SOCIO-RELATIONAL RESOURCES AND HEALTH IN CHINA

by

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STATEMENT OF DISSERTATION APPROVAL

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ABSTRACT

Building upon the existing theoretical framework and abundant empirical evidence supporting an association between socio-relational resources and health in the United States and other Western countries, this dissertation extended these analyses to the population of contemporary China, which is characterized with rapid economic development, a fast-growing population age 65 and above, epidemic rates of chronic diseases and conditions, and recent transformation of families' and communities' roles in providing long-term care for older adults. Individual level data from the 2010-2012 China Family Panel Studies and the 2007-2010 World Health Organization Study on Global Aging and Adult Health were utilized to empirically examine 1) whether different types of familial and extra familial socio-relational resources influence health behaviors, self-reported health status, and health care utilization among Chinese, as commonly observed in Western countries; 2) whether health behaviors and psychological pathways are contributory to the explanation of the association between socio-relational resources and health; and 3) whether socio-relational resources impact health differently across segments of the population. Mediation and moderation analysis, multilevel approach, and cross-lagged methods were performed to address these research questions. Results showed that social engagement, neighborhood social cohesion, social participation, and other types of socio-relational resources were protective against poor physical and mental health of adults and older adults, as previously observed in other cultures and contexts.

Findings from mediation analyses also suggested that lifestyle and psychological wellbeing partially explained the main effects of social engagement on hypertension. Regarding health behaviors, results indicated that cigarette smoking and heavy alcohol consumption among middle aged and older Chinese men were regarded as social bonding activities, which resembles the "social smoking and drinking" phenomenon found in the existing literature. Moderation analyses also depicted the effects of stratification of socio-relational resources on health between men and women, and urban and rural residents.

I dedicate this dissertation to my beloved family.

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CHAPTER 1

INTRODUCTION

Building upon a large body of literature in the United States (US) and other Western countries, my dissertation examines the association between socio-relational resources and health in China in order to address two research gaps. The first gap in knowledge pertains to the paucity of research on socio-relational resources and health in nonwestern cultures and contexts, with only an emerging body of research found in East Asia (Yamaoka, 2008). Within this group of emerging East Asian studies, researchers are often focusing primarily on socio-relational resources' main effects upon health (Li & Zhang, 2015). This limitation points to the second research gap addressed in the dissertation; the weak emphasis in existing research on the pathways linking social relational resources and health, and variations in the associations between population subgroups. As the associations between socio-relational resources and health are complex and culturally diverse (Zhang & Wu, 2015), the observed patterns in the Western literature might not be applicable in non-Western contexts, which are characterized by different cultural and socioeconomic features (Ferlander & Mäkinen, 2009). Following the guidelines and approaches suggested in studies conducted in the US and other Western countries, my dissertation carves out the complexity of the relationship between

different types of socio-relational resources and three health outcomes, namely health behaviors, self-reported health status, and health care utilization. Besides the main effect analyses, my dissertation also examines the mechanisms linking socio-relational resources and health and additionally examines whether these effects differ across segments of the Chinese population by age, gender, and rural and urban residence. In addition, my study demonstrates how socio-relational resources, as they exist and operate at both the individual and community level, play a role in influencing health outcomes. Thus, my dissertation research not only sheds light on an understudied health topic in a non-Western population but also enhances the extant knowledge, which, according to Umberson and Montez (2010), needs further investigation in order to dissect multidimensional features of the main effects and to fully comprehend the complex pathways. Specifically, my study delineates certain forms of familial and extra familial resources, namely living arrangements, intergenerational transfers, social support, social cohesion, social participation, and social engagement, and examines whether they influence health in China in ways similar to those observed in the US and other Western countries.

Background

To better understand the complex links between socio-relational resources and health, I review the concepts, theoretical framework, and empirical evidences from the existing literature in different contexts and cultures. In the following section I critically review the literature on the developing concepts of socio-relational resources, the

proposed mechanisms linking socio-relational resources and health, and some of the moderating effects of the sociodemographic factors.

Socio-relational Resources and Health in the US and other Western Countries

Socio-relational resource is a term used throughout my dissertation. It is a term which refers to a set of theoretical concepts measuring social relationship, sometimes expressed as social connectedness. I choose to use socio-relational resources as an umbrella term, as it encompasses two distinct domains of social relationships: one concerned with structure (size and density), the other focused on content (support, conflict, and cohesion) (Berkman & Glass, 2000; Kawachi & Berkman, 2000). Depending on which domain is being addressed, scholars have employed more specific and/or interchangeable concepts such as social network, social support, social capital, social cohesion, social engagement, and so on.

Before discussing the main findings of the association between socio-relational resources and health in the existing literature, I briefly review some of the most influential concepts in the study of social relationships and health, namely social network, social support, social capital, social engagement and social cohesion. According to Berkman and Glass (2000) and Kawachi and Berkman (2000), social network often captures the structural dimensions of social relationships. These structural dimensions provide the interactive environment for "giving and taking" activities, which are referred to as social support. Social capital is another sociological concept which is frequently studied in association with health outcomes (Ferlander & Mäkinen, 2009; Harpham,

Grant, & Rodriguez, 2004). The measurement of social capital often taps into three major domains of secondary network involvement, interpersonal trust, and reciprocity at both individual and community levels. In addition, social engagement and social cohesion also receive much attention in the health literature in Western countries. As Greiner and colleagues (2004) noted, social cohesion is understood as a combination of engagement in community organizations and/or activities and an individual's perceptions of the community. In some variants, social cohesion is also referred to as collective efficacy, or a sense of community belongingness. Social engagement, sometimes expressed as social participation, refers to involvement in a set of formal and informal social activities which are not bounded by community or neighborhood boundaries (Umberson & Montez, 2010). Each of these concepts' definition and measurement will be provided in detail in the empirical chapters.

Studies conducted in the US and other Western countries provide abundant evidence on the beneficial effects of socio-relational resources on a wide range of health outcomes (Ferlander & Mäkinen, 2009; Harpham, Grant, & Rodriguez, 2004). Some studies have emphasized the positive impacts of socio-relational resources on improving the survival rates of patients with ischemic heart disease, stroke, and cancer (Kroenke, Kubzansky, Schernhammer, Holmes, & Kawachi, 2006; Vogt, Mullooly, Ernst, Pope, & Hollis, 1992); lowering rates of circulatory illness, coronary heart disease, and all-cause mortality (Wainwright et al., 2007); and increasing subjective health and wellbeing in all age groups (Oxman, Berkman, Kasl, Freeman, & Barrett, 1992; Riumallo-Herl, Kawachi, & Avendano, 2014). As empirical evidence has accumulated in a voluminous body of literature, the Mayo Clinic has recommended increasing social contact, and improving

the quality of social relationships for patients with myocardial infraction as a form of prevention and treatment in the US (Shaya et al., 2013). This recommendation might also be effective in other cultural contexts, as suggested by these authors.

In addition, Ferlander and Mäkinen (2009) argue that certain types of socio-relational resources are more important in enhancing health and wellbeing than others. For example, strong social cohesion and social capital can improve the cardiovascular health of African Americans (Troxel et al., 2010), while cohesive community ties along with parental support reduce acculturation stress for Indian and Korean immigrant adolescents in the US (Thomas & Choi, 2006). In contrast to the general patterns in which socio-relational resources are credited with positively influencing health, several studies have demonstrated that specific types of socio-relational resources can exert effects that threaten or erode good health (Carpiano, 2007). In his study, Carpiano (2007) found that social support increased smoking and heavy drinking among community-dwelling older adults in the US. He further noted that this result was consistent with Bourdieu's argument on the negative impacts of social capital (Bourdieu, 1986), and can represent an example of how socio-relational resources may impose harmful effects on individuals' health.

Although the relationships between socio-relational resources and health have been well studied in Western countries, at least two critical challenges persist that hamper our understanding of the nature of the effects of social relationships on health. Specifically, these are the challenges around the specification and modeling of mechanisms that link individual socio-relational resources and health; and the specification of types of relationships beneficial to specific health outcomes (Ferlander &

Mäkinen, 2009; Umberson & Montez, 2010). As Umberson and Montez (2010) noted, although the mechanisms linking socio-relational resources and health outcomes have been well studied in Western countries, many critical questions remain unanswered. For example, we are not fully aware of how biological pathways underlie the studied associations (Eisenberger & Cole, 2012). Furthermore, some aspects of psychological pathways, including the role of personality traits, have not received adequate attention (Umberson, Crosnoe, & Reczek, 2010). And the often inconsistent patterns that emerge with respect to health behavior pathways still challenge our understanding of the studied associations (Umberson et al., 2010). Moreover, associations between socio-relational resources and health vary across social and cultural contexts, and this variation must be addressed in study designs so that we create knowledge on the types of relationships that are influential within particular contexts, and thereby are able to provide relevant knowledge to public health improvement efforts.

Mechanisms Linking Socio-relational Resources and Health

Attending to the nature of the association between socio-relational resources and health, a group of scholars has attempted to uncover the mechanisms linking socio-relational resources to health outcomes in the US. Led by the pioneering work of Berkman and Umberson and their colleagues, this group of scholars has suggested that socio-relational resources are linked to health outcomes through three central pathways of health behaviors, biological functioning, and psychological factors (Berkman & Glass, 2000; Kawachi & Berkman, 2000). Specifically, the health behavior pathway that links socio-relational resources and health encompasses a variety of processes, including social

influence, social control, diffusion of health-related information, and resource exchange through person-to-person contacts (Ford, Spallek, & Dobson, 2008; Umberson & Montez, 2010). As noted in the two collaborative studies of Umberson (2010) and Ford (2008), specific health behaviors can exert positive impacts upon health, e.g., physical activities, healthy diet, frequent health screening, and persistent disease treatment. For example, a group of scholars utilized the MacArthur Studies of Successful Aging to examine the mediating effects of health behaviors on the association between social networks and cognitive functioning. They found that the two behavioral mediators of healthy diet and regular physical activity in the baseline study in 2001explained one key pathway through which social networks influenced improvement in cognitive functioning in older adults over the 7.5-year follow-up period (Seeman, Lusignolo, Albert, & Berkman, 2001).

Turning to the biological pathways linking socio-relational resources and health outcomes, a body of research underlines the role of the human brain on stress adaptation processes, and how the prolonged stress response imposes wear and tear effects on the human body (McEwen, 2012; McEwen & Gianaros, 2010; McEwen & Seeman, 1999). The two concepts of allostasis and allostatic load, which refer to a set of elevated physiological activities generated in adaptation to prolonged stressors, are often used in the explanation of the stress response process (Brody et al., 2013). The main argument is that the overuse and dysregulation of allostatic load leads to maladaptation of the immune, metabolic, and cardiovascular systems, and over the long term this maladaptation can cause chronic diseases and conditions (Beckie, 2012). Socio-relational resources, specifically social support, frequent communication with members of one's

social network, and greater feelings of closeness and comfort derived from social relationships can moderate allostatic load, and are therefore identified as health-protective factors (Beckie, 2012; Eisenberger & Cole, 2012). For instance, experiencing feelings of closeness and comfort, in combination with frequent communication with supportive individuals, has been shown to lower cortisol responses to daily stress in a clinical study in the US (Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007).

Attending to the last pathway emphasized in the work of Berkman, Umberson and others, psychological factors explain the association between socio-relational resources and health through their stress-buffering effects (Cohen, 2004; Cohen & Wills, 1985). As noted by Cohen and Wills (1985), the stress-buffering model explains the psychological benefits (coping mechanisms and problem solving skills) of socio-relational resources in times of stress. Specifically, the coping mechanisms and problem solving skills provided by socio-relational resources significantly reduce the duration and impacts of stressors on individual health. Other psychological factors such as sense of wellbeing, self-esteem, and self-efficacy also play a significant role in alleviating the perception of stress and enhancing resilience (Cohen, 2004) . As Cohen (2004) noted, these psychological factors are also enhanced by certain types of socio-relational resources, such as social support and social cohesion. For example, close familial relationships are associated with improved feelings of wellbeing, and thus are beneficial to mental health in older adulthood (Ryan & Willits, 2007).

Although knowledge of these mechanisms is fundamentally important, as they indicate specific resources for health improvement through socio-relational resources (Ferlander & Mäkinen, 2009), many dimensions of these mechanisms still remain

unknown to us. Specifically, we are not fully aware of how social environment, including socio-relational resources, "gets under the skin" through the biological pathway (Eisenberger & Cole, 2012). The inconsistent patterns of health behaviors as mediators between socio-relational resources and health still challenge us (Patterson, Eberly, Ding, & Hargreaves, 2004). And the links between the psychological mechanism and physical health, although they are becoming clearer, need further explanation (Ryan & Willits, 2007; Seeman, 1996). Although these marked gaps have grown narrower in recent research, they still limit our knowledge. And it is possible that a comprehensive understanding of the three pathways would provide valuable policy implications for public health interventions in different social and cultural contexts (Cohen, 2004).

Moderators of the Socio-relational Resources and Health Association

It is important to note that the socio-relational resource characteristics and health effects can vary across sociodemographic conditions of age, gender, race or ethnicity, and socioeconomic status. During each life stage, individuals are exposed to different social networks which can either promote or damage health (Altman et al., 1998). For instance, parental involvement, peer and friendship networks, school and/or community belongingness help shape adolescents' lifestyles, and these influences can leave long-term marks on their health in later life (Altman et al., 1998; Bosma, van de Mheen, & Mackenbach, 1999). Involvement in family relationships and career networks in middle age, and exposure to occupational and relational stress in these realms, are also key factors posing health risks in the long run (Matthews, Stansfeld, & Power, 1999). Older

adults experience the dissolution of social relationships upon the deaths of their spouses, close friends and relatives, and associated changes in living arrangements can greatly impact their mental health and wellbeing (Deng, Hu, Wu, Dong, & Wu, 2010; Moon, Park, & Cho, 2010).

Gender is also a key determinant predicting both socio-relational resources and health. The gender paradox arises from the observation that women experience longer lives but with more health problems than men, and women report higher satisfaction of social relationships. These arguments are illustrative examples of the gender-based variations in the studied association (Luy & Minagawa, 2014). In addition to age and gender, studies in the US and other Western countries also emphasize racial or ethnic stratification in socio-relational resources and health outcomes. One of the main explanations for racial or ethnic variations in the effects of socio-relational resources on health is that some racial or ethnic groups prefer certain types of socio-relational resources, and these preferences contribute to better health status for such groups (Ellison, 1995; Gorman & Porter, 2011). Some examples are religious attendance and religiosity improving mental health for African Americans in the Southeastern region (Hummer, Rogers, Nam, & Ellison, 1999), and immigrant enclaves with strong community ties and supports reducing the stress of acculturation for many Asian and European descendants in the US (Thomas & Choi, 2006; Wong, Yoo, & Stewart, 2005). These robust results from the Western literature recommend that sociodemographic factors need to be fully accounted for and treated as moderators when examining the association between socio-relational resources and health in other study contexts.

Socio-relational Resources and Health in other Contexts

The literature on the mechanisms linking socio-relational resources to health outcomes outside the US and other Western countries remains quite thin (Cao, Li, Zhou, & Zhou, 2015; Gao, Fu, Li, & Jia, 2015; Thanakwang & Soonthorndhada, 2011). There has been an emerging body of literature which focuses on the main effects of familial resources, namely living arrangements, transfers, social capital, and social support, on subjective health outcomes in several East Asian societies (Ichida et al., 2009; Kumar, Calvo, Avendano, Sivaramakrishnan, & Berkman, 2012; Yamaoka, 2008; Yip & Cross, 2004; Yip et al., 2007). For example, living alone increases the risks of depressive symptoms and suicidal ideation for men but not for women in South Korea (Jeon, Jang, Kim, & Cho, 2013). Among the oldest Chinese, harmonious family relationships and perceived strong filial piety are among significant contributors to healthy aging (Li et al., 2014). As to extrafamilial resources, an emerging of body of studies conducted in Japan has paid attention to community and neighborhood characteristics and how these features affect older adults' health and wellbeing (Aida et al., 2013; Cramm & Nieboer, 2013; Fujisawa, Hamano, & Takegawa, 2009; Hibino et al., 2012; Ichida et al., 2009; Inoue, Yorifuji, Takao, Doi, & Kawachi, 2013; Iwase et al., 2012; Kanamori et al., 2012; Kishimoto, Suzuki, Iwase, Doi, & Takao, 2013; Takagi et al., 2013). Overall, these studies found links between community-level and individual-level social capital and health, with empirical evidence supporting the general pattern of socio-relational resources improving health and wellbeing at older ages. Although continuing to expand our knowledge of community characteristics' impacts upon health in Japan, these studies mostly focused on modeling how self-reported health is affected by social capital,

measured by social participation and social trust among community dwelling older adults. However, the links between other types of socio-relational resources and health outcomes still remain unknown.

There is great potential for advancing understanding of the ways that socio-relational resources influence health in Asian contexts, beyond the findings emerging from this body of research on familial and extrafamilial resources. These studies contain certain methodological and data limitations, as East Asian societies are undergoing major social changes (Li, Lin, Fetzer, & Chen, 2014; Liang et al., 2014), which open up potential directions for future research. For example, social support was captured in a limited way in Kumar's study (2012), as the authors only examined "crisis social support" rather than focusing on long-term support. The two studies by Yip in 2004 and 2007 only utilized subgroups of rural Chinese, which do not fully reflect the complex patterns of socio-relational resources and health in increasingly urbanized societies of East Asia. Yamaoka's study in 2008 utilized data dated from the early 2000s and, in light of rapid social change, these data sources are not necessarily reflective of the current contexts in East Asia. Other studies conducted in Japan shared the same focus on social capital and self-reported health and paid very little attention to other measures of socio-relational resources. In addition, all of these studies have relied upon cross-sectional data which are insufficient to establish causality. Perhaps most importantly, this emerging body of literature has done little to explore particular mechanisms, akin to those elaborated in the US literature, whereby socio-relational resources influence health. Accordingly, there is much room for theoretical and empirical advances in research that

delineates both the patterns and mechanisms of association between socio-relational resources and health in Asian societies.

Study Aims

Borrowing heavily from the existing body of literature on socio-relational resources and health and based on the extant gaps of knowledge, the main aims of my dissertation research are: 1) To expand knowledge of the association between socio-relational resources and health within the context of the collectivistic orientation found in many Asian countries, in particular focusing upon China; and 2) To address a gap in knowledge on the specific types of socio-relational resources that are beneficial or threatening to health outcomes by modeling the moderating and mediating effects of socio-relational resources upon health. Regarding my first aim, Ferlander and Mäkinen (2009) emphasize that the association between socio-relational resources and health varies across cultural and social contexts. This argument implies that the patterns and nature of the studied association in non-Western contexts might not be identical to those observed in Western countries. Consistent with Ferlander and Mäkinen's argument, Thanakwang and Soonthorndhada (2011) suggest that the association between socio-relational resources and health in Asia is substantially different from that observed in Western countries due to the preferences for collectivism and individualism, which tend to maintain across Eastern and Western cultures, respectively (Markus & Kitayama, 1991). Collectivism, which strongly emphasizes the relatedness of individuals to each other and encourages the harmonious interdependence between individuals, prevails in Asia. As opposed to the Asian cultural emphasis upon collectivism, Western cultures tend to exhibit a preference for independence, which is often characterized as individualism.

This cultural opposition, alongside the local ideologies of family orientation and strong filial norms across much of Asia (Bongaarts & Zimmer, 2002), means that it is possible that socio-relational resources from family and community will be more influential for individual health outcomes in Asian countries, in juxtaposition to the findings observed for Western countries. Another distinction to attend to is that family is central in East Asian societies (Thanakwang & Soonthorndhada, 2011). Due to this family orientation preference, extrafamilial relations may play a weaker role in individuals' health in such contexts.

I have selected China as a setting in which to conduct my analyses for several reasons. China is the largest population in the world, and is facing problems of a rapidly aging population and unsustainable development, both of which pose great challenges for the country's public health systems (Chatterji et al., 2008; Li et al., 2011). Funded by the World Health Organization [WHO] in 2008, Chatterji and colleagues thoroughly examined the population health profile in China and discovered several patterns which implied urgent needs for public health interventions. Specifically, they identified heightened risks of infectious disease complications, increasing prevalence of smoking and sedentary lifestyles, and accelerating chronic illness burden caused by a large and increasing number of older adults in the population. Chatterji's study also emphasized that, by 2030, about 65.5 % of the health burden in China, mostly noncommunicable diseases, will be caused by the aging population. The public health system in China is unprepared for these health challenges, which calls for mobilizing informal support from other institutions, including families and communities (Liang et al., 2014).

With regard to cultural background, older generations of Chinese still maintain the traditions of valuing and relying upon family and community for health care, due to the influence of Confucian ideologies that advocate family orientation and filial norms (Zhang & Wu, 2015; Zhang, Feng, Liu, & Zhen, 2015). Some studies in China have suggested the prevalence of multigenerational households where co-residence and generational transfers are common, and the critical role of these family and household forms for supporting the health and wellbeing of older adults (Liang et al., 2014; Wang, Zhao, Liu, & Ma, 2012; Zimmer & Korinek, 2008). However, these studies only focused on the main effects of the association between socio-relational resources and health in China, and the mediating effects of health behaviors, psychological factors, and biological functioning are largely unknown. Thus, studying the association between socio-relational resources and health in China not only uncovers the patterns and nature of the association but also provides valuable findings for public health interventions.

In addition, China is in the midst of rapid economic growth and urbanization, and these macro-level changes possibly affect the tradition of extended family co-residence and other forms of informal support (Abegunde, Mathers, Adam, Ortegon, & Strong, 2007; Gong et al., 2012). Changing ideals and preferences around living arrangements, adult children's migration, and ways of living in a more urbanized society might cause health deterioration for older adults, as many of them are now living in "empty nested" households with weakened intergenerational supports and filial piety (Chen, Hicks, & While, 2014). In such circumstances, extrafamilial resources, such as participation in social organizations, hobby clubs, and/or community activities, and social connections with neighbors, friends, and nonresident family members, might be beneficial to older

adults' health and wellbeing (Cao et al., 2015; Gao et al., 2015; Li, Chi, & Xu, 2013; Li & Zhang, 2015; Li, Lin, & Chen, 2011). Overall, these studies have found that social capital, and other measurements of extrafamilial resources, such as social engagement and social cohesion, are associated with reducing isolation and depression, promoting healthy and active lifestyles, and increasing quality of life in both rural and urban residents. These studies collectively maintain that older adults' physical and mental health enjoy the benefits of extrafamilial resources, and they suggest that older adults are adapting well in response to the changing living circumstances in contemporary China. However, these studies may be supplemented by approaches that involve longitudinal surveys and nationally representative data in order to provide valuable information for policy making.

As for the second aim, we are not fully aware of what types of socio-relational resources are beneficial and what forms are harmful to health, and how these effects vary across population subgroups (Ferlander & Mäkinen, 2009). In addition, although the existing literature has suggested moderating effects of gender, age, and urban and rural residence in China (Li & Hsu, 2015; Luy & Minagawa, 2014; Moon et al., 2010; Wong et al., 2005), the examination of these demographic factors still needs more attention when dealing with longitudinal data and a nationally representative sample. Understanding the variations between subgroups is important, as they possess important public health policy implications for targeting groups at greater risk of adverse health outcomes related to their socio-relational resources. The existing body of literature also recommends modelling the mediating effects, potentially operating through health behaviors and psychological pathways, involved in the associations between socio-relational resources

and health (Liang et al., 2014; Wang et al., 2012; Zimmer & Korinek, 2008). Such research directions are fruitful as they will further specify the resources needed for public health improvements in China (Ferlander & Mäkinen, 2009). As observed in the US health care system, socio-relational resources have been highly credited and utilized as a recommendation for treatment and prevention of heart disease (Shaya et al., 2013). This research stands to provide concrete suggestions for the health policy realm concerning whether improvements in socio-relational resources might also provide effective solutions for disease prevention and treatment in China and other East Asian contexts.

Organization of the Dissertation

Three empirical analyses are presented in Chapters 2, 3, and 4, following the Introduction chapter. Each empirical chapter consists of a review of pertinent literature, discussion of the study context, elaboration of research problems and hypotheses, deliberation of data, sample, methods, and study results, discussion of results, and study conclusions.

The empirical analyses begin within Chapter 2, which provides a comprehensive examination of multiple familial and extrafamilial resources as they correlate with health-related behaviors of cigarette smoking and heavy drinking. Chapter 2 relies on a sample of Chinese men in middle age and older adulthood, drawn from two waves of the longitudinal China Family Panel Study, referred to as CFPS, conducted in 2010 and 2012. As smoking and heavy drinking are only prevalent among older Chinese men (Chuang & Chuang, 2008; Li et al., 2011), the significant effects of socio-relational resources on these two outcomes were completely diminished in the female sample when gender was treated as the moderator. Using the cross-lagged analyses and a series of

logistic and multinomial regressions, Chapter 2 analyses are promising in establishing the main effects of different types of familial and extrafamilial social resources on smoking and drinking behaviors among Chinese men age 50 and above. Although there have been several studies investigating a single measure of familial resources and smoking and/or drinking behaviors in China (Li et al., 2014; Li et al., 2011; Zhang et al., 2013; Zhang & Wu, 2015; Zhang et al., 2009), the analyses in Chapter 2 are, to my knowledge, the first to compare and contrast the influential role of each major type of socio-relational resource upon these two health behaviors.

The CFPS Wave 1 and 2 data are again examined in Chapter 3, which focuses on neighborhood social cohesion and social participation and how these extrafamilial resources exert impacts on psychological wellbeing. Cross-lagged analyses, multilevel and mixed-effects approaches, and a sample of middle aged and older Chinese are utilized in this chapter. In addition, the analyses are stratified by urban and rural residence. The analyses in Chapter 3 are among the first to use a nationally representative sample, longitudinal data, and multilevel analyses to study the association between neighborhood social characteristics and health in China. To date, few studies have analyzed neighborhood characteristics as health indicators in China (Gao et al., 2015; Meng & Chen, 2014; Shen, 2014). Thus, the results presented in this chapter promise to yield innovative implications for public health improvement in China. As the country is undergoing immense social changes, such as the increase in number of older adults living alone or living in skipped-generation households and loosened filial norms, neighborhood and communities' social characteristics may be substituted for familial relationships to promote healthy aging (Chen et al., 2014).

The last empirical chapter (Chapter 4) relies upon data from the WHO Study on Aging and Adults Health, commonly known as the WHO-SAGE, Wave 1, collected in China between 2007 and 2010. Similar to the CFPS data, the WHO-SAGE has not been widely utilized, has a nationally representative sample, and provides rich information on socio-relational resources and health (Kowal et al., 2012). The WHO-SAGE data have several advantages as compared to the CFPS, such as the availability of both subjective and objective measurements of health status, and the use of a set of standardized questionnaires which allow researchers to conduct cross-national analyses. Chapter 4 models the association between social engagement and hypertensive medication and treatment. As hypertension has been identified as an alarming public health issue among all age groups in China (Basu & Millett, 2013; Feng, Pang, & Beard, 2014; Ma, Chen, Zhou, & Huang, 2013; Wu et al., 2015), Chapter 4 expands the analytic sample to adults age 18 to 69. This wider age range consists of the working group which shares a large proportion of diagnosed hypertension, as this disease is closely linked with occupational stress and sedentary lifestyle in contemporary China (Ariely, Evans, & Mills, 2013). This wider age range also reflects the healthy adult population, which potentially helps with reducing the selection bias of poor health associated with social isolation (Nummela, Sulander, Rahkonen, Karisto, & Uutela, 2008). A series of logistic regressions is analyzed for the whole sample and separately for men and women. The analyses performed in Chapter 4 carve out interesting findings on the main effects and mediating effects of health behaviors and psychological wellbeing upon use of hypertensive medication and treatment. These analyses establish the possible connections between social engagement, health behaviors, psychological wellbeing, and hypertension

medication and treatment. Chapter 4 was published online in December, 2015 and is currently in press at the *Journal of Biosocial Science*.

Following these three empirical chapters, my dissertation ends with a chapter that provides an overarching conclusion. In this last chapter, I briefly summarize and broadly discuss the key findings from all three empirical analyses. I also critically review the data and methodological limitations, and propose several possible directions for future research to broaden the knowledge of socio-relational resources as they influence health in nonwestern contexts.

CHAPTER 2

SOCIAL CONTEXTS OF CIGARETTE AND ALCOHOL CONSUMPTION IN MIDDLE-AGED AND OLDER CHINESE MEN

Introduction

Practice of healthy behaviors, such as avoidance of smoking and excessive drinking, can increase self-reported physical and mental health, reduce mortality risks, and promote healthy aging and longevity (Carter et al., 2015; Li et al., 2014; Woo, Ho, & Yu, 2002; Zhu et al., 2015). Smoking and passive smoking can double or triple mortality risks from at least 21 known smoking-related diseases, for example coronary heart disease, various types of cancer, and pregnancy complications (Carter et al., 2015). Heavy drinking not only causes cardiovascular and other chronic diseases, but also closely links to a wide range of injuries and risky behaviors, such as drunk driving, gambling, violence, unprotected sexual intercourse, alcohol dependence, and anxiety and suicidal ideation across the life course (Zhu et al., 2015). A group of studies in the US and other Western countries found that smoking and drinking behaviors might follow a U-shape pattern in conjunction with age (Mauro, Canham, Martins, & Spira, 2015; Nandi, Charters, Strumpf, Heymann, & Harper, 2013; Stranges, Samaraweera, Taggart, Kandala, & Stewart-Brown, 2014). This U-shape pattern possibly indicates that a

subgroup of middle-aged and older adults engaged in alcohol and tobacco use to cope with occupational stress and other life strains (Nandi et al., 2013). However, stress or strain may not be a major cause of cigarette smoking and excessive alcohol consumption in the case of community-dwelling middle-aged and older Chinese, in particular because the Chinese social context possibly encourages individuals to practice such health-related behaviors (Cheng, Chen, McBride, & Phillips, 2016; Chuang & Chuang, 2008). Although the prevalence of chronic diseases related to smoking and excessive drinking is rapidly on the rise (Basu & Millett, 2013; Wu et al., 2015), controls of alcohol and cigarette consumption are more relaxed in China than in other countries with the same income levels (Zhang et al., 2013). A recent cross-national study found that among six low- and middle-income countries included in the WHO-SAGE, China reported the highest percentage (6.3%) of population aged 50 and above reporting frequent practice of heavy drinking and smoking, while the lowest percentage (0.2%) was among Indian participants (Wu et al., 2015). As empirical evidence accumulates in several studies conducted in similar contexts, namely Taiwan and South Korea, smoking and heavy drinking appear to be widely encouraged, commonly practiced forms of social bonding among men of all ages (Ayers et al., 2010; Chuang & Chuang, 2008). However, aside from masculinity and other gender norms, very little is known about other social determinants of cigarette smoking and excessive alcohol consumption in the middle-aged and older Chinese population (Cheng et al., 2016). Based on gaps of research suggested in these previous studies, in this chapter I tackle the social contexts of smoking and heavy drinking in middle-aged and older Chinese men. Specifically, I examine a comprehensive set of

socio-relational determinants of familial and extrafamilial resources in order to shed light on an understudied health topic in a nonwestern context.

Social Contexts of Cigarette Smoking and Heavy Drinking in Western Countries

The social contexts of heavy drinking and smoking in adults have been well established in Western countries (Broman, 1993; Johnson & Jennison, 1992). Many studies have found that these two health-related behaviors are closely related, with smokers tending to have problematic drinking behaviors or vice versa (Zhu et al., 2015). Several key determinants of excessive drinking and smoking are gender, age, socio-economic status, marital status, stress and mental health status, neighborhood conditions, social participation, social capital, social support, and social network characteristics (Broman, 1993; Carpiano, 2007; Drum, Shiovitz-Ezra, Gaumer, & Lindau, 2009; Foster & Spencer, 2013; Greiner, Li, Kawachi, Hunt, & Ahluwalia, 2004; Lin, Witten, Casswell, & You, 2012; Watt et al., 2014; Wray, Alwin, & McCammon, 2005). For example, the general patterns of smoking and heavy drinking are shown to be stratified by gender and age group. A study employing Wave 1 of the US National Social Life, Health, and Aging Project, collected in 2009, reported that men were more likely to report problematic drinking and smoking than women (Drum et al., 2009). Wray's (2005) and Drum's (2009) studies found that frequent drinking and smoking were prevalent in adolescents and younger adults, but such behaviors were likely to reduce at older ages in the absence of chronic stress or strain.

As to socio-relational resources, a study by Watt and colleagues (2014) used three

waves of the US National Health and Nutrition Examination Survey from 1999 to 2004 to model the relationship between marital status and heavy drinking and smoking in adults aged 60 or older. While results were differentiated between men and women, generally, the status of divorce, separation, or widowhood increased the prevalence ratios for smoking and heavy drinking, as compared to married persons. The study also noted that additional research is much needed to assess whether strengthening marital or other social relationships would significantly improve older adults' health-related behaviors. Such a call demonstrates the persistent need to examine the influence of particular socio-relational resources on health behaviors in Western countries (Watt et al., 2014). In addition to familial resources, a study on neighborhood social cohesion and substance use in New Zealand in 2003 and 2004 found a mixed set of results (Lin et al., 2012). Residents of highly cohesive neighborhoods reported more frequent consumption of alcohol, but lesser probability of smoking cigarettes and cannabis. Such mixed results from Lin and colleagues' (2012) study strengthened Watt's (2014) assessment that there is an urgent need to further investigate the association between different types of socio-relational resources and health behaviors.

Since 2007, Carpiano had argued that different types of neighborhood-level and individual-level social capital are associated with smoking and binge drinking, and the mechanisms connecting socio-relational resources and health behaviors are very complex. In his study, which used a sample of more than 2,000 adult participants from Wave 1 of the Los Angeles Neighborhood Survey conducted in 2003, Carpiano examined the influences of four types of social support, social leverage, informal social control, and neighborhood social participation upon smoking and binge drinking. Social leverage and

informal social control associated with lower odds of smoking and binge drinking, while social support correlated with higher odds for both smoking and drinking. Pertaining to these mixed results, Carpiano borrowed Bourdieu's social capital theory to argue that social capital can produce both positive and negative consequences. He further explained that smoking and drinking were individual behaviors but were more likely to be practiced in a group. Carpiano referred to the mechanism linking social contexts to individuals' health behaviors as the basis of the "social smoking" and "social drinking" approach. He also argued that smoking and binge drinking were likely to be negative influences of social interactions. Carpiano's ideas of the "social smoker" and "social drinker" offer a fruitful and potential approach for specifying the connections between socio-relational resources and smoking and drinking behaviors in non-Western contexts.

Social Contexts of Smoking and Heavy Drinking in China

The social contexts surrounding smoking and drinking behaviors in older adults are complicated, and empirical information documenting such contexts and health behaviors is very scant in China (Chuang & Chuang, 2008; Sun et al., 2015; Zhang & Wu, 2015). Some studies claim that socio-relational resources such as familial relationships are protective of health behaviors at older ages (Zhang et al., 2013; Zhang & Wu, 2015). For example, Zhang and Wu (2015) studied smoking and drinking behaviors in relation to living arrangements of older adults in China. Using five waves of the Chinese Longitudinal Healthy Longevity Survey from 1998 to 2008, they found that compared to living alone, older adults living with a spouse, or both spouse and children, were less likely to smoke or drink. In another study by Sun and colleagues (2015),

smoking and heavy drinking were found in older adults who reported poor-perceived filial piety in an urban setting in Liaoning Province. Sun's study also found that these two risky health behaviors were highly associated with lower quality of life and increased mental health issues. In addition to living arrangement and filial piety, in a study conducted in Chongqing province, Li and colleagues (2014) found that abstinence from smoking and heavy drinking in the oldest old group highly correlated with harmonious family relationships.

With regard to extrafamilial resources, Zhang and colleagues (2013) examined different types of smoking status among older adults in five Chinese provinces between 2007 and 2009. They found that current smoking status correlated with never married status and depression. Former smoking status was associated with widowhood, less frequent visits to children, relatives, and/or friends, and concerns about children's wellbeing. However, those with nonsmoker status, especially women in low socioeconomic households, were at higher risk of passive smoking. Passive smoking status also correlated with religiosity and daily visits to children, relatives, and/or friends. Overall, Zhang's (2013) findings followed the "social smoking" patterns mentioned in Carpiano (2007), and confirmed that Carpiano's explanation was appropriate in the Chinese cultural context. In addition to Zhang's research (2013), Chuang's and Chuang's study (2008) found significant results suggesting that extrafamilial socio-relational resources are associated with smoking and drinking behaviors in older Taiwanese. Specifically, social participation increased drinking behaviors, while social trust and neighborhood social connectedness reduced both smoking and drinking. Mixed results from these studies strengthened the impression that drinking and smoking in

contemporary Chinese society are determined by both familial and extrafamilial relationships. However, knowledge regarding the harmful and protective types of socio-relational resources and smoking and drinking behaviors among middle and older age groups is still negligible.

Gender Stratification in Smoking, Heavy Drinking, and Socio-relational Resources

Smoking and heavy drinking are highly stratified between men and women with more men than women engaged in smoking, heavy drinking, or dual consumption, i.e., both smoking and heavy drinking, across many cultures and contexts (Chuang & Chuang, 2008; Drum et al., 2009). More than one third of older Chinese reported frequent alcohol consumption, most of them drinking distilled spirits, with an average consumption of 372 grams per week (46.5 units per week) (Yang et al., 2012). Comparing men and women, more than half of men reported drinking about 47.8 grams of alcohol per day, while only 15% of women reported drinking, with a daily average of 19.1 grams (Li et al., 2011). With regard to smoking, two thirds of Chinese men were current smokers, while very few women smoked (Masood et al., 2015). As Zhang and colleagues (2013) noted, Chinese alcohol and cigarette control programs should consider this gender stratification and develop more male-focused agenda and services in order to reduce the pandemic levels of smoking- and drinking-related problems.

In addition to the differences in drinking and smoking behaviors, middle-aged and older Chinese men and women also reported different patterns of socio-relational resources and their associations with health outcomes, possibly due to the preservation

and persistence of traditional gender roles, norms, and expectations within this age group (Zhang & Wu, 2015). For example, social control perspectives, which have been prevalent in Western studies, argue that in a marital relationship, women exert greater influence upon their spouse's health behaviors than vice versa, meaning that men tend to quit smoking or drinking under their wives' control or influence (Carpiano, 2007; Zhang & Wu, 2015). On the other hand, Zhang and Wu (2015) argued that in the context of traditional Chinese society, in which women played a submissive role in the marital relationship, older women's abilities to influence their husbands' health behaviors might be much more restricted as compared to those of younger Westerners. Following the lack of spousal control argument (Zhang & Wu, 2015) and the wide practice of "social smoking" and "social drinking" (Chuang & Chuang, 2008), my study leverages existing knowledge of the association between socio-relational resources and older Chinese men's risky health behaviors by examining the influence of numerous types of social relationships upon the use of cigarettes and alcohol. I formulate the following hypotheses:

> Hypothesis 1: Socio-relational resources significantly influence smoking and heavy drinking in Chinese men aged 50 and above. Each type of socio-relational resource might pose different effects on smoking and drinking behaviors as suggested in the previous studies.
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> Hypothesis 2: Among various types of socio-relational resources being examined, extrafamilial relationships are more influential on men's smoking and drinking behaviors than familial relationships, as suggested by the "social drinking" and

"social smoking" approach and the "lack of spousal control" argument (Ayers et al., 2010; Carpiano, 2007; Chuang & Chuang, 2008; Zhang & Wu, 2015).

Methods

Data

My analyses in this chapter rely on the CFPS, Waves 1 and 2. The CFPS data offer a longitudinal and nationally representative sample of Chinese communities, families, and individuals. The surveys were conducted by the Institute of Social Science Survey (ISSS) at Peking University, China, in collaboration with the University of Michigan. The study addresses both economic and noneconomic measures of wellbeing, for example, community amenities and infrastructure, total household income and wealth, individual life events, and individual health and socio-relational resources. With few exceptions, such measurements of wellbeing are relatively rare in most population surveys conducted in Asian developing countries. Up to now only the 2010 and 2012 data have been made publicly available on the ISSS website. To my knowledge, these data sets are underutilized and stand to contribute valuable findings to the field of health and healthcare.

A total of more than 34,000 individuals within about 15,000 households were recruited in the baseline CFPS survey in 2010. These participants, ages 9 and above, are reinterviewed every two years. The average response rate for each wave has been about 79%. The analytical sample consists of 3,727 men ages 50 and above. I chose to focus on men only, as smoking and heavy drinking behaviors are much more prevalent among Chinese men than women (Li et al., 2011; Masood et al., 2015; Zhang et al., 2013). The

sample size limits to participants who reported “average” or “good” health status in the baseline in order to reduce the bias of poor health causing social inactivity at older ages (Nummela et al., 2008). The sample also targets men who had at least one living child at baseline to capture the intergenerational transfer aspects of familial resources (Silverstein, Cong, & Li, 2006).

Measurements

Dependent variables: The two dependent variables derive from several questions on smoking and drinking in CFPS Wave 2. Smoking questions are “How many cigarettes do you smoke per day?” and “At what age did you stop smoking?” These questions identify former smoking and current smoking status, and form my first dependent variable of smoking behavior with three categories of “non-smoker” (1), “former smoker” (2), and “current smoker” (3). Questions pertaining to drinking are “How much alcohol did you drink in the past week (in liang)?” Three options of hard liquor or distilled spirit, wine, and beer were given. The volume of alcohol was converted into milliliters (ml) with one liang equivalent to 50 ml. Because the consumption of wine is minimal (data not shown), as reported by Yang and colleagues (2012), only hard liquor and beer consumption are included in the second dependent variable measurement. Consuming a total of more than 55 ml of hard liquor or over 355 ml of beer at once are identified as heavy drinking, as suggested by previous studies on drinking behaviors in China (Yang et al., 2012; Zhang et al., 2009; Zhu et al., 2015).

Independent variables: I test four different sets of independent variables for familial resources, social interaction, stress or strain, and social support at baseline. The

first set of familial resource variables relies on Silverstein's (2006) measurement of living arrangement and intergenerational transfer. Living arrangement includes five categories, namely "married, living with spouse and children" (1), "unmarried, living with only children" (2), "married, living with only children" (3), "married, living with only spouse" (4), and "living alone" (5). Intergenerational transfers measure the bidirectional transfers of offering help to children and receiving help from children. Help includes any type from and/or to all adult children, including housework, financial management, emotional support, and child care or care when respondent is sick.

The second set of independent variables focuses on social interaction, mostly within extrafamilial relationships, following from Zhang's (2013) measurements. Interaction with neighbors assesses the frequency of sharing food or gifts, providing help, visiting, chatting, and doing leisure activities such as going out for dinner or movies together. Each item ranges from "0" as "once a month" to "4" as "almost every day." Interactions with friends or nonresident relatives are measured similarly to interactions with neighbors. Social participation is assessed through a count of the number of formal and informal organizations, such as political parties, religious groups, occupational associations, networks, hobby groups, and others, in which respondents were involved at the time of the baseline interview.

The third set of independent variables pertains to social support, which is measured according to acute and long-term support at the baseline interview (Hughes & Howard, 2009; O'Donovan & Hughes, 2008). These measures encompass both emotional and instrumental forms of support. Acute social support is referenced by four dummy variables indicating whether respondents had someone to rely on when they needed help,

namely “someone to talk to when in trouble,” “someone to turn to when in trouble,” “someone to take care of respondent during sickness,” and “someone from whom to borrow money when in need.” Long-term support includes two items measuring emotional support; specifically, whether respondents had a confidant or someone to chat with daily.

The last set of dependent variables measures stress and strain, which also covers the psychological wellbeing and self-reported health status (Drum et al., 2009). Quality of life is a 5-point Likert scale with higher scores indicating better status. No difficulty with depression/stress/anxiety is constructed by the CFPS team, which resembled the Center for Epidemiological Depression (CESD) short scale. Chronic disease and condition is a dummy variable coded as “1” for participants with any doctor-diagnosed diseases or conditions and “0” for those without any diseases or conditions. The functional limitations variable indicates the total number of daily activities that respondents report they cannot perform independently. As aforementioned, self-reported health status only includes “average” (1) and “good” (2) health at baseline.

Control variables: In line with the previous studies in the field, control variables covering socioeconomic status and demographic factors at baseline are adjusted in my analyses. Age, marital status, educational level, annual family income (logged transformation), agricultural occupation, and retirement status are added into the analyses. As suggested by Stenholm and colleagues (2014), retirement status is possibly a key factor measuring social participation and health behaviors at older ages, as it predicts availability for frequent social interactions. Accordingly, retirement status, measured by

respondents' reports of their current status as working or retired, is included in the models.

Analytical Techniques

Descriptive statistics, and a series of multinomial logistic regression and logistic regression analyses, are estimated using Stata Statistical Software, Release 14 (StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP.). Descriptive statistics, including percentage, or mean, and standard deviation (SD), are shown in Table 2.1. Tables 2.2 and 2.3 present odds ratios (OR) and robust standard errors (SE) for former smoking and current smoking relative to nonsmoking status. Table 2.4 shows logistic regression results, including ORs and robust SEs, for heavy drinking behavior. Each regression table has a total of six models. Model 1 tests only the effects of the control variables. Model 2 examines familial resources. Model 3 tests the effects of social interaction. Model 4 focuses on social support. Model 5 includes all stress and strain variables. Model 6 is the last and joint model of all significant variables found in the previous models.

Results

Table 2.1 contains descriptive statistics stratified by former smokers, smokers, and heavy drinkers. The average age is 61.23 (SD 8.04), and ranges between 63.16 (SD 8.38) and 60.31 (SD 7.63) for former smokers and smokers, respectively. More than 90% of men are married, and about 45% of them lived in urban areas. Most men in the analytical sample report having high school education or lower. Very few men with

college degree or higher smoke or drink heavily. Only 2% are retired and about 30% engage in agricultural activities. The mean annual income (logged) is 9.86 Yuan (SD 1.23), highest among former smokers (9.99, SD 1.21) and lowest among heavy drinkers (9.72, SD 1.23).

Almost half of the participants live with spouse and children (44.06%) or with spouse only (46.66%). Very few men live with children only or live alone. The mean score for providing help to children is 0.49 (SD 1.10), but analyses of variance (ANOVA) indicate that this result is nonsignificant across groups of drinking and smoking status. The mean score for receiving help from children is 0.69 (SD 1.69). The former smoker groups share highest mean scores (0.94, SD 1.97) of receiving help from children as compared to other groups. The mean score for social interactions is 7.06 (SD 6.08), and the social participation mean score is 0.41 (SD 0.59). Both lowest scores for the two social interaction variables are found among smokers, and the highest scores are observed for the former smoker group.

As to social support variables, none of them are statistically significant in their bivariate associations with heavy drinking. Only three of them, namely having someone from whom to borrow money when in need (79.80%), having someone with whom to chat daily (92.73%), and having a confidant (33.16%) are significant across the three smoking categories. Between the two smoking groups, former smokers report more long-term social supports than current smoker groups. Among stress and strain variables, ANOVA results show that functional limitations are insignificant for both smoking and drinking behaviors. The quality of life mean score is 3.67 (SD 1.01), highest among heavy drinkers (3.76, SD 0.98) and lowest among smokers (3.66, SD 1.02). Former

smokers share the highest score for no difficulty with depression, stress, and anxiety (28.19, SD 2.89). Only 15% of participant report having at least one chronic disease or condition, with former smokers possessing the highest percentage, 22.28%. Almost half of the sample have good self-reported health. About 60% of heavy drinkers report good self-rated health as compared to about 44% of former smokers.

Table 2.2 shows odds ratios and robust standard errors for former smokers as compared to nonsmokers. In Model 2, relative to nonsmokers, being unmarried, living with children (OR 11.302, $p < 0.05$), and living alone (OR 9.125, $p < 0.05$) associate with higher odds of being former smokers. In Model 3, both frequent interactions with neighbors, friends, and/or nonresident relatives (OR 1.024, $p < 0.01$) and social participation (OR 1.257, $p < 0.05$) are significant. Model 4 shows that only long-term social support significantly correlates with higher odds for former smoking status. Having a confidant significantly associates with higher odds of being former smokers by about 54% ($p < 0.01$), while daily chat increases these odds by 51% ($p < 0.10$). Only chronic diseases or conditions (OR 0.604, $p < 0.001$) significantly change the odds for being former smokers in Model 5. Most of the significant socio-relational variables, except living arrangement, tend to reduce in magnitude and strength in the joint model. Attending to the control variables, age and retirement slightly associate with the increase in former smoking odds. On the other hand, graduate degree correlates with lower odds for being a former smoker as compared to nonsmoking status.

Table 2.3 shows odds ratios and robust standard errors for current smoking as compared to nonsmoking status. In Model 2, being married and living with spouse reduce the odds of smoking ($p < 0.10$) by about 24%. In contrast, providing help to adult

children associates with higher odds of smoking (OR 1.075, $p < 0.10$). In Model 3, only interactions with neighbors, friends, and extended family members are statistically significant (OR 1.017, $p < 0.05$). As to social supports in Model 4, having someone to turn to when in trouble reduces by about 20% the odds of smoking ($p < 0.05$), while having someone from whom to borrow money when in need increases the odds by about 19% ($p < 0.10$). Having a confidant also significantly associates with increased smoking status (OR 1.206, $p < 0.05$). While quality of life marginally associates with higher smoking odds (OR 1.083, $p < 0.10$), having no difficulty with depression, anxiety, or stress reduces these odds (OR 0.957, $p < 0.01$). Model 6 controls for all significant socio-relational variables, and most of their effects reduce in the joint model, except for living arrangement and no difficulty with depression/stress/anxiety. As to control variables, age and urban residence significantly associate with lower odds of smoking. Among socioeconomic variables, having a college degree or graduate degree, and higher income, reduce the odds of current smoking relative to nonsmoking status.

Table 2.4 illustrates results for heavy drinking. Unlike smoking, living with one's spouse is associated with higher odds of heavy drinking (OR 1.257, $p < 0.01$) relative to living with both spouse and children. Similar to smoking, providing help to adult children increases the odds of heavy drinking (OR 1.083, $p < 0.05$). Both social interaction variables are positively correlated with heavy drinking status in Model 3. None of the social support variables are statistically significant in Model 4. Among stress and/or strain variables, quality of life (OR 1.119, $p < 0.01$), and good self-reported health (OR 1.422, $p < 0.001$) associate with increased odds of heavy drinking. Only chronic diseases and conditions correlate with the reduced odds of heavy drinking (OR 0.644, $p < 0.01$). In

the last model, except for good self-rated health, other socio-relational variables reduce their effects on heavy drinking. As to the control variables, older age, higher educational level, and greater annual income negatively associate with heavy drinking. In contrast, retirement marginally associates with the increased odds of drinking by about 20%, relative to the working group.

Conclusion and Discussion

I employ data from the CFPS Wave 1 and 2 to examine the effects of several familial and extrafamilial resources and cigarette smoking and heavy drinking in Chinese men age 50 and above. My findings provide full or partial support to two hypotheses. Specifically, hypothesis 1 is fully supported by evidence that both familial and extrafamilial socio-relational resources influenced smoking and drinking behaviors among middle-aged and older Chinese men. The second hypothesis, which asserts that, compared to familial relationships, the effects of extrafamilial resources are stronger for smoking and drinking behaviors, is partially supported. The results which show that "social drinking" is prevalent among middle-aged and older Chinese men provide support to the second hypothesis. However, smoking behavior is mainly explained by other mechanisms such as psychological wellbeing, which contributes to the rejection of this hypothesis.

My analyses yield five important findings. First, several familial resources predict smoking and drinking behaviors among middle-aged and older Chinese men. Frequently providing help to adult children increases both smoking and heavy drinking, although the effects are only marginally significant for current smoking status. There are two potential

explanations for this finding. First, the provision of help to one's adult children can be an indicator of a potentially stressful situation such that older adults frequently worry about their children and continue to provide multiple types of support to them, rather than having support flow in the opposite, upward direction (Zhang et al., 2013). As previously informed by Zhang's study (2013), smoking and drinking behaviors are likely to serve as coping mechanisms in such cases. It can also be interpreted that intergenerational transfers flowing to children are indicative of frequent interactions with adult children. These activities are parts of the social interactions, which might increase smoking and drinking behaviors as evidenced in Zhang's study (2013). As the effects of providing help to and receiving support from children drop in the joint models, in which social interaction variables are controlled for, the second explanation might be more suitable than the first one.

In line with Zhang's and Wu's (2015) findings, my results suggest that living arrangements also played a significant role in shaping the smoking and drinking behaviors of older Chinese men. Men who are unmarried and living with children only or living alone tend to quit smoking and to drink moderately as compared to those who live with spouse and children. The result of higher odds of former smoking status in unmarried men living with children is possibly caused by old age or small sample size. Specifically, former smokers are older than other groups, as shown in the descriptive results. In addition, among types of living arrangement, unmarried men living with children are the oldest, followed by those living alone (results not shown). The observed results for men living alone, specifically their higher odds of smoking cessation, might be related to a small sample size. Besides smoking cessation results, living with one's

spouse reduces smoking but increases heavy drinking. This finding partially supports Zhang's and Wu's (2015) argument that drinking was prevalent among Chinese men due to weak or ineffective spousal control. In contrast to Zhang's and Wu's (2015) findings, in my analyses of the CFPS data, men living with their spouses are less likely to smoke compared to those who live with both spouse and children. The smoking odds drop when psychological wellbeing is accounted for in the last model, suggesting that there might be a connection between marital status, depression, and smoking behaviors, as evidenced in various studies conducted in Western countries (Bisconti & Bergeman, 1999; Cockerham, Hinote, & Abbott, 2006; Grundy & Sloggett, 2003).

A second major finding of the chapter is that social interactions act as significant determinants of smoking and drinking behavior in middle-aged and older Chinese men. Although this result is in line with findings from previous studies in China and other East Asian countries (Ayers et al., 2010; Chuang & Chuang, 2008; Zhang & Wu, 2015), the findings are mixed across specific types of health behaviors and social interaction variables. Specifically, men who have frequent interaction with neighbors, friends, or relatives and more involvement in formal and informal associations, groups, or clubs are more likely to be former smokers. This result contradicts results from Zhang's and Wu's cross-sectional study (2015), which found that former smokers were less likely to visit friends and family members. In my longitudinal analyses, former smokers are older than other groups and are more prone to chronic diseases that possibly stop them from smoking, as evidenced by the lowered odds in the joint model. It is also likely that older adults with poor health profiles experience social control and health message transfers embedded in frequent social interactions (Knoll, Burkert, Scholz, Roigas, & Gralla, 2012)

and that these contribute to their smoking cessation. However, as the timing of chronic disease onset and smoking cessation are unknown, this result requires cautious interpretation and further investigation.

On the other hand, frequent interactions with neighbors/friends/nonresident family members also increase both current smoking and heavy drinking behaviors. Social participation also positively correlates with heavy drinking. This set of findings provides support to the "social smoking" and "social drinking" approach developed by Carpiano (2007), which has also been confirmed in previous studies in Asia (Ayers et al., 2010; Chuang & Chuang, 2008).

Third, social supports are only influential on smoking behavior, while their effects on heavy drinking are insignificant. For former smoking status, only long-term social support shows significant results. It is possible that the pathological impacts of life stress and strain are minimized and eliminated by support from long-term confidants (Chou & Chi, 2001), helping men to stop smoking. Similarly, the effects of a daily conversation with another person, such as a child or spouse who is possibly a health-conscious individual, could encourage smoking cessation decisions (Bisconti & Bergeman, 1999). However, as aforementioned, the explanation for former smoking status might be more complex, as the timing of smoking cessation was unaccounted for. Unlike former smoking, both acute and long-term social supports are significant determinants of current smoking status. The finding that having a person to turn to when in trouble significantly reduces smoking likelihood points in the direction of the stress-buffering hypothesis (Stockdale et al., 2007). Smoking might be a coping mechanism during the onset and across the duration of a stressful condition. Acute support, such as having a supportive

person, during the stressful period might ameliorate psychological wellbeing and protect against the practice of risky behaviors such as smoking. In contrast, having a confidant is likely characterized as long-term support. Its increased effects on smoking might be explained by unmeasured factors, such as the negative impacts of social networks (Thanakwang & Soonthorndhada, 2011).

Fourth, health-related stress and strain are also significantly associated with smoking and drinking behaviors among middle-aged and older Chinese men. Men with at least one chronic disease or condition tend to quit smoking and drink moderately, possibly due to the effects of social control (Knoll et al., 2012) or health messages being advocated by health care professionals (Holmes & Joseph, 2011). The unexpected result is that positive self-rated health status and higher quality of life increase both smoking and heavy drinking. Unlike the objective measure of chronic diseases and conditions, which was doctor diagnosed, self-reported health, quality of life, and other psychological wellbeing measures are subjective in the CFPS questionnaire, which can be prone to biases. Chinese men's health status and health behaviors might follow the same patterns of the gender paradox established in other populations (Bastos, Canesqui, & Barros, 2015; Chun, Doyal, Payne, Il-Cho, & Kim, 2006; Lindahl-Jacobsen et al., 2013; Anna Oksuzyan, Juel, Vaupel, & Christensen, 2008; Oksuzyan, Shkolnikova, Vaupel, Christensen, & Shkolnikov, 2014; Yong, Saito, & Chan, 2011). The paradox argued that women reported more diseases and illnesses, but their mortality risks were lower than men. In contrast, men did not report as many diseases and illnesses as women, but they were more likely to practice unhealthy behaviors, and had higher mortality risks and hospitalization rates due to serious health problems (Lindahl-Jacobsen et al., 2013;

Oksuzyan et al., 2008; Oksuzyan et al., 2014). In a couple of publications in 2008 and 2014, Oksuzyan further explained this stratification in men's and women's health profiles from the gender identity viewpoint, which depicted the biological, social, and behavioral differences between men and women. Unlike women, men were unwilling to openly discuss their illness and mental health, considering disclosing such information as a sign of weakness. Thus, men tended to report less depression and more satisfaction with their lives, which can fully explain the results of good self-rated physical and mental health being correlated with smoking and heavy drinking among older Chinese men, a generation in which patriarchal norms and Confucianism are well preserved (Zhang & Wu, 2015). Embedded in an East Asian society where the traditional social status between men and women is heavily imbalanced by the expectation that women serve as loyal and subordinate wives, elderly men would not freely express their ill health status to maintain their hierarchy within their family or community (Zhang & Wu, 2015). Another mixed result is that middle-aged and elderly Chinese men without any or little experience with depression, stress, anxiety and other mental health issues are less likely to smoke, but more likely to drink. This finding strengthens the possibility that excessive consumption of alcohol might not be a stress coping mechanism as cigarette smoking may be, but is likely to be a normative group activity among older age groups.

Finally, the findings for the sociodemographic variables are in line with the previous studies (Cheng et al., 2016; Henkens, van Solinge, & Gallo, 2008; Khlat, Sermet, & Le Pape, 2004; Zhang et al., 2013). The general pattern is that higher socioeconomic status protects against the practice of risky health behaviors such as smoking and heavy drinking. The results of retirement associated with heavy drinking

supported of the idea that drinking is more of a group activity than smoking, as retired men report more social interactions and group participation compared with their working counterparts (results not shown). This result is consistent with Henkens' (2008) and Khlat's (2004) findings that retired Dutch and unemployed French showed higher risks for drinking relative to the employed group. However, one important note about retirement's impacts on smoking and drinking behaviors is the different effects of involuntary and voluntary retirement on the practice of risky health behaviors. As Henkens and colleagues (2008) noted, heavy drinking in the case of involuntary retirement was potentially an indicator of stress and strain, and excessive consumption of alcohol was identified as a coping mechanism. Only in the case of voluntary retirement, heavy drinking in older men can be associated with social interactions. In my analyses, retirement status is correlated with older age (results not shown), thus, the "social drinking" approach is acceptable as most of the retirement cases in the CFPS sample are possibly voluntary.

In conclusion, the social contexts of smoking and drinking behaviors among middle-aged and older Chinese men are complex, as previously observed in other populations (Li et al., 2011). The multidimensional approach of examining various types of socio-relational resources in my analyses finds that while smoking is more related to stress and strain, heavy drinking is identified as a group activity. This main finding might offer valuable lessons for the Chinese public health system as both smoking and heavy drinking have been identified as an epidemiology in contemporary China (Li et al., 2011). However, my analyses possess several limitations due to the use of a secondary data source. First, the measurements of dependent variables are somewhat problematic. My

analyses are unable to account for timing of smoking cessation. Additionally, heavy drinking is measured by the total amount of alcohol consumed in the past week. Another secondary data limitation is the unstandardized measures of socio-relational resources, as many scales developed in Western countries are missing in the CFPS. However, to my knowledge, the CFPS possesses valuable information that covered a wide range of social determinants of risky health behaviors that are relatively rare in other Asian population surveys. In addition, socio-relational resources are perceived as relatively new concepts (Umberson et al., 2010) and are possibly varied across cultural contexts (Zhang & Wu, 2015). Therefore, using an inventory list of socio-relational variables in a nonwestern culture and an underused data source is acceptable.

The use of time-lagged models poses another methodological issue. Time-lagged models are chosen due to the discontinuation of the social interaction module in the follow-up survey. Time-lagged models are not fully considered longitudinal analysis, but are critically helpful in capturing the direction of the association between socio-relational resources and health. As suggested in prior studies, healthy individuals and the practice of good health behaviors generate the selection effects on social life, meaning that people with a better health profile find themselves in an active lifestyle and fully enjoy the benefits of social ties and interactions (Nummela et al., 2008). These various limitations aside, overall my analyses contribute valuable findings for the field of socio-relational resources, especially in the case of scarce knowledge in Asian countries, where the growing rate of aging population is immense and older adults' growing experiences with chronic disease continue to be an alarming public health issue (Aida et al., 2013).

Table 2.1

Descriptive Statistics for Middle-Aged and Older Chinese Men

Variables	Total N=3,727	Former Smokers N=588	*p- value*	Smokers N=2,279	*p-value*	Heavy Drinkers N=772	*p-value*
Sociodemographic characteristics							
Age	61.23 (8.04)	63.16 (8.38)	0.000	60.31 (7.63)	0.000	60.71 (7.20)	0.045
Married	91.84%	92.52%	0.813	91.79%	0.813	91.97%	0.910
Urban	45.02%	50.34%	0.000	40.63%	0.000	42.10%	0.067
Education level:							
Illiterate/Semi-illiterate	30.80%	26.70%	0.000	32.78%	0.000	36.01%	0.000
Primary	25.22%	26.02%	0.000	25.54%	0.000	26.17%	0.000
High school completion	26.11%	27.72%	0.000	26.37%	0.000	25.65%	0.000
Some college	12.96%	14.63%	0.000	11.67%	0.000	9.33%	0.000
Graduate degree	4.91%	4.93%	0.000	3.64%	0.000	2.85%	0.000
Retired	2.36%	3.40%	0.153	2.28%	0.153	2.59%	0.637
Farm	28.12%	23.30%	0.001	30.32%	0.001	33.42%	0.000
Annual family income (logged)	9.86 (1.23)	9.99 (1.21)	0.000	9.78 (1.24)	0.000	9.72 (1.23)	0.000
Familial resources							
Living arrangement:							
Married, living with spouse and children	44.06%	40.99%	0.142	45.90%	0.142	40.41%	0.211
Unmarried, living with children	4.61%	4.59%	0.142	4.65%	0.142	4.53%	0.211
Married, living with children	0.78%	0.85%	0.142	0.92%	0.142	0.78%	0.211
Married, living with spouse	46.66%	49.66%	0.142	44.67%	0.142	50.39%	0.211
Living alone	3.89%	3.91%	0.142	3.86%	0.142	3.89%	0.211
Helping children	0.49 (1.10)	0.57 (1.14)	0.153	0.47 (1.11)	0.153	0.51 (1.18)	0.556

Table 2.1 Continued

Variables	Total N=3,727	Former Smokers N=588	*p- value*	Smokers N=2,279	*p-value*	Heavy Drinkers N=772	*p-value*
Receiving help from children	0.69 (1.69)	0.94 (1.97)	0.000	0.64 (1.64)	0.000	0.63 (1.69)	0.268
Social interactions							
Frequent interactions with neighbors/friends/relatives	7.06 (6.08)	7.59 (6.37)	0.019	7.07 (6.17)	0.019	7.27 (6.46)	0.287
Social participation	0.41 (0.59)	0.50 (0.61)	0.000	0.38 (0.57)	0.000	0.40 (0.57)	0.769
Social support							
Having someone to talk to when in trouble	84.01%	85.88%	0.400	83.63%	0.400	85.62%	0.170
Having someone to turn to when in trouble	73.71%	76.36%	0.800	72.44%	0.80	74.35%	0.647
Having someone to care for when sick	95.89%	95.92%	0.997	95.88%	0.997	96.37%	0.452
Having someone to borrow money when in need	79.80%	78.23%	0.005	81.44%	0.005	81.09%	0.315
Chat with someone daily	92.73%	94.90%	0.084	92.41%	0.084	93.39%	0.424
Having a confidant	33.16%	39.12%	0.003	32.47%	0.003	32.38%	0.605
Stress/strain							
Quality of life	3.67 (1.01)	3.71 (0.95)	0.371	3.66 (1.02)	0.371	3.76 (0.98)	0.004
No difficulty with depression/stress/anxiety/etc.	27.82 (3.28)	28.19 (2.89)	0.000	27.60 (3.44)	0.000	28.05 (3.10)	0.029
Any chronic diseases/condition(s)	15.11%	22.28%	0.000	13.51%	0.000	9.72%	0.000
Any functional limitation(s)	0.13 (0.62)	0.16 (0.73)	0.225	0.11 (0.56)	0.225	0.09 (0.43)	0.113
Good self-reported health	49.48%	44.22%s	0.019	50.72%	0.019	58.55%	0.000

Notes: Percentage, or mean and standard deviation

Table 2.2

Multinomial Logistic Regression Results for Former Smoking Relative to Nonsmoking Status

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sociodemographic characteristics						
Age	1.016*	1.009	1.014+	1.017*	1.011	1.008
	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)	(0.008)
Married (ref: unmarried)	1.232	12.190*	1.192	1.194	1.255	11.780*
	(0.253)	(13.767)	(0.245)	(0.250)	(0.261)	(12.970)
Urban (ref: rural)	0.834	0.844	0.816+	0.815+	0.841	0.817
	(0.099)	(0.101)	(0.098)	(0.098)	(0.102)	(0.101)
Education level (ref: Illiterate/Semi-illiterate)						
Primary	1.192	1.182	1.161	1.142	1.172	1.102
	(0.178)	(0.177)	(0.174)	(0.172)	(0.175)	(0.166)
High school completion	1.281	1.277	1.198	1.206	1.253	1.127
	(0.200)	(0.200)	(0.189)	(0.189)	(0.195)	(0.180)
Some college	1.072	1.065	0.962	1.002	1.030	0.890
	(0.201)	(0.201)	(0.185)	(0.188)	(0.195)	(0.172)
Graduate degree	0.604*	0.620+	0.517*	0.530*	0.575*	0.468**
	(0.154)	(0.160)	(0.136)	(0.136)	(0.150)	(0.126)
Retired (ref: non-retired)	1.909+	1.852+	1.865+	1.966+	1.851+	1.825+
	(0.659)	(0.637)	(0.649)	(0.679)	(0.647)	(0.645)
Farm (ref: non-farm)	0.840	0.845	0.846	0.840	0.849	0.852
	(0.117)	(0.118)	(0.118)	(0.117)	(0.118)	(0.119)
Annual family income (logged)	1.055	1.051	1.022	1.043	1.039	1.003
	(0.053)	(0.056)	(0.052)	(0.052)	(0.053)	(0.055)
Familial resources						

Table 2.2 Continued

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Living arrangement (ref: Married, living with spouse and children)						
Unmarried, living with children		11.302*				11.469*
		(13.087)				(12.965)
Married, living with children		2.065				2.094
		(1.532)				(1.527)
Married, living with spouse		1.001				0.979
		(0.120)				(0.119)
Living alone		9.125*				9.129*
		(9.943)				(9.687)
Helping children		1.029				1.014
		(0.053)				(0.053)
Receiving help from children		1.061+				1.040
		(0.036)				(0.037)
Social interactions						
Frequent interactions with neighbors/friends/relatives			1.024**			1.017+
			(0.009)			(0.009)
Social participation			1.257*			1.197+
			(0.119)			(0.116)
Social support						
Having someone to talk to when in trouble				1.022		
				(0.174)		
Having someone to turn to when in trouble				0.973		0.969
				(0.133)		(0.127)

Table 2.2 Continued

	Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Having someone to care for when sick				0.805		
					(0.231)		
	Having someone to borrow money when in need				1.095		1.085
					(0.149)		(0.148)
	Chat with someone daily				1.506+		1.485+
					(0.364)		(0.346)
	Having a confidant				1.459**		1.372**
					(0.169)		(0.161)
Stress/strain							
	Quality of life					1.062	1.027
						(0.059)	(0.057)
	No difficulty with depression/stress/anxiety/etc.					1.009	1.005
						(0.020)	(0.020)
	Any chronic diseases/condition(s)					1.604***	1.548**
						(0.230)	(0.225)
	Any functional limitation(s)					1.050	
						(0.085)	
	Good self-reported health					0.840	
						(0.094)	
N		3727	3727	3727	3727	3727	3727
chi2		177.005** *	198.123** *	196.073** *	202.549** *	215.194** *	264.752** *
bic		6934.108	7009.023	6952.049	7008.495	6976.980	7094.375

Notes: Odds ratios and robust standard errors

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.3

Multinomial Logistic Regression Results for Smoking Relative to Nonsmoking Status

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sociodemographic characteristics						
Age	0.963***	0.958***	0.962***	0.965***	0.963***	0.960***
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
Married (ref: unmarried)	0.896	2.869	0.881	0.880	0.907	2.805
	(0.139)	(3.316)	(0.137)	(0.137)	(0.141)	(3.167)
Urban (ref: rural)	0.683***	0.694***	0.678***	0.676***	0.707***	0.707***
	(0.062)	(0.063)	(0.061)	(0.062)	(0.065)	(0.065)
Education level (ref: Illiterate/Semi-illiterate)						
Primary	0.908	0.907	0.899	0.887	0.923	0.902
	(0.101)	(0.101)	(0.100)	(0.099)	(0.103)	(0.102)
High school completion	0.856	0.864	0.834	0.833	0.878	0.852
	(0.099)	(0.100)	(0.098)	(0.097)	(0.102)	(0.101)
Some college	0.592***	0.596***	0.565***	0.570***	0.609***	0.577***
	(0.082)	(0.083)	(0.080)	(0.080)	(0.085)	(0.083)
Graduate degree	0.454***	0.475***	0.426***	0.429***	0.463***	0.442***
	(0.085)	(0.091)	(0.083)	(0.081)	(0.088)	(0.088)
Retired (ref: non-retired)	1.399	1.371	1.392	1.420	1.399	1.409
	(0.404)	(0.395)	(0.404)	(0.411)	(0.404)	(0.409)
Farm (ref: non-farm)	0.876	0.881	0.875	0.873	0.876	0.880
	(0.089)	(0.090)	(0.089)	(0.089)	(0.089)	(0.090)
Annual family income (logged)	0.953	0.932+	0.936+	0.949	0.956	0.918*
	(0.035)	(0.036)	(0.035)	(0.035)	(0.036)	(0.037)
Familial resources						

Table 2.3 Continued

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Living arrangement (ref: Married, living with spouse and children)						
Unmarried, living with children		3.261				3.242
		(3.826)				(3.720)
Married, living with children		2.740				2.797+
		(1.693)				(1.704)
Married, living with spouse		0.855+				0.853+
		(0.076)				(0.077)
Living alone		2.785				2.709
		(3.165)				(3.006)
Helping children		1.075+				1.067
		(0.046)				(0.046)
Receiving help from children		1.037				1.027
		(0.030)				(0.030)
Social interactions						
Frequent interactions with neighbors/friends/relatives			1.017*			1.014+
			(0.007)			(0.007)
Social participation			1.088			1.068
			(0.082)			(0.082)
Social support						
Having someone to talk to when in trouble				0.997		
				(0.127)		
Having someone to turn to when in trouble				0.808*		0.796*
				(0.084)		(0.078)
Having someone to care for when sick				1.018		
				(0.224)		

Table 2.3 Continued

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Having someone to borrow money when in need				1.173		
				(0.125)		(0.123)
Chat with someone daily				1.112		1.112
				(0.182)		(0.175)
Having a confidant				1.206*		1.179+
				(0.109)		(0.107)
Stress/strain						
Quality of life					1.083+	1.076+
					(0.046)	(0.046)
No difficulty with depression/stress/anxiety/etc.					0.958**	0.960**
					(0.014)	(0.014)
Any chronic diseases/condition(s)					1.008	0.955
					(0.120)	(0.113)
Any functional limitation(s)					0.946	
					(0.067)	
Good self-reported health					1.007	
					(0.085)	
N	3727	3727	3727	3727	3727	3727
chi2	177.005***	198.123***	196.073***	202.549***	215.194***	264.752***
bic	6934.108	7009.023	6952.049	7008.495	6976.980	7094.375

Notes: Odds ratios and robust standard errors

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2.4

Logistic Regression Results for Heavy Drinking Relative to Moderate Drinking Status

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sociodemographic characteristics						
Age	0.985**	0.981**	0.983**	0.985**	0.986**	0.978***
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
Married (ref: unmarried)	1.016	1.122	1.000	0.961	0.964	1.144
	(0.157)	(0.786)	(0.155)	(0.151)	(0.151)	(0.835)
Urban (ref: rural)	1.070	1.071	1.054	1.072	1.087	1.080
	(0.099)	(0.099)	(0.099)	(0.100)	(0.103)	(0.103)
Education level (ref: Illiterate/Semi-illiterate)						
Primary	0.844	0.829+	0.825+	0.832+	0.818+	0.798*
	(0.090)	(0.089)	(0.088)	(0.089)	(0.088)	(0.087)
High school completion	0.778*	0.763*	0.738**	0.762*	0.752*	0.707**
	(0.087)	(0.086)	(0.084)	(0.086)	(0.085)	(0.082)
Some college	0.542***	0.526***	0.498***	0.529***	0.529***	0.482***
	(0.083)	(0.081)	(0.078)	(0.081)	(0.082)	(0.077)
Graduate degree	0.482**	0.461**	0.424***	0.471**	0.463**	0.405***
	(0.119)	(0.115)	(0.108)	(0.117)	(0.114)	(0.103)
Retired (ref: non-retired)	1.208*	1.197+	1.214*	1.213*	1.182+	1.187+
	(0.115)	(0.114)	(0.117)	(0.115)	(0.113)	(0.114)
Farm (ref: non-farm)	1.196	1.184	1.163	1.196	1.195	1.163
	(0.311)	(0.310)	(0.302)	(0.310)	(0.319)	(0.311)
Annual family income (logged)	0.928*	0.939+	0.912**	0.927*	0.908**	0.903**
	(0.032)	(0.034)	(0.032)	(0.032)	(0.032)	(0.033)
Familial resources						

Table 2.4 Continued

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Living arrangement (ref: Married, living with spouse and children)						
Unmarried, living with children		1.324				1.403
		(0.966)				(1.064)
Married, living with children		1.155				1.234
		(0.556)				(0.588)
Married, living with spouse		1.257**				1.199*
		(0.111)				(0.108)
Living alone		1.264				1.354
		(0.843)				(0.943)
Helping children		1.083*				1.072+
		(0.043)				(0.041)
Receiving help from children		0.974				
		(0.030)				
Social interactions						
Frequent interactions with neighbors/friends/relatives			1.012+			1.012+
			(0.007)			(0.007)
Social participation			1.183*			1.179*
			(0.089)			(0.091)
Social support						
Having someone to talk to when in trouble				1.188		
				(0.156)		
Having someone to turn to when in trouble				0.967		
				(0.097)		
Having someone to care for when sick				1.130		
				(0.263)		

Table 2.4 Continued

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Having someone to borrow money when in need		1.019				
		(0.108)				
Chat with someone daily				1.138		
				(0.198)		
Having a confidant				1.011		
				(0.090)		
Stress/strain						
Quality of life					1.119**	1.103*
					(0.049)	(0.048)
No difficulty with depression/stress/anxiety/etc.					1.026+	1.026+
					(0.015)	(0.015)
Any chronic diseases/condition(s)					0.644**	0.625***
					(0.087)	(0.086)
Any functional limitation(s)					0.908	
					(0.063)	
Good self-reported health					1.422***	1.430***
					(0.121)	(0.122)
N	3727	3727	3727	3727	3727	3727
chi2	46.299***	54.277***	53.466***	49.081***	102.707***	113.075***
bic	3845.096	3884.195	3853.079	3890.136	3828.806	3864.132

Notes: Odds ratios and robust standard errors

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER 3

NEIGHBORHOOD SOCIAL COHESION, SOCIAL PARTICIPATION AND PSYCHOLOGICAL WELLBEING OF MIDDLE AGED AND OLDER ADULTS IN CHINA

Introduction

China is undergoing rapid economic and social transformation, including rapid growth in the aging population (Zimmer & Kwong, 2003), evolving patterns of rural to urban migration (Silverstein, Cong, & Li, 2006), and an increasing capacity for community-level provision of services to residents (Shen, 2014). These recent transformations are driving forces for new demographic trends in family formation, living arrangements, and also health and wellbeing of older adults, including those who have seen their children migrate great distances for work, as well as those whose communities and social networks are changing rapidly in tandem with urban expansion, rising economic inequality between regions, individuals' mobility, and other processes that coincide with China's social and economic transformations (Norstrand & Xu, 2012; Silverstein et al., 2006; Zimmer & Kwong, 2003; Zimmer & Korinek, 2008). While a large body of literature about familial relationships, such as living arrangements and intergenerational transfers and older adults' health in China, is amassing, very little is

known about extrafamilial and community socio-relational resources as determinants of health and wellbeing in older adulthood (Meng & Chen, 2014; Norstrand & Xu, 2012; Yamaoka, 2008). Drawing upon the extant literature on extrafamilial and community socio-relational resources and health in Western countries, my study fills in the gap of knowledge in social determinants of health by examining the effects of neighborhood social cohesion and social participation on health and wellbeing among middle-aged and older adults in China.

Neighborhood Social Cohesion, Social Participation and Health in the US and other Western Countries

A voluminous body of literature has found that neighborhood characteristics, including the built environment, collective measures of socioeconomic status, and the socio-relational linkages among residents, are closely linked with individuals' health in the US and other Western countries (Kawachi & Berkman, 2000; Rios, Aiken, & Zautra, 2012; Steptoe & Feldman, 2001). Neighborhood characteristics can influence health outcomes in different directions and the effect size and direction empirically observed are mixed (Echeverria, Diez-Roux, Shea, Borrell, & Jackson, 2008). For example, a study by Steptoe and Feldman (2001) found that a neighborhood's physical problem, such as poor amenities and services, noise and pollution, were associated with poorer self-reported health, higher psychological distress, and impaired physical function in the United Kingdom. They speculated that long-term exposure to neighborhood problems possibly caused chronic stress, which may have partially explained the relationship between community built environment and individual health (Steptoe & Feldman, 2001). Other

studies noted that a neighborhood's social characteristics, such as social cohesion or residents' participation in community activities, can reduce the negativity of chronic stress and mediate the impacts of poor neighborhood built environment on individuals' health (Berkman, 2000; Echeverria et al., 2008; O'Campo, Salmon, & Burke, 2009; Rios et al., 2012). Rios and colleague (2012) found that neighborhood social cohesion can buffer the ill effects of neighborhood problems on both physical and mental health. Specifically, residents of highly cohesive communities were least affected by neighborhood socioeconomic deprivation and maintained better self-reported health and less psychological distress as compared to residents of less socially cohesive communities with similar levels of poverty.

In addition to neighborhood social cohesion, social participation is widely recognized as another extrafamilial factor improving both physical health and psychological wellbeing in Western countries (Berkman, 2000; Kawachi & Berkman, 2000). Social participation is considered a broader term as compared to neighborhood social cohesion because it measures other individuals' social activities, such as participation in political parties, or voluntary organizations of social groups and hobby clubs (Greiner, Li, Kawachi, Hunt, & Ahluwalia, 2004). Social participation contributed to maintaining good health behaviors of physical activities and healthy body mass index, and improving health-related quality of life and self-rated physical and mental health (Greiner et al., 2004; Lindström, Hanson, & Ostergren, 2001; Nummela, Sulander, Rahkonen, Karisto, & Uutela, 2008; Sirven & Debrand, 2008). Among these studies, Nummela and colleagues (2008) noted that compared to individuals' demographic and socioeconomic factors, social participation had stronger effects on the frequent practice

of good health behaviors, which improved other health outcomes in the long run. Nummela (2008) further discussed that social participation's effects on healthy behaviors were heavily dependent on the group's norms on health awareness and peer pressure between its members. This means that the health impacts of social participation might be complicated and in some cases, such as smoking and drinking, social participation can worsen health status (Greiner et al., 2004).

Neighborhood Social Cohesion, Social Participation and Health in Asian Countries

Research that considers contextual and neighborhood effects on health in East Asian societies is nascent (Murayama et al., 2015). While relatively new, some studies have explored various mechanisms whereby neighborhood cohesion and social participation influenced individuals' health. Similar to empirical evidence in Western countries, several studies in East Asian countries have found positive effects of social participation and neighborhood social cohesion on health for noninstitutionalized older adults. For example, participating in any hobby group, club, or organization within or outside community correlated with relatively positive self-reported health (Hanibuchi et al., 2012), reduced risks of functional limitation (Kanamori et al., 2014), and enhanced mental health and quality of life (Yuasa, Ukawa, Ikeno, & Kawabata, 2014) in older Japanese. Consistent with findings in Japan, a group of studies in South Korea found that participation in social activities associated with reduced depressive symptoms (Choi et al., 2015), and performing leisure activities involving social interaction with others associated with more positive quality of life (Lee & Park, 2014).

In addition to social participation, neighborhood social cohesion in Japan and South Korea was also positively associated with health and wellbeing of older adults. Neighborhood social cohesion, as conceived at both individual and community level, was associated with lower risks of mortality from cardiovascular, pulmonary, and all other mortality causes in older Japanese (Inoue, Yorifuji, Takao, Doi, & Kawachi, 2013). A community characterized by more reciprocity also predicted better health status and health behaviors among residents living in the M-region in Japan (Hanibuchi et al., 2012). Neighborhood social cohesion also inversely related to depression in older adults age 65 and above living in Yabu, Japan (Murayama et al., 2015). In South Korea, a cross-sectional study in Seoul found that stronger community identity, which was measured by a combination of factors including social cohesion, participation, length of residence, extent and strength of member's networks, and social trust can improve health status (Jung & Rhee, 2013). Another study in South Korea further found that individuals living in communities with higher levels of communication between residents reported better health status than those living in communities with less social interaction (Jung, Bigman-Galimore, & Viswanath, 2014).

Collectively, these research findings point toward a robust role for social participation and neighborhood social cohesion in promoting health and healthy aging in East Asian countries. The potential for these community-level features to reinforce health and wellbeing is particularly strong in those many communities of East Asia where traditional living arrangements of multigenerational households are slowly fading away due to rapid industrialization and urbanization (Brown et al., 2002).

Although studies centered on neighborhood social cohesion and social

participation are abundant in Western countries, and valuable knowledge has begun to accumulate in the Japanese and South Korean settings, there has been a scarcity of research examining this set of relationships in China. While a large number of studies investigated familial relationships, in particular living arrangements, and their implications for older adults' health in China, little work has been conducted which address extrafamilial and community socio-relational resources as determinants of health and wellbeing in older adulthood (Meng & Chen, 2014; Yamaoka, 2008). Parallel to the findings for family-based social relationships and health, these studies have found that extrafamilial social resources also exhibit significant, positive associations with older adults' health and wellbeing in China. For example, in Shanghai, social factors such as social activity participation and caring for grandchildren were among the most important measured predictors of self-rated health and psychological wellbeing in a sample of adults age 50 and above (Zhang, Feng, Liu, & Zhen, 2015), while neighborhood satisfaction and social cohesion each correlated positively with adults' health status (Wen, Fan, Jin, & Wang, 2010). Among Taiwanese at all ages, besides frequent contacts with family members, social participation and social connection influenced happiness across the life course, an association that was particularly strong and salient in older adulthood (Hsu & Chang, 2015). A study relying upon a nationally representative sample from the Chinese General Social Survey conducted in 2005 also found that aggregated social trust within community was associated with better self-reported health (Meng & Chen, 2014). Another multilevel study which utilized nationally representative data from the pilot wave of the China Health and Retirement Longitudinal Study conducted in 2008 found that the number of amenities and organizations present within one's community

exhibited a significant, positive association with mental health in middle and later life (Shen, 2014). These studies have shed light on the association between social participation and social cohesion in China. However, they are either regional or cross-sectional studies and thus they feature limitations for assessing causality and for addressing changes in patterns of association.

Urban and Rural Stratification in Neighborhood Social Cohesion, Social Participation, and Health in China

A large body of literature on rural to urban migration and health in China has shown uneven patterns of change in community development and family structures and norms (Norstrand & Xu, 2012). Patterns of social participation and neighborhood social cohesion are likely different between areas, and the effects of extrafamilial relationships on psychological wellbeing in older adults will differ across these geographic lines of stratification in China. Zimmer and Kwong (2003) argued that with the aging population continuing to grow in more economically disadvantaged communities as well as individuals' increased occupational mobility and geographic mobility from rural to urban areas, the role of family members, particularly adult children, in providing support and care for the older parents may be heavily shifted to the community. A recent study by Norstrand and Xu (2012) confirms that rural elderly are at higher risk of adverse health outcomes due to their disadvantaged socioeconomic status and the abrupt changes in traditional living arrangements and familial norms they have experienced. As the new role of community in providing services and support for older adults has developed over the years (Shen, 2014), a few recent studies in China have observed positive impacts of

extrafamilial resources, such as social trust, interpersonal reciprocity, and neighborhood satisfaction and cohesion, on health status in rural as well as urban communities (Cao, Li, Zhou, & Zhou, 2015; Gao, Fu, Li, & Jia, 2015; Meng & Chen, 2014; Shen & Yeatts, 2013; Wen et al., 2010). However, the rural and urban comparison in the association between extrafamilial relationships and health still remains unclear, even though there are clear distinctions between these geographical settings in terms of economic and social resource distributions (Gao et al., 2015; Meng & Chen, 2014; Norstrand & Xu, 2012). There have been a couple of studies by Nostrand and Xu (2012) and Meng and Chen (2014) which investigate the associations between social capital and social participation and health status across geographical settings. Both employed the nationally representative sample from the 2005 Chinese General Social Survey. Nonetheless, their results were inconsistent for social capital, measured by bonding and bridging social trust, and insignificant for social participation.

Informed by this existing body of literature and motivated by the remaining gaps in knowledge, this study examines the associations between community-level social cohesion and social participation and psychological wellbeing, measured by depressive symptoms and overall life satisfaction, among Chinese middle-aged and older adults. As suggested by the WHO, healthy aging includes a state of balanced physical, psychological, social, and spiritual wellbeing in later years, but psychological and spiritual wellbeing seems to be have been ignored in health scholarship in the Asian context, potentially due to reluctance to talk openly about depression and other mental health problems (Han et al., 2015). This study also employs a nationally representative sample from recent longitudinal surveys to examine the causal relationship between

neighborhood social cohesion and social participation and psychological wellbeing. As Nummela and colleagues (2008) noted that the roles of social participation and self-rated health in the association can be interchangeable, meaning that good health can possibly increase participation in social activities, using longitudinal data can potentially generate better inference for causal effects of these extrafamilial resources on health. In addition, I also model the moderating effects of urban and rural settings on the relationship between social participation, neighborhood cohesion, and health. These socio-relational resources' effects on health are moderated by gender and age as well documented in the existing literature (Li, Lin, & Chen, 2011; Li, Lin, Fetzer, & Chen, 2014; Zhang et al., 2015). However, little is known about how the association between extrafamilial socio-relational resources and health may vary between urban and rural areas (Cao et al., 2015; Meng & Chen, 2014; Wen et al., 2010). With the advantages of using more recent longitudinal study and multilevel analyses, I aim to fill the research gaps by examining two hypotheses:

Hypothesis 1: Neighborhood social cohesion and social participation are significant predictors of depression and quality of life in middle-aged and older Chinese. Individuals living in more socially cohesive communities and those living in communities with higher levels of social participation have fewer depressive symptoms and are more satisfied with life.

Hypothesis 2: The associations between neighborhood social cohesion and social participation and psychological wellbeing in China are moderated by urban and rural settings. Economic and social developments in contemporary China increase individuals' mobility from rural to urban areas. These changes might affect health

and wellbeing of older parents in rural areas as they experience changes in the traditional living arrangement and intergenerational relationships. Thus, in terms of psychological wellbeing, a cohesive neighborhood and participation in social organizations might be more beneficial for older parents in rural areas as compared to their urban counterparts.

Methods

Data

My analyses rely on the CFPS Wave 1 and 2, conducted in 2010 and 2012, respectively. The CFPS is a nationally representative study implemented by the ISSS at Peking University in collaboration with the Survey Research Center at the University of Michigan. The data cover multiple economic and noneconomic topics, such as education, migration, family dynamics, social relationships, and health and wellbeing. The study includes individual, household, and community surveys. The core family members are followed up every year and theoretically can only leave the surveys through death. Currently, only the baseline (2010) and follow-up data in 2012 are publically available at the ISSS website. The respond rate for each wave is approximately 79%.

This study mainly uses the individual data, which contain more than 30,000 participants age 18 years and older. I also partially utilize the household data of about 15,000 households to generate two variables that measure living arrangement and family income. The analytical sample includes only adults age 50 and above, who had at least one living adult child and do not live with their older parents at the time of baseline interview. I also limit the sample to participants who reported “fair or average” or “good”

self-reported health in the baseline as my aim is minimizing the risk of poor health causing socially inactive status in older adults (Nummela et al., 2008). All participants who did not meet these criteria are dropped out of our analyses. Thus, the final analytical sample purposely reduces to 7,159 participants nested in 619 communities which are identified by the China census.

Measurements

Dependent variables. As recommended by O'Campo's study (2009), psychological wellbeing is measured by overall life satisfaction and depressive symptoms in the follow-up survey. Overall life satisfaction is derived from the question of "Are you satisfied with your life?" The variable is a 5-point Likert scale where the higher score denotes more satisfaction. The second dependent variable is the CESD score, which is a sum of 20 items measuring depressive symptoms occurring in the past week. Each of these items is originally a 4-point scale from "1" as "Almost never" to "4" as "Most of the time (5 to 7 days)." These variables are recoded into dummy variables of "1" if depressive symptom occurred or "0" for no symptom. Four of these items are reversely coded because the original wordings indicate better mental health. These 20 items are summed and the final score ranges from 0 to 20, where higher score associates with more depressive symptoms (α=.84).

Independent variables. The main independent variables measuring extrafamilial socio-relational resources are neighborhood social cohesion and social participation following Li, Chi and Xu's (2013) measurements. Neighborhood social cohesion is a sum of five items measuring frequencies of interaction with neighbors in the past month.

Interactions include sharing food or gifts, providing help, visiting, chatting, and doing leisure activities such as going out for movies or having dinner together. Each item is reverse-coded and ranges from "0" as "Once a month" to "4" as "Almost every day." The reliability coefficient for neighborhood social cohesion is acceptable at α=.70. Social participation is a number of formal (e.g., political party, economic, industry, or education association, religious group, and so on) or informal organizations (e.g. community, network, or others) in which respondents were currently involved.

Control variables. The analyses control for several sets of variables as suggested in previous studies (Meng & Chen, 2014; Shen & Yeatts, 2013; Zhang et al., 2015). The first set accounts for individuals' sociodemographic characteristics, namely gender, age, marital status, respondent's education, respondent's occupation, and total family income at baseline. Gender includes male coded as "1" and female coded as "0." Age is continuous. Being married is coded as "1" and "0" for nonmarried participants. Respondent's education includes five levels of illiterate/semi-illiterate (1), primary school (2), high school completion (3), some college (4), and graduate degree (5). I dummy code respondent's occupation into "1" if respondent engaged in agriculture at the time of interview and "0" if otherwise. Family income is a continuous variable measuring the total annual income from different sources and has been transformed (log) to represent a normal distribution.

I follow Silverstein and colleagues' work (2006) to construct the second set of control variables measuring respondents' familial relationships of living arrangement, emotional cohesion with adult children, and intergenerational transfers at baseline. Living arrangement has five categories: "1" as living in a skipped-generation household with

grandchildren and without adult children, “2” as living with adult children, “3” as living with both adult children and grandchildren, “4” as living in a single-generation household with children living in the same village or street, and “5” as living in a single-generation household with children living outside of the village or street. Emotional cohesion is measured by the sum of scores from the question, “How close is your relationship with child [Name] in the past six months?” The answer ranges from “1” as “Not close at all” to “5” as “Very close” for all children. The variables measuring “giving to” and “receiving from” adult children derive from a multiple-choice question of “In the past six months, have you engaged in any of these activities with your child [Name]?” The activities are “You gave them economic help,” “They gave you economic help,” “You did housework for them,” “They did housework for you,” “You helped take care of their children,” “They took care of you,” “You help them with financial management,” and “They help you with financial management.” Each of these items is asked for all adult children, and they are dummy-coded to measure intergenerational transfers between parents and their adult children.

The last set of control variables measures health status at baseline. As the analytical sample dropped participants with poor health at baseline, the self-reported health variable only includes two categories of “good” (2) and “fair or average” (1) health status and is reverse-coded so that higher score indicates better health. A participant with any chronic disease is coded as “1,” and “0” is coded for those without disease. Functional limitation is the number of difficulties with daily activities that respondents listed.

Moderator. As aforementioned we model the causal relationships of neighborhood

social cohesion, social participation, and psychological wellbeing in different geographical settings of urban and rural areas. Urban is coded as "1" and rural is coded as "0." Urban or rural residence are identified by the CFPS team based on China census' information.

Analytical Techniques

Principle component analysis is used for variable construction. The sample has a two-level structure of individual and community. I fit a series of mixed-effects multilevel ordinal logistic regression and Poisson regressions. The first two models examine the effects of neighborhood social cohesion and social participation separately. The third model is a joint model including both neighborhood social cohesion and social participation. Table 3.1 shows descriptive results, either percentage or mean and standard deviation (SD), for each variable in our analyses. Odds ratios (OR) for ordinal logistic regression and incidence rate ratios (IRR) for Poisson regression along with robust standard errors are displayed in Table 3.2 and 3.3. As interaction test was significant, I also report results stratified by urban and rural residence. The analyses are conducted in Stata Statistical Software, Release 14 (StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP.).

Results

Table 3.1 shows descriptive statistics for all variables in my analyses. Urban residents exhibit slightly higher overall life satisfaction (3.52, SD 1.03) as compared to rural residents (3.44, SD 1.05). Urban residents also report fewer depressive symptoms

(4.95, SD 3.89) than their rural counterparts (6.33, SD 4.24). As to extrafamilial socio-relational resources, based on respondents' perceptions, rural communities (4.26, SD 3.55) are slightly more socially cohesive compared with urban communities (4.11, SD 3.62). However, urban residents (0.44, SD 0.62) are more involved in social organizations than rural residents (0.22, SD 0.46).

Among the control variables, results for marital status and intergenerational transfer variables are insignificant between urban and rural groups. Other control variables indicate that middle-aged and older adults in urban areas are better off in terms of socioeconomic status, however, they have higher percentages with chronic diseases and lower self-reported health as compared to their rural counterparts. Rural residents (0.19, SD 0.71), on the other hand, report relatively more functional limitations than urban residents (0.12, SD 0.63). Attending to living arrangement, skipped-generation household of those living with only grandchildren (20.12%), and multigeneration households (34.33%) are more common in rural areas than in urban areas (8.23% and 30.11%, respectively). Urban dwellers also live in smaller size households of two generations, 22.35% as compared to 16.44% of rural residents.

Table 3.2 displays odds ratios and robust standard errors for overall life satisfaction. Across all models, neighborhood social cohesion and social participation at baseline associate with better overall quality of life in the follow-up survey. Given that the other variables are held constant, for one unit change in neighborhood social cohesion, the odds of higher satisfaction are 1.021 times greater, a 2.1% increase ($p<0.01$). Similarly, one unit change in social participation increases the odds for higher satisfaction by 1.199, a 19.9% increase ($p<0.001$). This finding lends partial support to

my first hypothesis that neighborhood social cohesion and social participation are positively linked to psychological wellbeing. In addition, standardized scores also indicate that social participation's effects on overall life satisfaction are stronger than the effects of neighborhood social cohesion.

Across the geographical settings, the effects of neighborhood social cohesion and social participation vary between urban and rural areas. Both neighborhood social cohesion and social participation effects are stronger for rural residents. The odds ratio of neighborhood social cohesion for urban residents is 1.019 ($p<0.10$) as compared to 1.023 ($p<0.05$) for rural residents. Consistently, the odds ratio of social participation for urban dwellers is 1.165 ($p<0.05$) as compared to 1.235 ($p<0.01$) for rural dwellers. This finding is also partially supportive of my second hypothesis that rural residents enjoy more benefits of extrafamilial resources than their urban counterparts. In all joint models, odds ratios for both neighborhood social cohesion and social participation are reduced in magnitude, meaning that these two variables are complementing each other. Across all models, other indicators of better life satisfaction are older age, higher family income, and higher self-reported health. Some control variables of socioeconomic status, living arrangement, and health status also show significant results but are stratified across urban and rural settings.

Table 3.3 contains incidence rate ratios and robust standard errors for depressive symptoms. Consistent with the findings presented in Table 3.2, the results from the mixed-effects multilevel Poisson regression analysis presented in Table 3.3 show that both neighborhood social cohesion and social participation are negatively associated with respondents' number of depressive symptoms. Given that all other variables are held

constant, if the neighborhood social cohesion score increases by one unit, the incidence rate for CESD score is expected to change by a factor of 0.996 (a 0.4% decrease) at $p<0.01$. If the social participation score increases by one unit, the incidence rate for CESD score is expected to change by a factor of 0.938 (a 6.2% decrease) at $p<0.001$. Thus, the results of social participation on depressive symptoms remained stronger than neighborhood social cohesion effects. This finding provides support to the first hypothesis that social cohesion and social participation have positive impacts on the psychological wellbeing of community-dwelling middle-aged and older adults in China.

Similar to Table 3.2, the results are stratified between rural and urban settings. Unlike findings for overall life satisfaction, neighborhood social cohesion and social participation are more protective against depression for urban residents than their counterparts. The incidence rates in the urban models are 0.992 ($p<0.01$) for neighborhood social cohesion and 0.916 ($p<0.001$) for social participation. In the rural models, the incidence rate for neighborhood social cohesion is insignificant, and the incidence rate for social participation is only marginally significant (IRR 0.968, $p<0.10$). This finding does not lend support to the second hypothesis that as compared to urban peers, psychological wellbeing of rural community dwellers receives more benefits from extra familial resources. In contrast to results shown in the joint models in Table 3.2, neighborhood social cohesion and social participation are no longer complementary of each other in Table 3.3. As to other variables, results are consistent across models that higher socioeconomic status and better health significantly reduce depression. Some familial resources also significantly predict depression but their results are mixed.

Conclusion and Discussion

Based on a recent longitudinal survey in China, this study examines the association between two extrafamilial socio-relational resources of neighborhood cohesion and social participation and psychological wellbeing of adults age 50 and above. The analyses also model the geographical differences between rural and urban communities in the association between extrafamilial resources and health. Two hypotheses guide my empirical work and the findings yield several important contributions to the existing literature.

These analyses provide evidence to support the first hypothesis that neighborhood social cohesion and social participation are positive covariates of quality of life and negative ones for depression among middle-aged and older Chinese. My analyses of a recently collected nationally representative sample confirm that both neighborhood social cohesion and social participation promote psychological wellbeing of adults age 50 and above. This finding is in line with the general patterns of the relationship between socio-relational resources and health found in the US and other Western countries (Kawachi & Berkman, 2000; Rios et al., 2012; Steptoe & Feldman, 2001). My finding is also consistent with the existing studies in Japan and South Korea (Choi et al., 2015; Yuasa et al., 2014), and strengthens the knowledge of extrafamilial relational resources and health in China (Meng & Chen, 2014; Norstrand & Xu, 2012). In addition, my study also found that social participation is more beneficial for psychological wellbeing of middle aged and older adults than neighborhood social cohesion. This finding is as expected because social participation goes beyond the neighborhood boundaries and covered a much wider range of social contacts and interactions (Greiner et al., 2004), including any formal

involvement in political party, occupational association, or religious groups, as well as participation in informal social groups and organizations. However, it might be possible that this result is a product of reverse causality, therefore, interpretation should be processed with caution.

My study only finds evidence to partially support the second hypothesis that results would be stratified by geographical setting and extrafamilial resources are more beneficial for the psychological wellbeing of rural residents. Only the results for life satisfaction support my second hypothesis that the effects of neighborhood social cohesion and social participation are stronger for rural residents. While there has been a scarcity of research that compares urban and rural correlates of psychological wellbeing (Cao et al., 2015; Meng & Chen, 2014; Wen et al., 2010), my result is consistent with previous studies which separately examined life satisfaction in either urban or rural settings. Li and colleagues (2013) found that life satisfaction in rural Chinese age 50 and above depended heavily on several socio-relational determinants of visiting neighbors, being invited to dinner by neighbors, house sitting for adult children, and receiving financial or other supports from adult children. On the other hand, studies in urban settings found that the life satisfaction of older adults was primarily determined by socioeconomic status, familial supports, and political participation as measured by Communist Party membership (Li et al., 2015).

As to CESD score, this study does not find significant evidence to support the stronger effects of neighborhood social cohesion and social participation for rural adults age 50 and above. Indeed, these extrafamilial resources are more beneficial in reducing urban residents' depression. This unexpected result might be explained by the living

conditions in urban areas as compared to rural areas (Li et al., 2013; Yi & Vaupel, 2002). In urban settings, older adults tend to live in apartment buildings which have less open space to interact with neighbors. Thus, a cohesive neighborhood with more social interaction between neighbors can significantly reduce loneliness and other depressive symptoms in older adults. On the other hand, the experience of frequently interacting with neighbors has probably been consistent across the life course for rural elders, and a minor change in neighborhood cohesion might not be a significant determinant of their depression. This explanation seems to fit with my descriptive result that urban residents report slightly lower neighborhood social cohesion scores than their rural counterparts. In addition, previous studies suggest that Chinese rural elders reported much higher levels of depression as compared to their urban peers (Li et al., 2015). Li and colleagues (2015) also argued that individuals' and communities' socioeconomic status were more likely to be the primary causes of later life depression than poor physical health and lack of socio-relational resources among rural residents. Specifically, individuals' socioeconomic disadvantages, in tandem with communities' poor amenities and lack of social services such as insurance and health care in rural areas, limited the abilities and resources for older adults to cope with chronic stresses. My models showed that farmers in rural areas were more depressed than their urban peers, which confirmed Li's argument (2015) on socioeconomic disadvantages as the primary cause of later life depression among rural residents.

Besides neighborhood social cohesion and social participation, this study also finds other key predictors of psychological wellbeing in Chinese age 50 and above. Better socioeconomic and good health status as well as several familial relationships positively

associate with increased life satisfaction and reduced depressive symptoms in both urban and rural residents, and generally these results are in line with the existing literature (O'Campo et al., 2009; Yamaoka, 2008; Zhang & Liu, 2007). However, some inconsistent findings remain as obstacles in establishing a comprehensive set of social determinants of psychological wellbeing in China. For example, my analyses find that rural elderly who engage in agricultural activities have higher life satisfaction and depressive symptoms. I rely on a couple of mechanisms, which were suggested in the existing literature, to explain these inconsistent results. Yi and Vaupel (2002) noted that the physical abilities to engage in agricultural activities at older ages were equivalent to lowered functional limitations, which were closely associated with better psychological wellbeing. However, being a farmer in later life also linked with disadvantaged socioeconomic status, which increased depression (Li et al., 2015). My finding that functional limitation was higher for rural residents, in Table 3.1, but only showed significance for urban dwellers, in Tables 3.2 and 3.3, indicate that there is a possible adaptation effect for rural residents. As explained by Yi and Vaupel (2002), rural residents might report more functional limitations, but without proper infrastructure, lack of health care, and fewer socioeconomic resources, they tended to carry on their daily activities, including agricultural work.

Another unexpected result is that living with only adult children, as compared to living in a skipped generation household, lowers life satisfaction for rural parents, and increase depression in urban elderly. While the explanation is unknown for this specific urban and rural stratification, some scholars argued that multigenerational households reflect the traditional preference of living arrangement (Zimmer & Korinek, 2008), and

caring for grandchildren can be associated with self-perceived usefulness (Zhang & Liu, 2007). When combined, these two factors of a larger family with older adults' role as caregivers for grandchildren play a positive role in increasing psychological wellbeing in later life (Shen & Yeatts, 2013; Zhang & Liu, 2007). Some studies also found that the elderly in skipped-generation households in rural China reported better psychological wellbeing due to the combined effects of greater economic remittances from their migrant adult children and the emotional support of living with and caring for grandchildren (Silverstein et al., 2006). These findings, alongside the traditional caregiver role for grandchildren, might explain the mixed results for living arrangement and psychological wellbeing in urban and rural residents.

Although my findings address several gaps in the literature, this study is limited in several important ways. First, I utilize time-lagged models with a 2-year gap, and using such models might not be appropriate for longitudinal analyses. However, time-lagged analyses are capable of establishing the direction of the association between extrafamilial relationships and psychological wellbeing. It is essentially important to determine the direction of the studied association because the roles of dependent and independent variables are highly interchangeable in my analyses (Nummela et al., 2008; O'Campo et al., 2009). In addition, my analyses reflect the change between the two CFPS waves. Neighborhood social cohesion was only being asked at the baseline and no longer available in the follow up data. Secondly, I construct an index for neighborhood social cohesion which makes it impossible to disentangle the distinct effects of each item on psychological wellbeing (Li et al., 2013). However, I believe that it might be redundant and not necessarily helpful to include all items in one model. My reasoning is that each

item is conceptually linked to each other, for example, chatting, visiting, and doing leisure activities with neighbors were much alike. Including all of them in the models might cause other analytical issues, such as multicollinearity. Lastly, there might be some arguable obstacles to using self-reported psychological wellbeing among Asian populations due to their reluctance to talk openly about depression (Han et al., 2015). However, my study relies on the CESD score for depression and this score has proven to be an accurate measure of mental health in multiple cultural contexts (O'Campo et al., 2009). These obstacles aside, my results provide evidence to strengthen the knowledge on extrafamilial resources and health in a critical, aging population. My findings echo Shen's work (2014) that there is an urgent need for improving community capabilities, including both social resources and economic investments, for better health status in both urban and rural areas. Specifically, I argue that more socio-relational resources such as frequent neighborly interaction are highly recommended for urban communities, while investing in the built environment, infrastructures, and social services are much needed for rural communities.

Table 3.1

Descriptive Statistics for Middle-Aged and Older Chinese

Variables	Full sample N=7159	Urban N=3401	Rural N=3758	*p-value*
Health outcomes in 2012				
Overall life satisfaction	3.48 (1.04)	3.52 (1.03)	3.44 (1.05)	0.003
Depressive symptoms (CESD score)	5.67 (4.13)	4.95 (3.89)	6.33 (4.24)	0.000
Community-level				
Neighborhood cohesion	4.19 (3.58)	4.11 (3.62)	4.26 (3.55)	0.086
Social participation	.33 (.55)	.44 (.62)	.22 (.46)	0.000
Demographic and socioeconomic characteristics				
Age	60.99 (8.04)	61.34 (8.40)	60.67 (7.70)	0.000
Male	52.06	49.34	54.52	0.000
Being married	88.77	88.42	89.09	0.370
Education level:				0.000
Illiterate/Semi-illiterate	43.13	31.46	53.70	
Primary	21.13	20.44	21.77	
High school completion	21.27	26.58	16.47	
Some college	10.98	15.11	7.24	
Graduate degree	3.48	6.41	0.82	
Annual family income (logged)	9.89 (1.24)	10.29 (1.10)	9.54 (1.26)	0.000
Farm	26.4	10.91	40.42	0.000
Familial relationships				
Living arrangement:				0.000
Living with grand children	14.47	8.23	20.12	

Table 3.1 Continued

Variables	Full sample N=7159	Urban N=3401	Rural N=3758	*p-value*
Living with children	19.25	22.35	16.44	
Living with children & grand children	32.32	30.11	34.33	
One generation, children living in same village/street	13.79	13.50	14.05	
One generation, children living outside of village/street	20.17	25.82	15.06	
Emotional cohesion with children	4.57 (6.95)	4.47 (6.67)	4.66 (7.19)	0.270
Transfers from adult children	0.70 (1.73)	0.69 (1.70)	0.71 (1.76)	0.640
Transfers to adult children	0.46 (1.07)	0.48 (1.11)	0.44 (1.03)	0.207
Health status at baseline				
Any chronic disease	15.73	17.02	14.56	0.004
Functional limitation	.16 (.67)	.12 (.63)	.19 (.71)	0.000
Self-reported health	1.46 (.50)	1.44 (.50)	1.46 (.50)	0.000

Notes: Percentage, or mean and standard deviation

Table 3.2

Mixed-Effects Multilevel Ordinal Logistic Regression Results for Life Satisfaction

Variables	Full sample			Urban			Rural		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Community level									
Neighbor-hood social cohesion	1.021**		1.020**	1.019+		1.018+	1.023*		1.022*
	(0.007)		(0.007)	(0.010)		(0.010)	(0.010)		(0.010)
Social participation		1.199***	1.192***		1.165*	1.159*		1.235**	1.226**
		(0.056)	(0.055)		(0.070)	(0.070)		(0.090)	(0.090)
Demographic and socioeconomic characteristics									
Age	1.022***	1.021***	1.021***	1.032***	1.031***	1.031***	1.012*	1.012+	1.012*
	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Male (ref: female)	0.933	0.912+	0.915+	0.900	0.881+	0.884+	0.963	0.939	0.943
	(0.044)	(0.044)	(0.044)	(0.061)	(0.060)	(0.060)	(0.065)	(0.064)	(0.064)
Married (ref: unmarried)	1.058	1.050	1.049	1.169	1.162	1.161	0.958	0.951	0.950
	(0.083)	(0.083)	(0.083)	(0.133)	(0.132)	(0.132)	(0.106)	(0.105)	(0.105)
Urban	1.031	1.007	1.015						
	(0.078)	(0.076)	(0.077)						
Education level (ref: Illiterate/Semi-illiterate):									
Primary	1.002	0.986	0.986	0.965	0.951	0.954	1.027	1.007	1.004
	(0.064)	(0.063)	(0.063)	(0.094)	(0.093)	(0.093)	(0.087)	(0.085)	(0.085)
High school completion	1.089	1.049	1.048	1.052	1.011	1.012	1.134	1.098	1.097
	(0.074)	(0.072)	(0.072)	(0.103)	(0.100)	(0.101)	(0.110)	(0.107)	(0.107)
Some college	1.153+	1.086	1.076	1.231+	1.166	1.163	1.008	0.945	0.928
	(0.098)	(0.094)	(0.094)	(0.143)	(0.138)	(0.137)	(0.132)	(0.127)	(0.125)

Table 3.2 Continued

Variables	Full Sample			Urban			Rural		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	1.310*	1.177	1.177	1.234	1.122	1.127	1.760+	1.610	1.579
Graduate degree	(0.174)	(0.160)	(0.160)	(0.189)	(0.177)	(0.178)	(0.584)	(0.537)	(0.526)
Family income (logged)	1.181***	1.180***	1.172***	1.188***	1.182***	1.177***	1.166***	1.168***	1.159***
	(0.027)	(0.027)	(0.027)	(0.045)	(0.045)	(0.044)	(0.034)	(0.034)	(0.034)
Farm (ref: non-farm)	1.123+	1.143*	1.133+	0.972	0.999	0.988	1.165*	1.183*	1.174*
	(0.072)	(0.073)	(0.073)	(0.121)	(0.124)	(0.123)	(0.089)	(0.090)	(0.089)
Familial relationships									
Living arrangement (ref: Living with grandchildren):									
Living with children	0.812*	0.816*	0.812*	0.959	0.961	0.957	0.742**	0.750**	0.747**
	(0.068)	(0.068)	(0.068)	(0.134)	(0.134)	(0.133)	(0.081)	(0.082)	(0.081)
Living with children & grandchildren	0.968	0.978	0.972	1.188	1.196	1.189	0.878	0.891	0.883
	(0.074)	(0.075)	(0.075)	(0.161)	(0.162)	(0.161)	(0.083)	(0.085)	(0.084)
One generation, children living in same village/street	1.236*	1.217*	1.222*	1.583**	1.556**	1.559**	1.067	1.052	1.057
	(0.116)	(0.114)	(0.115)	(0.246)	(0.242)	(0.243)	(0.129)	(0.127)	(0.127)
One generation, children living outside of village/street	1.108	1.092	1.092	1.211	1.194	1.194	1.118	1.105	1.104
	(0.095)	(0.093)	(0.093)	(0.169)	(0.166)	(0.166)	(0.129)	(0.127)	(0.127)

Table 3.2 Continued

Variables	Full sample			Urban			Rural		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Emotional cohesion with children	1.005	1.005	1.005	1.001	1.001	1.002	1.007	1.008	1.007
	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
Transfers from adult children	1.014	1.016	1.014	1.001	1.004	1.001	1.027	1.027	1.025
	(0.017)	(0.017)	(0.017)	(0.025)	(0.025)	(0.025)	(0.023)	(0.023)	(0.023)
Transfers to adult children	1.047+	1.046+	1.044+	1.040	1.040	1.038	1.056	1.055	1.053
	(0.025)	(0.025)	(0.025)	(0.035)	(0.035)	(0.035)	(0.037)	(0.037)	(0.037)
Health status at baseline									
Self-reported health	1.381***	1.383***	1.383***	1.511***	1.512***	1.513***	1.269***	1.273***	1.271***
	(0.065)	(0.066)	(0.066)	(0.103)	(0.103)	(0.103)	(0.084)	(0.084)	(0.084)
Functional limitation	0.914*	0.917*	0.916*	0.903+	0.903+	0.904+	0.928	0.934	0.932
	(0.034)	(0.034)	(0.034)	(0.050)	(0.050)	(0.050)	(0.048)	(0.048)	(0.048)
Any chronic disease	1.062	1.061	1.056	1.050	1.051	1.044	1.080	1.076	1.072
	(0.068)	(0.068)	(0.068)	(0.094)	(0.094)	(0.093)	(0.101)	(0.100)	(0.100)
N	7159	7159	7159	3401	3401	3401	3758	3758	3758
Chi-square	251.804 ***	257.941 ***	265.656 ***	163.978 ***	166.442 ***	169.475 ***	104.889 ***	107.861 ***	112.564 ***
Log Likelihood	-9685.759	-9682.567	-9678.586	-4553.293	-4551.912	-4550.283	-5117.769	-5116.289	-113.905

Notes: Odds ratios and Robust Standard Errors

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3.3

Mixed-Effects Multilevel Poisson Regression Results for Depressive Symptoms (CESD Score)

	Full sample			Urban			Rural		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Community level									
Neighborhood social cohesion	0.996**		0.996*	0.992**		0.993**	0.998		0.998
	(0.002)		(0.002)	(0.003)		(0.003)	(0.002)		(0.002)
Social participation		0.938***	0.939***		0.916***	0.918***		0.968+	0.969+
		(0.011)	(0.011)		(0.015)	(0.015)		(0.017)	(0.017)
Demographic and socioeconomic characteristics									
Age	0.998	0.999	0.999	0.996*	0.997*	0.997*	1.000	1.000	1.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Male (ref: female)	0.847***	0.853***	0.853***	0.828***	0.839***	0.837***	0.860***	0.863***	0.862***
	(0.009)	(0.009)	(0.009)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)
Married (ref: unmarried)	0.912***	0.914***	0.915***	0.897***	0.901***	0.901***	0.936**	0.937**	0.937**
	(0.016)	(0.016)	(0.016)	(0.024)	(0.024)	(0.024)	(0.021)	(0.021)	(0.021)
Urban	0.822***	0.828***	0.826***						
	(0.026)	(0.026)	(0.026)						
Education level (ref: Illiterate/Semi-illiterate):									
Primary	0.927***	0.932***	0.932***	0.929**	0.935**	0.934**	0.916***	0.919***	0.919***
	(0.014)	(0.014)	(0.014)	(0.022)	(0.022)	(0.022)	(0.017)	(0.018)	(0.018)
High school completion	0.865***	0.876***	0.876***	0.810***	0.825***	0.825***	0.908***	0.913***	0.913***
	(0.014)	(0.015)	(0.015)	(0.020)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)
Some college	0.843***	0.862***	0.863***	0.816***	0.840***	0.842***	0.852***	0.862***	0.863***
	(0.018)	(0.019)	(0.019)	(0.024)	(0.026)	(0.026)	(0.027)	(0.028)	(0.028)
Graduate degree	0.805***	0.834***	0.835***	0.800***	0.840***	0.841***	0.775**	0.788**	0.789**
	(0.030)	(0.032)	(0.032)	(0.034)	(0.037)	(0.037)	(0.071)	(0.072)	(0.072)

Table 3.3 Continued

	Full sample			Urban			Rural		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Family income (logged)	0.963***	0.963***	0.964***	0.941***	0.943***	0.945***	0.973***	0.973***	0.973***
	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)	(0.009)	(0.006)	(0.006)	(0.006)
Farm (ref: non-farm)	1.025	1.021	1.022	1.004	0.997	0.996	1.032+	1.030+	1.031+
	(0.016)	(0.016)	(0.016)	(0.033)	(0.032)	(0.032)	(0.019)	(0.019)	(0.019)
Familial relationships									
Living arrangement (ref: Living with grandchildren):									
Living with children	1.028	1.027	1.028	1.076*	1.071*	1.076*	1.007	1.007	1.007
	(0.020)	(0.020)	(0.020)	(0.037)	(0.037)	(0.037)	(0.024)	(0.024)	(0.024)
Living with children & grandchildren	0.969+	0.967+	0.968+	0.979	0.975	0.979	0.979	0.978	0.979
	(0.017)	(0.017)	(0.017)	(0.033)	(0.033)	(0.033)	(0.021)	(0.021)	(0.021)
One generation, children living in same village/street	0.927***	0.930**	0.930***	0.934+	0.939	0.939	0.930**	0.932*	0.932*
	(0.020)	(0.021)	(0.021)	(0.036)	(0.036)	(0.036)	(0.026)	(0.026)	(0.026)
One generation, children living outside of village/street	0.970	0.973	0.973	0.999	0.999	1.001	0.965	0.967	0.967
	(0.020)	(0.020)	(0.020)	(0.035)	(0.035)	(0.035)	(0.025)	(0.025)	(0.025)
Emotional cohesion with children	1.001	1.001	1.001	1.001	1.001	1.001	1.000	1.000	1.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Transfers from adult children	0.995	0.995	0.995	0.996	0.995	0.996	0.993	0.993	0.993
	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Transfers to adult children	0.995	0.995	0.995	0.982*	0.982*	0.982*	1.008	1.009	1.009
	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)

Table 3.3 Continued

	Full sample			Urban			Rural		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Health status at baseline									
Self-reported health	0.849***	0.849***	0.849***	0.840***	0.840***	0.840***	0.854***	0.855***	0.855***
	(0.010)	(0.010)	(0.010)	(0.015)	(0.015)	(0.014)	(0.013)	(0.013)	(0.013)
Functional limitation	1.037***	1.036***	1.036***	1.069***	1.068***	1.069***	1.012	1.011	1.011
	(0.008)	(0.008)	(0.008)	(0.013)	(0.013)	(0.013)	(0.011)	(0.011)	(0.011)
Any chronic disease	1.045**	1.047**	1.048**	1.049*	1.052*	1.054*	1.044*	1.045*	1.046*
	(0.016)	(0.016)	(0.016)	(0.023)	(0.023)	(0.023)	(0.021)	(0.021)	(0.021)
N	7159	7159	7159	3401	3401	3401	3758	3758	3758
Chi-square	1135.160***	1156.567***	1161.898***	658.398***	677.873***	684.992***	477.956***	480.460***	481.164***
Log Likelihood	-20373.294	-20361.992	-20359.057	-9432.050	-9421.908	-9418.064	-10905.131	-10903.832	-10903.428

Notes: Odds ratios and Robust Standard Errors

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER 4

SOCIAL ENGAGEMENT AND USE OF HYPERTENSIVE MEDICATION AMONG ADULTS IN CHINA

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SOCIAL ENGAGEMENT AND USE OF HYPERTENSIVE MEDICATION AMONG ADULTS IN CHINA

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Summary. This study's objectives were, first, to examine the association between social engagement and the odds of taking hypertensive medications and treatment among adults in China; and second, to explore the lifestyle and psychological mechanisms underlying this association. Data were from the WHO Study on Global AGEing and Adult Health (WHO-SAGE), a national survey of 11,046 participants aged 18 to 69 conducted in China in 2010. The key outcome was a dichotomous indicator of whether the respondent was taking hypertensive medication or other treatment. A series of logistic regression models were fitted to examine the research questions. Higher levels of social engagement were found to be associated with a lower odds of taking hypertensive medication or treatment, and the association was stronger for women than for men. Lifestyle factors (i.e. smoking and BMI) and perceived overall life satisfaction were significant covariates. Life satisfaction helped explain some of the social engagement benefit for both men and women and BMI only appeared to be a mediator for men. Being married was not significantly associated with lower odds of taking hypertensive medication or treatment in either men or women. Social engagement seems to be protective against hypertension for adult men and women in China, although causation could not be determined in this cross-sectional study. Psychosocial mechanisms are probably at work, but these vary by gender.

Introduction

Hypertension-related complications have become a major global health risk, accounting for nearly 9.4 million deaths annually (WHO, 2013), with heart disease being responsible for about 45% of these deaths and 51% of other cases related to stroke. A major concern is that hypertension tends to be under-diagnosed and under-treated (Cornwell & Waite, 2012; Basu & Millett, 2013). It is estimated that only about half of people with hypertension are diagnosed, and only half of diagnosed patients are treated and have their blood pressure

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controlled (Cornwell & Waite, 2012). Hypertension can be asymptomatic; many people with high blood pressure often experience no pain, discomfort or declining function, resulting in inadequate disease awareness and management (Cornwell & Waite, 2012). Lack of awareness and/or effective treatment or control of hypertension poses higher risk of deaths from hypertension-related conditions such as cardiovascular diseases, stroke or kidney diseases, often causing a devastating economic burden for the family and society due to the ensuing high health care cost (Cai *et al*., 2012; Cornwell & Waite, 2012; Feng *et al*., 2014).

In recent years, multiple global health campaigns have been undertaken, ranging from healthy lifestyle promotion to other non-lifestyle-based approaches (Ueshima *et al*., 2000; Shaya *et al*., 2013). One of the recommended preventions and treatments of hypertension by the Mayo Clinic is to increase social contacts and quality of social relationships for patients with myocardial infraction (Shaya *et al*., 2013). This recommendation was based on a large body of literature pointing to the positive associations between social engagement and health outcomes observed in both clinical and community settings in Western countries (Christenfeld *et al*., 1997; Berkman, 2000; Kawachi & Berkman, 2000; Holt-Lunstad *et al*., 2009; Hughes & Howard, 2009; Cornwell & Waite, 2012). An abundant literature has indicated that social engagement with friends, relatives and community members is beneficial to health, as manifested by reduced risk of mortality, disability and cognitive impairment among adults (Berkman *et al*., 2000; Lennartsson & Silverstein, 2001; Mendes de Leon *et al*., 2003; Zunzunegui *et al*., 2003).

The association between social engagement and physical health outcomes such as hypertension can operate through mechanisms such as psychological benefits conferred by social support received from, or provided for, social ties (Carels *et al*., 1998; Hughes & Howard, 2009) and healthy lifestyles being promoted among socially engaged peers (Nieminen *et al*., 2010; Gorman & Porter, 2011). However, theoretical and empirical support for these hypotheses is largely based on studies conducted in the West, with little evidence available for low- or middle-income societies where the prevalence of hypertension has been rapidly growing in recent years (Elwell-Sutton *et al*., 2013; Kim, 2014) and social engagement may carry different social meanings and exert different impacts on health is different settings. More research is clearly needed to understand the risk or protective factors of hypertension in these non-western regions.

The present study examines the association between social engagement and hypertension in China, a unique setting characteristic of an enormous population size, rapid ageing trend, remarkable economic growth and fast-paced urbanization (Ueshima *et al*., 2000; Cook & Dummer, 2004). The estimated prevalence of hypertension in China was 34% in 2010, but this is likely to be an underestimate due to the common unawareness issue of hypertension (Ahn *et al*., 2012; Feng *et al*., 2014). There are more than 100 million annual cases of hypertension in China and the count has been steadily increasing in recent years, partly due to the adverse forces of urbanization and the adoption of Westernized lifestyles (Ueshima *et al*., 2000; Cook & Dummer, 2004; Van de Poel *et al*., 2009). The increasing prevalence of obesity and unhealthy health behaviours such as sedentary lifestyles, the consumption of processed food, binge drinking and cigarette smoking have placed today's Chinese people at higher risk of hypertension compared with earlier generations (Katz *et al*., 2012;

Meng *et al*., 2012; Elwell-Sutton *et al*., 2013). Although many studies have examined the awareness, prevalence, treatment and risk factors of hypertension in China, there is limited knowledge on whether and how social engagement may play a role in lowering the risk of hypertension. In addition, previous studies in China used data that were either old, or small-scale and non-representative, with limited generalizability of the study findings (Li *et al*., 2005; Prince *et al*., 2012). Studies using recent and large-scale data are needed to examine the prevalence and aetiology of hypertension in China.

To fill the gap, this study used data from a recent national survey conducted in China to examine the link between social engagement and hypertension and explore the underlying psychological and lifestyle mechanisms. In addition to examining the main association between social engagement and hypertension, the study also explores how this association may vary by gender. Men and women have been found to differ in hypertension prevalence and social network patterns. Specifically, men tend to have higher hypertension prevalence than women (Carels *et al*., 1998; Hughes & Howard, 2009) and women are likely to report greater number of social contacts and greater satisfaction with them than men (Pugliesi & Shook, 1998; Okamoto & Tanaka, 2004; Musalia, 2006; Hughes & Howard, 2009; McLaughlin *et al*., 2010; Gorman & Porter, 2011; Staber, 2013; Baheiraei *et al*., 2014). In addition, men and women also differ in the health effects of social influences. Evidence is mixed, however, regarding how gender interacts with social influences on health, with some studies finding that women are more responsive to social-relational contexts than men (Fuhrer & Stansfeld, 2002; Wen & Zhang, 2009), while others report that men are more vulnerable to social deprivation indicated by factors such as living alone (Jeon *et al*., 2007) and being separated, divorced or single (McLaughlin *et al*., 2010).

The following hypotheses were thus formulated: 1) in general, people reporting greater social engagement with friends, relatives, neighbours and coworkers, and more social outings, are less likely to take any hypertensive medication or treatment as an indicator of their having hypertension; 2) lifestyle factors (i.e. body mass index (BMI), cigarette smoking and physical activity) and psychological factors (i.e. depression, anxiety and overall quality of life) are important covariates as well as mediators of the link between social engagement and hypertension; and 3) gender moderates these associations with the direction of these interactions hard to predict *a priori* given the inconsistent findings in previous work.

Methods

Data

Data were from the first wave of the longitudinal WHO Study on Global AGEing and Adult Health (WHO-SAGE), which collected data from six low- and middle-income countries (China, Ghana, India, Mexico, Russia and South Africa) between 2007 and 2010. Information was collected at both the household and individual level, resembling the World Health Survey and the Health and Retirement Survey conducted in the US and the Longitudinal Study of Ageing conducted in England. The strengths of the WHO-SAGE include its longitudinal design, large sample size, nationally representative sample, high response rates and rich social and health information typically unavailable in developing countries (Kowal *et al*., 2012). The present study focuses on China, with

data collection completed in 2010. The response rate was 93%. After list-wise deletion of missing data, the analytical sample size included 11,046 participants aged between 18 and 69 years at the time of the survey. The focus was on working-age adults, considering that the role of social engagement in hypertension prevention can be quite different for people under 18 years or older than 70 years due to physiological and social differences across the age groups.

Measurements

The dependent variable was *self-reported use of hypertensive medication or treatment* based on responses to the question 'Have you ever been taking any medication or other treatments for it [hypertension] during the last 12 months? Other treatments might include weight loss programmes or changes in eating habits.' The hypertensive medication variable was coded as '1' for any medication or treatment, and '0' otherwise. In an *ad hoc* analysis, this variable was positively correlated with the objective measures of hypertension in the survey, including clinical diagnosis and readings of systolic and diastolic blood pressure (data not shown but available upon request). This subjective measure of hypertension was chosen as the key outcome, rather than the clinical measure of blood pressure, because blood pressure was only taken once at the clinic visit rather than several times (as recommended to avoid so-called 'white coat bias').

The key independent variable was *social engagement*, measured by the frequency of the following social activities: visiting friends, visiting relatives, socializing with co-workers after work, volunteer work with neighbours and social outings in the previous 12 months. The response categories ranged from 'never' (coded 1) to 'daily' (coded 5). An index for social engagement was constructed using factor principal component analysis (Cronbach's $\alpha = 0.62$). Factor loadings for the five items ranged from 0.55 to 0.76. Higher values of this variable indicated greater levels of social engagement.

Three lifestyle factors were included: *ever smoking status* ('1' for 'ever smoked' and '0' for 'otherwise'), *regular physical activity* ('1' for '75+ minutes of vigorous activity or 140+ minutes of moderate exercise weekly' and '0' for 'otherwise') and *BMI* tapped by five dummy variables indicating categories (in kg/m^2) of 'less than 18.5', '18.5–24.9', '25–29.9', '30–34.9' and 'more than 35'. Psychological health was captured by three variables. *Depressive symptoms* were tapped by a question asking 'Overall in the last 30 days, how much of a problem did you have with feeling sad, low or depressed?' *Anxiety* was measured by a question asking 'Overall, in the last 30 days, how much of a problem did you have with worry or anxiety?' For both variables, the response categories ranged from 'Not at all a problem' (coded 1) to 'Severe problem' (coded 5). In addition, a measure of *overall quality of life* was created based on responses to the question 'How would you rate your overall quality of life?' with response categories ranging from 'Very dissatisfied' (coded 1) to 'Very satisfied' (coded 5).

Following prior research (Gong *et al*., 2012; Ploubidis *et al*., 2013; Wu *et al*., 2013), the study's analyses also controlled for several socio-demographic variables, including *age* (two groups: 18–49 versus 50–69), *marital status* (currently married versus other), *socioeconomic status* (completed high school or not, currently employed or not, and a five-level ordinal measure of wealth quintile) and *urban–rural residence*. Urban–rural residence was determined by WHO-SAGE in accordance with the World Bank standard

definition; it was controlled in the analysis to account for the rural–urban contextual differences in China (Basu & Millett, 2013).

Statistical analyses

Factor principal component analysis was conducted to create the social engagement scale and a series of logistic regression modelling analyses were performed to test the hypotheses. Model 1 tested the main effects of social engagement on use of hypertensive medication or treatment net of control variables, including age, gender, marital status, education, employment, wealth and urban–rural residence. Model 2 added lifestyle factors to Model 1, including ever smoked, regular physical activity and BMI dummy variables. Model 3 added three psychological variables to Model 1, including overall quality of life, depression and anxiety. The last model included all significant variables in the previous models. The interaction between social engagement and gender was also examined, and a significant effect was found. Thus, findings are reported for the whole sample as well as for female and male subsamples. All analyses were performed using Stata Statistical Software Release 13 (Stata Corp LP, College Station, TX).

Results

Table 1 shows sample statistics of 5121 female and 5925 male respondents. About 18% of the participants reported having used hypertensive medication or treatment (abbreviated as 'hypertension' below) in the 12 months before the survey. Proportionally more men (19%) reported hypertension than women (16%). Women reported a slightly higher level of social engagement (10.70) than men (10.58). Consistent with the design of the WHO-SAGE, 85% of the sample were aged between 50 and 69 at the time of the survey. About 89% of the sample were married. In terms of socioeconomic status, 15% of the sample had completed high school or higher formal education, 88% were currently employed and the majority of the participants were in the third wealth quintile. A slight minority of respondents were urban residents, with more men living in urban areas than women (49.18% versus 42.34%, respectively). Regarding lifestyle factors, about 66% of the sample had ever smoked, with more men (96%) reporting ever smoking than women (31%). A minority of the sample reported conducting regular physical activity (29%). Proportionally more women (70%) had normal weight than did men (62%). As for psychological health, men seemed to be more psychologically distressed than women, reporting higher levels of depressive symptoms (1.23 in men and 1.17 in women) and anxiety (1.24 in men and 1.17 in women) and lower levels of overall quality of life reported compared with women (3.70 in women and 3.65 in men).

Table 2 presents the logistic regression results for both men and women. In Model 1, social engagement was significantly correlated with lower odds of hypertension (OR = 0.957, $p < 0.001$). In Model 2 adding the lifestyle factors, physical activity was not a significant covariate but the odds ratios of ever-smoking (OR = 1.325, $p < 0.001$) and BMI categories were all significant and positive. In addition, the odds ratio of social engagement barely changed from Model 1 to Model 2, suggesting little mediating effects of these lifestyle factors. By contrast, in Model 3, the odds ratio of social engagement decreased to 0.962 ($p < 0.001$), a 12.0% reduction (from 4.49% (1/0.957)) in Model 1 to

Table 1. Descriptive statistics (percentages, or means and standard deviations in parentheses) of WHO-SAGE sample, China, 2010

Variable	Range	Total	Women	Men	Sig.
Use of hypertensive medicine	0–1	17.73	16.13	19.11	***
Social engagement	5–25	10.64 (3.00)	10.70 (3.02)	10.58 (2.99)	*
Age 18–49	0–1	14.58	13.81	15.24	*
Age 50–69	0–1	85.42	86.19	84.76	*
Currently married	0–1	89.34	91.27	87.66	***
High school completion	0–1	15.20	7.67	21.70	***
Currently employed	0–1	87.69	90.80	85.00	***
Wealth quintile	1–5	3.15 (1.39)	3.14 (1.38)	3.17 (1.39)	NS
Urban residence	0–1	46.01	42.34	49.18	***
Ever smoked	0–1	66.17	31.13	96.46	***
Regular physical activity	0–1	28.72	28.08	29.27	NS
BMI <18.5 kg/m²	0–1	2.34	2.15	2.51	NS
BMI 18.5–24.9 kg/m²	0–1	65.62	69.79	62.01	***
BMI 25–29.9 kg/m²	0–1	26.64	24.25	28.71	***
BMI 30–34.9 kg/m²	0–1	4.20	2.79	5.42	***
BMI >35 kg/m²	0–1	1.20	1.02	1.35	NS
Overall quality of life	1–5	3.68 (0.68)	3.70 (0.69)	3.65 (0.68)	**
Difficulty with depression	1–5	1.20 (0.51)	1.17 (0.46)	1.23 (0.55)	***
Difficulty with anxiety	1–5	1.21 (0.51)	1.17 (0.46)	1.24 (0.55)	***
Total		11,046	5121	5925	

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; NS, not significant.

3.95% (1/0.962) in Model 3), suggesting some mediating effect of psychological factors. In fact, among the three psychological factors examined in Model 3, only quality of life was significant, negatively correlated with the odds of hypertension (OR = 0.811, $p < 0.001$).

Table 3 shows logistic regression results for women only. Similar patterns were observed for women to those for the whole sample. That is, the social engagement effect remained strong across all four models; BMI categories, smoking and overall life satisfaction were all significant covariates of hypertension but only life satisfaction played some mediating role in the link between social engagement and hypertension. From Model 1 to Model 3 (with the addition of the psychological factors), the odds ratios of social engagement slightly decreased from 0.950 to 0.954, an 8.4% reduction (from 5.26% (1/0.950) to 4.82% (1/0.954)).

Table 4 presents the logistic regression results for men only. In Model 1, similar to the results for women, social engagement was associated with lower odds of hypertension (OR = 0.963, $p < 0.01$). What remained unchanged were the insignificant effect of physical activity and significant effects of BMI categories and overall life satisfaction in the same directions. Moreover, the mediating effect of life satisfaction emerged again; the odds ratio of social engagement reduced from 0.963 in Model 1 to 0.969 in Model 3, a 16.7% reduction (from 3.84% (1/0.963) to 3.20% (1/0.969)). Two differences are noteworthy. First, smoking became insignificant for men; second, the

Table 2. Logistic regression results for use of hypertensive medication or treatment for women and men, WHO-SAGE, China, 2010

Variable	Model 1	Model 2	Model 3	Model 4
Social engagement	0.957***	0.958***	0.962***	0.963***
	(0.009)	(0.009)	(0.009)	(0.009)
Age 50–69 vs 18–49	5.126***	4.941***	5.138***	4.958***
	(0.668)	(0.642)	(0.669)	(0.644)
Male	1.164**	0.914	1.149**	0.901
	(0.062)	(0.066)	(0.061)	(0.065)
Currently married	1.066	1.025	1.107	1.050
	(0.089)	(0.088)	(0.093)	(0.091)
High school completion	1.183*	1.191*	1.181*	1.193*
	(0.091)	(0.093)	(0.090)	(0.093)
Currently employed	0.747***	0.745***	0.750***	0.746***
	(0.037)	(0.037)	(0.037)	(0.037)
Wealth quintile	1.056**	1.041†	1.092***	1.073***
	(0.021)	(0.022)	(0.023)	(0.023)
Urban residence	1.528***	1.476***	1.526***	1.466***
	(0.099)	(0.098)	(0.099)	(0.097)
Ever smoked		1.325***		1.340***
		(0.102)		(0.104)
Regular physical activity		0.996		
		(0.057)		
BMI <18.5 kg/m²		0.551*		0.547*
		(0.132)		(0.131)
BMI 18.5–24.9 kg/m² (Reference)				
BMI 25–29.9 kg/m²		1.950***		1.960***
		(0.110)		(0.111)
BMI 30–34.9 kg/m²		3.105***		3.087***
		(0.343)		(0.343)
BMI >35 kg/m²		2.707***		2.668***
		(0.535)		(0.526)
Overall life satisfaction			0.811***	0.782***
			(0.033)	(0.031)
Difficulty with depression			1.055	
			(0.111)	
Difficulty with anxiety			1.084	
			(0.115)	
N	11,046	11,046	11,046	11,046
Pseudo R^2	0.056	0.080	0.060	0.084

Odds ratios and robust standard errors in parentheses.
†$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

mediating effects of BMI categories emerged, which was not observed for women. The odds ratio of social engagement decreased from 0.963 in Model 1 to 0.966 Model 2, an 8.1% reduction (from 3.84% (1/0.963) to 3.52% (1/0.966)), suggesting some mediating effect of weight status for the social engagement benefits among men.

Table 3. Logistic regression results for use of hypertensive medication or treatment for women, WHO-SAGE, China, 2010

Variable	Model 1	Model 2	Model 3	Model 4
Social engagement	0.950***	0.948***	0.954***	0.951***
	(0.013)	(0.014)	(0.014)	(0.014)
Age 50–69 vs 18–49	4.465***	4.577***	4.481***	4.596***
	(0.887)	(0.911)	(0.892)	(0.917)
Currently married	1.190	1.139	1.229	1.166
	(0.181)	(0.175)	(0.187)	(0.179)
High school completion	0.981	1.023	0.979	1.018
	(0.157)	(0.167)	(0.156)	(0.166)
Currently employed	0.691***	0.691***	0.702***	0.699***
	(0.060)	(0.060)	(0.061)	(0.061)
Wealth quintile	1.086**	1.051	1.111***	1.076*
	(0.033)	(0.033)	(0.035)	(0.035)
Urban residence	1.878***	1.726***	1.876***	1.732***
	(0.188)	(0.178)	(0.188)	(0.179)
Ever smoked		1.349***		1.359***
		(0.113)		(0.114)
Regular physical activity		1.073		
		(0.093)		
BMI <18.5 kg/m²		0.413*		0.421*
		(0.178)		(0.181)
BMI 18.5–24.9 kg/m² (Reference)				
BMI 25–29.9 kg/m²		2.170***		2.179***
		(0.189)		(0.189)
BMI 30–34.9 kg/m²		3.634***		3.600***
		(0.737)		(0.735)
BMI >35 kg/m²		1.826†		1.823†
		(0.581)		(0.585)
Overall life satisfaction			0.881*	0.841**
			(0.056)	(0.051)
Difficulty with depression			1.017	
			(0.201)	
Difficulty with anxiety			1.132	
			(0.221)	
N	5121	5121	5121	5121
Pseudo R^2	0.070	0.099	0.072	0.101

Odds ratios and robust standard errors in parentheses.
†$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Among all the control variables, three variables exhibited fairly consistent effects across gender: the older age group, greater wealth and urban residence were all positively associated with the odds of hypertension. Marital status and education were not significant covariates for either men or women, whereas being currently employed was beneficial for both men and women.

Table 4. Logistic regression results for use of hypertensive medication or treatment for men, WHO-SAGE, China, 2010

Variables	Model 1	Model 2	Model 3	Model 4
Social engagement	0.963**	0.966**	0.969**	0.971*
	(0.011)	(0.012)	(0.012)	(0.012)
Age 50–69 vs 18–49	5.613***	5.246***	5.621***	5.261***
	(0.969)	(0.906)	(0.968)	(0.906)
Currently married	1.001	0.968	1.045	0.998
	(0.101)	(0.100)	(0.107)	(0.104)
High school completion	1.136	1.157	1.141	1.166†
	(0.103)	(0.106)	(0.104)	(0.107)
Currently employed	0.772***	0.764***	0.768***	0.759***
	(0.047)	(0.046)	(0.046)	(0.046)
Wealth quintile	1.035	1.032	1.076**	1.068*
	(0.028)	(0.029)	(0.030)	(0.030)
Urban residence	1.251**	1.255**	1.257**	1.242*
	(0.106)	(0.108)	(0.107)	(0.107)
Ever smoked		0.979		0.990
		(0.180)		(0.184)
Regular physical activity		0.949		
		(0.072)		
BMI <18.5 kg/m²		0.621†		0.599†
		(0.180)		(0.175)
BMI 18.5–24.9 kg/m² (Reference)				
BMI 25–29.9 kg/m²		1.772***		1.776***
		(0.131)		(0.132)
BMI 30–34.9kg/m²		2.810***		2.799***
		(0.370)		(0.371)
BMI >35 kg/m²		3.307***		3.230***
		(0.821)		(0.797)
Overall life satisfaction			0.767***	0.745***
			(0.040)	(0.039)
Difficulty with depression			1.072	
			(0.131)	
Difficulty with anxiety			1.046	
			(0.129)	
N	5925	5925	5925	5925
Pseudo R^2	0.047	0.068	0.053	0.073

Odds ratios and robust standard errors in parentheses.
†$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Discussion

The results of this cross-sectional analysis of the first wave of the WHO-SAGE data collected in China suggest three important messages. First, social engagement with friends, relatives, coworkers and neighbours, and social outings, were significantly and negatively associated with the odds of taking hypertensive medication or treatment

regardless of gender, lending support to the study's first hypothesis. This finding is consistent with a body of literature, conducted in Western societies, highlighting the beneficial effects of greater social engagement on health outcomes, including, but not limited to, cognitive functioning (Zunzunegui *et al*., 2003), cardiovascular functioning (Christenfeld *et al*., 1997; Cornwell & Waite, 2012; Shaya *et al*., 2013), disability (Mendes de Leon *et al*., 2003) and mortality (Lennartsson & Silverstein, 2001). That said, it is noteworthy that the effect of being married, albeit statistically insignificant, goes in an opposite direction to the social engagement effect. These findings suggest that the relationship between social ties and health can be complex and the beneficial health effects of social engagement observed in this study do not necessarily extend to other aspects of social relationships.

Second, overweight and obesity and smoking were significant risk factors for hypertension, whereas overall life satisfaction was a negative covariate of hypertension. In addition, life satisfaction helped explain some of the social engagement and hypertension link with the mediating role being stronger for men than for women. If the observed effects were causal, the story could go like this: social engagement enhances individuals' psychological health, which in turn can help prevent hypertension (Christenfeld *et al*., 1997; Cornwell & Waite, 2012; Shaya *et al*., 2013). This result provides support for part of the second hypothesis, but not all. It was surprising to see that feelings of depression and anxiety were neither significant covariates of hypertension nor mediators of the social engagement and hypertension link. It is possible that the effect of overall life satisfaction has fully absorbed the effects of specific aspects of psychological states, manifested in affect factors such as depression and anxiety.

It was also found that a portion of the social engagement effect on hypertension was attributable to a lower odds of overweight and obesity among more socially engaged men (but not women). This finding lends support to the notion that social engagement may facilitate the rapid diffusion and implementation of healthful message, increasing the likelihood of involved individuals following healthy lifestyles and being healthy (Seeman *et al*., 2001; Christensen & Carpiano, 2014). That said, how social engagement may affect lifestyle conceivably depends on the lifestyle norms of an individual's social circle. US-based evidence (Christakis & Fowler, 2007) has shown that obesity may spread in social networks in a quantifiable and discernable pattern that depends on the nature of social ties, and that social distance appears to be more important than geographic distance within these social networks in terms of the person-to-person spread of obesity. Lacking relevant data, the present study was not able to account for this nuance in social engagement processes. Theoretically, behavioural contagion can occur via psychosocial mechanisms such as altered tolerance level of overweight and perceptional and behavioural changes of energy-balance-related factors among a group of friends. It can be speculated that working-age adult men in China who are more socially engaged may have a lower prevalence of overweight and obesity compared with the general male population and are thus at lower risk of hypertension. Why this mediating pattern was observed in men but not in women is intriguing. One possible explanation is that there may be gendered patterns of social engagement in China where men are less likely than women to conduct sedentary activities when hanging out with friends (Fan *et al*., 2012; Hallal *et al*., 2012). More research is clearly needed to sort out these complex processes.

Third, the association between social engagement and hypertension was stronger for women than for men, providing support for the notion that men experience weaker

effects of social engagement than women. This result is consistent with previous work showing that women tend to report more social contacts and more satisfaction with social relationships compared with men (Pugliesi & Shook, 1998; Okamoto & Tanaka, 2004; Musalia, 2006; Hughes & Howard, 2009; McLaughlin *et al*., 2010; Gorman & Porter, 2011; Staber, 2013; Baheiraei *et al*., 2014).

This study is limited in two important ways. The analyses relied on cross-sectional data, producing no causal inferences on the observed associations. Reverse causation cannot be ruled out. Individuals with hypertension may be less likely to be socially engaged due to their health issues. Nonetheless, being a silent killer, hypertension typically does not cause symptoms that would affect their social behaviours unless it is at a severe stage. The nature of this condition to some extent mitigates the reverse selection concern. The social engagement and hypertension link can be more rigorously studied in the future with the second wave of WHO-SAGE and other longitudinal data becoming available.

Another limitation lies in the dependent variable. The key outcome was use of hypertensive medication or treatment, which was conceptualized as a proxy measure of hypertension. As noted earlier, onsite readings of blood pressure were not used because they were only taken at one time in the WHO-SAGE data, whereas the standard procedure is to take three consecutive readings at one visit to reduce the 'white-coat' reaction during blood pressure measurement (Cornwell & Waite, 2012). Ideally, objective and reliable measures of blood pressure should be used to identify hypertension.

This study focused on working-age adults. Since the prevalence of hypertension increases with age, and also considering that older people tend to experience role loss and reduced socializing opportunities, social engagement may become particularly important in later life than in prime-age adulthood. Future research should examine these issues for older people who are facing increasing amount of social and physical challenges in life. Despite these limitations, this study provides novel evidence to suggest that among Chinese adults social engagement should be a protective factor against hypertension, suggesting that the development of chronic conditions like hypertension can be socially patterned across different settings (Wen & Li, 2015). Psychological mechanisms appeared to play a role in this association for both men and women and BMI-related lifestyle factors seemed to help explain some of the benefits of social engagement for men. To replicate this study and to put these findings into perspective, longitudinal research is needed to comprehensively examine the multiple dimensions of social engagement and their prospective effects on health risk factors such as hypertension in developing countries, where hypertension has become a silent killer and a public health crisis (WHO, 2013).

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CHAPTER 5

CONCLUSION

This dissertation examined the influence of different types of socio-relational resources on three aspects of health, namely health behaviors, self-reported health, and disease treatment in China, where collectivistic orientation and strong filial piety prevail alongside rapid economic growth and urbanization (Markus & Kitayama, 1991; Uchida, Kitayama, Mesquita, Reyes, & Morling, 2008). In addition to modelling the main effects, this study carves out the underlying mechanisms of lifestyle and psychological wellbeing, which explain the nature of the association between socio-relational resources and health. This dissertation also depicts the stratifications of the socio-relational resources' impacts on health across gender, age, and urban and rural residence. The findings greatly contribute to the existing knowledge gaps and offer several important policy implications for China's public health, which are currently facing immense challenges of accelerating rates of chronic diseases and conditions created by the increasing number of people with sedentary lifestyle in addition to the aging population (Wu et al., 2015).

Relying on two waves of data from the CFPS, Chapter 2 depicted the social contexts of smoking and drinking behavior among middle-aged and older Chinese men. The main findings from the time-lagged analyses indicated that socio-relational resources in the baseline survey were predictors of smoking and heavy drinking behaviors in the

follow-up study. While the results were mixed for familial resources such as living arrangement and intergenerational transfers, extrafamilial resources' effects on smoking and heavy drinking were consistent with previous studies. Logistic regression and multinomial regression results confirmed Carpiano's (2007) argument and resembled existing empirical evidence in Ayers and colleagues (2010) and Chuang and Chuang (2008) of the "social smoking" and "social drinking" mechanisms, which explained the complex links between socio-relational resources and health behaviors. Comparing the two studied behaviors, cigarette smoking might not be completely explained by the "social smoking" approach, with more convincing evidence suggesting a possible link through psychological wellbeing. On the contrary, heavy drinking is characterized as a group activity, with all forms of social interaction and social participation in Wave 1 increasing the odds of heavy drinking in Wave 2. In addition to socio-relational resources, socioeconomic profile also exerted an affect on smoking and drinking behavior among Chinese men. The results suggest that lower educational level, lower family income, and having retired from the labor force are each a significant predictor of smoking and heavy drinking in these ages. As Zhang and colleagues (2013) noted, tobacco and alcohol control in China is more relaxed than other countries in the same income level, therefore, smoking and drinking and their health-related consequences are possibly more problematic among Chinese. This argument urgently calls for health-related policies which aim at reducing the smoking and drinking epidemic in China. The main findings from Chapter 2 suggested that alcohol and cigarette consumption are more prevalent among men, and are closely linked with social interactions and lower socioeconomic status. Thus, these findings necessitate several important health

promotion messages and policy implications, for example, raising awareness of the harmful health impacts of smoking, secondhand smoking, and heavy drinking among lower socioeconomic groups (Zhang et al., 2013). Education also plays a major role in changing the misconception that smoking and heavy drinking are parts of social bonding and are widely encouraged in social activities (Chuang & Chuang, 2008). Similar to other cultural contexts, smoking and drinking behaviors are highly stratified across the gender line in contemporary China. Health promotion campaigns or health-related policies should consider and develop gender-specific programs to effectively reduce the pandemic rates of cigarette- and alcohol-related problems (Ayers et al., 2010; Chuang & Chuang, 2008).

Using the same data source as Chapter 2, Chapter 3empirically examined the causal relationship between two forms of extrafamilial resources and self-reported psychological wellbeing of adults aged 50 and above. Specifically, this chapter models the urban and rural stratification of the association between neighborhood social cohesion, social participation, and psychological health of middle-aged and older Chinese. Psychological wellbeing was measured by self-reported overall life satisfaction and CESD score. Mixed effects model results showed that neighborhood social cohesion and social participation at baseline associated with improved life satisfaction and reduced depression in the follow-up study. Rural residents' life satisfaction possibly received greater benefits from neighborhood social cohesion and social participation than their urban peers. However, neighborhood social cohesion and social participation were more important in reducing urban residents' depression. Other determinants, such as better socioeconomic status, good self-reported health status, and familial resources, also

significantly improved middle-aged and older adults' psychological wellbeing. These analyses were among the first to employ multilevel analyses and longitudinal data to study the effects of neighborhood social characteristics on individuals' health in China. As the analyses possess conceptual and methodological advantages, the findings might be suitable for health-related policy implications. In order to improve older adults' health and wellbeing in contemporary China, health-related policies should pay more attention to the community's social characteristics such as neighborhood social cohesion and social participation. Specifically, the results suggest that increased social interaction between neighbors in urban areas and improved rural community amenities and social services are sorely needed for older adults' health and wellbeing in the context of rapid economic development, urbanization, and the abrupt transformation in traditional living arrangement and filial norms in China.

Chapter 4 turned to the links between social engagement, which was measured by social interactions with friends, relatives, neighbors, and social outings, and use of hypertensive medication and treatments. This chapter employed the WHO-SAGE Wave 1 data and focused on a wider age range as hypertension has reached an epidemic stage for all age groups in China (Wu et al., 2015). The analyses also investigated the lifestyle and psychological mechanisms linking social engagement and the use of hypertensive medication and treatment, and the moderating effects of gender. Results from a series of cross-sectional logistic regression analyses showed that higher levels of social engagement correlated with lesser likelihood of using hypertensive medication. As to the two mechanisms, mediation analyses suggested that factors related to lifestyle, namely smoking and body mass index, along with overall life satisfaction, mediated the main

effects of social engagement on the use of hypertensive medication. While smoking status and being overweight or obese were associated with higher likelihood of using hypertensive medication, life satisfaction was a negative covariate. Moderation analysis pointed out that the main effects were stronger for women, but women experienced weaker mediating effects compared to men. If the analyses were longitudinal, the findings would be that social engagement enhances life satisfaction and promotes the practice of healthy behaviors, which in turn can prevent hypertension. Such findings would be greatly beneficial for policy implications as hypertension has reached an epidemic stage in China (Wu et al., 2015). One of the key outcomes from this study for improving public health is that promoting social engagement can be an inexpensive way to prevent hypertension in China, and this practice has actually been applied in the US (Shaya et al., 2013). However, the observed effects in Chapter 4 were cross sectional, thus, these findings might be inadequate for policy implications. Although being limited by using cross-sectional data, these novel analyses targeted an alarming health problem in China, carved out the mechanisms of how social engagement influenced hypertension control and treatment, and delineated how these mechanisms varied across men and women.

An important note that emerged from the three empirical chapters is that the relationship between socio-relational resources and health is complex, as socio-relational resources are multidimensional. This dissertation uses socio-relational resources as an overarching term, which referred to various types of social relationships, each of which exerted distinctive impacts on health. Chapter 2 provided empirical evidences to support this claim, as smoking and drinking behaviors were modified across different types of

socio-relational resources. The associations between socio-relational resources and health also changed dramatically across subgroups, as evidenced in Chapters 3 and 4. Age, gender, and urban and rural residence are only few of the several examples of these subgroup variations. Other sociodemographic variables, such as region, ethnicity, or socioeconomic status, might hold more complicated patterns of the association between socio-relational resources and health. In addition, the association between socio-relational resources and health might not simply be direct effects. As partially observed in Chapter 2, and supported in Chapter 4, there are multiple complex pathways connecting socio-relational resources and health outcomes. Future research in this field needs to further investigate these and other potential pathways and mechanisms linking each type of socio-relational resource with different sets of health outcomes (Ferlander & Mäkinen, 2009). For example, a comprehensive examination of how multiple familial and extrafamilial resources influence biological measures, such as allostasis and allostatic load, and in turn, how these biological measures impact overall health status in the long run would be greatly appreciated among scholars and health translational communities.

Building upon the voluminous body of literature in Western countries, my dissertation provided three examples of how socio-relational resources influenced health and how these main effects changed when moderation and mediation analyses were accounted for in an interesting Asian population. As the relationship between socio-relational resources and health is intricate and culturally diverse (Markus & Kitayama, 1991), my dissertation opens up several promising venues for future studies. Using standard measures of socio-relational resources, such as the Duke Social Support and Stress Scale, Personal Social Capital Scale, the Social Capital and Social Cohesion Scale,

and so on, might enable scholars to conduct cross-cultural or cross-countries analyses of how socio-relational resources exert influences on health outcomes (Markus & Kitayama, 1991; Seeman et al., 2004). More than 20 years ago, Markus and Kitayama (1991) recorded the differences between two cultural regimes of individualism and collectivism as seen in Western and Eastern cultures. These macro-level orientations can play in tandem with the countries' health profiles to exert considerable influences on the association between socio-relational resources and health. Thus, a cross-cultural study could yield significant and interesting findings on the roles of family and community on individuals' health. An important note for conducting a cross-cultural analysis is that as many scholars recently observed the cultural changes in adaptation to the rapid economic growth in China and other Asian countries, the practice of collectivism might not prevail in all segments of the population (Chan, 2005). This note leads to another potential future research direction, which would involve a 3-stage multilevel study of socio-relational resources and health. Chapter 3 only included a simple 2-stage analysis of individual and community level effects, stratified between urban and rural areas. However, socio-relational resources might be different at a larger scale, such as region. In fact, a multilevel study conducted in Japan depicted interesting effects of a specific "M" region on the collective mindset of its people, which influences both social capital and self-reported health among community-dwelling older adults (Hanibuchi et al., 2012). This approach might be adaptable to study regional effects on socio-relational resources in China and other less frequently studied populations, as geographic location can create barriers, as well as assets, for economic development and social change.

Chapter 4 utilized conventional mediation analysis to establish the lifestyle and

psychological pathways linking socio-relational resources and health outcomes. Biological pathway, which is another mechanism linking socio-relational resources and health, has recently emerged in social sciences as a concept of interest with the availability of biomarker data. Despite its relatively recent recognition as a mechanism connecting socio-relational resources and health, biological pathway has proven to be a key predictor of how social conditions "get under the skin" (McEwen, 2012; McEwen & Gianaros, 2010; McEwen & Seeman, 1999). This mechanism explains the biological nature of the association between socio-relational resources and health by targeting the regulating role of the human brain in adaptation to stressful conditions, and addressing the ways that socio-relational resources, such as long term and acute social support, improve or exacerbate the effects of life stress and strain on individuals' health (McEwen, 2012; Seeman et al., 2004). Similar to the other pathways, most of the research examining the biological mechanism have taken place in Western countries where biomarker data are abundant (Beckie, 2012; Seeman et al., 2004). Such health topics are emerging in nonwestern contexts, such as Seeman's (2004) study of social relationship and its regulations of allostasis and allostatic load among older Taiwanese. However, as many Asian population surveys have not invested in collecting biomarker data, the biological pathway has not received adequate attention. Being tailored with the cultural distinction between Eastern and Western contexts aforementioned, examining the biological pathway would be an innovative approach for future research in an interesting Asian population such as China (Seeman et al., 2004). Along with biomarker data, subjective measures of health outcomes should be employed to minimize self-reported health bias.

Another note when conducting moderation or mediation analysis is the use of unconventional analytical techniques for more accurate results. Structural equation modelling, path analyses, or formal mediation analysis such as Sobel's test should be employed in future research (MacKinnon, 2008). Finally, longitudinal data, preferably more than two waves of data as discussed in all empirical chapters, should be considered for making causal inferences about socio-relational resources and health, and to limit the selection bias (Nummela et al., 2008). Provided that the CFPS and WHO-SAGE continue to collect more waves of data, these surveys, and potentially other publicly available sources, such as the China Health and Retirement Longitudinal Study, Chinese Longitudinal Healthy Longevity Survey, or the China Health and Nutrition Survey, are well suited for longitudinal analyses. These data improvements, along with other recent strides mentioned earlier, would significantly increase the quality of research in the field and allow scholars to make confident policy recommendations about the influences of socio-relational resources and health.

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