amount of time (3-4 days)
3=All of the time (5-7 days)

Items:

1. I was bothered by things that usually don't bother me.
2. I had trouble keeping my mind on what I was doing.
3. I felt depressed.
4. I felt that everything I did was an effort.
5. I felt hopeful about the future. (Reverse code item)
6. I felt fearful.
7. My sleep was restless.
8. I was happy. (Reverse code item)
9. I felt lonely.
10. I could not "get going."

# Appendix D. Missing Group Tests

## Outpatient Service Use

| | Frequency | Percent |
|---|---|---|
| **Not missing data** | 4022 | 52.31 |
| **Missing data** | 3667 | 47.69 |
| **Total** | 7689 | 100.00 |

**T-test: Age**

| Group | Obs | Mean | Std.Error | Std. Dev. | 95% CI | |
|---|---|---|---|---|---|---|
| **Not missing** | 4022 | 68.478 | .107 | 6.796 | 68.268 | 68.688 |
| **Missing** | 3667 | 68.477 | .122 | 7.366 | 68.238 | 68.715 |
| **Combined** | 7689 | 68.477 | .081 | 7.073 | 68.319 | 68.636 |
| **Difference** | | .0092 | .162 | | -.316 | .318 |

$t$=.0057, $df$=7687, $p$=0.9955

**T-test: Annual Household Expenditure**

| Group | Obs | Mean | Std.Error | Std. Dev. | 95% CI | |
|---|---|---|---|---|---|---|
| **Not missing** | 4022 | -.027 | .016 | .988 | -.057 | .004 |
| **Missing** | 2327 | .046 | .021 | 1.019 | .005 | .087 |
| **Combined** | 6349 | $4.61e^{-10}$ | .013 | 1 | -.025 | .025 |
| **Difference** | | -.073 | .026 | | -.124 | -.021 |

$t$=-2.7861, $df$=6347, $p$=0.0054

**Chi-Square test: Gender**

| | Not missing | Missing | Total |
|---|---|---|---|
| **Female** | 2160 | 1675 | 3835 |
| **Male** | 1862 | 1987 | 3849 |
| **Total** | 4022 | 3662 | 7684 |

$X^2(1)$=48.6364; $p$=0.000

**Chi-Square test: Urban/Rural Residence**

| | Not missing | Missing | Total |
|---|---|---|---|
| **Rural** | 2561 | 2070 | 4631 |
| **Urban** | 1461 | 1597 | 3058 |
| **Total** | 4022 | 3667 | 7689 |

$X^2(1)$=41.8053; $p$=0.000

**Chi-Square test: Education**

| | Not missing | Missing | Total |
|---|---|---|---|
| **No formal education** | 1529 | 1320 | 2849 |
| **Less than high school** | 2255 | 2022 | 4277 |
| **High school or more** | 238 | 308 | 546 |
| **Total** | 4022 | 3650 | 7672 |

$X^2(1)=19.0068$; $p=0.000$

**Chi-Square test: Marital Status**

| | Not missing | Missing | Total |
|---|---|---|---|
| **Unmarried/unpartnered** | 857 | 843 | 1700 |
| **Married** | 3165 | 2819 | 5984 |
| **Total** | 4022 | 3662 | 7684 |

$X^2(1)=3.2623$; $p=0.071$

## Inpatient Service Use

| | Frequency | Percent |
|---|---|---|
| **Not missing data** | 4025 | 52.35 |
| **Missing data** | 3664 | 47.65 |
| **Total** | 7689 | 100.00 |

***T*-test: Age**

| Group | Obs | Mean | Std.Error | Std. Dev. | 95% CI | |
|---|---|---|---|---|---|---|
| **Not missing** | 4025 | 68.476 | .107 | 6.795 | 68.266 | 68.686 |
| **Missing** | 3664 | 68.479 | .122 | 7.368 | 68.241 | 68.718 |
| **Combined** | 7689 | 68.477 | .081 | 7.073 | 68.319 | 68.636 |
| **Difference** | | -.003 | .162 | | -.320 | .313 |

$t$=-.0216, $df$=7687, $p$=0.9828

***T*-test: Annual Household Expenditure**

| Group | Obs | Mean | Std.Error | Std. Dev. | 95% CI | |
|---|---|---|---|---|---|---|
| **Not missing** | 4025 | -.027 | .016 | .988 | -.057 | .004 |
| **Missing** | 2324 | .046 | .021 | 1.019 | .005 | .088 |
| **Combined** | 6349 | $4.61e^{-10}$ | .013 | 1 | -.025 | .025 |
| **Difference** | | -.073 | .026 | | -.124 | -.022 |

$t$=-2.8153, $df$=6347, $p$=0.0049

**Chi-Square test: Gender**

| | Not missing | Missing | Total |
|---|---|---|---|
| **Female** | 2162 | 1673 | 3835 |
| **Male** | 1863 | 1986 | 3849 |
| **Total** | 4025 | 3659 | 7684 |

$X^2(1)$=48.9609; $p$=0.000

**Chi-Square test: Urban/Rural Residence**

| | Not missing | Missing | Total |
|---|---|---|---|
| **Rural** | 2562 | 2069 | 4631 |
| **Urban** | 1463 | 1595 | 3058 |
| **Total** | 4025 | 3664 | 7689 |

$X^2(1)$=41.3230; $p$=0.000

**Chi-Square test: Education**

| | Not missing | Missing | Total |
|---|---|---|---|
| **No formal education** | 1530 | 1319 | 2849 |
| **Less than high school** | 2257 | 2020 | 4277 |
| **High school or more** | 238 | 308 | 546 |
| **Total** | 4025 | 3647 | 7672 |

$X^2(1)=19.1565$; $p=0.000$

**Chi-Square test: Marital Status**

| | Not missing | Missing | Total |
|---|---|---|---|
| **Unmarried/unpartnered** | 857 | 843 | 1700 |
| **Married** | 3168 | 2816 | 5984 |
| **Total** | 4025 | 3659 | 7684 |

$X^2(1)=3.3958$; $p=0.065$