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Social Capital and Mental Health among Chinese Older Adults

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Social Capital and Mental Health among Chinese Older Adults

by

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ABSTRACT OF THE DISSERTATION

Social Capital and Mental Health among Chinese Older Adults

by

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Professor Nancy Morrow-Howell, Chair

This study aims to develop our understanding of social capital by exploring the dimensions and profiles of social capital among Chinese older adults and the factors and health conditions associated with social capital in later life. The approach was secondary analyses of the China Family Panel Study (CFPS), a nationally representative survey of the Chinese population. It is the intent of this work to offer applicable guidance on policy and project design regarding health promotion for the aging population through social intervention.

Aim 1 explores the dimensions and associative factors of social capital of Chinese older adults. It was found that the social capital of Chinese older adults was derived from three levels of social environment---family, community and the macro society. Older adults who relied heavily on family-level social capital may be constrained in their capacity to seek resources and social supports outside their immediate family. The physical community environment plays an influential determinant of social capital.

Aim 2 identifies three distinct social capital profiles among Chinese older adults: Family-centered, Moderate and Diverse social capital. The use of individual-based categorization contributes to our understandings as it better captures the reality of older adults engaging in various social relationships and provides valuable insights into the complex interaction between

aspects of social capital and heterogeneous older groups. The results suggest that family is still a salient source of social capital for Chinese older adults, while a deficiency in community-level social capital is faced by many older people. The findings also highlight the vulnerability of the Family-centered group whose access to all forms of social capital was limited. Results suggest that supporting communities to improve the physical environment and developing social capital interventions targeting older adults could be effective strategies to prevent depressive symptoms and promote Chinese older adults' overall wellbeing.

Aim 3 examines the mediating role of community social capital underlying the link between the built neighborhood environment and depressive symptoms among urban and rural older adults. It also explores the moderating role of other sources of social capital. Results suggest that the interaction between the built and social neighborhood environments is related to depressive symptoms for urban and rural older adults in later life. Other levels of social environment also played a role in this process, but the effects have differed in rural/urban areas. Supporting rural and urban communities with physical infrastructure and service availability and developing social capital interventions targeting older adults could be effective strategies to prevent depressive symptoms and promote Chinese older adults' overall wellbeing.

In summary, the results of this present study show that social capital, as an interaction between the actor and the multiple levels of the social environment, was derived from different environmental levels, including families, communities and the broader society. In the Chinese context, family is still an important source of social capital for older adults despite increasing reliance and sometimes preference for formal support. Meanwhile, older adults' social capital is highly connected with the community they live in.

The findings from this dissertation expand our understanding of social capital by integrating the ecological perspective and addressing limitations introduced by viewing social capital by single indicators. The methodology used to identify social capital compositions and profiles in this dissertation provides a more stable and accurate base for studying the complex social relationship of a "whole" person in real life. It is also suggested that health promoting interventions should incorporate environmental components, and use social capital building as a crucial pathway in health-promoting. Since community social capital plays an increasingly important role in maintaining older people's mental health, community development should be prioritized in health-promoting programs for the older population.

Chapter I: Introduction

1.1. Purpose of the Study

As the number of older adults increases worldwide, policy strategies to promote older people's health and wellbeing have received widespread attention, nationally and internationally. There is a growing consensus that a healthy aging experience is by no means uniform nor random and is highly influenced by social context (Marmot & Wilkinson, 2005). Evidence in the literature supports the idea that social capital can be an essential element of social context and that social capital is an appropriate focus for policies and programs at the local level (B. D. Hunter et al., 2011). Social capital is a complex construct with distinct components. It can be understood as an inherent cohesive force within networks that enables collective action at the collective level, and the resources embedded in social networks are accessed and used by the members at the individual level (Bhandari & Yasunobu, 2009). In this regard, social capital involves social relations at the individual level, such as informal social relations and memberships in social networks and groups, as well as the social environment at the community level, such as the cohesiveness of the neighborhood (Bhandari & Yasunobu, 2009).

Despite growing research on social capital and health among older adults, considerable ambiguity remains in the literature. Much of this stems from the need for further clarification of the conceptualization of social capital and developing measures that are suitable for older populations from different cultural backgrounds. Current literature primarily focuses on one dimension of social capital at a time without realizing that older people may benefit from various social networks and social environments in reality. Meanwhile, social capital is context-specific, and the social capital theory and measurement based on empirical data collected in Western

developed societies may not fully capture the patterns of social relations that are unique to non-Western and developing societies.

Therefore, this study aims to develop the conceptualization of social capital based on exploring the dimensions of social capital among Chinese older adults and the factors and health outcomes associated with social capital in later life. Findings from this proposed study will serve as applicable guidance on policy and project design in terms of health promotion for the aging population through social intervention.

1.2. Significance of the Topic

1.2.1. Social Capital Theory

The concept of social capital has been developed to make sense of how social connections and relationships influence the lives of individuals and the nature of society as a whole. One widely cited definition of social capital within health research is the one by Putnam, who suggests that social capital is "...features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (Putnam, 1993, p. 167), which is often referred to as the communitarian/social cohesion definition of social capital (Bhandari & Yasunobu, 2009). According to Putnam, participation and trust are central features of social capital and the stronger these characteristics, the more collaboration for mutual benefits will be facilitated.

Unlike the communitarian approach, the network theory of social capital conceptualizes and measures social capital as real or potential individual assets that exist within social networks or groups for personal benefits. For example, Pierre Bourdieu conceptualized social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition"

(Bourdieu, 1986). The difference between communitarian and network approaches is significant. Whereas communitarian approaches examine the effects of civic participation and trust on health, network approaches analyze relational dimensions of solidarity, highlighting the influence of social networks, social structure, and disparities in access to resources on health. Examing the quality and quantity of support and resources available from the respondents' networks is commonly seen in the network approach operationalization of social capital.

Also, different dimensions of social capital fall within both communitarian and network approach to health, such as cognitive, structural, bonding, bridging and linking social capital (Putnam, 2001; Szreter & Woolcock, 2004). Structural social capital refers to what people do with their networks, such as the composition, extent, and activities of local-level institutions and networks. In contrast, cognitive social capital refers to people's feelings about social relations, such as trust, solidarity and reciprocity. Bonding social capital refers to networks of dense ties between members of a group who are similar in social status and race and ethnicity. This type of social capital is thought to underpin norms of reciprocity, solidarity and loyalty within groups and typically provides social and emotional support (Putnam, 2001). By contrast, bridging social capital refers to fragmented networks in which actors are heterogeneous and have weak ties to each other. Linking capital describes vertical ties between people in different formal or institutionalized power hierarchies. Bridging and linking social capital are thought to provide links to external assets, assist in information diffusion, and create broader identities and broader social relationships and connections (Putnam, 2001).

Although the literature on social capital has boomed in the last two decades, there is no consistent set of definitions of social capital in scientific literature. The variety of definition is not due to a lack of understanding about what social capital is, but because social capital is a complex

multidimensional concept having various dimensions, types, levels and determinants, and varieties of definitions exist depending on the discipline and interest (Bhandari & Yasunobu, 2009). There is an increasing consensus that the cpmmunitarian and netwotk approach to social capital are not necessarily mutually exclusive. Each has strengths and limitations, and it is suggested that both types of measures should be included in future studies to reflect the multiple dimensions of the subject(Moore et al., 2006). However, limited research has been done to integrate the two approaches into a more comprehensive social capital theory and further develop the conceptualization and operationalization of social capital.

1.2.2. The Importance of Social Capital in Later Life

Much research has indicated that social capital is related to the health and wellbeing of older adults. The physical health outcomes include all-cause mortality (Aida et al., 2011), physical function (Amemiya et al., 2019), self-rated health (Cain et al., 2018) and multiple chronic diseases. Social capital has also been suggested to be related to psychological health and life satisfaction outcomes for older adults. Previous research indicated that having more social capital was associated with fewer mental health problems and less psychological distress; affected the trajectory of depressive symptoms; and contributed to higher levels of life satisfaction and lower level of loneliness (Nyqvist et al., 2013).

The social capital aspects of the health and wellbeing of older adults should attract more attention to the development of policy and programs. Various social determinants could affect older adults' health and wellbeing, including sociodemographic characteristics, socioeconomic status, education, and living arrangement. Many of those factors are difficult to modify among older people. The literature has shown that social capital is a valuable social resource for promoting health and wellbeing among older adults and can be modified and changed in later life

(Cain et al., 2018). Older adults and their community are expected to be empowered during the process of social capital building as the social connections once brought into existence for one set of purposes can also be available for use in other circumstances. Therefore, social capital improves not only the older individual's capability of seeking resources and supports but also the community's collective efficacy that facilitates coordination and cooperation for mutual benefits. In this vein, the conceptualization of social capital is consistent with the ecological framework, which involves dynamic transactions between people and their environments (Bronfenbrenner & Morris, 2006; Lawton, 1989).

1.2.3. The Chinese Context

Though the concept of social capital was developed in the Western context, in other societies, similar concepts share the same core components such as social networks and social resources. The Chinese word "guanxi" (literally translated as relations) has been widely discussed as a localized form of social capital. Guanxi is referred to as ''a dyadic, family-like, and sentimental tie that has the potential of facilitating favor exchange between the parties connected by the tie'' (Bian, 2019). The characteristics of guanxi reflect the kind of networks and connections that prevail and are valued in the Chinese context. For example, scholars have found the family was the preferred source of social supports and social connections that had a more significant impact on the wellbeing of Chinese older adults (Lu et al., 2016; Luo, 2016). The social relations developed in China and other East Asian societies emphasize relatively informal, narrow and introverted relations, which reflect the unique composition and mechanism of social capital in these societies (Wang, 2020). These findings bring the discussion that very different components are likely grouped under the umbrella of "social capital" in different cultures, and they exert impacts on health through very different pathways. The commonly used social capital

indicators in Western countries, such as membership in volunteering and religious organizations, may not make sense for Chinese older adults; and the family dimension of social capital, which has been ignored in previous research, is likely to be significant in maintaining the wellbeing of older people.

However, the possibility of the guanxi-like informal and strong ties negatively affecting wellbeing has also been conceptualized in some literature, where it is argues that social relationships may may strain an individual's resources and thus may carry negative consequences (Awaworyi Churchill & Mishra, 2017). On the one hand, the current supportive system for older people could be partially attributed to China's substantial informal networks in-place; on the other hand, China encountered problems pertinent to the lack of general trust and norms for the society and the scarcity of public resources. Without sufficient and influential social organizations and neighborhood committees, it is difficult for the Chinese to cultivate community and collective-level social capital based on trust and participation (Awaworyi Churchill & Mishra, 2017).

As the Chinese society is experiencing demographic shifts and socioeconomic changes, the changes in household size and the migration of the population may have altered the mechanisms linking social capital to health outcomes. Some researchers have proposed that the rapid social changes are altering the cultural norms regarding traditional family arrangements and causing Chinese older adults to favor community, organizations and formal services as a source of independence and peer support (Zhou & Walker, 2020), and decreases the importance of family social capital in the health and wellbeing of Chinese older adults. However, few attempts have been made to investigate the role of different sources of social capital in maintaining the health and wellbeing of older adults in a transitioning familistic society like China.

1.2.4. Gaps in Knowledge

While the positive association between social capital and mental health in later life has been documented, a key source of bias in summarizing the current knowledge of social capital in later life was the heterogeneous operationalization of social capital. Contemporary literature largely focuses on one piece of social capital at a time (such as "trust") without acknowledging that older adults may be involved in multiple social relationships simultaneously. According to the ecological framework, individuals are embedded within overlapping layers of environments, which consist of families, neighborhoods and broader social institutions (Bronfenbrenner, 1986). Evidence shows that different dimensions of social capital derived from various environments are not equivalent and exchangeable(Putnam, 2001; Szreter & Woolcock, 2004). However, very little research has attempted to examine the multiple dimension of social capital.

Further, social capitals can be complementary or in competition with one another regarding time commitments and opportunities (Owen & Videras, 2009), and the interplay among different layers of the social environment is culturally sensitive. The social relations developed in China and other East Asian societies emphasize relatively informal, narrow and introverted relations, which reflect the unique composition and mechanism of social capital in these societies (Wang, 2020). Families, close kin and other informal, homogeneous and non-political networks are more frequently considered the primary carriers of social capital, which is in stark contrast to what was regarded as the core component of social capital in the U.S. and other Western countries----civic participation and formal networks (Helliwell & Putnam, 2004). Examining the structure of social capital and its influence on health in the Chinese context will shed some new light on understanding the role of social capital in maintaining the health and wellbeing of older adults health from contextual perspectives.

Also, social capital is not a stand-alone variable in isolation from broader contextual variables. What has largely been overlooked in previous research is the interrelations among different types of the neighborhood environment. An environment can either increase social capital by supporting network building or decrease social capital by restricting access to available or potential resources (Hargrove et al., 2020). However, relatively little is understood about the extent to which characteristics of the environment influence older people's social capital.

1.3. The Present Study

Social capital is a resource that is context- and culture-relative (Grant et al., 2017), thus it is inappropriate to treat social capital or social capital elements as a static property. To respond to how health benefits were generated, it is crucial to show how actors, including older individuals and their environment, interact with one another within different contexts, as well as how this influences the types of social capital that they are privy to (Ehsan et al., 2019). Social capital and health research could benefit from looking more deeply into person-environment dynamics.

Guided by the ecological framework, this dissertation builds on and extends the limited existing literature on social capital among older adults by investigating different dimensions and patterns of social capital in later life, its related individual and environmental characteristics, and its influence on mental health in the Chinese context. This dissertation will consist of three empirical papers reporting secondary analyses of the China Family Panel Studies (CFPS), a nationally representative longitudinal study of Chinese families.

Specifically, the first study explored the dimensions that consisted of the concept of social capital among Chinese older adults. Drawing on the social capital theories and ecological

framework, the research questions of the first study included: “What dimensions of social capital are present among Chinese older adults?” and “What factors are related to each identified dimension of social capital?”. To accomplish this aim, factor analysis was used to explore the latent factors that comprise the social capital of Chinese older adults.

The second paper aims to understand the profiles of social capital among Chinese older adults. Latent class analysis (LCA) was used to illustrate the multidimensional construct of social capital while also distinguishing between various types of social capital that are qualitatively different. Then, the second paper examined what factors and mental health conditions were associated with social capital profiles, to understand better the heterogeneous population of older adults and their different needs and characteristics.

The third paper explored the relationships among social capital, built neighborhood environment and depressive symptoms of urban and rural older adults in China. This paper posed two research questions. The first is whether community social capital mediates the relationship between the built neighborhood environment and depressive symptoms among urban and rural older adults. Second, whether family and society social capital moderate the above mediation model. It is hypothesized that there may be a complementary effect between different dimensions of social capital, and the mediation role of community social capital would be stronger among older adults with lower levels of other sources of SC than those with higher levels.

Chapter II: Assessing Social Capital among Chinese Older Adults: Dimensions and Associative Factors

2.1 Introduction

As the number of older adults increases worldwide, policy strategies to promote older people's health and wellbeing have received widespread attention, nationally and internationally. There is a growing consensus that the experience of healthy aging is by no means uniform nor random and is highly influenced by social context (Marmot & Wilkinson, 2005). Evidence in the literature supports the idea that social capital can be an essential element of social context and that social capital is an appropriate focus for policies and programs at the local level (Hunter, Neiger, & West, 2011). Social capital is a complex construct with distinct components. It can be understood as an inherent cohesive force within networks that enables collective action at the collective level, and the resources embedded in social networks are accessed and used by the members at the individual level (Bhandari & Yasunobu, 2009). In this regard, social capital involves social relations at the individual level, such as informal social relations and memberships in social networks and groups, as well as the social environment at the community level, such as the cohesiveness of the neighborhood (Bhandari & Yasunobu, 2009).

Despite growing research on social capital and health among older adults, considerable ambiguity remains in the literature. Much of this stems from the need for further clarification of the conceptualization of social capital and developing measures that are suitable for older populations from different cultural backgrounds. Current literature primarily focuses on one dimension of social capital at a time without realizing that older people may benefit from

different social networks and social environments in reality. Meanwhile, social capital is context-specific, and the social capital theory and measurement based on empirical data collected in Western developed societies may not fully capture the patterns of social relations that are unique to non-Western and developing societies.

Therefore, this study aims to further develop the conceptualization of social capital by exploring the dimensions of social capital among Chinese older adults and the factors and health outcomes associated with social capital in later life. Findings from this proposed study will serve as applicable guidance on policy and project design in terms of health promotion for the aging population through social intervention.

2.2 Literature Review

2.2.1 Social Capital Dimensions and Social Environment

Older adults' social relationships with others are essential to older adults' wellbeing, as well as the context in which these relationships occur. According to the ecological theory of aging (Lawton, 1982), the health and independence of older adults can be determined by the balance between environmental demand and individual competencies. In this vein, social capital is not only a stock of property an individual obtained, but also a process of the interaction between the social environment and the individuals' ability to draw on resources within the environment (Carpiano, 2006). Social capital improves the older individual's capability to seek resources and support and the community's collective efficacy that facilitates coordination and cooperation for mutual benefits. Also, older adults and their community are expected to be empowered during the process of social capital building as the social connections once brought into existence for one set of purposes can also be available for use in other circumstances (Sampson et al., 1997). Since the conceptualization of social capital is consistent with ecological

perspectives, which involve dynamic transactions between people and their environments (Bronfenbrenner & Morris, 2006; Lawton, 1989), it is necessary to consider an individual's social environments in understanding social capital in later life.

While previous research has supported that social capital benefits the health and wellbeing of older adults, the limitations of the lack of a clear and consistent conceptualization and various measurements are increasingly apparent. However, the variety of definitions is not due to a lack of understanding of social capital, but because an individual is usually embedded in diverse levels of environments(Greenfield, 2012), and different dimensions of social capital derived from these environments make social capital a complex multidimensional concept (Bhandari & Yasunobu, 2009). For example, a growing consensus is that the trusting and cooperative relations in a dense network and the weak ties in an open network serve different purposes (Putnam, 2001; Szreter & Woolcock, 2004). Mohnen et al. (2015) have shown that connecting to family and friends differs from connecting to the more extensive network in the neighborhood.

From this perspective, Putnam (2001) and Szreter & Woolcock (2004) have defined bonding, bridging and linking social capital. Bonding capital refers to networks of dense ties between members of a group who are similar to each other, bridging social capital refers to fragmented networks in which actors are of heterogeneous backgrounds, and are structured by weak ties between members. In addition, linking social capital refers to ties and networks among individuals and groups who occupy very different social positions and power. Previous studies have proved that bonding, bridging and linking social capital may play different roles in later life.

However, though the classification of bonding, bridging and linking social capital is tied to the environment, it could not fully match different levels and contexts of the social environment. For example, while some residents generated bonding social capital at the community level, those distant from their neighbors may only have bridging social capital. The traditional definition of bonding, bridging and linking social capital cannot fully describe the interaction between individuals and contexts and the resources embedded within the social networks vary across levels. Therefore, it is important to examine social capital from the perspective of social environments, including families, communities and the broader social institutions (Greenfield, 2012). This operationalization of social capital will help understand the dynamics through which social capital is fostered, accessed, maintained, or lost in a specific context. It may also help to know how the individual's position within these contexts may alter how they perceive the environment and the social capital they can access (Ehsan et al., 2019).

2.2.2 The Chinese Context

Though the concept of social capital was developed in the Western context, in other societies, similar concepts share the same core components such as social networks and social resources. The Chinese word “guanxi” (literally translated as relations) has been widely discussed as a localized form of social capital. Guanxi is referred to as ‘‘a dyadic, family-like, and sentimental tie that has the potential of facilitating favor exchange between the parties connected by the tie’’ (Bian, 2019). The characteristics of guanxi reflect the kind of networks and connections that prevail and are valued in the Chinese context. For example, scholars have found that family is often the preferred source of social support and social connections that has a more significant impact on the well-being of Chinese older adults than on older adults from Western countries (Lu et al., 2016; Luo, 2016). The social relations developed in China and other East

Asian societies emphasize relatively informal, narrow and introverted relations, which reflect the unique composition and mechanism of social capital in these societies (W. Wang, 2020). Families, close kin and other informal, homogeneous and non-political networks are more frequently considered the primary carriers of social capital, which is in stark contrast to what was regarded as the core component of social capital in the U.S. and other Western countries----civic participation and formal networks (Helliwell & Putnam, 2004).

As contemporary Chinese society is transitioning from a familistic society to a more modernized one, it is the first time in history that demographic shifts (e.g., changes in the family structure and reduction in household size) and socioeconomic changes (e.g., large-scale labor force migration) have increasingly eroded the capacity of Chinese families to support their older members. Meanwhile, the traditional neighborhood based on kinship networks and informal relationships has been replaced by administrative communities officially defined by geography, in which residents often share less in common. Some researchers have proposed that the rapid social changes are altering the cultural norms regarding traditional family arrangements and causing Chinese older adults to favor community, organizations and formal services as a source of independence and social capital (Zhou & Walker, 2020) while decreasing the importance of family social capital in the health and wellbeing of Chinese older adults. However, few attempts have been made to investigate the different sources of social capital of older adults in a transitioning familistic society like China. As the social capital theory and measurement based on empirical data collected in Western developed societies may not fully capture the patterns of social relations unique to Chinese older adults, it is necessary to explore the unique cultural and structural contexts of social capital of older adults in China.

The present study aims to 1) explore the dimensions of social capital of Chinese older adults and 2) examine the factors associated with the dimensions of social capital. Research questions include: “What dimensions of social capital are present among Chinese older adults?” and “What factors are related to each identified dimension of social capital?”. To accomplish this aim, factor analysis was used with the China Family Panel Study (CFPS), a nationally representative survey of the Chinese population, to explore the latent factors that comprise the social capital of Chinese older adults.

2.2.3 Conceptual Framework

Previous research indicates that it is essential to distinguish the trusting and cooperative relations in a dense network from the weak ties in an open network as they serve different purposes. Therefore, to better understand the mechanisms underlying social capital, it is necessary to break down the concept along with various relationships and the environment where the connections are facilitated. The ecological framework (Bronfenbrenner, 1992; Lawton, 1989) provides a conceptual framework to investigate the interactions between the actor and the multiple levels of social environments.

The micro-level is the interpersonal environment that involves groups in which the person is a member; this in the Chinese context mainly includes the immediate family and the extended kin-based networks. Social capital at this level aligns with the bonding social capital. The meso level is the suprapersonal environment, which is the aggregate of people physically proximate to the person or refers to the characteristics defining a person's place in terms of the broader social environment such as the working place, neighborhood, or a racial community (Lawton, 1982, 1989). Social capital at this level may include bonding and bridging social capital. For older adults in China, the meso-level primarily manifested as the neighborhood of

residence. The macro-level is the structural environment in which all characteristics of the social structure are at the level of aggregation beyond any personal characteristic (Lawton, 1989). This is the most vertical network where relationships are rules according to hierarchy and power asymmetries. Social capital facilitated at this level may involve both bridging and linking social capital. For Chinese older adults, this level of the environment may include networks and interactions between an individual and unknown people, as well as social institutions, such as service providers and governmental agencies.

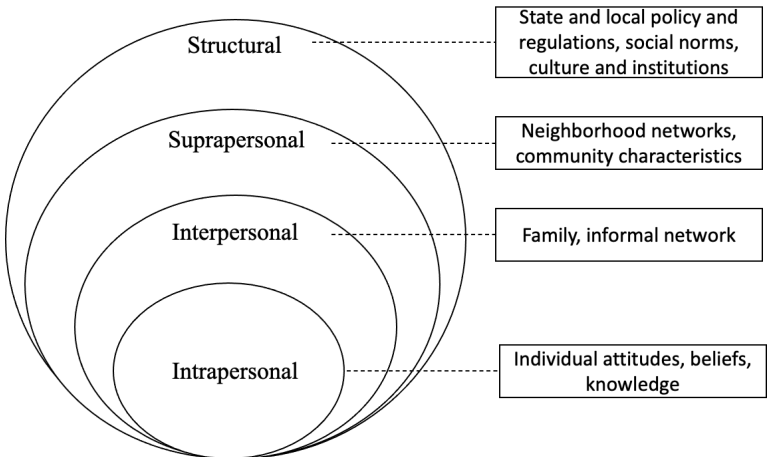

Figure 2. 1 Conceptual framework: the ecological perspective

2.3 Method

2.3.1 Sample

The data in this study are from the China Family Panel Studies (CFPS), a nationally representative survey that collects information at three levels, including individuals, households and communities. The nationwide survey adopted a multi-stage stratified sampling method, allowing the data to cover 25 provinces, cities and autonomous regions in China, representing 95% of the total population (Chen and Meng, 2015). In addition to the 2010 baseline survey, four

waves of follow-up data (2012, 2014, 2016, and 2018) were collected and made available to interested parties.

Data used in this study were obtained from the 2016 dataset because the 2016 wave was the only sample year that contained individual subjective evaluations of neighborhood characteristics. There is a total of 33,297 observations in the 2016 CFPS dataset. For the purpose of this study, only respondents who were 60 years and older were kept (9,253 left). In addition, 1,156 respondents out of the 9,253 had missing values on more than 50% of the social capital variables. To avoid the disturbance caused by missing values in social capital variables, the 1,156 respondents were deleted (8,097 left). A sensitivity test comparing including the 1,156 respondents and without these respondents showed that the results of the main analysis did not differ. Therefore, the final analytic sample comprises 8,097 adults aged 60 and above in China.

2.3.2 Measures

Social capital measures

I used 15 items that captured a wide range of social relationships and interactions involving three social environment levels in which older adults were engaged: family, community, and the broader society (Table 2.1). In the family environment, five items were selected ("number of close children," "number of children providing economic supports," "number of children providing instrumental help," "number of children meet weekly," and "number of children contact weekly.") to measure intergenerational family relationships. In the community environment, five items regarding community relationships were selected ("community relationship," "community reciprocity," "community trust," "community safety," and "sense of belonging"). In the broader environment, five items were selected ("general trust," "general reciprocity," "trust towards government officials," "trust towards doctors," and "rate of

county/district government) to measure networks and interactions between an individual and unknown people, as well as social institutions, such as service providers and governmental agencies.

Antecedents

Individual characteristics

Individual characteristics used in this study including gender (0 = male, 1 = female), age (continuous years), marital status (0 = not married, 1 = married), education (1= less than primary school, 2= primary school, 3= junior high school, 4=high school and higher), residency (1=rural, 0=urban). Because the income varied widely across rural and urban regions in China, self-rated income level instead of household income was selected to measure individual-level financial status (range 1-5, 1=very low, 5=very high). Physical functioning is measured by the sum score of six IADL difficulties, including three indoor activities (do cleaning, do laundry and perform kitchen activities) and three outdoor activities (go outside for activities, take public transportation and go shopping) (range 0-6). In addition, depressive symptoms in 2014 were used as the control variable.

Environmental characteristics

The neighborhood environment was measured by the physical environment and facilities of the neighborhood. Participants were asked, "how is the surrounding environment of your community (noise, trash disposal, etc.)" and "How do you think of the public facilities for education, medical and transportation in general around your community." A 5-point Likert scale scored both answers: "very poor," "poor," "fair," "good," and "very good" a higher score indicates a better neighborhood environment.

2.3.3 Data Analysis

Exploratory factor analyses (EFA) and confirmatory factor analyses (CFA) were conducted to analyze the construct validity of dimensions of social capital. EFA was used to explore the optimal number of factors and the factorial structure. CFA further confirmed factor structures drawn from EFA. CFA is a theory-based approach that allows identifying the underlying dimensions of social capital and then allows testing theoretical validity and latent variable relationships. I use both model interpretability and objective indices to determine the best model for CFA analyses. Since the social capital items included ordinal, nominal and continuous measures, the WLSMV estimator for all CFA analyses was used to address the violation of the assumption about a multivariate normal distribution. I also allow some measurement errors to be correlated, but only when they meet the two criteria: the modification indexes (MI) >30 and substantive rationale to justify a correlational pattern among these measurement errors.

The influence of other individual and environmental characteristics on latent factors was estimated using multiple indicators, multiple cause (MIMIC) structural equation models. MIMIC models allowed estimating the influence of covariate characteristics such as age, gender, and race on latent variables. MIMIC models contain two parts: 1) a measurement model relating the indicators to the latent variables of social capital (equivalent to CFA models), and 2) a regression model, regressing latent variables on the covariates. Considering that this assumption of factor loading invariance is often violated in practice (Kim et al., 2012), it is important to include the direct effects of the covariate on the item in the MIMIC model to get unbiased estimates not only for the measurement parameters but also of the structural parameters (Tsaousis et al., 2020). This model thus allows direct effects of the covariates on the latent factors, and a significant direct effect of the covariate on an item of the latent factor suggests that the item mean is different at the different levels of the covariate, after controlling for the latent factor mean.

Model chi-square, comparative fit index (CFI), Tucker–Lewis index (TLI), Standardized root mean square residual (SRMR) and root mean square error of approximation (RMSEA) with a 90% confidence interval (CI) will serve as indicators of model fit. A non-significant chi-square typically indicates a good fit; however, it is well known that chi-square goodness-of-fit tests are sensitive to large samples since they tend to mistakenly reject the null hypothesis (Agresti, 2013) even when deviations from a perfect model are negligible. Thus, in this study, I mainly use CFI > 0.90, TLI > 0.90, RMSEA < 0.05 (upper bound of the 90% CI < .08) and SRMR <0.1 as indicators of good fit (Bowen & Guo, 2011). Also, Chi-square difference tests using the DIFFTEST command in Mplus are conducted for model selection.

Full information maximum likelihood (FIML) estimation and multiple imputations was used to handle missing data. As mentioned earlier, respondents with missing values on more than 50% of the social capital variables were deleted, and FIML was used in CFA for respondents who had missing values on less than 50% of the social capital. Multiple imputations with chained equations was used in the MIMIC analysis to impute missing values in determinant variables. All analyses were conducted with Mplus 8.

2.4 Results

2.4.1 Descriptive Results

Table 2.1 presents descriptive statistics of the sample. The average age of the sample was 68.23 (SD=6.64) years. More than half of the participants lived in rural areas (52.46%). Male was about the same percentage as female, and about 80% of participants were married. Educational attainment was overall low in this sample. Only less than 10% of the participants had finished high school. 28.97% of participants reported poor self-rated health and 23.43% had

functional difficulties. Regarding the community factors, 43.72% and 43.95% of participants reported good surrounding environment and public facilities of their community, respectively.

Table 2. 1 Descriptive results

	Whole N=8,097 M(SD) or %
Demographic	
Age(yrs)	68.23(6.64)
Gender	
Male	49.78%
Female	50.22%
Rural/Urban	
Urban	47.54%
Rural	52.46%
Marital status	
Married	79.76%
Not married	20.24%
Education	
Less than primary	52.51%
Primary	21.89%
Junior high	15.99%
High school +	9.60%
Health	
Self-rated health (1-5)	3.58(1.19)
IADL (0-6)	0.57(1.33)
Neighborhood Characteristics	
Neighborhood environment (1-5)	3.38(0.99)
Neighborhood facility (1-5)	3.44(0.96)

2.4.2 Factor Analysis Results

Exploratory factor analysis (EFA) was used in the first part of the analysis to delineate the key elements and structures of social capital in China. Principal factors analysis was conducted

on 15 items with principal axis factoring and oblique rotation. A three-factor structure is consistent with the three levels of the social environment where items were collected emerged.

The three-factor model was further confirmed by CFA. Results are presented in Table 2.2. the Kaiser–Meyer–Olkin (KMO) measure checked sampling adequacy (KMO = 0.74). This KMO value of more than 0.6 is acceptable and indicates adequate sample size. The estimates of fit indices indicated that the model adequately fit the data ($\chi 2$ (74) = 297.94, p<.001, RMSEA = 0.020(0.017-0.022), CFI = 0.990, TLI = 0.985, and SRMR = 0.017).

Table 2. 2 Confirmatory factor analysis

	β
Factor 1: family level	
1. Number of children providing instrumental support	1.00
2. Number of children providing financial support	1.59
3. Number of close children	3.50
4. Number of children contact weekly	1.11
5. Number of children meet weekly	1.08
Factor2: community level	
6. Community safety	1.00
7. Community reciprocity	1.61
8. Community relationship	1.68
9. Feeling of belonging	1.72
Factor 3: macro level	
10. Rate of county/district government	1.00
11. General trust	1.05
12. General reciprocity	1.13
13. Trust towards government	3.37
14. Trust towards doctors	2.58
15. Neighborhood trust	4.17
Model Statistics	
X^2 (p)	297.94(p< .001)

	df =73
RMSEA/SRMR	0.020(0.017-0.022)/0.017
CFI/TLI	0.990/0.985

Internal consistency and validity

Correlation analysis indicated that all items were positively correlated with the total scale score. Cronbach alphas were 0.67 for the overall scale, 0.66 for the family-level social capital subscale, and 0.63 for the community-level social capital subscale and 0.61 for the society-level social capital subscale. Data on known-group differences are frequently used as evidence supporting for construct validity. Three variables were used to assess construct validity: income, social class and rural/urban residency. Social capital theories and previous research indicated that social capital is positively associated with socioeconomic status(Cain et al., 2018), people with higher income and social class often have more social capital. In addition, Chinese studies have shown that rural residents possess more social capital than urban residents(X. Chen et al., 2009). As expected, the results of this study showed that participants with higher income possessed more social capital, including the total social capital ($p<.001$), the community-level capital ($p<.001$) and the society-level capital ($p<.001$). Participants with higher self-reported social class scored higher on total social capital($p<.001$), family-level capital($p<.001$), community-level capital($p<.001$) and society-level capital($p<.001$). Rural residents possessed more social capital than urban residents, including the total social capital($p<.001$), family-level capital($p<.001$), community-level capital($p<.001$) and society-level capital($p<.001$). These between-group differences are consistent with the findings from both theoretical analysis and empirical results (X. Chen et al., 2009; Simons et al., 2019), supporting the instrument's construct validity.

2.4.3 MIMIC Results

A MIMIC model was conducted to test the relationship between individual and neighborhood characteristics and the three latent social capital constructs among older Chinese adults (Table 2.3, Figure 2.2). The model statistics indicated a good model fit with the data: CFI = 0.965, RMSEA = 0.024, TLI=0.950. Compared to the community- and society-level social capital, demographic factors, including rural, female, age, marital status and education had a stronger relationship with family-level social capital. Older adults who were female, older, not married, living in rural area and had lower educational attainment were more likely to have higher family social capital (female: $\beta = 0.23$, $p<.000$; age: $\beta = 0.06$, $p<.000$; married: $\beta = -0.20$, $p<.000$; rural: $\beta = 0.43$, $p<.000$; education: $\beta = -0.08$, $p<.000$;). Additionally, older people with functional limitation were associated with higher family social capital (functions: $\beta = -0.09$, $p=0.015$). Neighborhood characteristics were also related to family social capital. Specifically, a better neighborhood environment was associated with higher family social capital (neighborhood environment: $\beta = 0.07$, $p<.000$).

In terms of the community-level social capital, female, having better economic status and living in rural areas were associated with a higher level of neighborhood-level social capital (female: $\beta = 0.05$, $p=.009$; economic status: $\beta = 0.03$, $p=.004$; rural: $\beta = 0.16$, $p<.000$). Older adults with better self-rated health were also associated with a higher level of community-level social capital ($\beta = -0.09$, $p<.001$). Community characteristics had a more evident association with the community-level social capital (facility: $\beta = 0.13$, $p<.000$; environment: $\beta = 0.24$, $p<.000$), older adults who lived in neighborhoods with good facilities and environment were more likely to report higher community-level social capital.

For the society-level social capital, living in rural area and old age were related to higher level of society-level level social capital (rural: $\beta = 0.05$, $p<.000$; age: $\beta = 0.01$, $p<.000$). Similar

to the community-level social capital, having higher income, better self-rated health, and living in neighborhoods with good facility and environment were associated with higher level of society-level social capital (income: $\beta = 0.04$, $p<.000$; health: $\beta = -0.03$, $p<.000$; facility: $\beta = 0.10$, $p<.000$; environment: $\beta = 0.07$, $p<.000$).

Table 2. 3 MIMIC Result

	Family level	Community level	Society level
Demographic			
Rural	0.43(0.03)***	0.16(0.02)***	0.05(0.01)***
Female	0.23(0.03)***	0.05(0.02)**	0.01(0.01)
Age	0.06(0.00)***	0.00(0.00)	0.01(0.00)***
Married	-0.20(0.04)***	-0.02(0.03)	0.02(0.01)
Education	-0.08(0.02)***	0.00(0.01)	0.00(0.01)
Income	0.01(0.02)	0.03(0.01)**	0.04(0.01)***
Health			
Self-rated health	-0.03(0.02)	-0.09(0.01)***	-0.03(0.01)***
Functions	0.09(0.04)*	-0.02(0.02)	-0.00(0.01)
Community characteristic			
Neighborhood facility	0.03(0.02)	0.13 (0.01)***	0.10(0.01)***
Neighborhood environment	0.07(0.02)***	0.24(0.01)***	0.07(0.01)***
Model fit indices			
X2 (df)	1005.02 (181)		
CFI/TLI	.965/.950		
RMSEA	.024		
R^2 of latent variables			
Factor1	0.149		
Factor2	0.221		
Factor3	0.147		

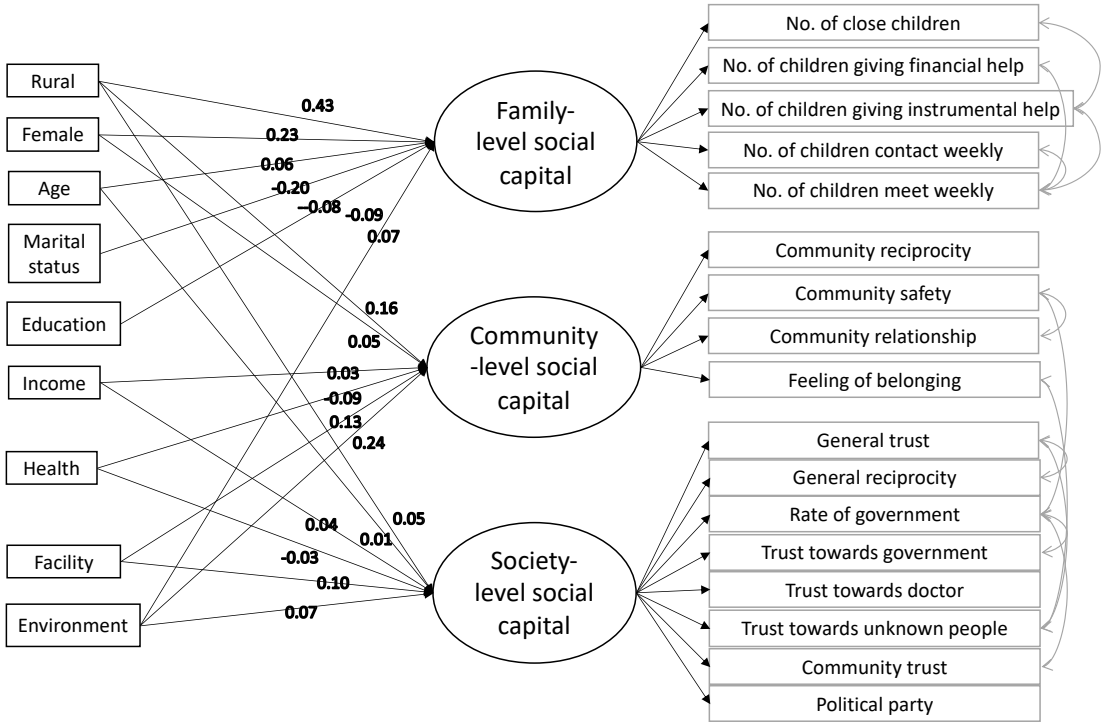

Figure 2. 2 Final model of the determinants of three-level of social capital

2.5 Discussion

This study explored the dimensions and associative factors of social capital of Chinese older adults. Findings from the present study confirm that social capital, as an interaction between the actor and the multiple levels of the social environment, was derived from different environment levels. It is also consistent with the ecological framework that an individual is an integral part of a complex and hierarchical social system (Dunning & Kim, 2007; Li, Du, & Van de Bunt, 2016), in which kinship is at the center of an individual's social network (Bian, 1994, 2017; Chen & Wu, 2011). The findings confirmed three latent constructs: family-level social capital, community-level social capital, and society-level social capital. Older adults with more family-level social capital received more intergenerational support and reported better family

relationships. Older adults with more community-level social capital reported more social trust and reciprocity in local communities. In contrast, older adults with more society-level social capital were more likely to report higher trust and reciprocity toward the general public, and have more trust in the authorities and institutions.

Findings from this study supported that family is still an important source of social capital for Chinese older adults, despite increasing reliance and sometimes preference for formal support. Family social capital is a distinct construct different from other dimensions of social capital; and this suggests that the way Chinese older adults trust and have expectations toward their family is different from the way they trust and expect support from their community and the rest of society. This may be because the care of older people in China has traditionally been confined to the domestic sphere, long enshrined by the norm of filial piety (Chou, 2010), and also reflect the familistic characteristics of the Chinese society.

Additionally, as the ability of Chinese families to take care of their older members was eroded by the demographic shifts and socioeconomic development (Feng et al., 2020), the community may serve as an increasingly important compensatory role for older adults. The findings of this study also confirmed that community is another layer of the social environment where older adults have access to social capital. Good community relationships and a safe and friendly community environment may have a contextual effect on older adults' health and wellbeing through forming collective efficacy and cohesion, and reducing the negative pressure from the environment while empowering older adults (Villalonga-Olives & Kawachi, 2017).

In China, the sense of community carries features that might be different from Western cultures. Historically, Communities in China are based on kinship networks, where extended families live closely together within a geographic area and look out for each other when needed

(Xu et al., 2010). Then, work units became the Chinese people's new community (Xu et al., 2010). Work units referred to enterprises and public institutions which provided social security, social services, and housing for their employees. All employees and retirees lived in the same residential community owned by the work unit, and residents were usually familiar with each other in such a closed and homogenous community (Xin et al., 2021). Since the economic and social reforms in 1978, both the working units and kinship networks were gradually dissolved and communities officially defined by geography are emerging, in which residents often share less in common (Xin et al., 2021; Xu et al., 2010). The current community is a mix of administratively-managed geographic communities and neighborhoods based on the Chinese tradition of informal networks (guanxi).

On the one hand, when talking about daily interactions between neighbors, the people who come up in people's minds are those who live close to them and in their informal networks. These relationships are closer to the bonding end of the social capital spectrum (W. Wang, 2020). On the other hand, one of the most important roles of the current geographic communities is to serve as the local administrative agency to manage community affairs and provide public services. Hence the community as a social environment is broader than the aggregation of the residents' informal networks. Such as civic participation and safety of the community are perceived as public issues and closer to the bridging end.

Regarding the society-level social capital, this latent construct included general social trust and reciprocity, as well as indicators denoting relationships between people across power and authority gradients. Accordingly, the society-level social capital includes bridging social capital and linking social capital. The differentiation between intimate trust (e.g., trust in the family) and trust in professionals such as authorities and public service providers reflects in-

group and family-centered collectivist cultures (Delhey et al., 2011). It is found in this study that the correlation between family-level social capital and society-level social capital was relatively low. In contrast, the community-level social capital was moderately correlated with both the family-level social capital and the society-level social capital. It seems that Chinese older adults' high level of social capital in the family-centered intimate group did not contribute to the social capital in the general population. However, the findings suggest that the community may serve as the intermediate zone between "family" and "society" for older adults.

Findings from this study also showed that influential personal and neighborhood characteristics were not uniform across different levels of social capital. Personal characteristics were found to be associated with family-level social capital. Older adults who reported a higher level of family-level social capital were more likely to be vulnerable and live with disadvantages. For example, they were more likely to have functional limitations, lower education and no partner present. In this vein, receiving a higher level of intergenerational family support might be related to the lack of available resources outside the family and older adults' impaired ability to adapt to the broader environment.

This result contradicts some research indicating that a higher level of social capital is often associated with better-off people. This might be because most previous literature only focused on community- and society-level social capital, measured by general trust, norms of reciprocity and social participation. Findings of this study also showed that better health conditions and income were associated with a higher level of both community- and society-level social capital because knowledge and skills for social interactions obtained from education, and higher income may contribute to a higher trust of others and society and more participation opportunities (J. Zhang & Lu, 2019). However, the findings of this study suggest that family-

level social capital, which emphasizes intergenerational relationships and supports, might play a different role in older adults' life.

Taking respondents who reported functional limitations as an example. I found functional-limited respondents had higher family-level social capital but lower community-level social capital compared to their functional intact counterparts. This maybe because functional difficulties led to damaged ability of older adults to reach out to the community resources and engagement opportunities. Community- and society-level social capital seemed to be based on the environment proactivity hypothesis (Lawton, 1989), meaning the greater proportion of resources in the social environment is accessible for people of higher competence. However, family-level social capital is more likely to be based on the environment docility hypothesis (Lawton & Nahemow, 1973) in which older adults are passive recipients and the disadvantaged receive more within-family resources.

A critical finding of this study is the association between environmental characteristics and social capital among Chinese older adults. Both neighborhood facility and neighborhood environment were influential determinants of all three levels of social capital. At the family level, a supportive neighborhood environment may pose less demand on older adults, thus alleviating the stress associated with the aging process and contributing to better mental health in later life (Li et al., 2020). Older adults with better psychological well-being may be able to develop healthier family relationships shown by frequent intergenerational interactions and support. At the community level, physical environmental factors have been related to the social community environment, including social capital (Mao et al., 2022). Older adults who perceive their community as helpful and age-friendly are more likely to trust their neighbors, participate in social activities (Hong et al., 2018), and have a strong sense of belonging to local communities

(Z. Zhang & Zhang, 2017). At the society level, as the lowest level of administrative organization and public service providers, communities become the place where interactions between older adults and agencies and institutions take place. As new geographic communities are replacing the traditional neighborhoods and are more heterogeneous than the old ones, the influence of the physical community environment may be more significant than expected. Whether the community environment promotes interactions and trust between people may work beyond the community sphere and influence the general social capital in the society.

Limitations

The present study has several limitations. First, although the CFPS contains relatively comprehensive information on a wide range of social capital indicators compared to other nationally representative datasets in China, the ability to capture the social capital of Chinese older adults is still limited by the available measures in the secondary data. Though information about the non-kin-based networks and participation in social activities were provided in the first wave of CFPS, it is not available in the 2016 wave. In this study, the focus was given to family relationships at the micro-level and cognitive social capital at the meso- and macro-level; however, a lack of information about non-kin-based networks and social activities will impede this study from exploring peer support in later life and may cause bias in the explanation of social capital of Chinese older adults. In addition, longitudinal data is unavailable because different social capital indicators were provided across waves of CFPS and some significant indicators were only used in the 2016 wave. The cross-sectional nature of this study limits the ability to infer causal directions and understand social capital in later life from a dynamic perspective.

Conclusion

Despite the limitations, this research has improved our understanding of the social capital and related factors of older adults in China. It was found that the social capital of Chinese older adults was derived from three levels of social environment---family, community and the macro society. Older adults who were heavily reliant on family-level social capital may be constrained in their capacity to seek resources and social supports outside their immediate family. The physical community environment plays an influential determinant of social capital. With the background of the active aging policy in China, our findings have important implications for policy-makers and practitioners who aim to promote healthy aging through community-building programs in China.

Chapter III: Social Capital Profiles among Chinese Older Adults: A Latent Class Analysis

3.1 Introduction

3.1.1 Social Capital in Later Life

The social capital theory proposes that the networks of individuals and their mutuality with others provide multiple resources and opportunities that benefit the development of individuals (Kawachi et al., 1999; Putnam, 1995). There has been an increasing interest in studying the health issues of older adults from the social capital perspective. Social capital issues are particularly relevant to older age groups for several reasons. First, older adults are more likely to rely on others to realize benefits to health due to decreased functional levels (N. Lin, 2017). However, older people are also more vulnerable to falling social networks as they are at greater risk of losing their partners and friends, making them more dependent on other social resources, including social capital within the society (Nyqvist et al., 2013). Second, community-level social capital has a stronger relationship with older adults' health because older adults are more exposed to or more vulnerable to local features than other populations; as their limited mobility increase the time spent at home and after retirement, older adults' social interactions shift over to family, neighbors, church, or community (Lager et al., 2015). Studies show that older adults should sustain a sense of attachment and connection to both their homes and communities to maintain their health and mental wellbeing (Wiles et al., 2012; Nyqvist et al., 2013).

A great deal of research has indicated social capital is related to the health outcomes of older adults. For example, previous research showed that having more social capital was

associated with fewer mental health problems and less psychological distress; affected the trajectory of depressive symptoms; and contributed to higher levels of life satisfaction and lower loneliness (Nyqvist et al., 2013). However, the concept of social capital suffers from a lack of clarity and multiple concepts are used to define social capital. One widely cited definition of social capital within health research is the one by Robert Putnam who suggests that social capital is "...features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (Putnam, 1993, p. 167), which is often referred to as the communitarian definition of social capital (Bhandari & Yasunobu, 2009). Unlike the communitarian approach, the network theory of social capital conceptualizes and measures social capital as real or potential individual assets that are inhered within social networks or groups for personal benefits (Bourdieu, 1986). The difference between communitarian and network approaches is significant. However, the variety of definitions is not due to a lack of understanding about what social capital is, but because social capital is a complex multidimensional concept having various dimensions, types, levels and determinants (Bhandari & Yasunobu, 2009), as people often have different social roles and identities in different contexts. These several forms of social capital also suggest that social capital can be operationalized and measured in various ways.

3.1.2 Multidimensions of Social Capital

Current literature primarily focuses on one piece of social capital at a time (such as "trust") or relies on a simple count of associational memberships as the measures of social capital, without acknowledging that individuals may be involved in multiple social relationships simultaneously. Instead, the diversity in dimensions of social capital has often been ignored in measuring social capital, which implies that all dimensions of social capital are equivalent and

exchangeable (Vadapalli, 2012). However, evidence shows that different types of social capital provide various resources that individuals can use (Szreter & Woolcock, 2004). Furthermore, the decision to be involved in a specific social relationship is not independent of the decision to join other relationships, social relationships can be complementary or in competition with one another with respect to time commitments and opportunities (Owen & Videras, 2009). There may be heterogeneity of social capital among older adults, and that health outcome varies by different social capital patterns.

There is an emerging trend of applying multivariate methods to account for multidimensionality in measuring social capital. Departing from conventional approaches to investigating social capital, Owen and Videras (2009) demonstrate latent class analysis (LCA)'s potential to define various types of social capital that are qualitatively different and are consistent with an interpretation that social capital is an unobservable multi-dimensional construct (Dzanja, 2018). Respondents were classified into distinct classes based on responses to various questions related to associational memberships, nationality, trust, and fairness. Although this innovative study has explored social capital as a pattern, this approach has rarely been applied to the investigation of the social capital of older adults, especially in Asian countries.

3.1.3 The Present Study

This proposed research aims to understand the profiles of social capital among Chinese older adults and how such profiles differ with respect to background characteristics as well as health conditions. Background characteristics include individual and built neighborhood factors such as public facilities and the surrounding environment. In this study, I focus on depressive symptoms in later life because mental health is recognized as a significant health issue among Chinese older adults (Li et al., 2020), and depression is a crucial mental health component. Since

the generally positive relationship between social capital and mental health has been established on both individual and collective levels (Ehsan & De Silva, 2015), social capital may play a crucial role in maintaining psychological health for Chinese older adults. Hence, I am interested in the association between social capital profiles (rather than a single dimension of social capital) and mental health. Research questions include: "What social capital profiles occur among Chinese older adults? "and " What factors and mental health conditions are associated with these profiles?".

3.1.4 Conceptual Framework

Social capital is multi-dimensional by nature, and the ecological perspective (Bronfenbrenner, 1992; Lawton, 1989) was adopted to provide a conceptual framework to investigate the multiple levels of social environments where social capital was derived. It is crucial to identify the culturally preferred social environment for Chinese older adults. Families, close kin and other informal, homogeneous and non-political networks are more frequently considered the primary carriers of social capital, which is in stark contrast to what was regarded as the core component of social capital in the U.S. and other Western countries----civic participation and formal networks (Helliwell & Putnam, 2004). In this vein, family, community and the broader society were considered the three levels of the social environment for Chinese older adults in this study. Also, since previous findings suggested that mechanisms through which social capital influences wellbeing in China are more consistently related to cognitive rather than structural social capital (Norstrand & Xu, 2012) and Chinese older adults were less likely to be involved in formal organizations and civic activities, this study included more cognitive social capital indicators (e.g., trust), instead of the structural social capital indicators

(e.g., associational membership) frequently used in previous research conducted in Western countries (such as Dzanja, 2018; van Hees et al., 2020).

In addition, social capital is not a stand-alone variable shared equally within a population, in isolation from broader contextual variables (Kawachi et al., 2007, p. 112). Older adults' multidimensional social relations vary by larger social forces, including gender, race, and SES; thus how older adults of different subgroups experience social capital may vary. The instruments of social capital should also reflect the structural difference of social capital across gender, culture, and other social settings. To better understand the heterogeneous population of older adults and their different needs and characteristics, I used socio-ecological and mental health variables to examine differences between clusters. These socio-ecological variables were not included in the cluster analysis but were expected to vary across the clusters, thus can be used to assess the predictive validity of the cluster solutions.

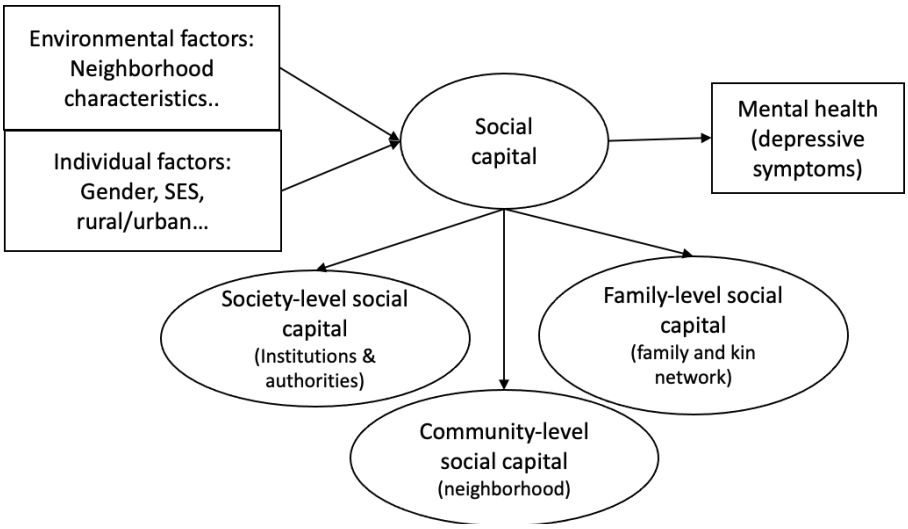

Figure 3. 1 Conceptual framework

3.2 Method

3.2.1 Sample

The data in this study are from the China Family Panel Studies (CFPS), a nationally representative survey that collects information at three levels, including individuals, households and communities. The nationwide survey adopted a multi-stage stratified sampling method, allowing the data to cover 25 provinces, cities and autonomous regions in China, representing 95% of the total population (H. Chen & Meng, 2015). In addition to the 2010 baseline survey, four waves of follow-up data (2012, 2014, 2016, and 2018) were collected and made available to interested parties.

Data used in this study were obtained from the 2016 dataset because the 2016 wave was the only sample year that contained individual subjective evaluations of neighborhood characteristics. There is a total of 33,297 observations in the 2016 CFPS dataset. For the purpose of this study, only respondents who were 60 years and older were kept (24,044 deleted). In addition, there were 1,156 respondents (12.49%) who had missing values on more than 50% of the social capital variables. A sensitivity test was conducted by comparing the LCA analysis, including the 1,156 respondents and the same LCA analysis without these respondents. The results of these two LCA analyses did not differ. Therefore, to avoid the disturbance caused by missing values in social capital variables, the 1,156 respondents were deleted. The final analytic sample comprises 8,097 adults aged 60 and above older adults.

3.2.2 Measures

Social capital measures

I used 15 items that captured a wide range of social relationships and interactions involving three social environment levels in which older adults were engaged: family,

community, and the broader society. Confirmatory factor analysis (CFA) with a WLSMV estimation (Muthen & Muthen, 2022) was conducted to reduce the number of social capital items for use in subsequent analyses. Three domains, including family-level social capital, community-level social capital and society-level social capital were yielded, and the results showed that the model fit the data well (first paper). Given the wide variation in the level of social capital across factors, following the empirical approaches of previous literature(Morrow-Howell et al., 2014), the social capital items in each domain were summed and then the scores in each domain were coded into three levels representing low, moderate, and high levels by dividing the distribution of the amount of each activity. Detailed information about social capital items and domains from CFA can be found in Supplementary Table 1.

Depressive symptoms

Depressive symptoms were measured by the Center for Epidemiological Studies Depression (CESD)(Radloff, 1977); this is a widely used scale with high validity and test-retest reliability (Hunter et al., 2003; Radloff, 1977) and was reviewed as adequate for the older, community-dwelling population in China. It recorded the frequency of mood and behavioral symptoms respondents had experienced in the previous week. Each item was scored on a 4-category scale ranging from 0 (rarely or none of the time / <1 day) to 3 (most or all of the time/ 5-7 days). The composite score range is comparable to the CESD20, which is 0-60, with a high score indicating severe depressive symptoms.

Individual characteristics

Covariates are mainly concerned with demographics and socioeconomic status at individual level (AARP, 2009), including gender (0 = male, 1 = female), age (continuous years), marital status (0 = not married, 1 = married), education (1= less than primary school, 2= primary

school, 3= junior high school, 4=high school and higher), residency (1=rural, 0=urban). Because the income varied widely across rural and urban regions in China, self-rated income level instead of household income was selected to measure individual-level financial status (range 1-5, 1=very low, 5=very high). Physical function is measured by the sum score of six IADL difficulties (range 0-6). In addition, depressive symptoms in 2014 were used as the control variable.

Environmental characteristics

The neighborhood environment was measured by the physical environment and facilities of the neighborhood. Participants were asked, "how is the surrounding environment of your community (noise, trash disposal, etc.)" and "How do you think of the public facilities for education, medical and transportation in general around your community." A 5-point Likert scale scored both answers: "very poor," "poor," "fair," "good," and "very good" a higher score indicates a better neighborhood environment (range=1-5).

3.2.3 Data Analysis

LCA was employed to identify the social capital profiles of older adults in the study. LCA is a model-based approach that identifies individuals' behavioral patterns and then allows individuals to be classified into subgroups based on their response to a set of observed indicators when variables are ordinal or categorical in nature. Compared to other clustering methods, LCA is less restrictive since it does not depend on statistical assumptions, including linearity, homogeneity of variance, and normally distributed data (Magidson & Vermunt, 2002). Such a methodology is a good fit for studying social capital among older adults(Owen & Videras, 2009). It captures a fuller range of the social relations that people may or may not concurrently perform and the interrelations between such relations.

The LCA was tested using the Mplus statistical program with maximum likelihood parameter estimation and the Estimation-Maximization algorithm (Muthén & Muthén, 1998-2006). A single class model was used as a reference model, followed by sequentially increasing the number of classes up to the model statistics would not improve. Fit statistics used in the current study include the Akaike's information criterion (AIC), Bayesian information criterion (BIC), the Lo-Mendell-Rubin (LMR) test and its bootstrap form and the Entropy value. This study used both model interpretability and objective indices to determine the best model for LCA analyses. Latent class membership and item response probabilities are the main parameter estimates in LCA, used for interpretation and distinct labeling of latent classes (Collins & Lanza, 2009). Latent class membership based on their posterior probability was retained using the first maximum probability rule (Bray et al., 2012). A categorical variable "social capital profiles" was created for subsequent analysis.

The multinomial logistic regression model was used with the antecedents described earlier to examine how personal and neighborhood characteristics were associated with the probability of being in one of the latent profiles of social capital. One class, usually the normative or most prevalent class, is chosen as the reference group and contrasted with the remaining classes using statistical tests for group comparisons. The covariates in this study do not cover all possible determinants of social capital. Our purpose is to understand better each subgroup of older adults with different social capital profiles. Then, linear regression modeling was used to estimate the relationships between social capital profiles and depressive symptoms, and dummy variables representing each latent class were created and included as main independent variables. OLS regression was selected in this study as the dependent variable depressive symptoms was a roughly normally distributed continuous variable. The variable had a mean of 13.63 years and a

variance of 9.29 years. Its skewness and kurtosis were 0.99 and 3.80, respectively. Because the sample size was large (n=8,097), and the skewness of distribution was within tolerance, the parametric approach can be used for this variable. Model diagnostics were also conducted and there did not appear to be significant problems with normality, independence and multicollinearity. However, because the p-value of the Cook-Weisberg test for heteroskedasticity was significant, the robust standard error was utilized to fix this problem.

Multiple imputations with chained equations were used to impute missing values in control variables and the depressive symptoms variable (the largest percentage of imputed value: 6.99%).

3.3 Results

3.3.1 Descriptive Results

Table 3.1 presents descriptive statistics of the sample. The average CES-D score was 13.63 (SD= 9.29). 36.88% of respondents had scores equal to or larger than 16, suggesting they were at risk for clinical depression. The average age of the sample was 68.23 (SD=6.64) years. More than half of the participants lived in rural areas (52.46%). Male was about the same percentage as female, and about 80% of participants were married. Educational attainment was overall low in this sample. Only less than 10% of the participants had finished high school. 28.97% of participants reported poor self-rated health and 23.36% had functional difficulties. Regarding the community factors, 43.72% and 43.95% of participants reported good surrounding environment and public facilities of their community, respectively.

Table 3. 1 Descriptive results of influential factors and depressive symptoms

	Whole N=8,097 M(SD) or %
Depressive symptoms (0-60)	13.63(9.29)
Demographic	
Age(yrs)	68.23(6.64)
Gender	
Male	49.78%
Female	50.22%
Rural/Urban	
Urban	47.54%
Rural	52.46%
Marital status	
Married	79.76%
Not married	20.24%
Education	
Less than primary	52.51%
Primary	21.89%
Junior high	15.99%
High school +	9.60%
Health	
Self-rated health (1-5)	3.58(1.19)
% of reporting poor health	28.97%
IADL (0-6)	0.57(1.33)
% of having IADL difficulties	23.36%
Neighborhood Characteristics	
Neighborhood environment (1-5)	3.38(0.99)
% of reporting good environment	43.84%
Neighborhood facility (1-5)	3.44(0.96)
% of reporting good facility	44.10%

3.3.2 Latent Analysis Results

Table 3.2 shows the results of the latent class analysis model testing procedure using the three social capital domains. I added classes or groups at each step until no further improvement in model fit was obtained. Based on model fit criteria, the three-group model was the best fit because this model had the lowest BIC (49487.73) and the highest score in entropy (.797). The

LMR test indicated that the three-group solution improved over the two-group model (p <. 00), while the four-group model was not better than the three-group model (p=.11).

Table 3. 2 Latent Class Analysis Model Fit Statistics

Class proportion	2-class	3-class	4-class
Class 1	50.09%	31.96%	28.61%
Class 2	49.91%	33.46%	26.29%
Class 3		34.58%	28.57%
Class 4			16.54%
Model fit			
df	13	20	27
AIC	49715.06	**49347.74**	49357.21
BIC	49806.05	**49487.73**	49546.19
Adjust BIC	49764.74	**49424.17**	49460.39
Entropy	0.777	**0.797**	0.614
LMR	3626.082***	**374.39*** **	4.462

Note. BIC = Bayesian Information Criterion; LMR = Lo–Mendell–Rubin. ***p < .001

Based on the item-response probabilities, I labeled the three latent classes of social capital profiles “Family-centered," “Moderate," and “Diverse." The Moderate social capital group was the largest class, including 34.6% of the sample. Respondents in this class had the highest conditional probabilities of family-level social capital, followed by society-level social capital and community-level social capital. However, in general, respondents in this group had a deficient community-level social capital available in their daily lives. The Family-centered social capital group comprised 33.5% of the sample and was characterized by engaging in each social capital domain at a deficient level. While respondents in this group had a slightly higher level of family-level social capital, they barely had any other source of social capital outside the family. The Diverse social capital group accounted for 32.0% of all respondents. High social capital in

all domains can be seen. In contrast to the other two classes, respondents in this group had the highest probability of community-level social capital. Only in the Diverse class were respondents more likely to have social capital from a broader social environment beyond the family sphere.

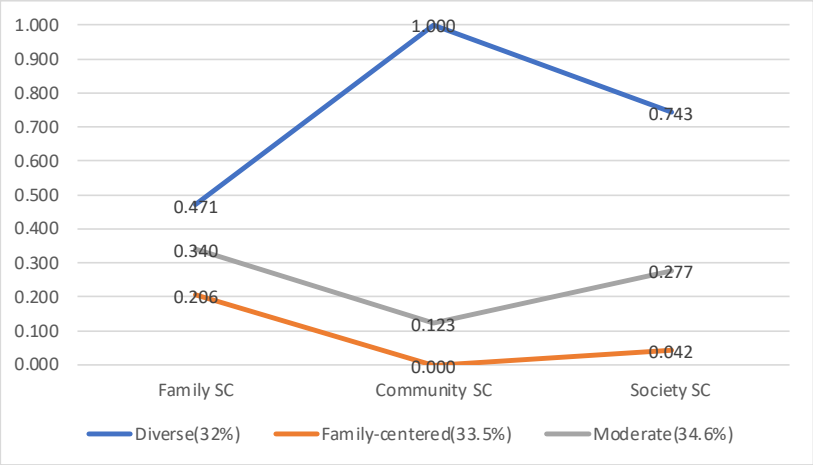

Figure 3. 2 Class profile on social capital clusters.

3.3.3 Individual, Environmental Factors and Social Capital Profiles

Table 3.3 shows the antecedents associated with the three profiles. With the Family-centered class being the constant comparison, older age was associated with being in the Diverse group. Rural respondents were more likely to be in the Moderate and Diverse groups. Being female was related to being in the Moderate group than in the Family-centered. Compared to respondents who did not finish primary education, those with primary education were less likely to be in the Moderate group. Socio-economic factors predicted older people's social capital profiles as those with higher income were more likely to belong to the Diverse group.

Additionally, self-rated health status was an influential factor related to social capital in later life. Respondents with worse self-rated health status were more likely to be in the Family-

centered class. In terms of community factors, both community environment and community facility were associated with social capital profiles. Living in communities with better environments and facilities increased the likelihood of being in the Moderate and Diverse social capital groups.

Table 3. 3 Multinomial logistic regression: Antecedents and social capital profiles

	Wald test	**Moderate vs. Family-centered**			**Diverse vs. Family-centered**			**Diverse vs. Moderate**		
	p	rrr	SE	p	rrr	SE	p	rrr	SE	p
Demographic										
Age	0.00	1.01	0.00	0.13	1.02	0.01	0.00	1.02	0.00	0.00
Rural (ref: urban)	0.00	1.28	0.07	0.00	1.63	0.10	0.00	1.27	0.08	0.00
Female	0.07	1.16	0.07	0.01	1.12	0.07	0.07	0.97	0.06	0.59
Education (ref: less than primary)										
Primary	0.11	0.84	0.06	0.02	0.97	0.08	0.71	1.16	0.08	0.06
Junior high	0.69	0.94	0.08	0.49	0.91	0.08	0.29	0.96	0.08	0.65
High school +	0.67	0.98	0.10	0.81	0.91	0.10	0.39	0.93	0.10	0.50
Marriage (ref: married)										
not married	0.28	0.89	0.07	0.12	0.94	0.07	0.43	1.05	0.08	0.49
Income	0.00	1.04	0.03	0.14	1.09	0.03	0.00	1.05	0.01	0.00
Health factors										
Health	0.00	0.86	0.02	0.00	0.80	0.02	0.00	0.93	0.02	0.00
Function	0.58	1.03	0.07	0.68	1.10	0.08	0.21	1.07	0.08	0.35
Community factors										
Surrounding environment	0.00	1.49	0.05	0.00	1.99	0.07	0.00	1.34	0.05	0.00
Community facility	0.00	1.15	0.04	0.00	1.66	0.06	0.00	1.45	0.05	0.00

rrr: relative-risk ratio
Average RVI = 0.0133, Largest FMI= 0.0889, F(24, 2.2e+06)=45.34, p<0.000, LR chi2(24)=1387.99

3.3.4 Depressive Symptoms and Profiles

Table 3.4 presents the linear regression results. Social capital profiles significantly influenced depressive symptoms after controlling other individual and environmental factors.

Compared to being in the Family-centered group, being in the Moderate and Diverse social capital group decreased the estimated depressive symptom score by 1.93 and 2.91, respectively. Older adults who were younger, female, poor, less educated, socially isolated and had poor self-rated health and sensory disability were more likely to have depressive symptoms. Rural residents also predicted depressive symptoms among older adults.

Table 3. 4 Social capital profiles and depressive symptoms

	CES-D (Coef(SE))	**p-value**
Social capital profile (ref: Family-centered)		
Moderate	-1.93(0.22)	0.00
Diverse	-2.91(0.24)	0.00
Demographic		
Age	-0.05(0.01)	0.00
Rural (ref: urban)	1.94(0.19)	0.00
Female	0.93(0.19)	0.00
Education (ref: less than primary)		
Primary	-1.01(0.24)	0.00
Junior high	-1.94(0.26)	0.00
High school +	-2.05(0.30)	0.00
Marriage (ref: married)		
Not married	2.76(0.26)	0.00
Income	-0.41(0.09)	0.00
Health factors		
Health	1.98(0.08)	0.00
Function	2.93(0.25)	0.00
Mental health in 2014	0.35(0.02)	0.00
Community factors		
Community environment	-0.27(0.11)	0.02
Community facility	-0.31(0.11)	0.01
Model statistics	F(15, 8080)= 203.73 R2=.2757	

3.4 Discussion

By using 15 social capital items factored into three domains, this study demonstrates that a latent pattern of social capital exists for these data with these indicators. I identified three distinct profiles of social capital among older adults: Family-centered, Moderate and Diverse social capital. These profiles can be described in terms of types and levels of social capital, and some signature features make them interpretable as unique profiles. Besides, this study also shows that older adults in different classes also differ in individual and community characteristics and mental health status.

The Family-centered group represented those who obtained a low level of social capital in all domains, intergenerational support within the family was almost the only source of social capital. Older people of this group barely had any other source of social capital from the community and the broader society. Associative factors suggested that older adults in this class had poorer health than the other groups. Their social capital profiles were prospectively related to higher levels of depressive symptoms. In addition, members of this group were more likely to live in urban areas and communities with poor environments and facilities.

The line of the Moderate group and the Family-centered group was almost parallel on the family- and community-level social capital indicators, suggesting that though the overall social capital level improved, family-level social capital was still the fundamental source of social capital for members of the Moderate group, and community social capital remained marginally available. However, what characterized the Moderate group was the increased society-level social capital. Compared to older adults with low social capital, the Moderate group reported

more interactions and trust with unknown people and social institutions, such as service providers and governmental agencies. This may motivate older adults in this group to utilize public services and gain more extensive networks outside their small circles, and tend to have beneficial mental health effects from these connections.

Our results show that the Diverse class stands in stark contrast to the other two classes. This class was characterized by a high probability of community and society social capital, and it was the only group of older adults for whom family was not the most important source of social capital. People of this group may represent the "active older adults" who engaged actively in community and society affairs. As expected, related factors included good self-rated health, higher economic status, and higher ratings of community environment and facilities. This is consistent with previous research indicating that engagement opportunities are not equal for all older adults; individuals with more resources have more options for engagement, while individuals that are socially disengaged tend to be those who are economically and socially disadvantaged (Berkman et al., 2000; Bowling & Stafford, 2007). Also, I found that the profile of Diverse social capital showed more significant protective effects against depressive symptoms than other profiles.

Findings from this study supported that family is still a salient source of social capital for Chinese older adults. Compared with older adults in Western societies, family social capital embedded in intergenerational relationships has been the preferred supportive source for older adults in China (Lu et al., 2016). A possible reason might be that the family has long been the primary and culturally favored source of caregiving (Feng et al., 2012). Overemphasizing the function of home care led to the lagged development of aging network services in China. Although formal aging services have increased in recent years, home and community-based

services (HCBSs) remain underdeveloped, fragmented and lacking coordination (Wong & Leung, 2012), and fail to meet the escalating care needs of older people. The critical role played by family-level social capital in the later life of Chinese people may be a result of both the family-centered collectivist cultures and the limited availability of public resources.

Compared to other age groups, older adults' social capital is highly connected with the community they live in (Nyqvist et al., 2013). The lack of supporting resources and an age-friendly environment may explain the low level of community social capital shown by the Low and Moderate social capital classes. Previous research has demonstrated that trust and reciprocity networks do not automatically develop between individuals who live in the same geographical community, but specific physical characteristics and the exercise of the agency are required to make it happen (Campbell and McLean 2002; Nyqvist et al., 2013). When the community environment fails to facilitate social participation, remove barriers facing older adults of disadvantages, and make local communities socially inclusive for older residents, older adults may become disconnected from the community and lose access to the supportive social resources based on social connections in the community. This may further reinforce the older group's social vulnerability and restrict older adults to their households. As evidenced by this study, a low level of community social capital was concurrent with a high level of family social capital and a poor community physical environment. In contrast, a higher level of community social capital was associated with a better community environment and facilities.

It should be noted that while previous research found that a lack of intergenerational family capital can be compensated by community social capital (Cramm et al., 2013; Lu et al., 2016), our findings found that older adults who lack family social capital were very likely to be the same group who lack access to community social capital and other form of social capital.

This is consistent with the ecological theory that processes occurring in the proximal environment may alter the relationship between the individual and the broader social networks. Since this group of older people barely had no social resources to complement their inadequate family support, they might be most vulnerable to the unequally distributed engagement opportunities and supporting resources, and faced the highest risk of social exclusion.

Chinese studies often touch upon the substantial socio-economic gaps between urban and rural areas. Compared to urban residents, rural older adults have limited access to a broad range of state-run social and health care services, including health care, housing, and pensions linked to employers (Norstrand & Xu, 2012). However, the results of this study show that urban older adults were more likely to have a low level of social capital. 37.1% of urban older adults and 30.0% of rural older adults belonged to the Family-centered group. This may suggest that although formal services for the older population in urban areas increased to meet the escalating care demands, a cohesive and inclusive environment that promotes social interactions for older adults is yet to be established. The crucial role of the social environment has been largely overlooked in previous service planning and may lead to unexpected health risks such as increased mental illness. On the other side, a significantly larger percentage of rural older adults belonged to the Diverse group than their urban counterparts, showing rural communities had advantages in forming social capital among older people. While rural older adults reported significantly higher depressive symptoms than urban older adults both in this study and previous research (Guo et al., 2017), social capital may play a substantial impact on depressive symptoms for rural older adults.

Implications

Our results suggest tailoring public health interventions to the characteristics of each group. Since the older people who had minor social capital and were least healthy were grouped in the same cluster, health promotion programs should seek strategies to identify these individuals and maximize their access or capacity to mobilize social capital. I also suggest that interventions should be designed not just to provide certain services or activities. Interventions with embedded social capital elements may be more effective in promoting health than interventions that do not address these factors. Social capital intervention complies with the components and dimensions of the following definition: "Any intervention which seeks to either create or increase group connection, and/or cooperation within and between community members, to strengthen the social connection that elicits mutual feelings of trust, reciprocity, and recognition of shared identity and/or increases access to shared information and resources within and between its members for mutual benefits" (Flores et al., 2018, p. 5). Researchers and practitioners must explore how to design, implement, and evaluate health-promoting interventions that integrate these components and dimensions to affect the quality of life and psychological wellbeing in later life.

This present study also expands analytical tools for measuring social capital for the older population and across the human life course. Using a clustering approach that consolidates multiple social capital elements advances our understanding of social capital in later life and its relationship with health. Since older adults usually engage in different social environments and relations simultaneously, this approach allows us to capture the “whole person” in the real world.

Limitations

The present study has several limitations. First, although the CFPS contains relatively comprehensive information on a wide range of social capital indicators compared to other

nationally representative datasets in China, the ability to capture the social capital of Chinese older adults is still limited by the available measures in the secondary data. Though information about the non-kin-based networks and participation in social activities were provided in the first wave of CFPS, it is not available in the 2016 wave. In this study, the focus was given to family relationships and kin-based networks at the micro-level; however, a lack of information about non-kin-based networks and social activities will impede this study from exploring peer support in later life and may cause bias in the explanation of social capital of Chinese older adults. Second, longitudinal data is unavailable because different social capital indicators were provided across waves of CFPS and some significant indicators were only used in the 2016 wave. The cross-sectional nature of this study limits the ability to infer causal directions and understand social capital in later life from a dynamic perspective. The results only show a significant association between social capital and depressive symptoms, the direction of the relationship cannot be confirmed. Future studies employing a longitudinal design should investigate the causality of the associations and the underlying mechanisms in more detail.

Notwithstanding these limitations, this research identified distinct social capital profiles among Chinese older adults. The use of individual-based categorization contributes to the literature as it better captures the reality of older adults engaging in various social relationships and, therefore, provides valuable insights into the complex interaction between aspects of social capital and heterogeneous older groups. The results suggest that family is still a salient source of social capital for Chinese older adults while a deficiency in community-level social capital faced many older people. Further, our study highlights the vulnerability of Family-centered groups whose access to all forms of social capital was limited. Implications for program development include designing social capital interventions with more attention to the Family-centered group

of older adults. Supporting communities to improve the physical environment and developing social capital interventions targeting older adults could be effective strategies to prevent depressive symptoms and promote Chinese older adults' overall wellbeing.

Chapter IV: Neighborhood Environment and Depressive Symptoms of Older Adults in Urban and Rural China: A Moderated Mediation Model of Social Capital

4.1 Introduction

Mental health is recognized as a significant health issue in many countries, and depression is a crucial mental health component. Depression is common among older adults, affecting approximately 7% of the world's older population and accounts for 5.7% of Years Lived with Disability (YLDs) among those over 60. Depression is also a leading cause of disease burden in the aging population (WHO, 2017). Depression in China has been rising and is particularly at high levels among rural older adults(He et al., 2016). Therefore, reducing and preventing the incidence of depression has become a crucial issue in healthy aging research.

Earlier efforts of researchers to understand, explain, and intervene in the depression of older adults usually focused on individual determinants, such as demographic factors, socioeconomic status, physical functions and health behaviors; what was largely ignored was that older adults' mental health and risk profiles are strongly determined by the environments in which they live (Kubzansky et al., 2005). Compared to other age groups, older adults are more exposed to or more vulnerable to local conditions, as their limited mobility increases the time spent at home. They are more reliant on community-level social connections and resources to maintain health and community residence (Lager et al., 2015). However, very little is known about how neighborhood environments benefit the mental health of rural and urban older adults in China, as substantial gaps exist between rural and urban areas in China. One mechanism by

which neighborhood likely confers psychological benefits to older adults is by improving social capital (SC) (Leyden, 2003; Mao et al., 2021). Social capital is defined as an individual asset that comes from access to networks and social connections (Bourdieu, 1986), or features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions (Putnam, 2001). While previous research has shown that both built and social neighborhood environment predict poor mental health in later life, this study aims to explore the mechanisms of social capital, built neighborhood environment, and depressive symptoms among urban and rural older adults in China.

4.1.1 Conceptual Framework

This article focuses on two ecological frameworks that were developed within gerontology and the field of human development: the general ecological model of aging (Lawton & Nahemow, 1973) and bioecological systems theory (Bronfenbrenner, 1992). According to the ecological model of aging (Lawton, 1982), people throughout their lives are influenced by the constant interaction between individuals and their social and built environment. The health and independence of older adults can be determined by the balance between environmental demand and individual competencies (Lawton, 1982), and depression is not only the result of unhealthy lifestyles, attitudes and behaviors but also reflects insufficient environmental support and resources. Similarly, bioecological systems theory (Bronfenbrenner, 1992) orients attention to how person-environment transactions influence individuals' functioning over time. While the general ecological model on aging focuses on built environments, this theory views individuals as embedded within interlocking social systems comprising various social structures—such as families, neighborhoods, and formal service providers and organizations. Interconnected social

systems are posited to influence individuals' development independently as well as in conjunction with each other (Bronfenbrenner et al., 1984).

Social capital is an essential aspect of the social environment. It can be understood as an inherent cohesive force within networks that enables collective action and the resources embedded in social networks accessed and used by the members (Bhandari & Yasunobu, 2009). In this regard, SC involves social relations at the individual level, such as informal social relations and memberships in social networks and groups, as well as the social environment at the community and the society level, such as the cohesiveness of a neighborhood and a society.

4.1.2 Neighborhood Environment and Depressive Symptoms

The neighborhood environment plays a critical role in mental health among older adults. Regarding the built neighborhood environment, previous researchers have found that neighborhoods with a poor environment, such as environmental barriers (e.g., cracked or nonexistent sidewalks), disorder (e.g., litter/garbage, vandalism), and lack of safety, were linked to social isolation (Lehning et al., 2015), increased fear and psychological stress, and poor mental health (Latham & Clarke, 2018). Regarding the social neighborhood environment, previous research shows that having extensive social networks encompassing both friends and family was associated with positive mental health (Litwin & Shiovitz-Ezra, 2011). Characterizing neighbors as helpful, trustworthy and safe is associated with better self-rated health and lower incidence of onset of mental illness, after controlling for the community, demographic and health variables (Cain et al., 2018).

4.1.3 Community Social Capital as a Mediator

There may be interrelations among different types of neighborhood environment, which is an important hypothesis of the ecological framework (Mao et al., 2022). Built neighborhood

environment factors may affect social neighborhood environment, including community SC. An environment can increase SC by providing support to network building or decrease SC by restricting access to available or potential resources (Hargrove et al., 2020). Previous research showed that for older adults, neighborhoods with adequate resources, convenient facilities, perception of walkability, and good public safety not only promote engagement in socially-oriented activities (Kingsley and Townsend, 2006) at the individual level but also foster a web of public respect and trust, a resource in time of personal or neighborhood needs at the community level (Leyden, 2003). Since SC is closely related to depressive symptoms in later life, it is hypothesized that community SC can be a potential mechanism by which the built neighborhood environment influences depressive symptoms (Figure 4.1).

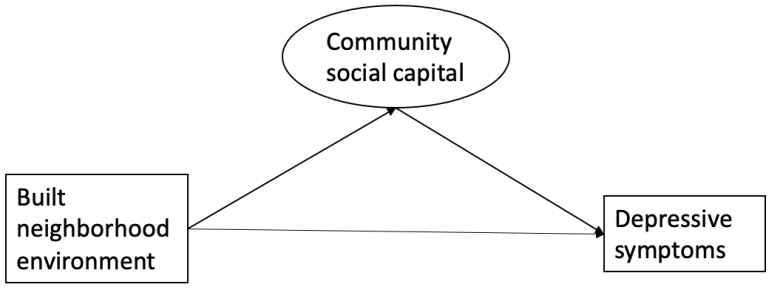

Figure 4. 1 Community social capital as a mediator

Note: community social capital may mediate between the built environment and depressive symptoms, in other words, community SC can be a potential mechanism by which the built neighborhood environment produces changes in depressive symptoms.

4.1.4 Potential Moderating Role of Family and Society Social Capital

According to the ecological framework, older adults simultaneously engage in multiple social relationships (Bronfenbrenner, 1992). Although the community-level social environment is a critical source of SC, it cannot meet all the needs of older adults. Older adults also receive supportive sources from their families and the broader society (Greenfield, 2012). Evidence

shows that different types of SC provide different resources that individuals can use (Szreter & Woolcock, 2004); it is invalid to assume SC from the family, community and society are equivalent and exchangeable.

Furthermore, the decision to be involved in a specific social relationship is not independent of the decision to engage in other relationships. Social relationships can be complementary or in competition with one another in regards to time commitments and opportunities (Owen & Videras, 2009), and the interplay among different layers of the social environment is culturally sensitive. For example, it was suggested that compared with older adults in Western societies, family SC embedded in intergenerational relationships had been the preferred supportive source for older adults in China, and community SC could play a compensatory role in maintaining the mental health of older adults who lack intergenerational family capital (Lu et al., 2016). Additionally, contextual forces and macro-level changes shape person-environment relationships at the micro-neighborhood and family levels. For example, older adults who have higher trust in service providers and governmental agencies, may be less likely to rely on nearby, informal sources of support to cope with the challenges brought by aging. Therefore, the family-level and society-level SC, as well as their interacting relationship with community-level SC, should be taken into consideration in the model. It is hypothesized family and society SC may either buffer or escalate the role played by community SC between the built environment and depressive symptoms (Figure 4.2).

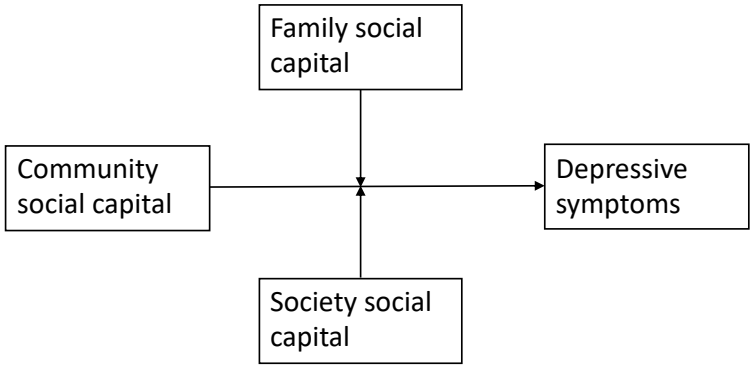

Figure 4. 2 The potential moderating role of family and society social capital Rural/urban disparity

Note: family and society social capital may moderate the relationship between the built environment, community social capital and depressive symptoms. In other words, family and society SC may either buffer or escalate the role played by community SC between the built environment and depressive symptoms.

Studies on the Chinese older population should fully consider the structural and cultural disparities between rural and urban older people (Wu et al., 2018). On the one hand, while urban residents have access to various state-owned social and health services, such as medical resources, elder care, and neighborhood amenities, rural residents have difficulty accessing such neighborhood resources and opportunities. In rural areas, families and neighbors have remained the primary source of care (Norstrand & Xu, 2012). These forms of structural segregation may affect the ability of rural residents to combat health and other aging-related challenges through the use of community resources and neighborhood amenities, access to health services, and additional economic support in later life (Forrest & Kearns, 2001). On the other hand, rural older adults with less economic capital were more likely to embrace the moral obligations of helping their peers and organize themselves into informal "make-do networks" to get by (Rozanova et al., 2012). Researchers have realized that due to the more traditional and family-centric interpersonal relations, the stock of SC and their outcomes in rural areas might differ

significantly from those in urban China(W. Wang, 2020). Considering the rural/urban disparity in terms of neighborhood environment and the patterns of social relations, it is hypothesized that the interplay between the neighborhood environment and SC, as well as its relationship with depressive symptoms, differs in urban and rural areas in China.

4.1.5 Aims

This present study aims to examine the mechanism underlying the link between neighborhood environment and depressive symptoms and how other levels of social environment condition this mechanism in a representative sample of urban and rural older adults from China. I hypothesize that community SC would mediate the relationship between the built neighborhood environment and depressive symptoms among both urban and rural older adults (H1) and that family and society SC would moderate the mediation model. The mediation role of community SC would be stronger among older adults with lower levels of other sources of SC than those with higher levels (H2). Moreover, considering the rural/urban differences in neighborhood environment and SC, it is also examined whether the findings would differ by rural/urban residence.

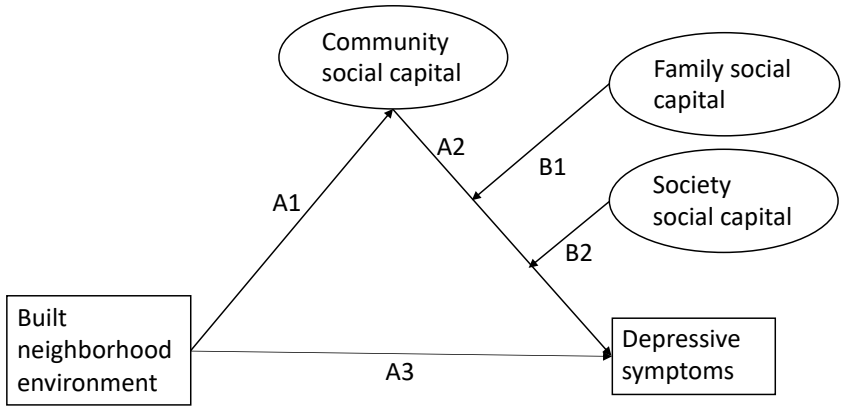

Figure 4. 3 Conceptual model linking built neighborhood environment to depressive symptoms

Note: A Paths are links for the mediation model; B Paths represent interaction effects—for example, B1 represents the interaction effect between community SC and family SC on older adults' depressive symptoms. The model also controlled age, gender, marital status, education, functional limitations and self-perceived income level.

4.2 Method

4.2.1 Sample

The data in this study are from the China Family Panel Studies (CFPS), a nationally representative and biennially follow-up survey that collects information at three levels, including individuals, households and communities. The nationwide survey adopted a multi-stage stratified sampling method, allowing the data to cover 25 provinces, cities and autonomous regions in China, representing 95% of the total population (H. Chen & Meng, 2015). Data used in this study were obtained from the 2016 dataset because the 2016 wave was the only sample year that contained individual subjective evaluations of neighborhood characteristics. Among the 33,297 participants in the 2016 CFPS dataset, I restricted our analysis to participants meeting the following inclusion criteria: (1) aged ≥60 years at baseline (24,044 deleted); (2) provided valid data for questions on the social capital measures (1,156 deleted); (3) provided valid data for individual and neighborhood characteristics (802 deleted). Therefore, the final analytic sample comprises 7,295 adults aged 60 and above in China.

4.2.2 Measures

Depressive symptoms

Depressive symptoms were measured by the Center for Epidemiological Studies Depression (CESD)(Radloff, 1977); this is a widely used scale with high validity and test-retest reliability (Hunter et al., 2003; Radloff, 1977) and was reviewed as adequate for the older, community-dwelling population in China. It recorded the frequency of mood and behavioral

symptoms respondents had experienced in the previous week. Each item was scored on a 4-category scale ranging from 1 (rarely or none of the time / <1 day) to 4 (most or all of the time/ 5-7 days). The composite score range is comparable to the CESD20, which is 0-60, with a high score indicating severe depressive symptoms.

Social environment: social capital

Followed the approach described in (paper 1), I used 15 items that captured SC from three levels of the social environment in which older adults were engaged: family, community, and the broader society. Family SC refers to the intergenerational emotional support and instrumental support from adult children and reciprocal exchanges across generations (Lu et al., 2016). Community SC indicated the trust in local communities, reciprocity among neighbors, feelings of belonging to the community, and local residents' willingness to cooperate with others and to engage in community affairs (Yip et al., 2007). Society SC delineated networks and interactions between an individual and unknown people, as well as social institutions, such as service providers and governmental agencies (Szreter & Woolcock, 2004).

Confirmatory factor analysis (CFA) with a WLSMV estimation (Muthen & Muthen, 2022) was conducted to reduce the 15 SC items into a three-factor solution. The results showed that the model fit the data well. The three factors confirmed the social capital identified in previous works (paper 1), including the family-level SC, community-level SC, and society-level SC. Older adults with more family-level social capital received more intergenerational support and reported better family relationships. Older adults with more community-level social capital reported more social trust and reciprocity in local communities. In contrast, older adults with more society-level social capital were more likely to report higher trust and reciprocity toward the general public and have more trust in the authorities and institutions.

Based on the CFA results, the index for the three levels of social environment was calculated by adding items within the same domain (family SC: mean (SD)=9.50(4.45), range=1-39; community SC: mean (SD)=21.01(3.12), range=5-27; society SC: mean (SD)=25.87(7.00), range=0-48). All scales were mean-centered for use in subsequent analyses.

Built neighborhood environment

The built neighborhood environment was measured by the following two items: surroundings and facilities of the neighborhood. Participants were asked, "how is the surroundings of your community (noise, trash disposal, etc.)" and "How do you think of the public facilities for education, medical and transportation in general around your community." A 5-point Likert scale scored both answers: "very poor," "poor," "fair," "good," and "very good" a higher score indicates a better neighborhood environment.

Rural/Urban

In China, the government has long classified communities as rural or urban. Generally speaking, rural areas are mainly engaged in agricultural production and have low population densities. In contrast, urban areas mainly engage in industrial, commercial, and other non-agricultural activities and have a higher population density(Li et al., 2020). In this data set, rural/urban status is predetermined, based on the national census bureau's definition. The final sample for this study included 3,483 participants from urban communities and 3,812 participants from rural communities.

Covariates

Covariates are mainly concerned with demographics and socioeconomic status at individual level (AARP, 2009), including gender (0 = male, 1 = female), age (continuous years), marital status (0 = not married, 1 = married), education (1= less than primary school, 2= primary

school, 3= junior high school, 4=high school and higher). Because the income varied widely across rural and urban regions in China, self-rated income level instead of household income was selected to measure individual-level financial status (range 1-5, 1=very low, 5=very high). Physical function is measured by the score of six IADL difficulties (range 0-6).

4.2.3 Data Analysis

To test whether the social neighborhood environment mediated the relationship between the built neighborhood environment and depressive symptoms among urban and rural older adults, mediation analyses were performed using a bootstrapping approach for the rural and urban groups separately. Among mediation hypotheses tests, early research was often guided by the multistep approach proposed by Baron and Kenny (1986) (Preacher & Hayes, 2004). However, such mediation approach suffers from low power and does not directly address the hypothesis of interest (MacKinnon et al., 2002), and a growing literature suggests that mediation analyses should be based on formal significance tests of the indirect effect, of which the Sobel (1982) test is the best known (Preacher & Hayes, 2004). Although the Sobel test have been found to have greater statistical power than that of other formal methods of assessing mediation, it requires the assumption that the indirect effect is normally distributed. Since the assumption is usually violated in practice, the symmetric confidence interval based on the assumption of normality may yield underpowered tests of mediation (Bollen & Stine, 1990; Lockwood & MacKinnon, 1998; Preacher & Hayes, 2004).

Therefore, bootstrapping is recommended. Bootstrapping is a nonparametric approach to effect-size estimation and hypothesis testing that makes no assumptions about the shape of the distributions of the variables or the sampling distribution of the statistic Through the application of bootstrapped confidence intervals, it is possible to avoid power problems introduced by

asymmetric and other forms of nonnormality in the sampling distribution of the indirect effect (Bollen & Stine, 1990; Lockwood & MacKinnon, 1998; Preacher & Hayes, 2004). The bootstrapping was conducted using Hayes' (2017) PROCESS macro program with R. The analysis involved 5,000 bootstrapping samples with 95% confidence intervals, using the percentile method. A 95% CI that does not include zero shows indirect effects significantly different from zero ($p < 0.05$). Individual characteristics were controlled.

Then, I further tested the moderated mediation model to see whether other levels of the social environment (family- and society-level) moderated the mediation model. Because the moderated mediation effects (also known as conditional indirect effects) is the product of two causal path estimates conditioned on the value of one or more moderators, bootstrapping can also be applied to the assessment of conditional indirect effects (Preacher et al., 2007). The bootstrap method with 5,000 replications was also used to obtain conditional indirect effects at the values of the moderators.

4.3 Results

4.3.1 Descriptive Results

Table 4.1 presents descriptive statistics on sample characteristics. The average CES-D score was 13.37 (SD=9.09), and 35.76% of the respondents had scores equal to or larger than 16, suggesting they were at risk for clinical depression. The average age in the sample was 67.95 years old, with a standard variation of 6.51 years. Male was about the same percentage as female. Educational attainment was low in this sample. Only 10% of the participants had educational attainment of higher school and more. About 22% of participants had functional difficulties, and the average reported income level was 2.41 (SD=1.12), indicating most respondents regarded their income level as low in their local areas. Regarding the neighborhood characteristics,

43.06% and 43.14% of participants reported good surroundings and public facilities in their neighborhood, respectively. The average score for the built environment was 6.79 (SD=1.70).

When comparing participants from rural areas to their counterparts living in urban cities, rural older adults reported more depressive symptoms. Additionally, rural older adults obtained higher SC across all three levels. An urban/rural disparity can also be found in neighborhood characteristics; the neighborhood surroundings was better in rural areas while the public facilities were better in urban areas. The total score of the built neighborhood environment did not show any rural/urban difference. In addition, rural older adults were more likely to have functional limitations and lower education.

Table 4. 1 Descriptive results

	Whole N=7,295 M(SD) or %	Urban N=3,483 M(SD) or %	Rural N=3,812 M(SD) or %	p
Depressive symptoms (0-60)	13.37(9.09)	11.93(8.61)	14.67(9.33)	***
Social capital				
Family social capital (1-39)	9.50(4.45)	8.96(4.24)	10.00(4.58)	***
Community social capital (5-27)	21.01(3.12)	20.76(3.06)	21.24(3.15)	***
Society social capital (0-48)	25.87(7.00)	25.61(6.90)	26.10(7.08)	**
Neighborhood Characteristics				
Neighborhood surroundings (1-5)	3.37(0.99)	3.33(0.98)	3.41(1.00)	***
% reported good surroundings	43.06%	40.17%	45.70%	***
Neighborhood facility (1-5)	3.43(0.97)	3.47(0.92)	3.39(1.00)	***
% reported good facility	43.14%	43.38%	42.92%	
Neighborhood physical environment (2-10)	6.79(1.70)	6.80(1.65)	6.79(1.75)	
Demographic				
Age(yrs)	67.95(6.51)	68.27(6.83)	67.66(6.19)	***
Gender				
Male	51.21%	49.90%	52.41%	*
Female	48.79%	50.10%	47.59%	
Marital status				
Married	81.09%	81.25%	81.09%	

Not married	18.91%	18.75%	18.91%	
Education				***
Less than primary	51.19%	40.51%	60.94%	
Primary	22.12%	22.22%	22.04%	
Junior high	16.66%	21.91%	11.86%	
High school +	10.03%	15.36%	5.17%	
IADL (0-6)	0.53(1.28)	0.49(1.26)	0.58(1.30)	**
% of having IADL	22.07%	19.61%	24.32%	***
Income level (1-5)	2.41(1.12)	2.44(1.08)	2.38(1.15)	*

Note: P-value shows the bivariate comparison between urban and rural participants. *<0.05, ** <0.01, ***<0.001

4.3.2 Results of Mediation Analysis

For urban older adults, the indirect effect of the community environment on depressive symptoms via community SC was significant (β= −0.24, SE = 0.04, 95% CI = (−0.31, −0.17). More specifically, community environment was positively associated with community SC (a path: β= 0.58, p < .000), and community SC in turn was negatively associated with depressive symptoms (b path: β= -0.41, p < .000). The total and the direct effect of community environment on depressive symptoms were significant for urban older adults (total β=−0.55, SE = 0.09, p < .000; direct β=− -0.31, SE = 0.09, p < .001.). The indirect effect accounted for 43.64% of the total effect. The findings suggest that community SC mediated the relationship between community environment and depressive symptoms among urban older adults in China.

For rural older adults, I also found a significant indirect effect of community environment on depressive symptoms through community SC (β= −0.33, SE = 0.04, 95% CI = (−0.40, −0.27). Similar to the results of urban older adults, the neighborhood environment was a positive predictor of community SC in rural areas, which in turn was a negative predictor of depressive symptoms in later life. The total and direct effects of the built neighborhood environment on

depressive symptoms were significant (total β=−0.67, SE = 0.08, p < .000; direct β=− -0.34, SE = 0.09, p < .001), suggesting that community SC partially mediated the relationship between community environment and depressive symptoms among rural older adults in China. The indirect effect accounted for 49.25% of the total effect. Compared to urban older adults, the whole model explained more variance of depressive symptoms in rural areas (R2: 0.1892 vs. 0.1600), and the mediating effect value of community SC in rural areas also accounted for more of the total effect value (49% vs. 43%). Despite these differences, the mechanisms linking community environment and depressive symptoms via SC did not vary between rural and urban areas.

I further built a supplementary model to examine the effect of specific neighborhood environment factors (surrounding environment and public facility) on the mediating mechanisms in urban and rural areas separately (Supplementary 2 & 3). Results showed that the partial mediating model was significant with the surrounding environment and public facilities in both urban and rural areas. However, the effects of public facilities on depressive symptoms were stronger for urban older adults, while for rural older adults, the effects of the surrounding environment were more substantial.

Table 4. 2 Test of mediation effects of community social capital on the relationship of neighborhood environment to depressive symptoms: Bootstrap results.

Urban

Path/Effect	β	Standard β	SE	p
C (total effect)	-0.55	-0.06	0.09	0.000
a Community environment →Community social capital	0.58	0.31	0.03	0.000
b Community social capital →Depressive symptoms	-0.41	-0.14	0.05	0.000
c' Community environment→ Depressive symptoms	-0.31	-0.04	0.09	0.001

	β (Boot 95%CI)	Standard β (Boot 95%CI)	Boot SE	
a×b (indirect effect)	-0.24(-0.31,-0.17)	-0.05(-0.06,-0.03)	0.04	
R^2				
Community social capital	0.2034			
Depressive symptoms	0.1600			

Rural

Path/Effect	β	Standard β	SE	p
C (total effect)	-0.67	-0.07	0.08	0.000
a Community environment →Community social capital	0.56	0.31	0.03	0.000
b Community social capital →Depressive symptoms	-0.59	-0.20	0.05	0.000
c' Community environment→ Depressive symptoms	-0.34	-0.04	0.09	0.000

	β (Boot 95%CI)	Standard β (Boot 95%CI)	Boot SE	Standard Boot SE
a×b (indirect effect)	-0.33(-0.40,-0.27)	-0.06(-0.08,-0.05)	0.04	0.01
R^2				
Community social capital	0.1845			
Depressive symptoms	0.1892			

4.3.3 Results of Moderated Mediation Analysis

I examined whether the other two levels of social environment---family SC and society SC moderated the above mediation models. The analysis was conducted for urban and rural older adults separately. For urban older adults (Table 4.3), the moderating effect of society SC, which is shown by the interaction between community SC and society SC, was statistically significant for depressive symptoms (b=0.02, p=0.004). In order to depict the results more descriptively, Figure 4.4 shows the conditional effect of community SC on depressive symptoms at high society SC versus moderate and low society SC (the 84th, 50th and 16th percentiles of the distribution of the society SC) (Hayes, 2017). The results reveal that the effect between community SC and depressive symptoms was stronger for older adults with low society SC (β =-0.56, CI=-0.61, -0.39) than those with moderate (β =-0.39, CI=-0.49, -0.29) and high society SC (β =-0.28, CI=-0.42, -0.13). The indices of partial moderated mediation show the slope of the

indirect effect is statistically different from zero (β=0.01, Boot CI=0.002,0.021), indicating the mediation is moderated by society SC. In other words, higher society SC could attenuate the mediation effect of community SC on the relationship between the built environment and depressive symptoms.

Table 4. 3 Results of the Moderated Mediation Analysis – Urban

	Community social capital		**Depressive symptoms**	
	B(SE)	95% CI	B(SE)	95% CI
Community environment	0.68(0.03)	0.62, 0.74	-0.33(0.09)	-0.51, -0.16
Age	-0.01(0.01)	-0.02,0.01	-0.11(0.02)	-0.15, -0.06
Not married (ref: married)	0.01(0.13)	-0.25,0.27	2.90(0.37)	2.18, 3.61
Female (ref: male)	0.02(0.10)	-0.17,0.22	1.49(0.28)	0.94, 2.03
Education (ref: less than primary)	-0.12(0.04)	-0.21, -0.03	-0.92(0.13)	-1.16, -0.67
IADL	-0.08(0.04)	-0.16, -0.00	1.49(0.11)	1.27, 1.71
Income	0.13(0.05)	0.04,0.22	-0.76(0.13)	-1.01, -0.51
Family SC			-0.10(0.03)	-0.16, -0.03
Society SC			-0.04(0.02)	-0.09, -0.00
Constant	-4.02 (0.55)	-5.10, -2.93	20.40(1.59)	17.29, 23.50
Mediator				
Community social capital			-0.38(0.05)	-0.47, -0.28
Interaction effect				
Community SC x Family SC			0.02(0.01)	-0.00, 0.04
Community SC x Society SC			0.02(0.01)	0.01, 0.03
Model statistics	F(7, 3475)= 84.78(p<0.000) R2=.1459		F(12, 3470)= 56.38(p<0.000) R2=.1632	

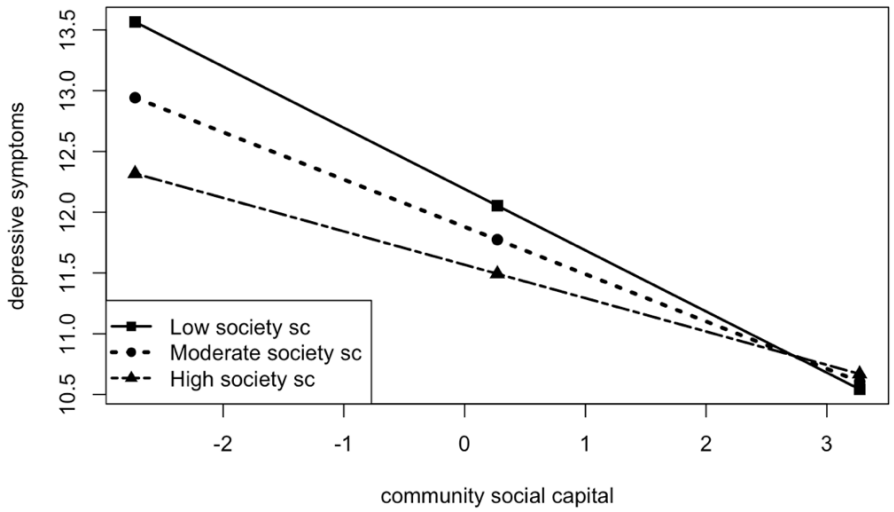

Figure 4. 4 Interaction (moderating) effect between older adults' community social capital and society social capital on their depressive symptoms—Urban.

Note: The link between community social capital and depressive symptoms was stronger when society social capital was lower than when society social capital was higher
Community SC and Society SC have been centered around the mean.

For rural older adults (Table 4.4), the moderating effect of other levels of social environment was not found. The indirect effect of the neighborhood environment on depressive symptoms via community SC was not influenced by either the family SC or the society SC. Although society SC is directly related to depressive symptoms, this level of social environment did not interact with the community social environment regarding depressive symptoms. These results did not support the proposed moderated mediation model for rural older adults.

Table 4. 4 Results of the Moderated Mediation Analysis – Rural

	Community social capital		**Depressive symptoms**	
	B(SE)	95% CI	B(SE)	95% CI
Community environment	0.66(0.03)	0.61, 0.71	-0.34(0.09)	-0.51, -0.17
Age	0.01(0.01)	-0.01,0.02	-0.07(0.02)	-0.12, -0.02
Not married (ref: married)	-0.21(0.13)	-0.46,0.05	2.43(0.37)	1.70, 3.17

Female (ref: male)	-0.00(0.10)	-0.20,0.20	1.60(0.29)	1.03, 2.18
Education (ref: less than primary)	0.32(0.06)	0.20,0.43	-1.05(0.17)	-1.37, -0.72
IADL	-0.10(0.04)	-0.17, -0.02	1.58 (0.11)	1.36, 1.79
Income	0.09(0.04)	0.01,0.17	-0.62(0.12)	-0.86, -0.38
Family SC			-0.19(0.03)	-0.25, -0.12
Society SC			-0.06(0.02)	-0.10, -0.02
Constant	-5.38(0.61)	-6.57, -4.19	20.36(1.79)	16.84, 23.87
Mediator				
Community social capital			-0.59(0.05)	-0.69, -0.49
Interaction effect				
Community SC x Family SC			0.01(0.01)	-0.01, 0.03
Community SC x Society SC			-0.00(0.01)	-0.01, 0.01
Model statistics	F(7, 3804)= 91.49 (p<0.000) R2=.1441		F(12, 3799)= 73.91(p<0.000) R2=.1893	

4.4 Discussion

Despite the increasing number of studies examining the relationship between built neighborhood environment, social capital and mental health of older adults, how these factors interplay with depressive symptoms is rarely studied, especially in China. This study extended previous research by examining the mediating role of community SC underlying the link between built neighborhood environment and depressive symptoms and exploring the moderating role of other sources of SC in a representative sample of older adults in China. Results demonstrated that community SC mediated the relationship between built neighborhood environment and depressive symptoms among urban and rural older adults. This replicated the psycho-social pathway linking neighborhood environment to depressive symptoms in previous research. Moreover, the indirect path linking neighborhood environment to fewer depressive symptoms through community SC was more evident when older adults reported less society SC,

suggesting a compensatory relationship between these two types of SC. However, this relationship was significant only for urban older adults.

The findings of our study show that the built neighborhood environment was directly associated with depressive symptoms among older people, which confirmed the importance of understanding older people's mental health from an ecological perspective. Specifically, I found that Chinese older adults who lived in communities with poor public facilities (e.g., health services and transportation) and the surrounding environment (e.g., road conditions, noise, trash disposal) were more depressive. Meanwhile, such neighborhoods constrain opportunities for healthy living not only by increasing residents' exposure to environmental stressors and environmental pollutants but also by restricting spaces for SC and social cohesion (Hargrove et al., 2020). Findings of this study show that while the built community SC is partially determined by the built environment, it is also the coping resource through which older adults resist the demands of the environment. The findings of this study suggest health and wellbeing promoting efforts for older adults should focus on the path from neighborhood environment to SC.

The mechanisms between built neighborhood environment, community SC and older adults' depressive symptoms did not differ significantly by urban/rural residence; the partial mediating effect of community SC was significant for both urban and rural older adults. However, the effects of public facilities on depressive symptoms were more robust for urban older adults, while for rural older adults, the effects of the surrounding environment were stronger. One potential explanation may be that lagging socioeconomic development was most noticeably embodied in the poor, deficient public facilities such as health services and transportation in rural villages (Y. Wang et al., 2018). Rural older adults rely less on institutional support, while families and neighbors have remained their primary support source (Luo et al.,

2019). In contrast, due to state-led urban development and urban housing reforms, community heterogeneity increased, and the traditional neighborhood ties were gradually dissolved in many newly formed urban communities (Xin et al., 2021). These changes have led to a reduction in community participation of urban older residents: although they had better access to the public services and facilities locally, there were fewer contacts and interactions with other residents occurring in the local places.

One contribution of this study is in its consideration of different dimensions of SC an individual may encounter, in line with the theoretical tenet that diverse social environments can inhibit or facilitate individuals' development (Bronfenbrenner, 1992; Lawton & Nahemow, 1973). I found that society SC moderated the mediation role of community SC in the relationship between built neighborhood environment and depressive symptoms for urban older adults but not for rural older adults. The findings suggest that the "community social capital replacement theory" (Lu et al., 2016) was supported in the urban context, which means community SC could play a compensatory role in maintaining the mental health of urban older adults who lack society SC.

The compensatory role of community SC could have important implications for Chinese older people's psychological wellbeing. It has been widely discussed that families, close kin and other informal and homogeneous networks are more frequently considered the primary carriers of SC in Asian countries, including China (Helliwell & Putnam, 2004). While the current support system for older people could be partially attributed to China's substantial informal networks in place, this form of support has been gradually eroded in the modernization process. China also encountered problems regarding the lack of general trust and norms for the society, and the lack of public services and resources (J. Lin & Si, 2010). The society SC (e.g., general trust and

general reciprocity, trust in public service providers) was not regarded as a part of the traditional source of SC in the Chinese context. However, this kind of SC carries more externalities than the narrow-spectrum trust in an increasingly diverse society, because it benefits people who are not in a specific and closed network (Horak et al., 2020). Findings of this study confirmed that all three levels of SC were related to older people's mental health; the lack of society SC and its detrimental effects potential to be compensated by efforts made in communities.

Notably, the moderated mediation model was not significant for rural older adults. There are several possible explanations for the urban/rural difference. First, a vast rural-urban gap exists not only in economic development but also in relation-based SC. It was found that urban residents benefit more from family, community and society SC because they are exposed to a more heterogeneous and open social context and abundant public resources (Norstrand & Xu, 2012). Urban older adults also have high expectations for the state's role and responsibility in preserving their needs in later life (Long & Li, 2016).

In contrast, although rural participants reported a similar level of society SC and similar direct effects of society SC on depressive symptoms, in daily life, rural older people often viewed every aspect of their wellbeing as their responsibility and thus rarely turn to society-level sources for supports (Long & Li, 2016). Second, it is also possible that for rural older adults, each dimension of SC has specific functions and cannot be compensated by the other. For example, families and neighbors may have played an irreplaceable role for rural older adults, and such role of families and neighbors is only workable in homogeneous, stable rural communities where close ties and mutual aid are common (Forrest & Kearns, 2001; Long & Li, 2016).

Implications

The findings of the present study highlight the importance of the neighborhood environment and resources for promoting SC and mental health. Our findings suggest that models should conceptualize SC as a result of and also a resource responding to the demands of the environment; therefore, in addition to intervening at the individual level, health promotion programs targeting community-dwelling older adults should always incorporate the environmental component, and use SC building as a crucial pathway in health-promoting. Since community SC plays an increasingly important role in maintaining older people's mental health, community development should be prioritized in health-promoting programs for the older population. It is crucial to make the built aspects of the local neighborhood to be perceived as age-friendly and social-promoting. For example, green spaces, fitness equipment, adequate lighting, and a safe pedestrian zone could encourage older people to come out of their homes and engage in community activities.

Our findings also highlight the importance of capturing a fuller range of the social relations that older people may involve in and the interrelations between such relations. It is necessary to distinguish between the different levels of the social environment because the interaction between individuals and groups/contexts and the resources embedded within the social networks vary across levels. This study expanded the previous conceptual framework of SC by integrating the ecological framework and SC theories. Findings of this study suggest community building could play a role in compensating for the lack of other social resources and adjusting the composition of SC of Chinese older adults, leading to better health and wellbeing outcomes among the aging population.

Limitations

The present study has several limitations. First, the cross-sectional nature of this study limits the ability to infer causal directions. Future studies using longitudinal data are necessary to increase our understanding of the development of depression and the role of the built and social environment in this process. Second, only a limited number of subjective measures of the built neighborhood environment was used rather than applying a holistic assessment tool. Future research should be conducted using a fuller range of critical environmental factors associated with older people's health and wellbeing to increase the accuracy and validity of the data. Third, PROCESS used in this study is an observed-variable modeling tool that relies on OLS regression. One of the weaknesses of regression analysis is its susceptibility to bias in the estimation of effects due to random measurement error. Given perfect reliability of measurement can rarely be assumed, this means that estimates of indirect and direct effects based on OLS regression probably are biased to some extent (Hayes et al., 2017). Last, although the CFPS contains relatively comprehensive information on a wide range of SC indicators compared to other nationally representative datasets in China, the ability to capture the SC of Chinese older adults is still limited by the available measures in the secondary data. A lack of information about non-kin-based networks and social activities will impede this study from exploring peer support in later life. It may cause bias in the explanation of the social capital of Chinese older adults.

Notwithstanding these limitations, the results suggest that the interaction between the built and social neighborhood environments is related to depressive symptoms in later life for both urban and rural older adults. Other levels of social environment also played a role in this process, but the effects have differed in rural/urban areas. Supporting rural and urban communities with physical infrastructure and service availability and developing social capital

interventions targeting older adults could be effective strategies to prevent depressive symptoms and promote Chinese older adults' overall wellbeing.

Chapter V: Conclusion

5.1 Summary of Findings

The concept of social capital has been used to explore the nature, role and value of social networks, connections and forms of community in the lives of older adults, and its importance for wellbeing in later life has received increased attention in social science and policy domains (Cramm et al., 2013). Using a nationally representative dataset and rigorous study design, this dissertation has explored the dimensions and profiles of social capital of Chinese older adults, and investigated the extent to which each dimension and profile is associated with individual characteristics, environmental characteristics, and mental health conditions. Overall, the results show that social capital, as an interaction between the actor and the multiple levels of the social environment, was derived from different environment levels, including families, communities and the broader society. In the Chinese context, family is still an important source of social capital for older adults despite increasing reliance and sometimes preference for formal support. Meanwhile, older adults' social capital is highly connected with the community they live in.

Specifically, Chapter 2 (the first paper) explored the dimensions and associative factors of social capital of Chinese older adults. The findings confirmed three latent constructs: family-level social capital, community-level social capital, and society-level social capital. Results from this study supported that family is still an important source of social capital for Chinese older adults. However, older adults who reported a higher level of family-level social capital were more likely to be vulnerable and live with disadvantages, suggesting that receiving a higher level of intergenerational family support might be related to the lack of available resources outside the family and older adults' impaired ability to adapt the broader environment. The results also

showed that neighborhood built environments were influential determinants of all three levels of social capital.

Chapter 3 (the second paper) built upon Chapter two. This study investigated the profiles of social capital among Chinese older adults, and explored how such profiles differ with respect to background characteristics and health conditions. It follows from the first paper in which three dimensions of social capital were identified: family social capital, community social capital and society social capital. Latent class analysis identified three distinct profiles of social capital in terms of dimensions and levels: Family-centered, Moderate and Diverse. The family-centered group represented the most vulnerable older adults who obtained a low level of social capital in all domains, intergenerational support within the family was almost the only source of social capital. This group was more likely to have poor physical and mental health, and live in urban areas and communities with poor environments and facilities. Compared to the Family-centered group, the Moderate group had better health, more access to society social capital and a good community environment; however, community social capital remained limited. The Diverse group represented the active older adults who engaged actively in community and society affairs. The profile of Diverse social capital showed more significant protective effects against depressive symptoms than that of other profiles.

Finally, Chapter 4 (the third paper) focus on the relationship between the built neighborhood environment, social capital and mental health of older adults. It followed the first paper in which family-, community- and society-level social capital were identified. This study examined a mediating role of community social capital underlying the link between built neighborhood environment and depressive symptoms in both urban and rural areas. It confirmed that the mediation effect of community social capital varied by society social capital in urban

areas. The indirect pathway linking neighborhood environment to fewer depressive symptoms through community social capital was more evident when older adults reported less society social capital, suggesting a compensatory relationship between these two types of social capital. However, this relationship was significant only for urban older adults.

5.2 Implications for Theory and Research

The findings from this dissertation expand our understanding of social capital by integrating the ecological perspective. This study suggests that social capital theory should conceptualize social capital as an interaction between individuals, their families, communities, and society. Though previous research has distinguished between bonding, bridging and linking social capital, this classification fail to fully describe the interaction between individuals and contexts, as well as the resources embedded within the social networks vary across levels. To address this limitation, the social capital constructs found in this dissertation distinguishes between the different social environment levels. This theoretical combination of the social capital theory and ecological framework would help to understand the dynamics through which social capital can be fostered, accessed, maintained, or lost in a specific context. It may also help to know how the individual's position within these contexts may alter how they perceive the environment and the social capital they can access (Ehsan et al., 2019).

This dissertation also addresses limitations introduced by viewing social capital by single indicators. It is an innovative exploratory study as such research has not been done on a Chinese national representative data set. Previous research often ignores that most older adults were involved in more than one social relationship and the wellbeing outcomes varied in response to the combination of social capital. The methodology used to identify social capital compositions

and profiles in this dissertation provides a more stable and accurate base for studying the complex social relationship of a "whole" person in real life.

As a way to extend the understanding of the multidimensional nature of social capital, the second and the third paper focus on the interplays between different dimensions of social capital. The ecological framework views individuals as embedded within interlocking social environments comprising various social structures—such as families, neighborhoods, and formal service providers and organizations. The interconnected social environment is posited to influence individuals' development independently and in conjunction with each other (Bronfenbrenner et al., 1984). Therefore, different dimensions of social capital are not disparate entities but conceptually interconnected. The findings of this dissertation confirmed that social capital could be complementary or in competition with one another in regards to time commitments and opportunities (Owen & Videras, 2009), and the interplay among different layers of the social environment is sensitive to local context and cultures.

Finally, this dissertation contributes to a sociocultural-sensitive social capital theory and measurement in a society transitioning from a familistic society to a more modernized one. The results show how the modernization process has increasingly changed the foundations where the traditional family-centered social capital relied upon. The findings of this dissertation may offer a frame and analytical tool for understanding how older adults in developing and familistic countries interact with their environments and benefit from engaging in social relationships.

5.3 Implications for Practice and Policy

Results of this dissertation suggest tailoring public health interventions to the characteristics of each group. Since the older people who had lower levels of social capital and were least healthy were grouped in the same cluster, health promotion programs should seek

strategies to identify these individuals and maximize their access or capacity to mobilize social capital. It is also suggested that interventions should be designed not just to provide certain services or activities. Interventions with embedded social capital elements may be more effective in promoting health than interventions that do not address these factors. Social capital intervention complies with the components and dimensions of the following definition: "Any intervention which seeks to either create or increase group connection, and/or cooperation within and between community members, to strengthen the social connection that elicits mutual feelings of trust, reciprocity, and recognition of shared identity and/or increases access to shared information and resources within and between its members for mutual benefits" (Flores et al., 2018, p. 5). Researchers and practitioners must explore how to design, implement, and evaluate health-promoting interventions that integrate these components and dimensions to affect the quality of life and psychological wellbeing in later life.

The findings of the present study highlight the importance of the neighborhood environment and resources for promoting social capital and mental health. Our findings suggest that models should conceptualize social capital as a result of and also a resource responding to the demands of the environment; therefore, in addition to intervening at the individual level, health promotion programs targeting community-dwelling older adults should always incorporate the environmental component, and use social capital building as a crucial pathway in health-promoting. Since community social capital plays an increasingly important role in maintaining older people's mental health, community development should be prioritized in health-promoting programs for the older population. It is crucial to make the built aspects of the local neighborhood to be perceived as age-friendly and social-promoting. For example, green

spaces, fitness equipment, adequate lighting, and a safe pedestrian zone could encourage older people to come out of their homes and engage in community activities.

The findings also highlight the importance of capturing a fuller range of the social relations that older people may involve and the interrelations between such relations. The compensatory role of community SC could have important implications for Chinese older people's psychological wellbeing. Since the society social capital was not regarded as a part of the traditional source of social capital in the Chinese context but carries more benefits to the whole society, community building could play a role in compensating for the lack of other social resources and adjusting the composition of social capital of Chinese older adults, leading to better health and wellbeing outcomes among the aging population.

5.4 Limitation

The present study has several limitations. First, although the CFPS contains relatively comprehensive information on a wide range of social capital indicators compared to other nationally representative datasets in China, the ability to capture the social capital of Chinese older adults is still limited by the available measures in the secondary data. Though information about the non-kin-based networks and participation in social activities were provided in the first wave of CFPS, it is not available in the 2016 wave. In this study, the focus was given to family relationships at the micro-level and cognitive social capital at the meso- and macro-level; however, a lack of information about non-kin-based networks and social activities will impede this study from exploring peer support in later life and may cause bias in the explanation of social capital of Chinese older adults.

Second, longitudinal data is unavailable because different social capital indicators were provided across waves of CFPS and some significant indicators were only used in the 2016 wave. The cross-sectional nature of this study limits the ability to infer causal directions and understand social capital in later life from a dynamic perspective. The results only show a significant association between social capital and depressive symptoms, the direction of the relationship cannot be confirmed. Future studies employing a longitudinal design should investigate the causality of the associations and the underlying mechanisms in more detail.

Third, this dissertation only used a limited number of subjective measures of the built neighborhood environment rather than applying a holistic assessment tool. Future research should be conducted using a fuller range of critical environmental factors associated with older people's health and wellbeing to increase the accuracy and validity of the data.

Notwithstanding these limitations, these papers contribute to our understanding of the different dimensions and profiles of social capital present among Chinese older adults. At the moment, the potential value of social capital theories can be harnessed when the concept is not well-defined, operationalized, and proven to have explanatory power. The findings on social capital theories and operationalization can serve as analytical tool and knowledge base for practice and policy in aging and health. As there is an increasing awareness of that health interventions and policies should be delivered in context-aware and context-tailored ways; it is an opportunity to reconsider social capital and the role it plays in shaping the health and wellbeing in the aging process.

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Appendix

Supplementary Table 1 Social Capital Items and Domains from Confirmatory Factor Analysis

	β
Factor 1: family level	
1. Number of children providing instrumental support	1.00
2. Number of children providing financial support	1.59
3. Number of close children	3.50
4. Number of children contact weekly	1.11
5. Number of children meet weekly	1.08
Factor2: community level	
6. Community safety	1.00
7. Community reciprocity	1.61
8. Community relationship	1.68
9. Feeling of belonging	1.72
Factor 3: macro level	
10. Rate of county/district government	1.00
11. General trust	1.05
12. General reciprocity	1.13
13. Trust towards government	3.37
14. Trust towards doctors	2.58
15. Neighborhood trust	4.17
Model Statistics	
X^2 (p)	297.94(p< .001) df =73
RMSEA/SRMR	0.020(0.017-0.022)/0.017
CFI/TLI	0.990/0.985

Supplementary Table 2 Test of mediation effects of community social capital on the relationship of surrounding environment to depressive symptoms: Bootstrap results.

Urban

Path/Effect	β	Standard β	SE	p
C (total effect)	-0.74	-0.08	0.14	0.000
a Community environment →Community social capital	0.93	0.30	0.05	0.000
b Community social capital →Depressive symptoms	-0.43	-0.15	0.05	0.000
c' Community environment→ Depressive symptoms	-0.34	-0.04	0.15	0.023
	β (Boot 95%CI)	Standard β (Boot 95%CI)	Boot SE	
a×b (indirect effect)	-0.40(-0.51,-0.29)	-0.05(-0.06,-0.03)	0.06	
R^2				
Community social capital	0.1977			
Depressive symptoms	0.1586			

Rural

Path/Effect	β	Standard β	SE	p
C (total effect)	-1.13	-0.12	0.14	0.000
a Community environment →Community social capital	0.92	0.29	0.05	0.000
b Community social capital →Depressive symptoms	-0.59	-0.20	0.05	0.000
c' Community environment→ Depressive symptoms	-0.58	-0.06	0.14	0.000
	β (Boot 95%CI)	Standard β (Boot 95%CI)	Boot SE	Standard Boot SE
a×b (indirect effect)	-0.54(-0.66,-0.43)	-0.06(-0.07,-0.05)	0.06	0.01
R^2				
Community social capital	0.1768			
Depressive symptoms	0.1875			

Supplementary Table 3 Test of mediation effects of community social capital on the relationship of public facility to depressive symptoms: Bootstrap results.

Urban

Path/Effect	β	Standard β	SE	p
C (total effect)	-0.89	-0.10	0.15	0.000
a Community environment →Community social capital	0.75	0.23	0.05	0.000
b Community social capital →Depressive symptoms	-0.43	-0.15	0.05	0.000
c' Community environment→ Depressive symptoms	-0.57	-0.07	0.15	0.000

	β (Boot 95%CI)	Standard β (Boot 95%CI)	Boot SE	Standard Boot SE
a×b (indirect effect)	-0.32(-0.42,-0.23)	-0.03(-0.05,-0.02)	0.05	0.01
R^2				
Community social capital	0.1634			
Depressive symptoms	0.1614			

Rural

Path/Effect	β	Standard β	SE	p
C (total effect)	-0.85	-0.09	0.14	0.000
a Community environment →Community social capital	0.76	0.24	0.05	0.000
b Community social capital →Depressive symptoms	-0.61	-0.21	0.05	0.000
c' Community environment→ Depressive symptoms	-0.39	-0.04	0.15	0.000

	β (Boot 95%CI)	Standard β (Boot 95%CI)	Boot SE	Standard Boot SE
a×b (indirect effect)	-0.47(-0.57,-0.37)	-0.05(-0.06,-0.04)	0.05	0.01
R^2				
Community social capital	0.1506			
Depressive symptoms	0.1865			