AGE-FRIENDLY ENVIRONMENTS (AFES) AND THEIR INFLUENCE ON PSYCHOLOGICAL WELL-BEING AND MENTAL HEALTH AMONG OLDER CHINESE ADULTS IN SHANGHAI

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CERTIFICATE OF ORIGINALITY

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_____ (Signed)

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Abstract

Background: Considerable social transformation of population ageing and urbanisation has attached more implications of AFEs on the well-being of older people. Nevertheless, it remains unclear the extent to which and how, various age-friendliness are linked with psychological well-being (PWB) and mental health of community-dwelling older people in China.

Objectives: First, this thesis adapts and validates an AFEs scale in the Chinese context. Second, it examines the association of age-friendliness with the PWB and mental health of older people with various health statuses. Third, underpinning the theoretical framework of person–environment interplay, this thesis investigates the psychological (i.e., sense of community) and behavioural (i.e., activity engagement) pathways that link age-friendliness to PWB and mental health. It also explores the roles of intergenerational relationship quality and urbanisation degree in moderating the nature or strength of the psychological and behavioural pathways, respectively.

Methods: In total, 506 community dwellers aged from 50 to 88 years from nine districts of Shanghai participated in this study. Scale validity and reliability were examined to assess the psychometric quality of the AFEs scale in the Chinese context. Multiple linear regression and logistic regression were employed to examine the relationships between age-friendliness domains and the PWB and depressive symptoms, respectively. Path analysis and multiple linear models were employed to test the underlying psychological and behavioural pathways.

Results: An appropriate AFEs scale that covers eight domains was validated in Chinese context. Of the eight age-friendliness domains, outdoor spaces, housing, social respect, and employment were revealed to be prominent predictors of the PWB of older adults. In addition, AFEs had higher influence on the PWB of older people when they have good health status. For the outcome of mental health, outdoor spaces, housing, community-based support and services were salient in reducing the severity of depressive symptoms. In analysis stratified by health status, service environments

significantly prevented mental disorder among older adults with poor health, and built environments were effective for depressive symptoms among people with good health.

For the psychological pathway, the associations between the age-friendliness domains (except housing) and the PWB and depressive symptoms of older adults were partially mediated by sense of community. Moreover, intergenerational relationships moderated the mediating effect, and the indirect effects of age-friendliness gradually attenuated with the enhancement of intergenerational relationships. For the behavioural pathway, activity engagement mediated the influence of social respect and employment on PWB and the influence of community-based support and health services on depressive symptoms. In addition, the degree of urbanisation moderated the mediating effect of activity engagement, and the behavioural pathway was only significant in highly urbanised districts.

Conclusions: This thesis provided empirical evidence supporting and expanding the theoretical framework of person–environment interplay. The complex psychological and behavioural pathways reflect the joint dynamics by which family, community, and structural forces shape the PWB and mental health of older adults. Intergenerational relationships and the urbanisation degree should be considered when conducting age-friendly interventions to promote PWB and prevent mental disorders of older adults.
(493 words)

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Chapter 1 Introduction

1.1 Choice of Research Topic

As humans, our natural rationality and self-awareness cause us to consider the relationship between humans and the environment (Fromm, 2006). In both Eastern and Western societies, philosophers have attempted to describe and interpret these relationships, which constitute a central topic in philosophy. In ancient China, Zhuangzi, the representative of Taoism, regards the harmonious state between humans and their environment as an effective method for freeing human nature (Wang, 2007). This is also the supreme dream of Taoism. Zhuangzi argued that as members of the universe, humans fully develop their power on the basis of the relationship between themselves and their external environment (Wang, 2007). Humans must live in harmony with their external environment before they can develop independent personalities and become free spirits. Otherwise, they will be driven and controlled by the myriad of distractions in the external world.

Approximately two thousand years following the emergence of Taoism, in the work *Being and Time,* the Western philosopher Heidegger discussed the roles of person–environment relations. Heidegger refers to *Dasein* as the *Being-in-the-world,* indicating its natural relation to environmental philosophy (Cameron, 2004). For Heidegger, the environment is an existential structure of *Dasein* that is characterised by its 'serviceability, conduciveness, usability, and manipulability' (Heidegger et al., 1962), and as embodied beings, humans seek and obtain resources from their environment to meet their living needs. In other words, the environment is an instrumental tool for humans. The essence, uniqueness, and meaning of material and environment are determined to an extent by their relatedness to humans. Without relatedness, material and environment exist without meaning (Blattner, 2006).

Collectively, the aforementioned philosophical perspectives reflect the attempts by philosophers to balance the interactions between humans and their environment; in these interactions, humans are typically proactive agents. However, this dynamic

equilibrium cannot always be maintained, especially during the later stage of an individual's life. When people age, their health and functions decline, and they must consider how they should control, manipulate, or utilise their external environment to meet their needs as older adults. The other topics that warrant exploration include the supportive or adverse influence of an environment on older adults, how multiple environmental factors affect the well-being in older people during the ageing process, and the roles of family and urban development in person–environment interactions. These are age-old but crucial philosophical questions that should be addressed in the context of our currently ageing society.

1.2 Research Background

1.2.1 Population Ageing in Urbanising China

China owes one of the fastest increasing ageing populations globally (World Health Organization [WHO], 2020), and it will soon have a deep ageing society. The seventh national census conducted in 2020 revealed that 190 million people in China aged 65 years and over, taking up 13.50% of the whole (National Bureau of Statistics, 2021). The share of the population with 65 years and over increased by 4.63% within a single decade in China, and this figure is considerably higher than the average global ageing rate. Urbanisation in China is another major social transformation that has occurred alongside demographic ageing in the past four decades. Consistent with the trend of urban sprawl, researchers have discovered that the spatial pattern of an ageing population exhibits aggregation characteristics involving the clustering of older adults in cities with high population densities (Zhao et al., 2017). This phenomenon indicates that, for older people, factors like urbanisation construction, economic conditions, and multiple environmental conditions largely influence the outcome of ageing in place.

1.2.2 Creating Age-Friendly Environments for an Ageing Society

The rapid ageing and urbanisation have made the creation of age-friendly environments (AFEs) become increasingly crucial. Successful healthy ageing is not only dependent on older people's individual intrinsic capacity, but also on their external environments and their interaction within these environments (WHO, 2015a). WHO (2007) defines

AFEs as the settings, structures, facilities, and services that enable people to age actively. AFEs provide barrier-free settings, accessible facilities, inclusive social atmosphere, and supportive resources and systems for older people with diverse levels of capacity. Under the WHO's framework, AFEs comprehensively cover physical, social, and service aspects within environments.

The growing attention on the living environments of older people represents a paradigm shift from individual capacity or family care to the broad support provided by a wide spectrum of environments (Greenfield et al., 2015). The life expectancy in China is increasing consistently (Han et al., 2020); thus, it is predicted that older people will spend more time living in communities to age in place. Against this backdrop, a key challenge is to develop methods for utilising various environmental domains to enhance the well-being of older people. In addition, declining family functions and filial norms, which are two aspects in the modernisation process (Cheung & Kwan, 2009), have made it necessary for China to develop AFEs where the responsibility of ageing should be shared beyond family realm.

1.2.3 Associations of AFEs With Psychological Well-Being and Mental Health of Older People

Maintaining and promoting psychological well-being (PWB) is a global social movement and a key step to realising successful ageing (Ardelt, 2015). Given the emerging initiative to develop AFEs globally, the effect of AFEs on the PWB of older people is a topic that deserves sufficient exploration. PWB is a concentrated reflection of the prolonged later lives of older adults (Steptoe, 2019). The dimensions that are conducive to PWB include a positive perception of self-identity, sense of mastery over the environment, autonomy, and independence (Bowling & Dieppe, 2005). A reasonable inference derived from these dimensions is that an accessible and supportive environmental design fosters the environmental mastery and autonomy of older people, thus, contributes to their PWB. An inclusive and respectful social environment can also cultivate a positive self-image in older adults. Yet, limited studies have comprehensively probed the link between AFEs and the PWB of older people.

A negative aspect of PWB is depression (and its symptoms), which is a typical mental disorder among Chinese older people. Meta-analyses have estimated that the pooled overall prevalence that Chinese older people had depressive symptoms is approximately 20%, and this figure is increasing from year to year (Li et al., 2013; Tang & Jiang et al., 2021). In their research on major protective factors for depressive symptoms, gerontologists have increasingly been exploring contextual components. For example, researchers have discovered that establishing more recreational or leisure facilities (Lei & Feng, 2021; Liu et al., 2021), green landscapes (Lu et al., 2021a), and community services (Jiang & Sun, 2021) can significantly mitigate the depressive symptoms of older adults. Therefore, the aforementioned environmental factors provide alternative perspectives that researchers and practitioners can apply to manage and prevent mental disorders among older community dwellers.

1.2.4 Behavioural and Psychological Pathways for Promoting Well-Being Outcomes in Older Adults

Clarifying the underlying mechanism or process that links environmental components to well-being outcomes can advance the understanding of key relationships between person and environment. Typically, behavioural and psychological pathways are two common approaches for attaining wellness. The behavioural manner encompasses various activities or behaviours that older people engaged through AFEs. Age-friendly designs of outdoor spaces, social participation, and community services may attract or facilitate older people to engage in more exercise and activities, and these activities may further enhance the wellness of older people (Herero & Extremera, 2010; Zhang & Zhang, 2015). Simultaneously, the degree of urbanisation during an urbanising process has long been associated with human well-being (He et al., 2020; Kuddus et al., 2020). Urbanisation refers to a continuous social transition involving structural changes to urban spaces, public facilities, residential segregation, and the attitudes and behavioural patterns of people (Gu, 2019). Given the uneven urbanisation in China, it is necessary to take into account the contextual role of urbanisation in promoting or inhibiting the influence of environments and activity engagement on the well-being

outcomes of older People. That is, the mechanisms where AFEs and the behavioural pathway interact with the urbanisation degree to jointly determine older people's PWB and mental health.

The psychological pathway pertains to a series of emotional or cognitive feelings in the process of interacting with AFEs. Researchers have verified that sense of belonging could be a prominent predictor of favourable mental status (as indicated by reduced depressive symptoms and an enhanced positive affect) in older people (Bailey & McLaren, 2005; Inoue et al., 2020). More recent studies have explored the function of sense of community in linking multiple environmental factors to the overall satisfaction with life (Au et al., 2020) and older people's mental and physical health (Tang et al., 2021) of older community dwellers. In addition to the sense of community deriving from community psychology, the relationships with family members (e.g., adult children) was an alternative important source of emotional connection to impact the wellness of older people (Lai et al., 2019). Given the collective psychological source of community and family, an interesting topic to explore is whether the environmental influences associated with community psychology may vary with different level of intergenerational relationships. This topic is particularly imperative in the context where family functions are increasingly difficult to provide support for older residents in China (Phillips, 2015), and clarifying how factors at community-level interact with family-level is important for the strategic interventions aiming at promoting the overall well-being of older people.

1.3 Research Objectives and Contributions

1.3.1 Research Objectives

Overall, AFEs can considerably promote the PWB of older adults and reduce their risk of mental disorders. Nevertheless, no study has conducted a comprehensive assessment of AFEs in mainland China. Notably, the mechanism by which environmental factors influence well-being outcomes through behavioural and psychological pathways requires further investigation. To narrow the existing research gaps, the research objectives of this thesis are demonstrated as below:

(1) To measure the ratings of perceived age-friendliness through a valid and reliable AFEs scale that is adapted for the Chinese context;
(2) To test the associations between overall AFEs and the PWB and mental health of older residents with different health statuses, and to identify the significant age-friendliness related to older people's PWB and mental health;
(3) To investigate the psychological pathway where sense of community links age-friendliness to the PWB and mental health, and to examine whether the indirect effects of age-friendliness are varying with the quality of intergenerational relationships;
(4) To investigate the behavioural pathway where activity engagement links age-friendliness to the PWB and mental health, and to probe whether the direct and indirect effects of age-friendliness are conditional on different degrees of urbanisation.

1.3.2 Contributions of This Thesis

The research on AFEs has shifted from an individual biomedical emphasis to an emphasis on developing a comprehensive understanding of ageing, PWB, and mental health in broader physical and social contexts. By achieving the aforementioned research objectives, this thesis conduces to the area of environmental gerontology (EG) in terms of knowledge building, theory expansion, and practical interventions.

First, for knowledge building, this thesis holistically describes the perceived ratings of age-friendliness deriving from WHO's framework for AFEs. To achieve this objective, an AFEs scale suiting in Chinese context is assessed for its validity and reliability among community-dwelling older people in Shanghai. Second, among numerous environmental factors, this thesis identifies the age-friendliness factors of AFEs that significantly influence the PWB and mental health of older community dwellers. Third, this thesis establishes a comprehensive model for understanding the pathways linking age-friendliness to the PWB and depressive symptoms by exploring the process of person–environment interplay. During the person–environment interplay, this thesis clarifies the complex mechanisms of behavioural and psychological process

by re-locating the abovementioned pathways in multi-layered systems (i.e., macro level presented by urbanisation degree, and micro level presented by intergenerational relationships). Specifically, within the framework of a psychological model, this thesis describes how the sense of community interacts with parent–adult children relationships to link age-friendliness to the elderly well-being. Within the framework of behavioural pathway, this thesis discusses the roles of activity engagement and the urbanisation level in mediating and moderating the association between age-friendliness and the PWB and depressive symptoms of older community dwellers.

At the theoretical level, this thesis expands the width and depth of the person–environment interplay framework derived from the theory of EG. For expanding the theoretical width, the measures of AFEs are not limited to a single environmental dimension. Instead, this thesis holistically covers a diverse range of age-friendliness domains that comprise the physical, social, and service aspects of environments. For expanding the theoretical depth, given that AFEs measures primarily focus on the community level, this thesis includes two additional components (i.e., urbanisation degree and intergenerational relationships) from structural and family realm to enhance theoretical connotations. Building upon this expanded framework, this thesis not only proves the pathways of person–environment interplay, but also re-establishes the theory's range of application at different levels of intergenerational relationships and urbanisation degree.

The findings of this thesis yield practical implications for the various stakeholders involved in AFEs development. For example, this thesis provides empirical evidence of the benefits of improving key age-friendliness domains in city design or policy-making processes. Pivotal age-friendliness domains serve salient roles in enhancing the PWB and mental health of older people. In addition, it also indicates that AFEs development should focus on adaptions for distinct groups, such as older community-dwellers who have tensions with adult children or those living in highly urbanised areas. Furthermore, psychological and behavioural pathways provide novel perspectives for the implementation of interventions designed to ameliorate the well-being outcomes of

older adults. Moreover, because developing AFEs requires cross-disciplinary cooperation among older adults, government, industry investors, and urban planners, the results of this thesis can inform establishing collaborations between the various systems related to AFEs.

1.4 Structure of Thesis

The present thesis is made up of nine chapters, and Figure 1.1 presents the overall organisation of the chapters. **Chapter 1** begins with the research background and provides an explanation of why a discourse on AFEs is essential for promoting older people's PWB and mental health against the backdrop of the accelerated population ageing and the urbanisation in China. The research objectives and potential contributions are also demonstrated. **Chapter 2** conducts a systematic review that comprehensively summarises the findings of empirical studies as well as the research characteristics, assessed domains of AFEs, well-being-related implications, and associations of AFEs with the well-being of older community dwellers. Several research gaps of extant literature are identified in this chapter. **Chapter 3** provides an overall introduction of the theory of EG and the theoretical framework of person–environment interplay in the later life. The primary research questions and corresponding hypotheses of this thesis are also proposed. **Chapter 4** presents the research methodology of the present thesis, including the rationale for conducting quantitative research, the background of the research site in Shanghai, the sampling strategy and data collection process, the measurement of various variables, and the analytical strategy applied for subsequent chapters. **Chapter 5** displays the procedures and results of the validation of the AFEs scale suiting in Chinese context. The validated version of AFEs scale cover the slightly modified eight domains with 38 items. **Chapter 6** identifies the overall AFEs and specific age-friendliness factors predicting the PWB and depressive symptoms of older people. The aforementioned associations are also examined in groups with different health statuses. **Chapter 7** reports the results of psychological pathway from which sense of community links certain age-friendliness to older adults' PWB and depressive symptoms. The moderating effect of

intergenerational relationships in the mediation process is verified. **Chapter 8** reports the behavioural pathway results that activity engagement mediates the influence of age-friendliness on the PWB and depressive symptoms. The degree of urbanisation moderates the direct and indirect paths of age-friendliness in the behavioural model. **Chapter 9** highlights the primary findings of the present study and summarises the testing results of the proposed research hypotheses. Theoretical and practical implications, research limitations, and overall conclusion are presented in this chapter.

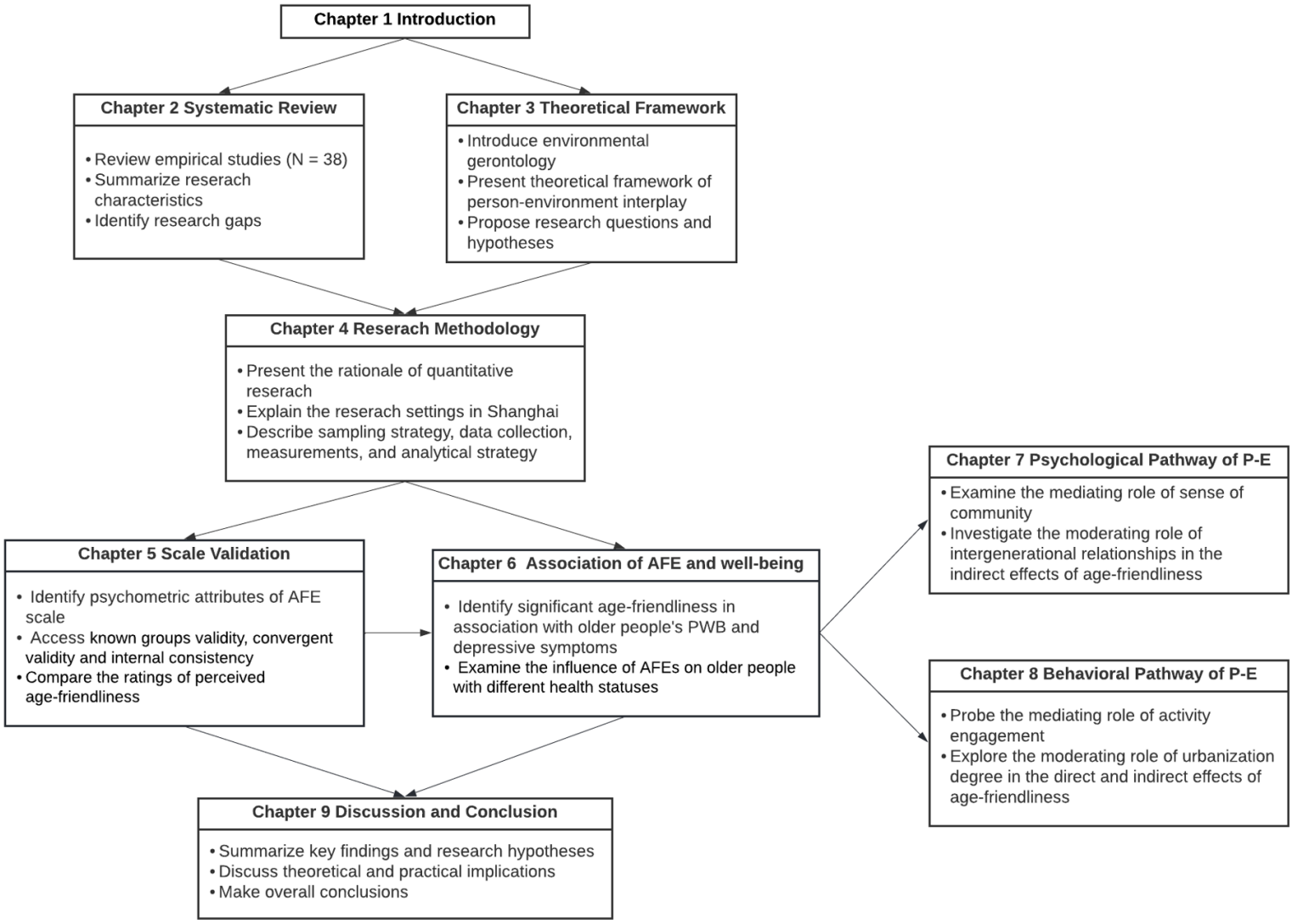

Figure 1.1 *Organization of the thesis*

Chapter 2 Systematic Review of Associations of AFEs With Well-being Outcomes of Older Adults

2.1 Brief Introduction

Understanding the associations between AFEs and the well-being outcomes at old age in previous studies can contribute to obtain a general portray of person–environment relations. In this chapter, a systematic review was carried out to scrutinise existing findings regarding the roles of AFEs for older people and to identify potential research orientations. The following topics are addressed in this chapter: (i) the aspects or components of AFEs that have been examined in previous studies, (ii) the associations of AFEs with the well-being outcomes of older adults, and (iii) the pathway or mechanism that AFEs influence the well-being of older adults. Totally, 38 articles published between 2007 and 2021 in seven electronic databases were selected and reviewed. The articles are reviewed to clarify the research gaps concerning the relationships of AFEs and individua various well-being outcomes in later life, particularly in the Chinese context.

2.2 Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009) was referred to perform the procedures of systematic review. Figure 2.1 displays the complete process of the systematic review conducted in the present study.

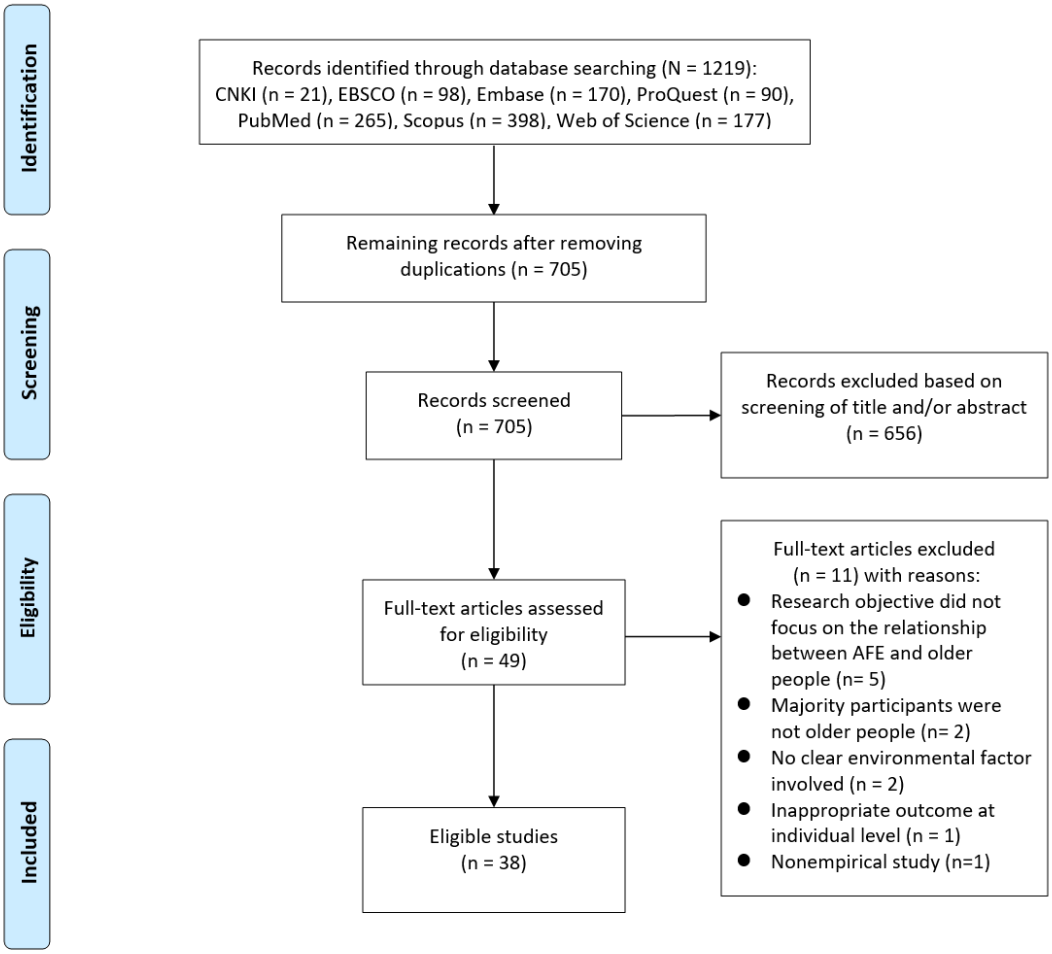

Figure 2.1 *Flow chart of systematic review*

2.2.1 Search Strategy

English-language studies were searched among six English academic databases, including PubMed, Scopus, EBSCO, Embase, ProQuest, and Web of Science; for Chinese-language studies, a similar search of the CNKI database was conducted. Searches of titles, keywords, and abstracts were conducted using search terms related to population, outcomes, and exposure. Table 2.1 lists the search terms used during the search process. Only studies published between 2007 and 2022 were included because the terms ‘age-friendly environments’ or ‘age-friendly community’ were formally conceptualised by WHO in 2007. Through the search process, 705 records (duplicates were removed) were obtained from the seven databases.

Table 2.1 *Searched terms in systematic review*

Concepts	Key words
Population	older people OR older adults OR community-dwelling older adults OR aged OR elderly OR old age
Outcomes	self-rated health OR physical health OR mental health OR healthy ageing OR active ageing OR subjective well-being OR psychological well-being OR quality of life OR life satisfaction OR happiness
Exposure	age-friendly environments OR age-friendly communities OR age-friendliness OR neighborhood environments OR residential environments

2.2.2 Inclusion Criteria

The following criteria are used for identifying eligible papers: Studies should (i) focused on the relationship between AFEs and the well-being outcomes of older people, (ii) included older adults (>= 60 years) as their majority participants, (iii) were written in English or Chinese, and (iv) adopted a quantitative design and/or a qualitative design. After the titles, abstracts, and full texts were screened during the final stage of the search, 38 studies were included.

2.2.3 Data Extraction

To summarise and compare the selected studies, their key information was extracted (i.e., authors, publication year, research site, research design, sample size, age of participants, measures of AFEs, theory employed, and outcomes).

2.2.4 Quality Assessment

To ensure the validity of information reported by the selected studies, a quality assessment of the studies was performed using several assessment tools. Siddaway et al. (2019) proposed the following criteria for assessing the scientific rigor of quantitative studies: (i) appropriate research design, (ii) representative and unbiased sample, (iii) reliable and valid assessment of key variables, (iv) appropriate data analysis, and (v) explicit discussion. For qualitative studies, the following criteria were applied for appraisal (Hannes, 2011): (i) adequate sample, (ii) appropriate data analysis, (iii) methodological soundness, (iv) reflectivity of researchers, and (v) theoretical consistency. Each factor was assigned a score of 1 (qualified) or 0 (unqualified), and a

higher score for a given factor indicated higher research quality for that factor. In the present review, all the selected studies had an overall score of 3 or higher; thus, they were regarded as having acceptable research quality.

2.3 Results of Systematic Review

2.3.1 Characteristics of Selected Studies

This systematic review consisted of 38 studies, including 36 quantitative studies, 1 qualitative study, and 1 mixed-methods study. As shown in Table 2.2, among the quantitative studies, around 90% (n = 33) were cross-sectional, and only 4 studies employed longitudinal data. Approximately 95% of studies (n = 35) were published in the recent five years (2017 to 2022), indicating increasing research attention to AFEs and older people. With respect to research sites, 23% of studies (n = 9) were located in Hong Kong, followed by 21% (n = 8) in Europe, 18% (n = 7) in mainland China, 13% (n = 5) in the United States, and 7% (n = 3) in South Korea. In quantitative studies, the sample size ranged from 192 (Zhang & Chan, 2020) to 13,828 (Schorr & Khalaila, 2018).

In terms of the age range of the participants, 67% of studies (n = 26) invited participants aged over 60 years old, with studies involving people over 50 years of age accounting for 25% (n = 10). Concerning the measures of AFEs, the eight age-friendliness domains from WHO's framework were most frequently assessed by current studies (n = 9). Among the selected studies, 33% (n = 13) did not adopt any relevant theory to help explain the associations between the person and their environment, and 23% (n = 9) employed the ecological theory of ageing in elaborating with research objectives. For the outcomes of well-being, 23% of studies (n = 9) examined the impacts of AFEs on older adults' quality of life, followed by 18% that focused on life satisfaction (n = 7), 15% on self-rated health (n = 6), and 13% on depressive symptoms (n = 5).

Table 2.2 *Information of selected studies in systematic review*

No.	Author(s) Year	Research sites	Research design	Sample size	Age	Measures of AFE	Employed theory	Outcome(s)
1	Au et al., 2020	Hong Kong, China	CS	898	55-97	Eight age-friendliness domains of WHO's framework	NM	Life satisfaction
2	Au et al., 2017	Hong Kong, China	CS	682	65-97	Eight age-friendliness domains of WHO's framework	Socioemotional selectivity theory	Life satisfaction
3	Aung et al., 2021	Japan	CS	243	67-81	Twenty WHO age-friendliness indicators	NM	Social network diversity; Active ageing; QoL
4	Cao et al., 2020	United States	CS	346	50-100	Public buildings and outdoors spaces; Community-based social participation	NM	Subjective isolation
5	Chen et al., 2020	Guangzhou, China	CS	403	60-80+	Outdoor spaces (Landscape quality; Spatial form; Microclimate environment)	NM	Mood status
6	Choi, 2020	United States	CS	3650	65-101	Eight age-friendliness domains of WHO's framework	Person-environment fit theory	Self-rated health; Functional limitations
7	Clarke, 2014	United States	CS	6578	65-85+	Built environments and supportive devices	Disablement model	Outdoor mobility
8	Del Barrio et al., 2021	Spain	CS	2469	55-80+	Eight age-friendliness domains of WHO's framework	NM	Subjective well-being
9	Dennis et al., 2020	Manchester, UK	CS	NM	20-60+	Quantity, Quality and Spatial Distribution of Green Infrastructure	NM	Population chronic morbidity

Table 2.2 *Continued*

No.	Author(s) Year	Research sites	Research design	Sample size	Age	Measures of AFE	Employed theory	Outcome(s)
10	Domínguez-Párraga, 2019	Cáceres, Spain	Qualitative study	32	65+	Psychological, social and emotional dimensions of the neighborhood	Activity theory of ageing; Urban sociology	Well-being; Loneliness; Identity; Comfort; Feeling of community
11	Flores et al., 2019	Castelló, Spain	MM	269	60-75+	Eight age-friendliness domains of WHO's framework	NM	Life satisfaction
12	Gibney et al., 2020	Ireland	CS	2094	55-75+	Walkability; Access to services; Safety	ETA	Psychological well-being
13	Gobbens et al., 2018	Netherlands	CS	1031	65-95	Housing; Facilities; Nuisance; Residents; Neighborhood; Stench/noise; Traffic	ETA	QoL
14	Hsu, 2020	Taiwan, China	CS	6920	55-80+	Eight age-friendliness domains of WHO's framework	Ecological perspective of gerontology	Life satisfaction; Health-related QoL
15	Jiang & Sun, 2022	Mainland China	CS	8122	60-80+	Community support and services; Community facilities	Ecological system	Depressive symptoms
16	Kim et al., 2021	United States	CS	3652	65-90+	Outdoor spaces; Transportation; Housing; Social participation; Community and health services	ETA	Self-rated health
17	Kim et al., 2019	South Korea	CS	615	55-72	Outdoor spaces; Transportation; Communication; Social respect; Community support and services;	NM	Physical health; Mental health
18	Lai et al., 2016	Malaysia	CS	613	45-65+	Communication and information; Outdoor spaces; Transportation and housing; Community support and health services; Social participation	Person-Environment fit; Bronfenbrenner's ecological theory	Active ageing; Social connectedness

Table 2.2 *Continued*

No.	Author(s) Year	Research sites	Research design	Sample size	Age	Measures of AFE	Employed theory	Outcome(s)
19	Lehning et al., 2014	Detroit, United States	CS	1372	57-97	Access to business and leisure, health care; Neighborhood problems; Social interaction; Social support; Community engagement	ETA	Self-rated health
20	Lei & Feng, 2021	Mainland China	CS	5461	60-73+	Outdoor spaces and buildings; Healthcare and consumption resources; Social participation; Public facilities	Stress-appraisal-coping theory	Depressive symptoms
21	Liu et al., 2021	Hong Kong, China	LS	2081	65-85+	Residential surrounding greenness; Terrain; Land use; Availability of facilities	ETA	Depressive symptoms
22	Lu et al., 2021a	Hong Kong, China	CS	2081	65-85+	Population density; Urban greenness;	Environmental gerontology	Depressive symptoms
23	Lu et al., 2021b	Hong Kong, China	LS	2081	65-85+	Green space; Land use diversity; Availability of facilities	ETA	Functional ability decline
24	Nieboer & Gramm, 2017	Netherlands	CS	588	70-93	Eight age-friendliness domains of WHO's framework	Social production function theory	Social well-being; Physical well-being
25	Park et al., 2021	South Korea	CS	1017	18-65+	Physical environment; Health and social services; Community engagement	Person-Environment fit	Depressive symptoms
26	Park & Lee, 2017	Seoul, South Korea	CS	1657	65-94	Housing; Transportation; Neighborhood; Social participation; Social inclusion; Community and health services	Person-Environment fit	Life satisfaction
27	Schorr & Khalaila, 2018	15 countries in Europe	CS	13828	65-108	Access to services and sites	Environmental gerontology	QoL
28	Stephens et al., 2020	New Zealand	LS	2910	60-70+	Housing satisfaction; Neighborhood satisfaction; Access to facilities; Neighborhood trust	Person-Environment fit	Mental and physical health-related QoL

Table 2.2 *Continued*

No.	Author(s) Year	Research sites	Research design	Sample size	Age	Measures of AFE	Employed theory	Outcome(s)
29	Stephens et al., 2019	New Zealand	CS	4028	50-89	Housing satisfaction; Neighborhood quality; Neighborhood social cohesion	ETA	QoL
30	Tang et al., 2021	Hong Kong, China	CS	2247	50-80+	Outdoor spaces; Outdoor buildings	ETA	Mental and physical health-related QoL
31	Tiraphat et al., 2017	Thailand	CS	4183	60-80+	Neighborhood built environments; Neighborhood safety; Social environments	NM	QoL
32	Wang et al., 2017	Hong Kong, China	LS	3544	65-75+	Green space	NM	Mortality
33	Wong et al., 2017	Hong Kong, China	CS	719	60-80+	Eight domains of WHO's age-friendly framework	NM	Self-rated health
34	Xie, 2018	Mainland China	CS	9965	60-80+	Housing; Local amenities; Community services; Social inclusion	Person-Environment fit	Life satisfaction
35	Yu et al., 2018	Hong Kong, China	CS	1798	60-80+	Eight domains of WHO's age-friendly framework	NM	Self-rated health
36	Zhang & Chan, 2020	Nanjing, China	CS	192	60-80+	Physical neighborhood environment; Natural environment; Social environment; Facilities and services; Safety and security	Person-Environment fit	QoL
37	Zheng & Yang, 2019	Shanghai, China	CS	2783	60-80	Leisure environment; Landscape environment	ETA	Self-rated health
38	Zhou et al., 2021	Mainland China	CS	3825	60-90+	Public facilities; Public safety; Pollution exposure; Neighborhood cohesion	NM	Life satisfaction

Note. CS = cross-sectional study; LS = longitudinal study; MM= mixed-methods; ETA = ecological theory of ageing; NM = not mentioned; QoL = quality of life.

2.3.2 Measured domains of AFEs

Because of the good validity and reliability of the WHO's framework (WHO, 2007), the eight age-friendliness or modifications of the eight domains were most frequently employed in empirical studies (n = 15). It consisted of outdoor spaces and buildings, housing, transportation for built environments; social participation, respect and social inclusion, civic participation and employment for social environments; and communication and information, community-based support and health services for service environments. The eight age-friendliness domains were extracted in a bottom-up participatory approach based on analyses of 158 focus groups involving 1,485 older adults, 250 care providers, and 515 service practitioners across 33 cities in lower- and middle-income areas globally (WHO, 2007, 2015b). Therefore, the eight themes comprehensively portrayed age-friendliness in terms of structures, environments, services, and policies that older people greatly value in the ageing process.

Specifically, various aspects of older people's lives could be affected by different domains of AFEs. For example, outdoor spaces and buildings, transportation, and housing are principal characteristics of built environments, yielding influences on older people's walkability and mobility, healthy behaviours, safety, and security (WHO, 2007). In addition, the components of social participation, civic participation and employment, and social respect and inclusion reflected a wider spectrum of social and cultural attitudes that affect mental well-being and social engagement. The last two age-friendliness domains, community support and health services, and communication and information, are particularly important for the care provision of those older people with frailty and vulnerability.

The eight age-friendliness domains, however, were not fully captured by all studies. Other researchers adapted some key features that might be crucial to their participants in local contexts, primarily focusing on the accessibility of facilities and services, as well as the inclusiveness of social environments. For instance, Gobbens et al. (2018), Jiang and Sun (2022), Lei and Feng (2021), Liu et al. (2021), Stephens et al. (2020), and Zhou et al. (2021) examined the public facilities or amenities for sports,

recreation, entertainment, and leisure in local communities, whilst Jiang and Sun (2022), Kim et al. (2021), Lai et al. (2016), Park et al. (2017, 2021), and Xie (2018) examined the availability of community-based support and services. In terms of built environments, geographic characteristics, such as quality, layout and spatial composition of green space, greenness, landscape, and land use were particularly investigated by some geographic gerontologists (Chen et al., 2020; Dennis et al., 2020; Liu et al., 2021; Wang et al., 2017). Such geographic features of outdoor environments could be measured by professional tools or software, which increased the objectivity and accuracy of the assessment. Moreover, the social dimensions of neighbourhoods, such as satisfaction with neighbourhood problems, neighbourhood trust, and neighbourhood cohesion, also consisted the focus of some literature (Domínguez-Párraga, 2019; Stephens et al., 2019, 2020; Zhou et al., 2021). Beyond traditional built and social environments, two studies (Zhang & Chan, 2020; Zhou et al., 2021) explored the natural aspects of the environment, including air quality, comfort level on rainy or snowy days, the greening rate of the neighbourhood, and pollution exposure, which further expanded the dimensions of AFEs.

2.3.3 Implications of AFEs

Quality of life (QoL). The influence of age-friendliness on QoL has been frequently researched. Schorr and Khalaila (2018) analysed data from 15 European countries and discovered that perception of better convenience to elderly services and particular sites is associated with higher overall QoL; this finding resonates with that of Zhang and Chan (2020), who highlighted the key role of accessibility to exercise and recreational facilities in improving QoL. Stephen et al. (2019) reported that housing and neighbourhood perceptions contribute additional variance that explains the model of QoL. In a super-aged society (e.g., Japan), the availability of health and healthcare–service information and the provision of personal care were significant for QoL (Aung et al., 2021). Tiraphat et al. (2017) reported that in the context of Thailand, the other contributors of QoL (in addition to accessible services and physical infrastructure) include psychosocial factors such as neighbourhood trust and social cohesion.

However, the overall QoL of older adults does not always reflect specific aspects of their lives. Therefore, researchers have explored the associations of QoL with various domains. Gobbens et al. (2018) indicated that physical components (e.g., facilities, traffic, and noise) were associated with the environmental related QoL, whereas the social scale (e.g., social participation of residents) was related to the psychological related QoL. Similarly, through the analysis of longitudinal data from New Zealand, Stephens et al. (2020) revealed that higher ratings of neighbourhood accessibility and trust significantly contributed to increased mental health–related QoL within 2 years, but they did not observe any changes in physical health–related QoL. Tang et al. (2021) reported the direct favourable influence of outdoor environments on the mental health–related QoL of participants in Hong Kong; however, this effect did not extend to the physical health of the participants. This result highlights the necessity of exploring the potential indirect effect of outdoor spaces on different aspects of QoL separately of older people.

Life satisfaction. The overall life satisfaction perceived by older adults is substantially affected by the quality of their immediate physical and social environments. Two social age-friendliness domains, namely community-based services and social engagement, were revealed to be related to overall life satisfaction among older people in Hong Kong (Au et al., 2020). Moreover, Flores et al. (2019) found that older adults in Spain also derived life satisfaction from their perceptions of outdoor spaces and buildings. Zhou et al. (2021) reported the positive associations of overall perceived residential environmental quality, encompassing facilities, residential safety, environmental pollution, and neighbourhood cohesion, with the general life satisfaction of the ageing adults in mainland China.

To precisely assess the discrepancies among diverse groups in terms of their age-friendly needs, researchers have conducted multigroup comparisons. Au et al. (2017) concluded that, in Hong Kong, community and health services were more crucial for young-old adults (65–75 years old) than for other older adult subpopulations. Notably, civic participation and employment were valued by the old-old group (75–97 years old),

although their functional ability sometimes prevented them from working. Park and Lee (2017) compared the associations between AFEs and life satisfaction in various subgroups in South Korea, and their results revealed that more favourable physical and social environments predicted higher satisfaction among the most vulnerable group of older adults, that is, those who are poor and live alone. By contrast, no disparities in person–environment relationships were found in multigroup comparisons among the Chinese population (Xie, 2018). The inconsistencies in the aforementioned results indicate that researchers should examine the associations between AFEs and the elderly well-being among diverse population groups and in diverse contexts.

Self-rated health (SRH). Studies have reported the protective roles of AFEs for health status. Researchers in the United States specified the effects of outdoor environments, public transportation, social participation, respect and inclusion on the SRH of older people (Choi, 2020; Wong et al., 2017). In a Hong Kong study, higher satisfaction with housing predicted better SRH in older people (Yu et al., 2018). By contrast, Lehning et al. (2014) conducted a Detroit-based study and discovered that various other social environmental factors (e.g., healthcare and support, community engagement, and problems with neighbours) also influence the SRH of older adults. For older people who were economically and socially deprived, AFEs had a buffering effect that alleviated the adverse impacts of economic and social deprivation on the SRH of these older people (Kim et al., 2021).

In addition to SRH, other indicators of the health status of older adults (e.g., functional ability, mortality, and chronic morbidity) were considered in previous research. In a Hong Kong–based study that examined longitudinal data from four waves of a survey, Lu et al. (2021b) discovered that the considerable decrease in functional ability over time can be delayed by the establishment of accessible green spaces, leisure facilities, and public transportation. Using chronic morbidity as a health indicator, Dennis et al. (2020) conducted a study in Manchester, United Kingdom, and revealed that providing more land cover and green infrastructure led to a more favourable health status among older adults in high-income regions, whereas proximity to public parks

and recreational areas had greater influence on the health of older residents from low-income communities. The major effect of green spaces on health was further verified by a 10-year longitudinal study in a highly urbanised city (Wang et al., 2017), estimating that a 10% expansion in greenness was associated with a significant decline in three types of mortality.

Depressive symptoms. Gerontologists are paying increasing attention to the mental health outcomes influenced by AFEs in the Chinese context. A study conducted in mainland China discovered that neighbourhoods with more exercising and recreational amenities were negatively related to depressive symptoms of older people (Lei & Feng, 2021). For Chinese older adults who live separately from their adult children, supportive community services and facilities mitigate the severity of mental disorders among this population (Jiang & Sun, 2021). A study in Hong Kong highlighted the protective role of AFEs against poor mental health outcomes; that is, community centres and leisure facilities decreased the likelihood of suffering depressive symptoms of older people in the long term (Liu et al., 2021). In addition, more greenness was discovered to be related to fewer depressive symptoms (Lu et al., 2021a). Park et al. (2021) discovered that AFEs significantly predicted depressive symptoms in the younger generations (<= 44 years old), but not for the older generations (>= 45 years old).

Additional outcomes. Various studies have explored the influence of AFEs on psychological and subjective well-being, mood status, and successful ageing. In Netherlands, Nieboer and Gramm (2017) discovered that all the eight domains of AFEs influenced the overall well-being of older people. Similarly, the total score of the Age-friendly Urban Index (i.e., combination of walkability, access to services, and safety) is also strongly related to the eudaimonic well-being of older citizens and is weakly associated with their hedonic well-being (Gibney et al., 2020). Results of a study in Spain highlighted the role of the social factors in promoting the subjective well-being of both older female and male participants (Del Barrio et al., 2021). Moreover, Chen et al. (2020) found that outdoor environmental elements can directly affect the mood

status of older residents; however, they indicated that the correlated factors differed depending on residential quality. Domínguez-Párraga (2019) was the only researcher to adopt a qualitative design and conduct in-depth interviews to understand how neighbourhood compositions influence the daily lives of older adults. They indicated that the psychological, social, and emotional dimensions of a neighbourhood can affect multiple domains of successful ageing.

2.3.4 Pathways Linking AFEs to Well-being of Older Adults

Researchers have also analysed specific psychological and behavioural pathways that link age-friendliness to well-being outcomes. Among the various psychological pathways, sense of community was typically identified as the psychological mediator in three studies. Au et al. (2020) discovered that such sense of connection at community level mediated the influences of social participation, community-based support and services on the satisfaction of life among older community dwellers. Yu et al. (2018) also discovered that the age-friendliness of transportation, as well as respect and social inclusion, were highly related to sense of community. Tang et al. (2021) further revealed that sense of community had a higher mediating ratio for linking age-friendliness and older residents' physical health (45%) than the mental health (14%). In addition to sense of community, various studies have tested the effects of other mediators (e.g., loneliness [Schorr & Khalaila, 2018; Park et al., 2021], social trust [Zhou et al., 2021], and social connectedness [Lai et al., 2016]) on person–environment relationships. Zhang and Chan (2020) considered physical health and social relationships as mediators, although the reported mediating relationship lacked sufficient theoretical explanations.

Only two studies have investigated how age-friendliness influence older adults through behavioural pathways. Zheng and Yang (2019) discovered that satisfied leisure environments and landscapes encouraged older adults to participate in outdoor exercise such as walking, which in turn improved their self-rated health. This finding was also documented by Lu et al. (2021), reporting that social activities mediated the influence of community facilities on mental problems in Chinese ageing adults. However, Zheng and Yang (2019) also revealed that the mediating role of social participation was

insignificant among young-old Chinese people (<80 years).

2.4 Research Gaps

2.4.1 Limited Focus on PWB and Mental Health

Seldom studies have examined the comprehensive outcomes of PWB and mental health. As an essential aspect of successful ageing, PWB is a concentrated reflection of a holistic image of well-being at old age. The PWB of older adults is related to their life satisfaction, QoL, and happiness, all of which have been examined by other studies; however, PWB is not limited to these unidimensional outcomes. From a growth perspective, PWB is a valuable and meaningful concept for indicating the overall autonomy, self-acceptance, and purpose in life of older adults. Moreover, research findings on the significant age-friendliness in association with mental health were inconclusive in different studies. Nevertheless, late-life mental and psychiatric disorders exhibited an increasing trend and have become major public health concerns. Therefore, it necessitates to further clarify the influence of age-friendliness on the PWB and mental health.

2.4.2 Theoretical Deficiency Within Empirical Studies

Theory serves an essential and propositional role in helping scholars to understand definite phenomena or to explain potential frameworks of research. However, among the studies included in the present systematic review, approximately one-third lacked theoretical orientations in their research. The application of good theory (or the appropriate application of theory) allows researchers to form a coherent and holistic vision of phenomena. It not only explains why a relationship exists but also its mechanism (Chijioke et al., 2021). This is crucial to the research regarding the person–environment relationship and how environmental factors influence the well-being outcomes (PWB and mental health) at old age. Without the application of appropriate theories, a study cannot produce convincing evidence that is accepted by researchers and readers. Correspondingly, the lacking of theoretical orientations also caused that few empirical studies have sufficiently explored specific pathways or mechanisms that links AFEs to the well-being of older adults.

2.4.3 Lack of Systematic Perspective

Ecological systems theory (Bronfenbrenner, 1977; 1992) suggests that the study of relationships should be conducted within multi-layered ecological systems. This theory assumes that ecological systems are nested structures with various interrelated layers. For example, the components in microsystems (e.g., individual and family), exosystems (e.g., community), and macrosystems (e.g., economic, political or structural forces) can affect each other. Among the selected studies of AFEs, most age-friendliness factors were embedded in the community at the exosystem level. However, the influence of age-friendliness could be conditional in different micro or macro factors. Without a systematic perspective, how the psychological and behavioural pathways at community level interact with intergenerational relationships and urbanisation degree remains unclear and requires further clarification, respectively. Thus, beyond the community level, future studies should employ a systematic perspective to examine person–environment relationships in broad and multi-layered contexts.

2.4.4 AFEs in Mainland China: Incomplete Measures and Unbalanced Studies

Although various studies of AFEs have been conducted in mainland China in the recent 3 years (2019-2022), it was criticised for incomplete measurements and an unbalanced focus. First, for AFEs measurements, none of the studies conducted in mainland China holistically assessed the eight domains of AFEs within the WHO's framework. Instead, most of them only focused on specific environmental aspects (e.g., community services and facilities, outdoor spaces, and social participation), which did not represent the full range of AFEs. Second, because China is a vast territory with uneven degrees of urbanisation and development, existing studies did not reflect the uneven influence of urbanisation on environmental factors in Chinese context. More specifically, no study has focused on the conditional impacts of age-friendliness on the well-being due to varying degrees of urbanisation. Considering the considerable contextual differences, mainland China–based studies should consider specific urbanisation or economic backgrounds when investigating person–environment relations.

Chapter 3 Theoretical Framework of Person–Environment Interplay

3.1 Brief Introduction

An overview of the theory of environmental gerontology (EG) is presented in this Chapter. It illustrates the historical retrospect, research tasks and scope, and primary perspectives of EG. Based on the theoretical orientation of EG, the framework of person–environment interplay was adopted to guide the overall research design and the subsequent development of research hypotheses.

3.2 Theoretical Orientation: Environmental Gerontology

3.2.1 Historical Retrospect

After more than half a century of development following its conceptualisation in the 1970s (Lawton & Nehamow, 1973; Lawton,1977; Rowles, 1978; Scheidt & Windley, 1985; Wahl & Weisman, 2003), EG has become an independent and major subfield within gerontology; EG describes, explains, and optimises the inter-relationships between older residents and socio-spatial surroundings in research as well as practical settings. Wahl and Weisman (2003) asserted that one of the key aspects of EG is its pluralism with respect to theory, research findings, and interdisciplinary elements, which are reflected in its historical roots. The origin of EG can be traced to the Chicago school of urban sociology, which investigated human behaviour and the neighbourhood effects in community organisations in the 1920s (Park et al., 1925). Furthermore, the formation of EG theory is influenced by the concept of psychological press that is applied in personality studies (Murray, 1938) and environmental theory developed from the field theory of social science (Lewin, 1951). With the exploration of gerontology from the social science perspective (Townsend, 1955) and the rise of environmental psychology (Barker, 1968), the theory of EG was broadened in the second half century by combining multiple disciplines (e.g., psychology, human behaviour, gerontology, and urban planning). The period from the 1970s to the early 1980s is regarded as the ‘golden era’ of EG research; during this period, the introduction of the influential press–competence model (Lawton and Nahemow, 1973) represented a milestone in the

theoretical development of EG. Conceptual and empirical EG studies expanded substantially in the next two decades.

3.2.2 Primary Tasks and Scope

The basic aims of EG are describing, explaining, reshaping, and optimising the relationship between external environments and older people (Wahl & Weisman, 2003). EG provides a comprehensive interpretation of how older adults interplay with physical and social environments and how these environmental elements are linked to various well-being outcomes (Wah & Oswald, 2010). With respect to the scope of environments, Wahl and Weisman (2003) adopted the concept proposed by Dannefer (1992), defining surrounding environments as the entirety of a wide range of external phenomena, events, and forces existing outside older people. Therefore, a wide spectrum of environmental components is involved under the scope of EG. In the present thesis, the eight age-friendliness domains of AFEs were examined on the basis of the age-friendly community framework (WHO, 2007), which covers the physical, social, and service aspects of environments.

3.3 Overview of Theoretical Framework

In this chapter, a comprehensive and integrative theoretical framework initially developed by Wahl and Oswald (2010) is expanded for application in the present study. The notable advantage of this framework is the provision of P–E processes that help researchers to understand how multiple psychological and behavioural pathways shape the ageing process and ultimately affect the environmental related outcomes of older people. Therefore, the process of belonging and agency were two core assumptions that were applied in the framework. Grounded on the originally proposed framework (Wahl & Oswald, 2010; Wahl et al., 2012) at the community level, the components of additional multilevel systems (e.g., family level and structural level) were added as moderators; this inclusion was suggested by Bronfenbrenner's ecological system theory as a means of capturing how factors from multilayers interact with each other. As presented in Figure 3.1, the overarching framework had three compositions, namely P–E interactions, P–E processes, environmental relevant outcomes. The three sections are

described in the subsequent subsections.

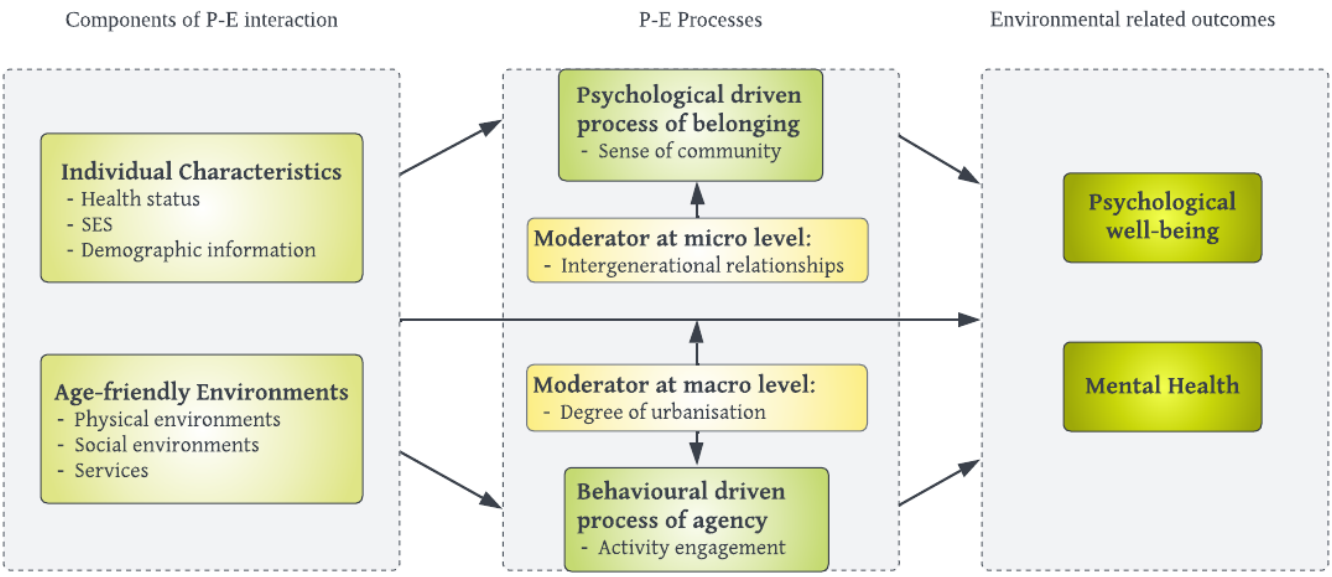

Figure 3.1 *Theoretical framework of person–environment interplay in later life*

Note. SES includes educational attainment, occupation, monthly income, and employment status. Demographic information comprises age, gender, marital status, and household registration.

3.3.1 Components of P–E Interaction

During the first stage, interactions are assumed to occur between individual components (e.g., health status, SES, demographic characteristics) and environmental factors (Chaudhury & Oswald, 2019). For example, older adults with different characteristics may develop different perceptions of age-friendliness, use environmental resources differently, and respond to environmental constraints differently. Conversely, the conditions of living environments can also reflect individual functional ability and socioeconomic status. Among various individual components, the health status of older adults is particularly stressed in the P–E interactions. This is because of the biological and functional decline as people age, which increase the dependence of older adults on the environment. In the press–competence model, press refers to poor environmental conditions that may have adverse consequences on an individual's life, and competence refers to the total intrinsic capability (combination of one's physical and mental ability) of individuals to utilise, adapt, and manipulate external environments (Lawton &

Nahemow, 1973). This model posits that older adults with poor competence are less capable of coping with adverse environments and are, thus, be more dependent on environmental conditions. In other words, for older adults with poorer competence, they are associated with a stronger connection with environments. In the present thesis, self-rated health was used to indicate the competence of older adults.

3.3.2 Sense of Community in the Process of Belonging

P–E belonging is a psychological process; it refers to the subjective evaluations and personal conceptions of geographic locations that lead to the formation of emotional or cognitive meaning pertaining to one's immediate surroundings (Wahl & Oswald, 2010; Wahl & Weisman, 2003). According to residential satisfaction theory (Aragonés et al., 2002; Weideman & Anderson, 1985), P–E belonging is a part of the cognitive process of conducting subjective evaluations of housing or residence. In addition, according to the theory of place attachment, the process of belonging is correlated with the affective, familiar, and social bonds and relationships in the experience of long-term living and attachment, in which residence transforms in place (Lewicka, 2008; Rowles & Watkins, 2003). It emphasises emotional connections with specific places or objectives (Rubinstein, 1987). From this perspective, place is regarded as a manifestation of the memories, sense of self-identity, and social networks that people develop when they age (Rowles, 1983).

To clearly describe the psychological pathway that links AFEs to environmental related outcomes, sense of community is typically to be used as a mediator in the process of belonging within this framework. Conceptualised as a shared feeling within an organisation or community, sense of community has the function to influence one another and feel a sense of belonging and mutual fulfilment that allows people to achieve common objectives (McMillan, 1976). Although the connecting effect of sense of community has been examined in other studies, no study has explored how the sense of community of older adults at the community level interacts with their feelings within the family realm. To address this research gap, the present study adopted an ecological system perspective and used the intergenerational relationships within families to

expand the theoretical framework. In the Chinese context, the intergenerational relationship quality considerably affects the PWB (Zhang & Silverstein, 2022) and mental health (Li et al., 2019; Wu & Chiou, 2020) of these older adults. Therefore, an intergenerational component at the family level was added to further advance the knowledge regarding whether the effects of community psychology vary depending on the quality of intergenerational relationships.

3.3.3 Activity Engagement in the Process of Agency

P–E agency is a behavioural process that emphasises a proactive agent in one's life that intentionally compensates, sustains, and modifies an environment through various behaviours (Wahl & Oswald, 2010; Wahl & Weisman, 2003). According to psychological control theory, the P–E agency process is derived from the assumption that control over external resources increases with age, whereas internal control is maintained at a consistent level (Lachman, 1986; Lachman & Burack, 1993). Under the assumption of environmental docility (Lawton, 1982, 1973), the decline in an individual's functional ability reduces their adaptive competence to the extent that they may be unable to cope with environmental press, which in turn leads to docility. Conversely, in environmental proactivity, it is hypothesised that older adults can modify environments to suit their personal needs through intentional actions; consequently, these older people can cope with environmental press and benefit from available resources (Lawton, 1989). In summary, the P–E agency process is strongly associated with goal-oriented behaviours that highlight individual proactive actions or activities in an individual's surroundings.

In alignment with the behavioural nature of the process, the frequency of activity engagement or social participation was employed as a potential mediator in the behavioural pathway in this study. Aroogh and Shahboulaghi (2020) defined the social participation of older adults as their engagement or involvement in social interactions within the community or broader sphere or interpersonal interactions beyond one's home. Few studies have examined activity engagement as the behavioural mediator between AFEs and older adults. However, the range of activities examined by other

studies was not clearly specified or relevant to community environments. Under this framework, community-based activities (including physical exercise, leisure or recreational activities, and voluntary activities) were used to denote the activity engagement of older adults at the community level. In the meanwhile, as mentioned earlier, population ageing normally occurs along with urbanisation. According to central place theory (King, 1985), the intensity and nature of various forms of human productivity, public services and amenities, and environmental characteristics may vary substantially with the urbanisation degree or the distance to urban centres (Lenzi & Perucca, 2020). From this perspective, the urbanisation degree, which represents a structural change in a macro-level system, may restrict or facilitate the impact of activity engagement (Huang et al., 2018), and thus moderate the direct and indirect influence of environments. Therefore, the urbanisation degree was also added to the theoretical framework to bridge the understanding of the joint influence of age-friendliness, activity engagement, and urbanisation on older adults.

3.3.4 Environmental Outcomes: PWB and Mental Health

PWB and depressive symptoms were applied as outcomes in the theoretical framework. These two outcomes are consistent with the developmental purpose of an individual in their later life, namely maintaining one's autonomy and integrity, which are emphasised in the initial framework developed by Wahl and Oswald (2010). Conceptually, PWB was concluded as the combination of positive feeling and successful functioning to have lives go well (Huppert, 2009). In contrast to the conception of subjective well-being, which highlights the hedonic aspects prioritising temporal emotions characterised by pleasure and happiness (Kahneman et al., 1999), PWB points to the general appraisal of individual life status and the long-term benefits from psychological growth (Burns & Machin, 2009). Ryff's six-dimension model (Ryff, 1989a, 1989b; Ryff & Keyes, 1995) is widely applied as a framework for PWB. On the basis of life course development together with the philosophical roots of the eudaimonic perspective, Ryff formulated six core dimensions (Figure 3.2) to describe the meaning of PWB (Ryff & Keyes, 1995).

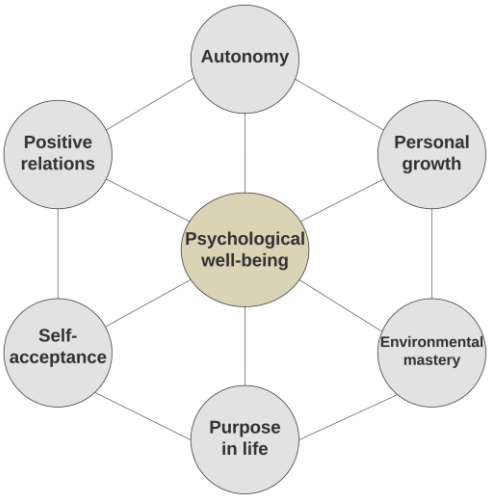

Figure 3.2 *Six core dimensions of Ryff's PWB model*

Note. (i) Autonomy: living is in line with personal willing; (ii) Personal growth: feelings of continued development; (iii) Environmental mastery: control or manage external environments; (iv) Purpose in life: feel lives are meaningful and worthwhile; (v) Self-acceptance: positive attitudes towards self or accept multiple aspects of self; (vi) Positive relations: have trusting, intimate, warm relationships with friends, relatives, and families.

Broadly, because PWB can be defined as positive psychological functioning and the absence of mental illness (Yeung, 2017), in this thesis, depressive symptoms were used as an indicator of mental disorder to measure the negative aspect of PWB. Depression is a universal and constant feeling of sober or desperation that can significantly impede people's thoughts, moods, behaviours, and physical health (Bjornlund & Gale, 2010). In addition to the conventional causes (e.g., bereavement, living alone, disability) leading to depressive symptoms, preventive or risky factors from multiple environmental components are attracting increasing research attention. Therefore, examining the age-friendliness domains that could prevent the depressive symptoms in late life is a meaningful and crucial task. In the following research hypotheses, given that depressive symptoms and PWB are two aspects of individual well-being, the mediating and moderating hypotheses should be simultaneously applicable in both outcomes.

3.4 Research Questions and Hypotheses

Research question (1): To what extent are overall AFEs and age-friendliness associated with the PWB and mental health of community-dwelling older people in

Shanghai?

Under the first question, the tentative sub-hypotheses are as follows:

H 1.1: Higher scores for overall AFEs and age-friendliness domains are associated with better PWB of older adults and its six dimensions of PWB.

H 1.2: Higher scores for overall AFEs and age-friendliness domains are related to more severe depressive symptoms in older community dwellers.

H1.3: The influence of AFEs on the PWB and depressive symptoms of older people is greater among group in poor or fair health status than among group in good health status.

Research questions (2): How does the age-friendliness influence the PWB and mental health of older people through the psychological pathway under different levels of intergenerational relationships?

Under the second question, the tentative sub-hypotheses are as follows:

H 2.1: Sense of community mediates the influences of age-friendliness on the PWB of older community dwellers.

H 2.2: Sense of community mediates the impacts of age-friendliness on the depressive symptoms of older community dwellers.

H 2.3: The quality of intergenerational relationships moderates the indirect effects of age-friendliness on the PWB through sense of community (the second stage of indirect path).

H 2.4: The quality of intergenerational relationships moderates the indirect influences of age-friendliness on the depressive symptoms through sense of community (the second stage of indirect path).

Research questions (3): How does the age-friendliness influence older people's PWB and mental health through the behavioural pathway under different degrees of urbanisation?

Under the third question, the tentative sub-hypotheses are as follows:

H3.1: The frequency of activity engagement mediates the association between age-friendliness and PWB.

H3.2: The frequency of activity engagement mediates the link between age-friendliness

and depressive symptoms.

H3.3: The urbanisation degree moderates the direct influences, and indirect influences of age-friendliness on the PWB of older people through activity engagement (the second stage of mediation process).

H3.4: The urbanisation degree moderates the direct influences, and indirect influences of age-friendliness on the depressive symptoms of older adults through activity engagement (the second stage of mediation process).

Chapter 4 Research Methodology

4.1 Brief Introduction

The present chapter introduces the research methodology in this thesis, including the rationale for conducting quantitative research, the background of the research site in Shanghai, the sampling strategy and data collection process, the measurement of various variables, and the analytical strategy applied in each chapter.

4.2 Rationale of Quantitative Research

Creswell (2009) and Tuli (2010) have suggested that when selecting research methodologies, researchers should combine their worldview and experience and consider the fitness of their research purposes. With respect to philosophical paradigms, the author of the present thesis accepted that there is an independent reality existing in the world, which is consistent with the ontology of positivism (Benton & Craib, 2010; Park & Artino, 2020). Positivism focuses on discovering and formulating universal laws that relate to patterned human activities in social sciences and can facilitate the explanation and prediction of such activities. It posits that truth exists apart from individual thoughts (Tuli, 2010). The epistemology of positivism is objectivism, believing that knowledge can be acquired through the application of deductive logic and precise empirical evidence and rational analyses. To achieve this objective, researchers must develop highly objective methods (e.g., comprehensive examination of collected data) to approximate reality to the highest extent (Tuli, 2010). Therefore, a quantitative research design that involves the testing of a large data set is more suitable for the positivistic philosophical paradigm and objectivism epistemology.

Pertaining to the fitness of the research purposes of the present thesis, a quantitative research design is appropriate for examining the relations between multiple age-friendliness domains and the well-being of older people. Under the hypothetico-deductive model of science (Park & Artino, 2020), the aforementioned functional relationships can be obtained from explanatory components (independent variables) and outcomes (dependent variables). Crucially, the present thesis attempted to clarify

how the associations between AFEs and older adults are linked through psychological and behavioural pathways. On the basis of an established theoretical framework and priori hypotheses, mediation and moderation analyses were conducted using quantitative methods to test the pathway hypotheses; this method can help researchers gain a clearer understanding of the related theory. Through this method, the present thesis completed the cyclical process of the hypothetico-deductive model, that is, theory–hypotheses–operationalising variables–data analyses–theory (Park & Artino, 2020).

4.3 Research Site in Shanghai

The research site of this study located in Shanghai, the city with the highest ageing rate in mainland China. It is because of three reasons that Shanghai was selected as an appropriate research site, namely its accelerating rate of ageing and increasing ageing trend, its high urbanisation level, and its efforts to create an age-friendly society citywide. First, population ageing is the prominent demographic trend in Shanghai. By the end of 2020, the population of aged more than 60 and 65 years reached 5.33 million (+3% from 2019; 36.1% of the population with household registration) and 3.82 million (+5.7% from 2019; 25.9% of the population with household registration), respectively in Shanghai (Shanghai Municipal Health Commission, 2021). Second, according to the National Bureau of Statistics of China (2021), the urbanisation rate of Shanghai was 89.3% in 2020, which was the highest among all cities in mainland China. Third, motivated by the double trends of ageing and urbanisation, the local government of Shanghai has provided increasing attention on developing an age-friendly society. For example, the Shanghai Civil Affairs Bureau (2017) formulated local standards for creating a liveable community for older adults; the standards comprise numerous criteria pertaining to environments and facilities, public transportation and travel, housing construction, and service supply. Moreover, developing age-friendly city was also regarded as one of the crucial purposes in the 14th Five Year Plan for Senior Citizens in Shanghai (General Office of Shanghai Municipal People's Government, 2021). Therefore, taken collectively, Shanghai is an appropriate research site to conduct

the study of AFEs in association with older people.

4.4 Sampling Strategy and Data Collection

The target population of the present thesis was selected on the basis of the following criteria: (i) Aged 50 years and older. As a result of the 50 years old of mandatory retirement age in mainland China, retired people may spend more time in their residential environment and thus be influenced more by the environments, (ii) Cognitively healthy and capable of undergoing an interview, and (iii) Lived in residential housing in Shanghai for at least 6 months (nursing houses were excluded).

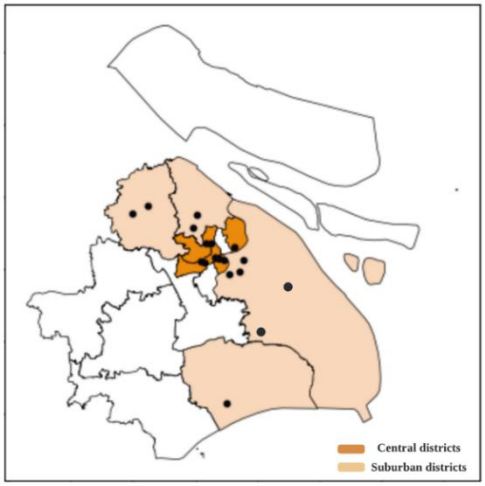

Figure 4.1 *Surveyed districts in Shanghai*

To ensure that the sample was unbiased and representative, the present thesis applied cluster sampling at two stages. In the first stage, 16 districts in Shanghai were used as the primary sampling units. According to Shanghai's city development plan (Shanghai Municipal People's Government, 2016), the city comprises 7 central districts[1] and 9 suburban districts. The two district groups reflected different degrees of urbanisation, manifested as distinct developmental stage of public infrastructure, economic prosperity, and industry aggregation. All 16 districts in the two groups were sorted, and the author randomly selected 5 districts from central districts and 4 districts from suburban districts by using random number method. Eventually, the selected

[1] The central districts in Shanghai include Huangpu, Jing'an, Xuhui, Changning, Yangpu, Hongkou, Putuo. Suburban districts include Pudong, Baoshan, Jiading, Minhang, Songjiang, Qingpu, Fengxian, Jinshan, and Chongming.

central districts include Huangpu, Jing'an, Changning, Putuo, Yangpu; and the suburban districts include Pudong, Baoshan, Jiading, Fengxian. Figure 4.1 presents the Shanghai districts that were selected for the survey in the present thesis.

In the second stage, on the basis of the population aged more than 60 years in each district (Shanghai Municipal Health Commission, 2021), the present thesis tried to make the sample size of people aged over 60 in each district was generally proportional to its population of 60-year-olds (Singleton & Straits, 2005; Skinner, 2014). A comparison of demographic characteristics between the sample in this thesis and the total population aged over 60 in Shanghai was further presented in Table 4.1. It was shown that although the age group of 65-69 in the sample (37.6%) might be overweighted (compared to the total population of 27.9%), the proportion of gender, other age groups, and districts between the sample and total population was generally equivalent. Therefore, it could be concluded that the representative ability of the sample in this thesis is good. Within each district, data collectors used purposive and snowball sampling to invite eligible respondents to participate in the survey of this study.

Table 4.1 *Comparison of demographic groups between sample and the total population aged 60 and over in Shanghai*

Demographic groups		**Sample aged 60 and over[a]**	**Total population aged over 60 in Shanghai[b]**
Gender	Proportion of female	56.1%	52.0%
Age groups	60-64	29.4%	28.3%
	65-69	37.6%	27.9%
	70-79	22.1%	28.3%
	>= 80	10.9%	15.5%
Districts	Central districts	51.8%	47.9%
	Suburban districts	48.2%	52.1%

Note. a. The sample aged 60 and over accounted for 78% of the total sample. b. The data were extracted from the Statistics on Demographics and Programs of Senior Citizens in Shanghai 2020 (Shanghai Municipal Health Commission, 2021).

Using a structured questionnaire, data were collected on site from March to August in 2021. Before starting the formal data collection process, a pilot survey involving 15 participants was conducted to obtain the respondents' view of the questionnaire and improve it accordingly. In accordance with the respondents' feedback, questions that

were ambiguous or difficult to answer were further revised. Prior to each interview, informed consent was acquired from the respondents to confirm that they have well understood the objective and content of the present study. Ethical approval (Appendix I) was obtained from the Institutional Review Board of The Hong Kong Polytechnic University (Reference Number: HSEARS20210113001). Data were collected by seven postgraduate students who received training regarding the content of questionnaires, fieldwork procedures, and interviewing skills. Data were collected from places where older adults regularly gathered (e.g., community-based elderly activity rooms, open areas in the neighbourhood where people could sit, street gardens, and corner parks, shopping malls). Each interview lasted for 45 to 60 min, with an overall response rate of 63.17%. Following the completion of the survey, to ensure the perceptions of AFEs were generally congruent with objective environments, data collectors invited older adults (n = 15) to further take part in the research of photovoice and in-depth interview. This method was used to further assess the data quality of AFEs in the survey with reference to the listed environments in photovoice. In total, 506 community residents from Shanghai aged from 50 to 88 years participated in the survey; 236 were from central districts, and 270 were from suburban districts.

4.5 Measurements

4.5.1 Independent Variable

Age-friendly environments. To the best of our knowledge, a complete AFEs scale in mainland China have yet to be systematically validated. Therefore, scale validation was carried out to identify the psychometric quality and reliability of AFEs in the Chinese context. In the questionnaire, AFEs were preliminarily measured on the basis of WHO's eight-domain framework (WHO, 2007), and minor revisions were made in accordance with the National Demonstrative Standards of Age-friendly Communities (National Health Commission & National Office on Ageing, 2020) for urban areas in China. The aforementioned standards are the first set of national guidelines published by the highest-level government institutions; they provide explicit standards for evaluating the work of age-friendly communities national wide. A thorough screening and comparison

of the listed items in the two guidelines revealed that most of the items were similar; thus, revisions were only made for specific items in the housing domain and the communication and information domain. For the housing domain, the content pertaining to age-friendly modifications (e.g., non-slip floors, safety handrails, shower handrails, and emergency call equipment) and housing safety (e.g., absence of housing safety risks related to utilities such as water, electricity, and gas) was highlighted in the measurements. In addition, ageing in the digital era was considered; thus, items related to the use of the internet, smartphone, and smart healthcare products were added in the communication and information domain.

A preliminary scale with 47 items pertaining to eight domains by combining the guidelines published by WHO and Chinese official commission was used to perform the initial AFE measurements (Appendix II). The participants were invited to rate their satisfaction or evaluation with each item of eight domains. A 5-point Likert-type scale scored from 1 (‘strongly disagree’) to 5 (‘strongly agree’) was used. On the basis of the initial scale, a more accurate and reliable AFEs scale that was adapted to the Chinese context was validated (see Chapter 5). The ratings for each age-friendliness domain were averaged to obtain a mean value that reflected the age-friendly level after the scale was validated; a higher value indicated a higher age-friendly level.

4.5.2 Dependent Variables

Psychological well-being *(PWB).* Measurement of PWB adopted Ryff’s model of 42 items, involving 6 dimensions (i.e., autonomy, environmental mastery, personal growth, positive relations, purpose in life, and self-acceptance) (Ryff et al., 2007). The 42-item version of PWB has received wide scrutiny to ensure the quality assessment of the construct (Ryff, 2014). Previous studies have employed Ryff’s PWB scale in Chinese contexts to ensure the scale validity applied in mainland China (Cheng & Chan, 2005; Chiang et al., 2016). The respondents were invited to appraise to what extent they approval each statement on a 7-point scale beginning from 1 (“strongly agree”) to 7 (“strongly disagree”). Among the 42 questions, there were half-questions being reversely scored. Then the score for each dimension was computed by averaging the

sum of total items, with the score spanning from 1 to 7 for each dimension. The internal consistency of the sub-scale of PWB was acceptable, with the Cronbach's alpha spanning from 0.662 to 0.720. The overall score of PWB ranged from 6 to 42, and Cronbach's alpha was 0.864.

Mental health. Depressive symptoms were utilised to reflect the mental health in older people. Measures from the Center for Epidemiologic Studies Depression Scale (CES-D) with 10 items (Radloff, 1977) were used, including measures of depressed affect, somatic symptoms and fewer words, feelings of a failed life, negative self-image, and so on. The 10-items CES-D has been proved to have exceptional properties as an instrument to screen and predict the severity or risks that older people suffered depressive symptoms (Andresen et al., 1994; Irwin et al., 1999). Its decent application in Chinese studies has also been acknowledged (Chang & Weng, 2013; Fu et al., 2022). Respondents are asked about the frequency with which they experienced the described feelings in the last week by using a four-point Likert scale (0 = less than one day or never, 1 = one to two days or occasionally, 2 = three to four days or moderately, 3 = more than five days or mostly). The scorings of positive affect statements (i.e., question 4) were reversed. The total value is from 0 to 30, and a larger value suggests more severe mental problem (Andresen et al., 1994). Previous study has identified the threshold of 8 as a cut-off score to predict a higher risk or severity that people suffered depression (Boey, 1999). The Cronbach's alpha value of 0.762 indicated a satisfactory scale reliability of the 10-item CES-D in this research.

4.5.3 Mediating Variables

Sense of community. In this thesis, an 8-item Brief Sense of Community Scale (BSCS) (Peterson et al., 2008) was adopted to reflect older people's group membership, needs fulfilment, influence, as well as emotional connection within a community. Membership denotes the feeling of belonging within a place; needs fulfilment measures whether one's needs could be satisfied by the identity within a group; influence refers to the ability to make a difference; and emotional connection reflects the degree that community dwellers feel they were connected to the community and people in the

community (McMillan & Chavis, 1986). Each question was asked using a five-point scale of 1 (“strongly disagree”) to 5 (“strongly agree”). The total span was 8 to 40, with a larger value indicating respondents’ greater sense of community. In this research, the scale reliability of BSCS was good as the Cronbach’s alpha was 0.915.

Activity engagement. Three types of activities were measured to reflect older adults’ frequency of community-based activity engagement. They encompassed (i) physical activity, (ii) recreational (e.g., playing chess, cards, mah-jong) and leisure activities (i.e., singing, square dancing), and (iii) voluntary activities, which were all closely related to the conditions of physical and social environments. Previous studies (Lu et al., 2021; Zheng & Yang, 2019) only used outdoor physical activity as a behavioural mediator; this thesis, therefore, added additional potential activities for community-dwelling older adults. Participants were asked about the frequency they engaged in the community-based activities since last week, ranging from 1 (“less than two days each week”) to 4 (“five days or more each week”). The total point was from 3 to 12, with a higher point implying older participant’s higher frequency of activity engagement.

4.5.4 Moderating Variables

Intergenerational relationships. The Intergenerational Relationship Quality Scale for Ageing Chinese Parents (IRQS-AP) (Bai, 2018) was used to measure the quality of intergenerational relationships. It consisted of 13 items for four important relationship domains: structural-associational solidarity (i.e., residential arrangement and frequency of interaction), consensual-normative solidarity (i.e., shared values or beliefs between generations), affectual closeness (i.e., emotional attachment), and intergenerational conflict. Each statement was rated using a five-point Likert scale, ranging from 1 to 5. The total score of IRQS-AP was from 13 to 65, and a higher score denoted better relationships with adult children. The Cronbach’s alpha was 0.783 in this thesis.

Degree of urbanisation. Two groups of districts were used to present different degrees of urbanisation in Shanghai. Central regions included the districts of Huangpu, Jing’an, Changning, Putuo, and Yangpu, and the remaining four districts of Pudong, Baoshan, Jiading, and Fengxian were second-rank urbanised regions. This grouping manner

comprehensively considered the official document of the city development plan in Shanghai (Shanghai Municipal People's Government, 2016), the population density of census records in 2019, and land use and land cover in Shanghai (Cui & Shi, 2012). In the next chapter, known groups' validity about the significant difference of some age-friendliness domains between central areas and lower urbanised areas further verified the rationale of such grouping of urbanisation.

4.5.5 Covariates

Respondents' age, gender, current marital status, ownership status of registered households in Shanghai, educational attainment, monthly income, occupation, employment status, and self-rated health. Gender was coded as 1 ("female") and 0 ("male"); current marital status comprises 1 ("married") and 0 ("unmarried"); educational attainment was made up of four levels (1 = primary school; 2 = middle school; 3 = high school or vocational school; 4 = college or higher); monthly income was recoded based on the average amount of elderly pension or salary[2] income in Shanghai in 2020 (1 = low; 2 = fair; 3 = high); occupation (1 = professionals for management or skills; 2 = clerks; 3 = farmers or self-employed); employment status was recoded as 1 ("retired") and 0 ("full-time or part-time job"). Self-rated health (SRH) was assessed by a five-point scale spanning from 1 ("very unhealthy") to 5 ("very healthy"). Extant study has proved that single-item SRH is a valid indicator for predicting mortality among populations at middle-aged and old-age (Wuorela et al., 2020). In this thesis, SRH was further recoded as two groups for 1 ("good health status") and 0 ("poor or fair health status").

4.6 Analytical Strategy

Preliminary data preparation and examination were conducted before a data analysis was performed. Among the collected data, the proportion of missing data for all variables was less than 2.2%, which would not lead to consequential or biased statistical inferences (Schafer, 1999). Skewness, histogram, and q-norm plot of the data were

[2] The average monthly salary for employers in Shanghai was 10,388 RMB in 2020 (Shanghai Human Resources and Social Security Bureau, 2021). The average employment pension was 4,603 RMB, and the average pension for residents was 1,535 RMB (Shanghai Bureau of Statistics, 2021).

examined to diagnose the distribution of the normality of all numeric variables. In addition, a scatter plot was used to examine the linearity of the association between paired key variables. After the data preparation process, a series of data analyses were performed. The overall analytical strategy is described in the subsequent paragraphs, and the exhaustive analytical procedures are further elaborated in each chapter.

To validate the AFE scale in the Chinese context, a confirmatory factor analysis (CFA) and an exploratory factor analysis (EFA) were utilised (see Chapter 5). First, an initial CFA with maximum likelihood estimation was adopted among the full sample to test whether the collected data fitted the existing structure validity. Second, if the indexes of the initial CFA indicated a poor model fit, then an EFA with principal components analysis and varimax rotation would be presented to further confirm the factor structure of the scale. Third, internal consistency was used to ensure the scale reliability; known groups validity was used to examine whether the perceived age-friendliness were significantly different in the two degrees of urbanisation in Shanghai; and convergent validity was tested to confirm that the verified AFEs scale was consistently related with other theoretically or empirically suggested variables.

Based on the validated AFEs scale, multivariate analyses were performed to test overall AFEs and age-friendliness in association with the PWB and depressive symptoms of older adults respectively (see Chapter 6). To analyse the extent that AFEs and age-friendliness in association with PWB and its six dimensions, multiple linear regression with robust errors was performed, including controlled covariates. For the outcome variable of depressive symptoms, this thesis applied cut-off point of 8 to classify the severity of depressive symptoms into two groups. Logistic regression was applied to probe the overall AFEs and age-friendliness in preventing the severity of depressive symptoms. In addition, health status was used as an indicator of competence to test whether age-friendliness influence people differently depending on their competences. The identified age-friendliness domains that influenced the PWB and depressive symptoms of older people were further used in Chapters 7 and 8 to investigate the pathways of the associations.

The psychological pathway that links age-friendliness to the PWB and depressive symptoms was examined in Chapter 7. Firstly, this research employed path analysis to test the mediating effect of sense of community in linking age-friendliness to PWB and depressive symptoms. Second, an interaction term of "sense of community × intergenerational relationships" (centred) was added in the models to test the moderating effect of intergenerational relationships at the second degree of mediation process. A simple slope analysis was performed to visually display the varying effects of psychological mediator on PWB and depressive symptoms at different levels of intergenerational relationships.

The behavioural pathway that links age-friendliness to PWB and depressive symptoms was examined in Chapter 8. Multiple linear models with maximum likelihood estimation were first established among age-friendliness, activity engagement, and outcome variables to examine the mediating effects. Subsequently, the interaction terms of "age-friendliness × urbanisation degree" were added to direct paths, and "activity engagement × urbanisation degree" was added to indirect path in the model, to test whether the direct and indirect associations vary depending on different degrees of urbanisation. Bootstrapping with 5,000 replications was applied to calculate the indirect, direct, and total effects with 95% confidence intervals (MacKinnon et al., 2004).

Chapter 5 Scale Validation of AFEs in Urban Communities in China

5.1 Brief Introduction

Adopting and validating a tool for measuring AFEs tailored to local contexts is the prerequisite step to investigating the relationships between environments and older adults. The instrument from WHO's framework (WHO, 2007), or adapted instrument to assess age-friendliness, covers a multidimensional aspect of older adults' living environments, which has been widely used in current empirical studies in Hong Kong, South Korea, and the United States (Au et al., 2020; Choi, 2020; Kim, 2019). However, to date, the scale of validation of AFEs that systematically captures eight domains under WHO's framework has never been applied in mainland China. Therefore, verifying a valid and reliable AFEs scale in the Chinese context is necessary.

Based on the age-friendly framework of WHO, this chapter employed EFA and CFA to validate the AFEs scale in the Chinese context. Internal consistency, known groups validity, and convergent validity were analysed. After identifying psychometric properties, a more precise AFEs scale with 38 items was generated to accurately measure eight domains in urban communities in China. This AFEs scale is more suitable for Chinese ageing adults' perceptions of local built, social, and service environments, which could be applied in comparing the ratings of various age-friendliness domains.

5.2 Procedures of Data Analysis

Data analyses were conducted using STATA 16 (StataCorp, 2019). Figure 5.1 presented the flowchart of scale validation where three-step procedures were involved. Firstly, an initial CFA with maximum likelihood estimation was performed in the total sample (N = 506) to inspect whether the observed variables fit the eight-domain construct. The following statistical criteria were referred to identify the model fit: relative chi-square value (CMIN/df) < 3 (Hair et al., 2010), comparative fit index (CFI), and the Tucker-Lewis index (TLI) >.90 for an acceptable fit (Hu & Bentler, 1999), root-mean-square error of approximation (RMSEA) <.08, and standardised root-mean-square residual

(SRMR) <.08 (Browne & Cudeck, 1993; Hopper et al., 2008).

Secondly, if the indexes of the initial CFA indicated a poor model fit, the EFA would be employed to specify the potential underlying construct. The purpose of the CFA was to check whether items covary in line with the predetermined eight domains and to reduce the number of items with lower factor loadings (Brown, 2015). At this stage, the whole sample was randomly distributed into two groups to conduct the EFA and subsequent CFA, respectively. DeVellis and Thorpe (2021) suggested that a sufficient sample size for the EFA should be no less than 300, or 5 – 10 times the number of items. For the CFA, the minimum sample size is required to be 5 times the amounts of selected items. Therefore, among the whole sample size of 506, a random sample of 316 was used for the EFA, and 190 samples for the CFA.

Thirdly, after the items of factor structure were identified, internal consistency was then tested by using the Cronbach's alpha, with the value of 0.7 for a reliable level (Peterson, 1994). This thesis further used known groups validity to examine whether the perceived score of the overall and sub-scale was significantly different between known groups (Boateng et al., 2018). In addition, convergent validity was tested to confirm that the scale of AFEs is consistently related to other theoretically or empirically suggested variables (Reichardt & Coleman, 1995). For instance, past studies have documented that a higher level of age-friendliness is positively correlated with psychosocial well-being, but negatively correlated with depressive symptoms of community dwellers (Gibney et al., 2020; Lei & Feng, 2021).

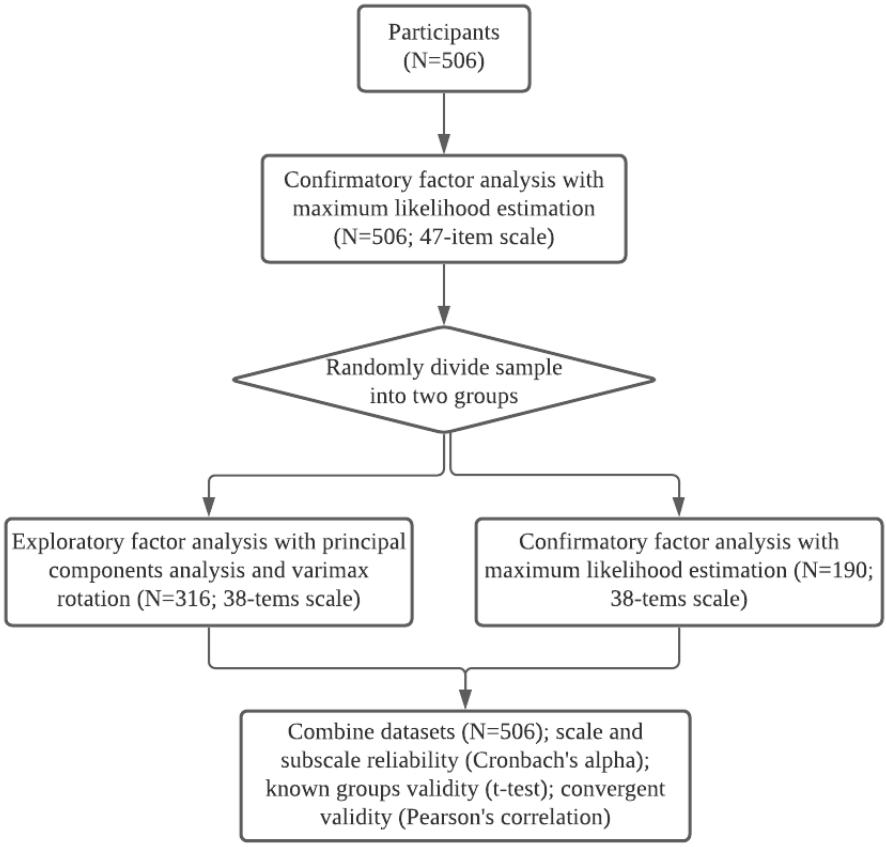

Figure 5.1 *Flowchart of analysis plan for scale validation*

5.3 Results of Scale Validation of AFEs

5.3.1 Initial Confirmatory Factor Analysis

This research used an initial CFA to probe whether the observed data sufficiently fit the eight-domain framework. Results of the initial CFA based on the total sample showed a poor model fit (χ^2 =3302.78, df = 1006, p <.001, CMIN/df > 3, CFI =.854, TFI =.841, and RMSEA =.068, SRMR =.073). Hence, EFA was followed to further adjust the allocation of items or factor structure. Then the whole sample was randomly separated into 316 and 190 for the EFA and CFA, respectively.

Table 5.1 showed the individual information of the participants in different sample groups. The average age among the 506 participants was 65.14 (SD = 7.51). 58.50% of the respondents were female (n = 296), and 87.35% of the respondents were married (n = 442). Most participants owned registered household in Shanghai (n = 385, 76.09%). For education attainment, 35.77% of participants (n = 181) graduated from high school

or vocational school, followed by middle school (*n* = 180, 35.57%), college or higher (*n* = 83, 16.40%), and primary school (*n* = 62, 12.25%). Nearly half of the respondents deemed their monthly income belonging to the low category (*n* = 259, 45.22%), and 28.44% (*n* = 128) and 26.34% (*n* = 119) participants' income resided in the middle and high groups respectively. More than half of the participants (*n* = 295, 58.42%) worked as clerks, followed by professionals (*n* = 134, 26.53%) and farmers or self-employed (*n* = 77, 15.22%). A total of 84.78% of respondents (*n* = 429) have retired. A total of 71.15% of participants (*n* = 360) have less than 2 children. The mean value of the full sample's self-rated health was 3.65 in this thesis.

Table 5.1 *Characteristics of participants in different sample groups*

Characteristics	**Total (*N* = 506)**	**EFA (*n* = 316)**	**CFA (*n* = 190)**
	M (SD) or N (%)	M (SD) or n (%)	M (SD) or n (%)
Age (50-88)	65.14 (7.51)	65.02 (7.20)	65.33 (8.03)
Female	296 (58.50%)	187 (59.18%)	109 (57.37%)
Married	442 (87.35%)	278 (87.97%)	164 (86.32%)
Registered household in Shanghai	385 (76.09%)	239 (75.63%)	146 (76.84%)
Education			
Primary school	62 (12.25%)	32 (10.13%)	30 (15.79%)
Middle school	180 (35.57%)	108 (34.38%)	72 (37.89%)
High school or vocational school	181 (35.77%)	119 (37.66%)	62 (32.63%)
College or higher	83 (16.40%)	57 (18.04%)	26 (13.68%)
Monthly income			
Low	259 (45.22%)	154 (48.73%)	105 (55.26%)
Middle	128 (28.44%)	81 (25.63%)	47 (24.74%)
High	119 (26.34%)	81 (25.63%)	38 (20.00%)
Occupation			
Professionals	134 (26.53%)	93 (29.52%)	41 (21.58%)
Clerk	295 (58.42%)	181 (57.46%)	114 (60.00%)
Farmers or self-employed	77 (15.22%)	42 (13.29%)	35 (18.42%)
Retired	429 (84.78%)	269 (85.13%)	160 (84.21%)
Number of Children			
0 - 1	360 (71.15%)	233 (73.73%)	127 (66.84%)
>= 2	146 (28.85%)	83 (26.27%)	63 (33.16%)
Health status (1-5)	3.65 (0.71)	3.66 (0.72)	3.64 (0.71)

Note. M = Mean; SD = Standard Deviation.

5.3.2 Exploratory Factor Analysis

The first round of EFA of the original 47 items was conducted. The Kaiser-Meyer-Olkin

Measure (KMO) was 0.923, implying the sample adequacy of each variable was sufficient to perform the EFA. Bartlett's Test of Sphericity (BTS) indicated the observed correlations of variables reached a significant level ($p < 0.001$) (Pett et al., 2003). Eight factors with an eigenvalue larger than 1 emerged, explaining a 65.75% variance overall. Three items (B16 "sufficient toilets nearby community", B17 "streetlight in the community", B51 "provide tailored services and products for older adults") of the original scale with communality lower than 0.5 were removed (Hair, 2019). Additionally, there were three cross-loadings (B26 "public transport is clean and uncrowded", B52 "organise community programmes to promote social inclusion", B73 "usage of smart products"). To distinguish factors more precisely and represent different domains under the concept of AFEs, the researcher adopted loadings stronger than 0.5 as a threshold because Costello and Osborne (2005) suggested that loading larger than 0.5 was desirable and indicated a solid factor. In this way, according to the threshold of 0.5, besides the items with cross-loadings, three additional items (B28 "safety of public transportation", B61 "vote in neighbourhood committee", B62 "self-governance in the community") were also dropped.

After deleting the 9 items as mentioned above, the remaining 38 items were retained to perform the second round of EFA. The value of KMO (0.914) and significant BTS ($p < 0.001$) indicated it is appropriate to conduct the EFA. As shown in Table 5.2, eight components with an eigenvalue larger than 1 were retained (Hayton et al., 2011), accounting for a total variance of 70.51%. The communality ranged from 0.547 to 0.827, indicating that variables have sufficient explanation (Hair, 2019). All rotated factor loadings were over 0.5. Factor 1 measured community support and health services (seven items; 13.01% explained). Factor 2 measured public transportation (five items; 11.79% variance explained). Factor 3 measured social participation (five items; 10.90% variance explained). Factor 4 measured outdoor spaces (six items; 9.47% variance explained). Factor 5 measured housing (five items; 8.18% variance explained). Factor 6 measured communication and information (four items; 6.58% variance explained). Factor 7 assessed social respect (three items; 5.64% variance explained). Factor 8

assessed employment (two items; 4.94% variance explained).

Table 5.2 *Rotated factor loadings of EFA (n = 316)*

Item	Communality	Component from Structure Matrix							
		F1	F2	F3	F4	F5	F6	F7	F8
B11	.654	.192	.264	.133	**.677**	.180	.032	.036	.187
B12	.653	.114	.197	.153	**.735**	.177	.006	.020	.082
B13	.629	.040	.214	.116	**.739**	.061	.038	.095	-.086
B14	.574	.084	.039	.008	**.654**	.199	.174	.232	-.117
B15	.621	.184	.053	.145	**.689**	.254	.102	-.066	.099
B16	.600	.143	.011	.172	**.607**	.060	.166	.280	-.269
B21	.773	.193	**.828**	.059	.166	.089	.080	.038	.054
B22	.681	.164	**.751**	.086	.119	.255	.040	.026	.035
B23	.789	.125	**.834**	.145	.178	.147	.012	.055	.023
B24	.787	.128	**.840**	.113	.144	.115	.084	.090	-.019
B25	.734	.185	**.805**	.066	.099	.125	.070	.069	-.109
B27	.612	.286	**.601**	.039	.008	.024	.266	.239	-.196
B31	.598	.013	.233	.340	.125	**.612**	-.175	.075	.037
B32	.709	.102	.136	.215	.308	**.730**	.048	.071	-.017
B33	.654	.151	.046	.279	.316	**.595**	.024	.241	-.197
B34	.755	.274	.208	.131	.190	**.729**	.209	.088	-.012
B35	.793	.202	.295	.162	.177	**.760**	.150	.088	-.012
B41	.688	.262	.129	**.709**	.162	.229	.136	.044	.039
B42	.827	.226	.121	**.814**	.127	.235	.139	.059	.069
B43	.766	.201	.140	**.796**	.168	.149	.135	.059	.013
B44	.818	.154	.089	**.825**	.102	.161	.154	.193	.094
B45	.764	.121	.025	**.815**	.119	.108	.033	.220	.097
B53	.644	.137	.144	.175	.171	.155	.004	**.710**	.130
B54	.633	.295	.083	.146	.033	-.022	.198	**.663**	.196
B55	.770	.101	.138	.173	.188	.212	.047	**.788**	.092
B63	.787	.168	-.023	.102	-.057	-.087	.247	.111	**.815**
B64	.784	.056	-.113	.133	-.003	-.015	.098	.227	**.831**
B71	.634	.266	.236	.334	.153	.104	**.538**	.018	.268
B72	.547	.090	.111	.282	.242	.198	**.530**	.129	.228
B74	.754	.258	.086	.168	.128	.048	**.789**	.071	.073
B75	.793	.354	.123	.046	.055	.003	**.795**	.075	.102
B81	.742	**.749**	.253	.080	.214	.165	.089	.139	.103
B82	.744	**.784**	.178	.155	.146	.188	.019	.097	.086
B83	.684	**.748**	.214	.220	.016	.044	.133	.097	.016
B84	.736	**.724**	.085	.255	.202	-.009	.289	.110	-.065
B85	.769	**.794**	.065	.245	.087	.008	.257	.020	-.017
B86	.656	**.689**	.260	.007	.094	.178	.200	.174	.059
B87	.645	**.700**	.158	.162	.117	.218	.091	.088	.164
Eigenvalue		12.899	3.343	2.942	2.001	1.751	1.460	1.270	1.128

% of Variance	13.01	11.79	10.90	9.47	8.18	6.58	5.64	4.94
Cumulative %	13.01	24.80	35.70	45.19	53.35	59.93	65.58	70.51

Note. F1: Community support and health services; F2: Public transportation; F3: Social participation; F4: Outdoor spaces; F5: Housing; F6: Communication and information; F7: Social respect; F8: Employment; Loadings higher than 0.5 were retained.

5.3.3 Confirmatory Factor Analysis

This thesis further used CFA to identify the structural validity with the sample of 190. In the CFA results, the model fit indices were acceptable (χ^2 =1072.70, df = 634, p <.001, CMIN/df < 3, CFI =.910, TFI =.901, and RMSEA =.061, SRMR =.066). Modification index suggested correlated errors between B84 and B83 within the factor of community-based support and services, B74 and B75 within the factor of communication and information, and B31 and B32 within the factor of housing (Collier, 2020). The covariance was added in these error terms because both paired items reflected community support, information provision adapting to ageing, and older adults' living environments, respectively. As shown in Figure 5.2, factor loadings of all the items exceeded 0.6, and all the factors of age-friendliness were significantly correlated with each other (except employment).

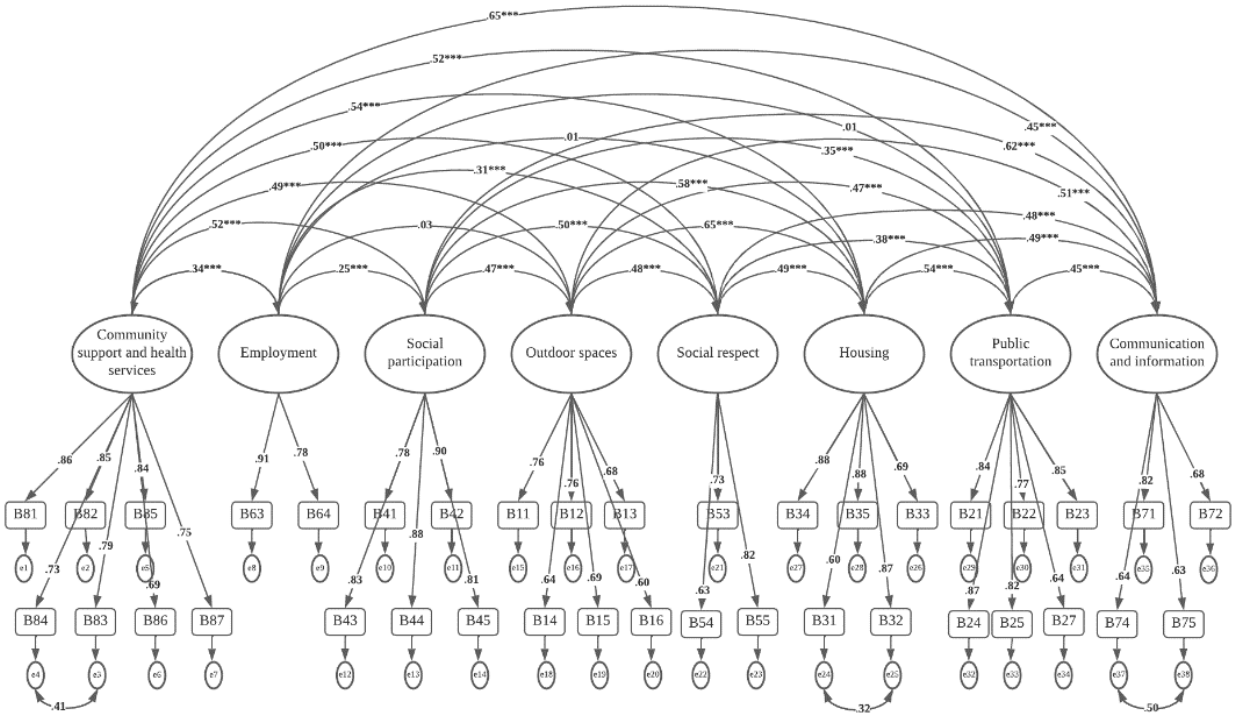

Figure 5.2 *Model of Confirmatory Factor Analysis (n = 190)*

Note. ***p < 0.001.

5.3.4 Scale Reliability, Known Groups Validity and Convergent Validity

As presented in Table 5.3, the Cronbach's alpha of overall AFEs was 0.815, and the sub-scale's Cronbach's alpha scoped from 0.789 to 0.921, indicating the reliability of the overall AFEs scale as well as each age-friendliness was good (Hair et al., 2010). Specifically, the corrected item-total correlation varied from 0.480 to 0.852, which expressed a high association or coherence between an item and the other items (Zijlmans et al., 2019). The mean score of the total AFEs was 29.257. For subscales, public transportation received the highest rating (M = 4.402), followed by community support and health services (M = 3.772), while older residents in Shanghai were mostly unsatisfied with employment (M = 2.751). The degree of urbanisation was used to test the known groups validity. It showed that the scores of public transportation (t = -2.059, $p < 0.05$) and employment (t = -4.168, $p < 0.001$) were significantly higher in areas with higher urbanisation degrees. This is consistent with the central place theory, where transportation and industry are aggregated in higher urbanised areas (King, 1985). By contrast, the levels of outdoor spaces (t = 6.491, $p < 0.001$), housing (t = 5.215, $p < 0.001$), social participation (t = 3.322, $p < 0.01$), and social respect (t = 2.195, $p < 0.05$) were significantly lower in higher urbanised areas.

Table 5.3 *Scale reliability and Known groups validity (N = 506)*

Variables	Cronbach's α	M (SD)	t-test by degree of urbanisation
Outdoor spaces	0.849	3.679 (.649)	6.491***
Public transportation	0.918	4.402 (.575)	-2.059*
Housing	0.911	3.759 (.675)	5.215***
Social participation	0.921	3.512 (.727)	3.322**
Social respect	0.789	3.756 (.570)	2.195*
Communication and information	0.812	3.636 (.565)	1.089
Community support and health services	0.918	3.772 (.714)	0.339
Employment	0.698	2.751 (.764)	-4.168***
Overall AFEs (range [8, 40])	0.815	29.257 (3.478)	2.211*

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. M = Mean; SD = Standard Deviation. The value of 0.698 for employment denotes the correlation between two items of employment.

Convergent validity was tested by correlational analyses of AFEs and age-friendliness with its theoretically and empirically related variables, including PWB and depressive

symptoms. The results in Table 5.4 indicated that overall AFEs was in positive correlation with PWB (r = 0.529) but negative correlation with depressive symptoms (r = -0.419). In addition, all the sub-domains of AFEs showed significantly positive correlations with PWB and negative correlations with depressive symptoms, respectively. Thus, the convergent validity of the AFEs scale has been verified.

Table 5.4 *Convergent validity (N = 506)*

Variables	1	2	3	4	5	6	7	8	9
1. Outdoor spaces									
2. Public transportation	.375***								
3. Housing	.563***	.459***							
4. Social participation	.437***	.297***	.506***						
5. Respect and social inclusion	.378***	.308***	.420***	.442***					
6. Communication and information	.367***	.344***	.360***	.510***	.470***				
7. Community support and health services	.395***	.448***	.451***	.520***	.425***	.593***			
8. Employment	.034	-.028	.061	.227***	.270***	.371***	.245***		
9. Overall AFEs	.659***	.578***	.714***	.750***	.682***	.744***	.769***	.435***	
10. PWB	.433***	.365***	.454***	.335***	.358***	.325***	.342***	.218***	.529***
11. Depressive symptoms	-.317***	-.232***	-.382***	-.275***	-.348***	-.314***	-.359***	-.040***	-.419***

Note. *** p< 0.001.

5.4 Discussion

A valid and contextually appropriate instrument tool is vital to investigate age-friendliness in association with PWB among older community dwellers. As far as we know, this is the first AFEs scale covering eight age-friendliness of WHO's framework formally measured in mainland China. Scale validation was conducted among older residents in Shanghai to address a comprehensive and reliable measurement of AFEs in the Chinese context. The final AFEs scale consisting of eight factors with an

abbreviated 38 items has been proposed in this study. Based on the composition of each factor, the average score of each age-friendliness domain was also generated, providing a general descriptive portrait of perceived AFEs in Shanghai.

5.4.1 The Scale of AFEs in Chinese Context

The validated scale of AFEs in mainland China suggested that the composed items in two age-friendly domains were subtly different from the original framework of WHO. Firstly, the initial factor of "respect and social inclusion" turned to "social respect" in this study as two items, "provide tailored services and products for older adults" and "organise community programmes to promote social inclusion," were dropped due to lower commonality and cross-loading. Thus, the rest of the items related to social respect (e.g., being respected, polite attitudes from younger generations, positive public image of older adults) remained. This result indicated that from older adults' perspective in Shanghai, social inclusion was highly equivalent to another age-friendliness domain, social participation, since both factors involved various community programmes/activities. Engaging in social activities was believed to increase social inclusion for older community dwellers. As such, items related to social inclusion and social participation could be functionally interchangeable. Therefore, the domain of social respect remained in the Chinese context. This result reflected that Chinese older people desired to be respected and recognised, and to establish positive images in society.

Secondly, the factor of "civic participation and employment" evolved to "employment." In the process of EFA, two items, "self-governance in the community" and "vote in neighbourhood committee," were removed due to lower factor loadings. The transformed factor is thus more applicable in the Chinese context. In mainland China, the terminology "civic participation" was normally used in the field of political science and public administration, referring to civic influences on political or public governance (Wei, 2005). Even more recently, the notion of community development refers to civic engagement as the process that empowers dwellers to contribute to community building (Chen & Adamek, 2017); older citizens have not engaged deeply

and widely in civic participation. Holding a vague awareness of the conception of civic participation, older adults may have fewer perceptions and experiences of participating in civic activities. Therefore, items related to the domain of elderly civic participation may not be appropriately applied in Chinese communities at current stage. Notably, the factor of employment remained within the scale of AFEs. Although the domain of employment only consisted of two items, the information to reflect an age-friendly employment is sufficient, including provision of flexible jobs, training and learning, and reliable information for re-employment. In this way, the validated scale of AFEs with abbreviated items is more precise and pertinent to be applied in the Chinese context.

5.4.2 Perceived Level of Age-Friendliness in Shanghai

The subjective perceptions of the established scale of AFEs provided a depiction of multiple aspects of Shanghai's physical and social environments. Overall, the results showed that scores of built environments (e.g., outdoor spaces, public transportation, housing) performed better than social and service environments (e.g., social participation, social respect, community-based services, communication and information, employment). Specifically, community-dwelling older adults in Shanghai were most satisfied with public transportation (M = 4.402). This result was basically consistent with a previous survey, documenting passengers thought highly of the accessibility and service quality of public transportation, especially rails and buses, in Shanghai (The Central People's Government of the People's Republic of China, 2012). On the contrary, environments of social participation (M = 3.512) and employment (M = 2.751) received lower ratings. Impeded by limited community-based services or facilities, past study found that merely a small proportion of older dwellers in Shanghai have opportunity to engaged in formal social activities (Tong et al., 2019). With respect to employment, as the current retirement policy legislated a mandatory retirement age for employees without supporting schemes, such as occupational training or flexible job opportunities, older retirees may find the workplace to be unfriendly for mature workers.

In addition, Shanghai is a megacity with uneven urbanisation degrees in different districts, which was reflected in the level of age-friendliness. The score of the total AFEs indicated a significant difference in comprehensive environments between the city's central areas and the suburbs with a lower urbanisation level ($t = 2.211$, $p < 0.05$). Central areas received significantly higher ratings regarding public transportation and employment. The disparity in public transportation echoed previous research (Lucas et al., 2018), revealing that residents who live in central places have greater access to public transport than those living in peripheral places in the same city. Additionally, central locations with higher urbanisation degrees normally have more open job opportunities applicable for various groups of workers due to aggregated industry (King, 1985). Conversely, the scores of outdoor spaces, housing, social participation, and social respect were significantly lower in central districts than suburban areas. It is understandable that rapid urban expansion threats more green spaces and ecosystem of outdoor environments in central places (Puplampu & Boafo, 2021). For housing conditions, due to the living segregation caused by urbanising process, there remained more old, poor, and small houses in central districts in Shanghai, especially in old communities. Moreover, according to the modernization theory (Cowgill, 1986; Zhang et al., 2021), ageism may increase with modernisation process. Hence, the perceived ratings for social respect and participation were lower in central places where were characterised with higher modernity in Shanghai.

Based on the framework of WHO in previous studies, it is possible to conduct an external comparison of age-friendliness in Shanghai with other cities. Compared with the other two Asian cities characterised by a high level of ageing, older adults' subjective ratings of age-friendliness, especially social environments, in Shanghai performed better than Seoul but worse than Hong Kong. For example, the average score of social participation was 4.57 in Hong Kong (Au et al., 2020), substantially higher than 3.51 in Shanghai and 3.16 in Seoul (Park & Lee, 2017). Likewise, the average community support and health services score was 3.89 in Hong Kong, compared to 3.77 in Shanghai and 3.42 in Seoul.

Chapter 6 AFEs in Association with PWB and Mental Health among Community-Dwelling Older Adults

6.1 Brief Introduction

Encompassing eight domains of age-friendliness, the AFEs scale provided a general outline pertaining to physical and social environments. Despite the comprehensive composition, however, the extent to which that overall AFEs and the sub-domains are associated with late-life PWB and depressive symptoms has not been precisely probed in urban China. Therefore, using the validated scale of AFEs in the Chinese context, the study in this chapter investigated the overall AFEs and eight age-friendliness domains in relation to PWB and depressive symptoms among older community dwellers in Shanghai. Specifically, hypotheses 1.1 to 1.3 were examined in this chapter.

The study found that the associations between overall AFEs and older people's PWB and depressive symptoms were significant. Stratified by health status, results showed that the influence of overall AFEs was greater on promoting PWB among people with good health. Concerning the specific age-friendliness, among the full sample, higher-rated outdoor spaces, housing, social respect, and employment were significantly related to better PWB. For the outcome of depressive symptoms, significant age-friendliness included outdoor spaces, housing, and community-based services.

6.2 Methods

6.2.1 Measurements

AFEs. The instrument of AFEs used the validated scale in Chapter 5, covering eight domains with 38 items. The participants were given a five-point Likert scale varying from 1 ("strongly disagree") to 5 ("strongly agree") to evaluate each description. Ratings for each age-friendliness domain have been averaged to yield a mean value to reflect the perceived age-friendly level, with a higher value indicating better age-friendliness. The scale reliability of AFEs was well established as the Cronbach's alpha of the total AFEs was 0.815. The Cronbach's alpha of the sub-scale of AFEs spanned

from 0.789 to 0.921.

PWB. This thesis used a 42-item scale to holistically measure the PWB of older people (Ryff et al., 2007). The scale consisted of six dimensions: autonomy, environmental mastery, personal growth, positive relations, purpose in life, and self-acceptance. The total score of overall PWB ranged from 6 to 42. Cronbach's alpha for the sub-dimensions varied from 0.662 to 0.720, and 0.864 for the overall PWB scale.

Mental health. The CES-D (Radloff, 1977) scale with 10 items was adopted to assess the depressive symptoms of older people. This scale was originally developed for older people (Irwin et al., 1999), and good psychometric attributes have been verified in both healthy and psychiatric samples (Boey, 1999). The scope of the total score is between 0 to 30, and a higher score indicates increased symptom severity. The CES-D was normally used as a screening tool to identify the risk of suffering depression among older groups. Therefore, this study employed the threshold of 8 as a cut-off score to predict a higher severity or risk of depressive symptoms (Boey, 1999). Cronbach's alpha for the CES-D scale was 0.762 in this thesis.

Covariates. Personal characteristics consisted of demographic traits (e.g., age, gender, marital status) and socioeconomic information (e.g., registered household in Shanghai, education, occupation, monthly income, employment status). In addition, the health status of older adults was measured by SRH. Because SRH was a complex outcome of bio-psychosocial factors, it was also considered an independent indicator of mortality, morbidity, disability, and functional capability of older adults (Ocampo, 2010). In this study, according to the reported score of participants, health status was recoded as a dichotomous variable (1 = good health status; 0 = poor or fair health status) to indicate the competence of respondents.

6.2.2 Data analysis

To have an overall view of the characteristics of the sample, descriptive analysis was first provided. Bivariate analyses were employed to examine differences of individual basic information and well-being outcomes between older adults with good and poor health status. A pairwise correlation of key variables was conducted in Chapter 5 (Table

5.4) with significantly positive correlations between overall AFEs and its eight age-friendliness domains and PWB and a negative correlation with depressive symptoms. This provided a preliminary statistical basis for the subsequent analysis.

Multivariate analyses were conducted where PWB and depressive symptoms were treated as outcome variables, and overall AFEs and the eight age-friendliness domains were independent variables. Individual demographic and socioeconomic variables were used as covariates. Analyses for PWB employed multiple linear regression. Considering the structured construction but independent meaning of the six domains of PWB, this study also separately examined age-friendliness in association with the six sub-domains of PWB. Robust standard errors were adopted to modify heteroscedasticity (Long & Ervin, 2000). No evidence of multicollinearity was observed since the values of the variance inflation factor (VIF) for all variables were between 1.11 to 3.42 (Alin, 2010). For depressive symptoms, the cut-off point has categorised the severity of depressive symptoms as dichotomous variable (i.e., minimal or mild depressive symptoms, moderate depressive symptoms). Logistic regression analysis was applied for the outcome variable of depressive symptoms. In addition, as suggested by the competence-press model (Lawton & Nehamow, 1973), the influences of AFEs may vary due to uneven levels of individual capability or ability. Thus, stratified models by health status were estimated to distinguish the influential power of AFEs on the well-being of people with different health statuses. All statistical analyses were conducted in STATA 16 (StataCorp, 2019).

6.3 Results

6.3.1 Descriptive analysis

The individual characteristics of participants and bivariate analysis by two distinct health statuses are presented in Table 6.1. Besides the demographic information and socioeconomic status (which have been demonstrated in Chapter 5), the average score of overall PWB was 28.98 (SD = 4.05), indicating a good well-being status among older community dwellers in Shanghai. Specifically, among the six domains, positive relations received the highest score of 5.48 (SD = 0.70), while the score of 4.35 (SD =

1.08) for purpose of life was the lowest. The average score of depressive symptoms was 4.46 (SD = 4.14), among which 81.23% of older adults (n = 411) had minimal or mild depressive symptoms, and 18.77% of older participants (n = 95) suffered moderate depressive symptoms. Regarding self-rated health, 60.28% of participants (n = 305) reported good health status, and 39.72% (n = 201) reported poor or fair health status. Bivariate analyses showed that marital status (χ^2 = 10.01, p <.01), owning registered household in Shanghai (χ^2 = 16.49, p <.001), monthly income (χ^2 = 7.06, p <.05), overall PWB (t = -6.03, p <.001), and depressive symptoms (t = 5.31, p <.001) are significantly different across different health statuses.

Table 6.1 *Descriptive analysis (N = 506)*

Individual Characteristics	**Total (*N* = 506)**	***t*-test/χ^2**
	M (SD) or N (%)	**by health status**
Age (50-88)	65.14 (7.51)	t = 1.37
Female	296 (58.50%)	χ^2 (1) = 0.66
Married	442 (87.35%)	χ^2 (1) = 10.01**
Registered household in Shanghai	385 (76.09%)	χ^2 (1) = 16.49***
Education		χ^2 (3) = 6.13
Primary school	62 (12.25%)	
Middle school	180 (35.57%)	
High school or vocational school	181 (35.77%)	
College or higher	83 (16.40%)	
Monthly income		χ^2 (2) = 7.06*
Low	259 (45.22%)	
Middle	128 (28.44%)	
High	119 (26.34%)	
Occupation		χ^2 (2) = 1.27
Professionals	134 (26.53%)	
Clerk	295 (58.42%)	
Farmers or self-employed	76 (15.05%)	
Retired	429 (84.78%)	χ^2 (1) = 2.78
Self-rated health		
Good	305 (60.28%)	
Poor or fair	201 (39.72%)	
Psychological well-being [6, 42]	28.98 (4.05)	t = -6.03***
Autonomy	4.60 (0.84)	
Environmental mastery	5.03 (0.80)	
Personal growth	4.63 (0.92)	
Positive relations	5.48 (0.70)	
Purpose in life	4.35 (1.08)	

Self-acceptance	4.89 (0.84)	
Depressive symptoms [0, 30]	4.464 (4.14)	t = 5.31***
Mild depressive symptoms (< 8)	411 (81.23%)	
Severe depressive symptoms (>= 8)	95 (18.77%)	

Note. M = Mean; SD = Standard Deviation. *** p < .001, ** p < .01, * p < .05

6.3.2 Overall AFEs and Age-Friendliness in Association with PWB

As shown in Figure 6.1, holding covariates constant, the relationships between overall AFEs and PWB was significant and positive among the full sample (β =.437, SE =.044, p <.001), older people with good health (β =.494, SE =.056, p <.001), and older people with poor or fair (β =.371, SE =.073, p <.001). It indicated that the influence of overall AFEs on PWB was larger among people with good health status instead of poor or fair health status.

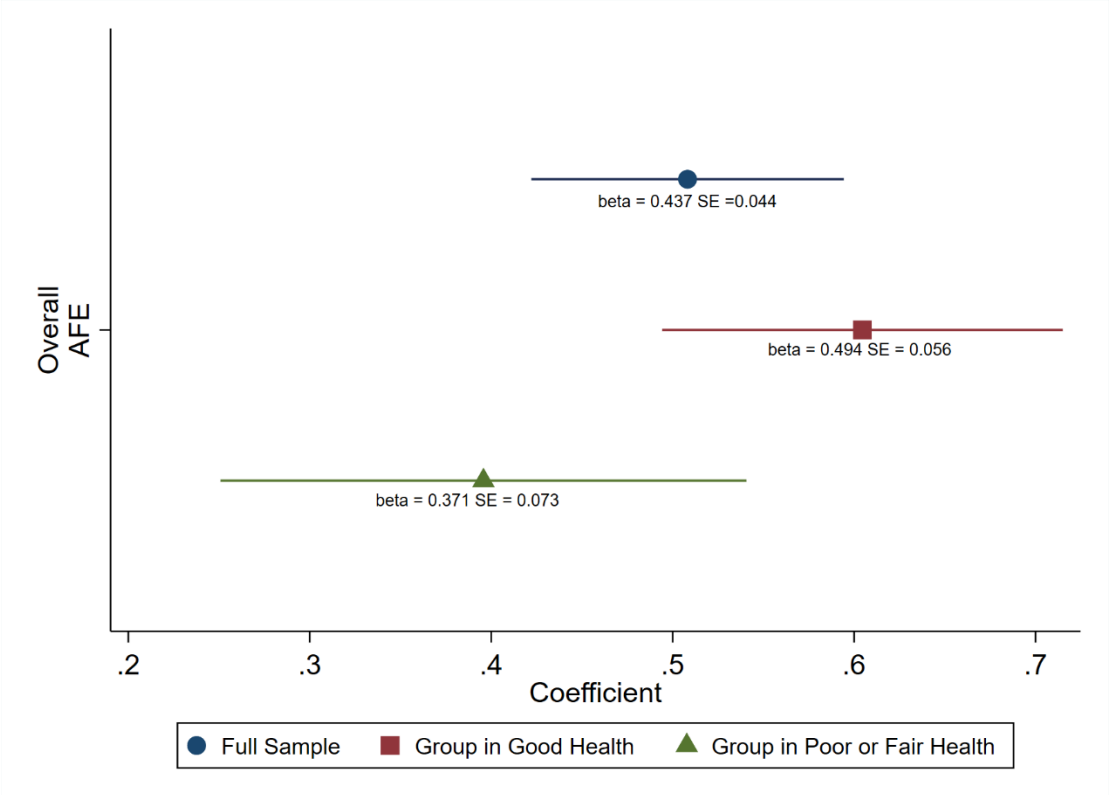

Figure 6.1 *Coefficient of overall AFEs in association with older people's PWB*

Note. Beta = standardised coefficient; SE = robust standard error; Covariates including age, gender, marital status, household registration in Shanghai, education, monthly income, occupation, employment status, and health status have been controlled among the full sample.

The results for the relationship of multiple age-friendliness and PWB are displayed in Table 6.2. Among the whole sample, holding demographic and socio-economic traits

as constant, higher age-friendly level of outdoor spaces (β =.199, *SE* =.334, p <.001), housing (β =.183, *SE* =.310, p <.001), social respect (β =.096, *SE* =.328, p <.05), and employment (β =.149, *SE* =.214, p <.001) were significantly related to better PWB. For participants with good health, it was found that outdoor spaces (β =.227, *SE* =.384, p <.001), public transportation (β =.152, *SE* =.426, p <.05), housing (β =.185, *SE* =.373, p <.01), and employment (β =.124, *SE* =.254, p <.05) were significant predictors of better PWB. However, for older people reported poor or fair health, only outdoor spaces (β =.147, *SE* =.496, p <.05) and housing (β =.197, *SE* =.556, p <.05) significantly related to PWB. In terms of individual characteristics, education and occupation were also significantly associated with older people's PWB.

Table 6.2 M*ultiple linear regression models of age-friendliness and PWB among older adults in Shanghai (N = 506)*

Independent variables	**Full sample** ***N* = 506**		**Good health** ***n* = 305**		**Poor or fair health** ***n* = 201**	
	β	*SE*	*β*	*SE*	*β*	*SE*
Age-friendliness						
Outdoor spaces	**.199*** **	.334	**.227*** **	.384	**.147***	.496
Public transportation	.090	.332	**.152***	.426	-.001	.568
Housing	**.183*** **	.310	**.185****	.373	**.197***	.556
Social participation	.010	.272	.072	.329	-.066	.474
Social respect	**.096***	.328	.052	.424	.167	.539
Information and communication	-.009	.356	-.025	.401	.050	.675
Community support and health services	-.016	.285	.023	.371	-.049	.466
Employment	**.149*** **	.214	**.124***	.254	.148	.410
Individual characteristics						
Age	.021	.022	.009	.026	.059	.038
Female	-.021	.296	-.042	.369	.037	.483
Married	.002	.484	-.029	.722	.012	.656
Registered household in Shanghai	.027	.420	-.001	.452	.008	.919
Education (ref. primary school)						
Middle school	.038	.559	.118	.737	-.040	.903
High/vocational school	.107	.579	.182	.776	.028	.918
College/university	.171*	.704	.221*	.899	.118	1.344
Occupation (ref. professionals)						
Clerk	-.115*	.401	-.139*	.469	-.096	.852
Farmers or self-employed	-.180**	.606	-.249***	.703	.082	1.187

Table 6.2 *Continued*

Independent variables	Full sample N = 506		Good health *n* = 305		Poor or fair health *n* = 201	
	β	*SE*	*β*	*SE*	*β*	*SE*
Monthly income (ref. low)						
Middle	-.001	0.381	-.010	.454	.016	.675
High	-.041	0.406	-.044	.471	.006	.874
Retired	-.050	0.499	-.063	.643	-.015	.898
Good health status	**.145****	0.332				
Constant		2.014		2.526		3.236
R-squared	.404		.466		.272	
F	17.71***		17.16**		4.36***	

Note. β = standardised coefficient; *SE* = robust standard error; *** $p < .001$, ** $p < .01$, * $p < .05$

Table 6.3 presents the results of the association between age-friendliness and six domains of PWB. Higher evaluations of public transportation (β =.163, *SE* =.078, p <.01) and employment (β =.159, *SE* =.053, p <.01) were significantly related to better autonomy. Moreover, females (β = -.127, *SE* =.072, p <.01) were less likely to have greater autonomy than males. In terms of environmental mastery, outdoor spaces (β =.132, *SE* =.056, p <.01), housing (β =.186, *SE* =.064, p <.001), social respect (β =.103, *SE* =.063, p <.05), and employment (β =.110, *SE* =.044, p <.05) were significant age-friendliness. Additionally, age (β =.125, *SE* =.004, p <.05) and owning registered household in Shanghai (β =.110, *SE* =.083, p <.01) could increase the older adults' feeling of environmental mastery. For personal growth, outdoor spaces (β =.245, *SE* =.073, p <.001), housing (β =.129, *SE* =.078, p <.05), and employment (β =.152, *SE* =.051, p <.01) were significant predictors. Public transportation (β =.138, *SE* =.068, p <.001) and employment (β =.140, *SE* =.039, p <.001) were significant contributors of positive relations among older people. In addition, outdoor spaces (β =.240, *SE* =.090, p <.001), housing (β =.219, *SE* =.078, p <.001), and social respect (β =.124, *SE* =.083, p <.01) were positively associated with purpose in life. Surprisingly, community-based services (β =-.128, *SE* =.075, p <.01) negatively predicted older people's purpose in life. Older adults' self-acceptance was positively contributed by outdoor spaces (β =.139, *SE* =.068, p <.01), housing (β =.264, *SE* =.073, p <.001), and community-based services (β =.108, *SE* =.063, p <.05). In addition, the results showed that older age was

associated with fewer purpose in life (β =.138, *SE* =.006, p <.01), but positively related to self-acceptance (β =.101, *SE* =.005, p <.05). Good health status was also positively associated with most domains of PWB (except autonomy and positive relations).

Table 6.3 M*ultiple linear regression models of age-friendliness and six domains of PWB among older adults in Shanghai (N = 506)*

Independent variables	**Autonomy**	**Environmental mastery**	**Personal growth**	**Positive relations**	**Purpose in life**	**Self-acceptance**
	β (SE)	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*
Age-friendliness						
Outdoor spaces	.043	**.132****	**.245*****	.086	**.240*****	**.139****
	(.072)	**(.056)**	**(.073)**	(.065)	**(.090)**	**(.068)**
Public transportation	**.163****	.110	-.006	**.138*****	.023	.014
	(.078)	(.068)	(.079)	**(.068)**	(.091)	(.079)
Housing	-.091	**.186*****	**.129***	.123	**.219*****	**.264*****
	(0.69)	**(.064)**	**(.078)**	(.057)	**(.078)**	**(.073)**
Social participation	.025	.036	-.009	-.031	.048	-.038
	(0.70)	(.053)	(.072)	(.048)	(.071)	(.062)
Social respect	-.094	**.103***	.095	.126	**.124****	.087
	(.080)	**(.063)**	(.082)	(.070)	**(.083)**	(.079)
Information and communication	.064	-.005	-.017	.011	-.020	-.068
	(.088)	(.070)	(.089)	(.067)	(.094)	(.079)
Community-based services	-.007	.015	-.019	-.006	**-.128****	**.108***
	(.064)	(.060)	(.071)	(.055)	**(.075)**	**(.063)**
Employment	**.159****	**.110***	**.152****	**.140*****	.084	.059
	(.053)	**(.044)**	**(.051)**	**(.039)**	(.056)	(.048)
Individual characteristics						
Age	.057	**.125***	-.061	.080	**-.138****	**.101***
	(.005)	**(.004)**	(.005)	(.004)	**(.006)**	**(.005)**
Female	**-.127****	-.025	-.039	.099	-.018	.035
	(.072)	(.061)	(.071)	(.009)	(.085)	(.066)
Married	-.042	.041	-.027	.102	-.045	.018
	(.119)	(.094)	(.108)	(.099)	(.136)	(.111)
Registered household in Shanghai	.031	**.110****	-.010	.017	-.004	-.003
	(.010)	**(.083)**	(.094)	(.075)	(.116)	(.092)
Education (ref. primary school)						
Middle school	-.018	-.015	.127	-.157	.148*	.015
	(.125)	(.110)	(.140)	(.106)	(.157)	(.122)
High/vocational school	-.009	.068	.179*	-.014	.177*	.047
	(.139)	(.114)	(.146)	(.109)	(.170)	(.127)
College/university	.112	.130*	.226**	-.012	.184*	.109
	(.171)	(.136)	(.178)	(.127)	(.195)	(.158)

Table 6.3 *Continued*

Independent variables	**Autonomy**	**Environmental mastery**	**Personal growth**	**Positive relations**	**Purpose in life**	**Self-acceptance**
	β (SE)	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*	*β (SE)*
Occupation (ref. professionals)						
Clerk	-.056	-.030	-.152**	-.051	-.147**	-.070
	(.101)	(.007)	(.096)	(.070)	(.104)	(.088)
Farmers or self-employed	-.121**	-.064	-.190**	-.201**	-.146**	-.120*
	(.132)	(.122)	(.142)	(.117)	(.150)	(.130)
Monthly income (ref. low)						
Middle	.061	-.018	.005	-.101*	-.022	.024
	(.093)	(.075)	(.090)	(.072)	(.104)	(.098)
High	.049	-.034	-.025	-.126**	-.096*	.041
	(.104)	(.084)	(.106)	(.080)	(.090)	(.096)
Retired	-.076	-.025	-.073	-.021	-.053	.025
	(.118)	(.100)	(.123)	(.101)	(.121)	(.120)
Good health status	.080	**.152*** **	**.127** **	.087	**.089* **	**.131** **
	(.081)	**(.064)**	**(.078)**	(.062)	**(.090)**	**(.072)**
R-squared	.177	.381	.349	.288	.363	.329
F	5.36***	15.59***	13.07***	7.02***	18.3***	12.82***

Note. β = standardised coefficient; *SE* = robust standard error; *** $p < .001$, ** $p < .01$, * $p < .05$

6.3.3 Overall AFEs and Age-Friendliness in Association with Depressive Symptoms

Figure 6.2 presents the coefficient of overall AFEs related to older people's depressive symptoms. It is shown that the associations between overall AFEs and depressive symptoms were significant and negative among the full sample (*OR* =.746, *SE* =.033, $p < .001$), older people with good health (*OR* =.719, *SE* =.052, $p < .001$), and older group with poor or fair health (*OR* =.751, *SE* =.046, $p < .001$). Overall, the influential magnitude of AFEs on older adults' depressive symptoms did not distinguish substantially in the two health statuses.

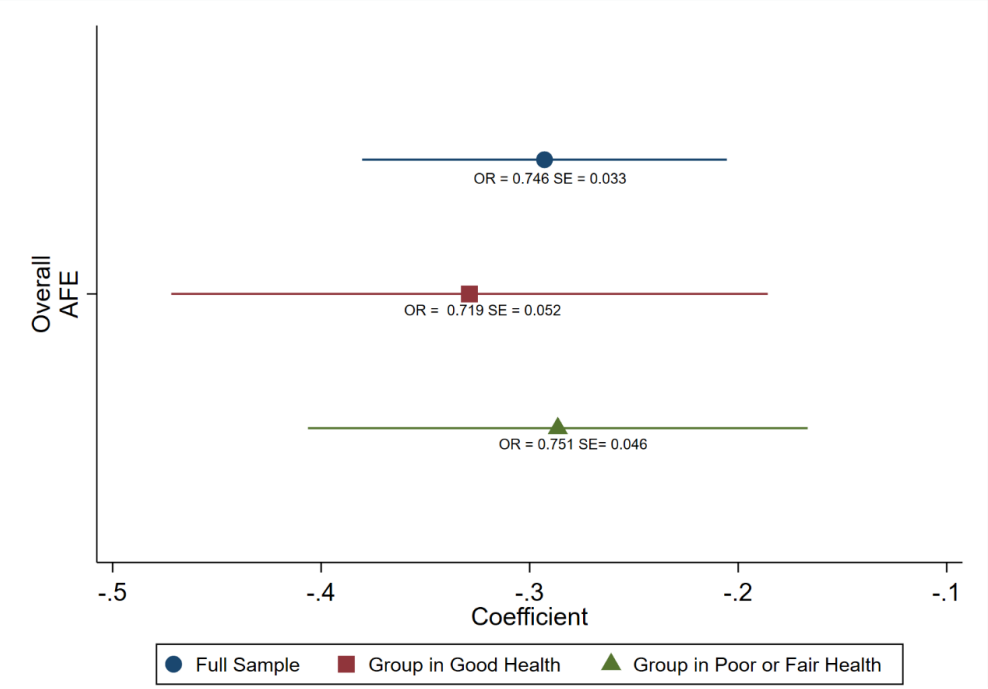

Figure 6.2 *Coefficient of overall AFEs in association with older people's depressive symptoms*

Note. OR = odds ratio; SE = standard error; Covariates including age, gender, marital status, household registration in Shanghai, education, monthly income, occupation, employment status, and SRH have been controlled in the full sample.

Table 6.4 presents the results that age-friendliness in association with depressive symptoms. Among the full sample, a unit increase of age-friendliness level in outdoor spaces (*OR* =.537, *SE* =.142, *p* <.05), housing (*OR* =.531, *SE* =.147, *p* <.05), and community support and health services (*OR* =.523, *SE* =.137, *p* <.05) was associated with a 46.3%, 46.9%, and 47.7% decline, respectively, in the odds of having severe depressive symptoms. Besides age-friendliness, being married (*OR* =.477, *SE* =.169, *p* <.05) and owning a registered household in Shanghai (*OR* =.475, *SE* =.168, *p* <.05) were also related to a 52.3% and 52.5% decline in the odds of high depressive risks. Among older people of good health status, it was shown that for a unit increase of built environments, including outdoor spaces (*OR* =.327, *SE* =.147, *p* <.05) and housing (*OR* =.405, *SE* =.167, *p* <.01), the odds of suffering severe depressive symptoms declined by 67.3% and 59.5%, respectively. Also, being married (*OR* =.186, *SE* =.157, *p* <.01) reduced the odds of experiencing severe mental disorders by 81.4%. For older adults with poor or fair health, social environments were more important in the association with mental disorders. It was found that one unit growth of satisfaction of information

and communication (*OR* =.359, *SE* =.173, *p* <.05) and community support and health services (*OR* =.384, *SE* =.145, *p* <.05) was associated with a 64.1% and 61.6% decrease in the odds of suffering severe depressive symptoms.

Table 6.4 *Logistic regression models of age-friendliness and depressive symptoms among older people in Shanghai (N = 506)*

Independent variables	**Full sample** ***N* = 506**		**Good health** ***n* = 305**		**Poor or fair health** ***n* = 201**	
	OR	*SE*	*OR*	*SE*	*OR*	*SE*
Age-friendliness						
Outdoor spaces	**.537***	.142	**.327***	.147	.745	.260
Public transportation	.972	.266	.633	.263	1.699	.727
Housing	**.531***	.147	**.405***	.167	.571	.237
Social participation	1.325	.339	.913	.369	1.589	.618
Social respect	.587	.166	.478	.229	.645	.254
Information and communication	.585	.197	1.078	.579	**.359***	.173
Community support and health services	**.523***	.137	.719	.340	**.384***	.145
Employment	1.414	.313	.709	.567	1.232	.422
Individual characteristics						
Age	1.020	.022	.987	.035	1.035	.033
Female	.776	.219	.957	.422	.506	.212
Married	.477*	.169	.186**	.111	.798	.388
Registered household in Shanghai	.475*	.168	.436	.226	.664	.391
Education (ref. primary school)						
Middle school	2.386	1.120	1.312	0.890	2.719	1.935
High/vocational school	4.186**	2.153	2.788	2.025	5.887	4.394
College/university	4.085*	2.637	2.763	2.404	6.749	7.231
Occupation (ref. professionals)						
Clerk	1.038	.415	0.767	.425	2.125	1.482
Farmers or self-employed	2.091	1.034	1.264	.868	5.299	4.506
Monthly income (ref. low)						
Middle	.493	.188	.296	.199	.549	.288
High	.688	.286	.518	.310	.747	.484
Retired	.860	.360	.709	.430	1.042	.682
Good health status	.649	.190				
Chi-squared	116.67***		71.39***		56.89***	

Note. OR = odds ratio; *** $p < .001$, ** $p < .01$, * $p < .05$

6.4 Discussion

This chapter examined the overall AFEs and the eight age-friendliness domains in association with older adults' PWB and mental disorders. Overall, AFEs was significantly related to both PWB and depressive symptoms. Certain age-friendliness domains were identified as significant contributors to improving PWB or preventing mental disorders. In addition, health status was used to stratify the model to specify the influential differences of AFEs on well-being between older people with good or poor health. Hence, the assumptions of the environmental competence-press model were revisited and discussed under different conditions. The results indicated that environments had more influence among people with good health status in improving PWB. However, for older people living with poor or fair health, AFEs, especially service environments, were more influential in preventing mental disorders (i.e., depressive symptoms). In addition, individual characteristics (e.g., age, gender, household in Shanghai) were also revealed to be associated with various dimensions of PWB among older people.

6.4.1 Individual Characteristics in Relation to PWB and Depressive Symptoms

Individual components, such as demographic attributes and SES, are undoubtedly linked with well-being outcomes of older community dwellers. In this chapter, higher SES, including higher education attainment and occupation levels, were related to better PWB or fewer depressive symptoms, which were consistent with previous findings (Back & Lee, 2010; Reyes et al., 2020). Intriguingly, in terms of demographic factors, it was found that an increase in age was positively related to environmental mastery and self-acceptance, but negatively associated with purpose in life. From a life-course perspective, psychological development may vary in different life stages. People in old age may grow to have more ability to manipulate or master their environments with a sense of control (Pearlin et al., 2007). Alternatively, because of a declined self-esteem at old age after 60 (Ogihara & Kusumi, 2020), older people may become more tolerant and accepting of themselves. However, the growth of age was associated with declined purpose in life. This outcome was supported by empirical evidence from a meta-

analysis (Pinquart, 2002), confirming that age-associated decline in purpose in life may become stronger later in life. It could be explained that due to narrowed social engagement and increased age stereotypes, older people are inclined to accept the losses of meaning in life rather than seeking novel sources of life purpose.

Moreover, it was found that females experienced less autonomy compared to males. This is consistent with previous findings, since, overall, women normally have lower social status than men (Jejeebhoy, 1995). Marriage may dissolve negative psychological functioning because being married was found to decrease the odds of having severe depressive symptoms. It is worth noting that owning a registered household in Shanghai was associated with older people's environmental mastery and decreased odds of serious depressive symptoms among the full sample. In China, holders of registered households are normally believed to have the advantage of obtaining better social benefits and social capital in a city, and are thus more likely to have better well-being (Song & Smith, 2019).

6.4.2 Age-Friendliness, PWB and Depressive Symptoms

The results in this chapter found that specific age-friendliness domains were significant predictors of the PWB and mental health of older community dwellers. These findings supported the basic assumption of the healthy ageing framework that individual well-being is dependent on a combination of individual and environmental factors (WHO, 2015). With respect to the built environments, both PWB and depressive symptoms were significantly influenced by outdoor spaces and housing, which was echoed by previous research conducted in the Netherlands and New Zealand (Gobbens et al., 2018; Stephens et al., 2019). More greenness, recreational amenities, and accessible design in outdoor spaces could facilitate older adults to have more social cohesion and engagement in community activities with neighbourhoods (Wan et al., 2021; Jennings & Bamkole, 2019), whilst affordable and comfortable immediate housing provides older residents with momentary pleasure and happiness (Su et al., 2022). Moreover, age-friendly housing design could help older people get accustomed to a declined functional ability by preventing falls, thereby decreasing the prevalence of depression

(Chen et al., 2021).

Concerning with social environments, the significant age-friendliness slightly differed in cultivating positive well-being and decreasing the risks of mental disorders. For instance, among the full sample, social respect and employment were significantly related to PWB, while community support and services were connected with decreased odds of severe depressive symptoms. Arguably, the prominence of social respect and employment in promoting PWB among older adults has been seldom elucidated in previous literature. Despite the unremarkable position of social respect in prior empirical research pertaining to AFEs, a systematic review of 40 studies found that intervention programmes to foster positive attitudes and behaviours towards older adults led to better outcomes of well-being (Ronzi et al., 2018). It further explained that the positive impacts of social respect might be mediated by enhanced self-esteem, social relationships, and reduced social isolation of older adults (Ronzi et al., 2018). In addition, the results showed that employment was underscored, probably because an age-friendly labour market and workplace were also a form of social respect for older people's skills, values, and contributions, bringing older people with more confidence and purpose in life. For the implications on depressive symptoms, results in this chapter found that the provision of community-based support and services would significantly reduce the chances that older people suffer severe depressive symptoms, which resonated with the findings in previous research (Chao et al., 2018; Lu et al., 2021; Pat et al., 2021).

The results showed, however, age-friendly conditions of public transportation, social participation, and communication and information did not significantly contribute to older people's well-being outcomes in Shanghai. Although transportation is not prominent for PWB among full sample, it was suggested that the effect may depend on the health status of older adults. In the stratification by health status, transportation could promote PWB among those in good health, revealing that only older people with satisfying health status could they be capable to go out and make use of public transportation. Additionally, because the social participation in this study was

limited with neighbours in community, it may not fully reflect multifaceted aspects of social participation with family members or friends. Likewise, echoed with previous research (Au et al., 2020; Flores et al., 2019; Yu et al., 2018), communication and information were found to be not effective in promoting PWB in this thesis.

6.4.3 Health Status as a Stratification

To test the assumption of the competence-press model (Lawton & Nehamow, 1973), health status was used as an indicator to distinguish older adults' competency. It was shown that health status acted as an obvious stratification in the person–environment relationship. Particularly, the results needed to be discussed on an outcome-oriented basis. Firstly, the association between AFEs and PWB was stronger amongst those with good health status. In other words, environmental influence is greater in promoting PWB among older people with better competency. This conclusion refuted the original assumption of the competence-press model, arguing that people with weaker competence tend to rely more on their immediate environments (Lawton & Nehamow, 1973). The results of this chapter indicated that for the function of improving PWB, AFEs were more effective among older adults with better competence. This may be explained that people with better competence are capable of having more interactions with AFEs through psychological or behavioural pathways, thus receiving more environmental influence in promoting PWB.

In terms of mental disorders, the health status of older people was also an evident stratification to distinguish different age-friendliness domains in association with depressive symptoms. For people living in poor or fair health status, service environments (i.e., information and communication, community-based support and services) were significant predictors in decreasing the severity of mental disorders. Rather, built environments (i.e., outdoor spaces, housing) were more pertinent for people with good health in preventing mental problems, which was echoed with the recent finding (Lu et al., 2021). This is possibly because depressed people with limited competencies normally experience a series of social withdrawals and reduced opportunities actively engaging in lifestyle activities (Arai et al., 2007), thereby they

may heavily rely on community-based services and support to gain resources. Conversely, people living in health status have higher chances to participate in outdoor activities, hence built environments like outdoor spaces were more important for them. This result provided evidence for social workers and community developers that interventions like enhancing communication or support provisions should be especially focused on those older people with poor health status.

Chapter 7 Psychological Pathway Linking Age-Friendliness to PWB and Mental Health: A Moderated Mediation of Sense of Community and Intergenerational Relationships

7.1 Brief Introduction

Amongst the eight domains of AFEs, the significant age-friendliness associated with PWB and depressive symptoms has been specified in the study of Chapter 6. However, the underlying mechanisms of the association, that is, the pathways linking age-friendliness and the well-being of older adults, are not sufficiently understood currently. Therefore, drawing upon the belonging process from the person–environment interplay model (Wahl & Oswald, 2010), the study in this chapter adopted sense of community as a psychological mediator to investigate the psychological pathway within this relationship. In addition, how the feeling of belonging and connection at the community level interacting with intergenerational relationships at the family level will be explored in this chapter. It is assumed that the form and strength of the mediating effects may be conditional on the quality of parents-adult children's relationships. Hypotheses 2.1 to 2.4 were examined in this chapter.

The results in this study revealed the psychological pathway linking different age-friendliness and PWB and mental health in older community dwellers. Results showed that the effects of all significant age-friendliness domains (except housing) on PWB and mental disorders were mediated by sense of community. In addition, intergenerational relationships moderated the second stage of the mediating process. Particularly, the mediating function of sense of community was particularly stronger if older people had weaker relationships with their adult children, indicating a substitution effect of intergenerational relationships to sense of community.

7.2 Moderated Mediation Through Psychological Pathway

7.2.1 Mediating Function of Sense of Community

Grounded on the theoretical model of person–environment interplay, sense of

community was assumed as a psychological mediator. The process of belonging includes the residential satisfaction or social bonds cultivated in the experience of living or attaching with the surrounding environment (Altman & Wohlwill, 2012; Lewicka, 2008). In other words, it is a process that constructs social meaning, attachment, and satisfaction (Stedman, 2003). In alignment with the connotation of the experience-driven process, sense of community was viewed as a sense of interdependence, belonging, needs fulfilment, and emotional connection derived from community life (Hill, 1996; McMillan & Chavis, 1986). From the perspective of community psychology, sense of community can be viewed as both resources and responsibility that incorporates the dynamics of community contexts and psychological needs (Nowell & Boyd, 2010). Therefore, it is reasonable to apply sense of community in linking the various age-friendliness and older people's PWB and mental health.

The empirical literature has shown that individual and environmental factors affect people's sense of community. For example, individual factors encompassing age, income, birthplace, and living period were significantly related to sense of community (Wilkinson, 2008). In addition, residential environmental characteristics such as age-friendly building design, public spaces, recreational facilities, and supportive services also benefitted the augmentation of sense of connection with immediate environment (Au et al., 2020; Tang et al., 2021). Conversely, inferior quality of environments, like crowded public places and unsafe sidewalks, may impede the sense of belonging or attachment. Moreover, previous studies documented that such community psychology was remarkably related to improved quality of life (Gattino et al., 2013), reduced depression severity (Fowler et al., 2013), personal well-being of older community dwellers (Yip et al., 2013), and self-rated health at all ages (Michalski et al., 2020). Combining the above findings, the perceived age-friendliness may affect residents' sense of community, further impacting the PWB and depressive symptoms among older adults.

7.2.2 Moderating Role of Intergenerational Relationships

Age-friendliness might influence older adults' well-being through sense of community;

however, the mediating effect may not be equally assigned among people who have different relations with their adult children. To more precisely identify the mediating effect of sense of community in conditional contexts, intergenerational relationships was employed as a moderator in this mediating association. As a crucial piece of social networks in later life, the relationship quality with adult children largely reflects the affective bonds, caregiving, and emotional and material support that older people could receive (Wong et al., 2020). Therefore, the well-being of older people could be gained from a sense of connection at the community level, and from a harmonious relationship with adult children at the family level simultaneously. It has been well proven that a stronger intergenerational relationship was positively correlated with subjective well-being (Lai et al., 2019), PWB (Zhang & Silverstein, 2021), as well as fewer mental problems of older adults of Chinese older people (Li et al., 2019; Wu & Chiou, 2020).

Although abundant evidence has consistently shown the benefits that sense of community and harmonious intergenerational relationships bring for older adults, how the community psychology interacting with family solidarity has not been explored yet. Theoretically, according to the hierarchical compensatory theory (Cantor, 1991; 1979), relationships with kin, particularly children or spouses, are the most essential source of support and social bonding for the well-being of older people, followed by friends or neighbours from wider scope. Such theory indicates that feelings from intergenerational relationships may substitute sense of community in affecting the PWB of older people. By contrast, the task-specific theory postulates that emotion or affection extracted from family and community are complementary since each plays a distinct role in affecting well-being (Litwak, 1985; Li et al., 2014). According to the task-specific theory, stronger intergenerational relationships may reinforce the impact of community psychology on well-being. Overall, it is reasonable to propose that intergenerational relationships moderate the mediating process of sense of community at the second phase of the mediation process (i.e., moderate the indirect effects of age-friendliness).

7.3 Conceptual Model and Research Questions

The study in this chapter examined the psychological pathway by which sense of

community mediates significant age-friendliness and the wellbeing outcomes, conditioned on different levels of intergenerational relationships. The identified significant age-friendliness with PWB and depressive symptoms were used as independent variables. The psychological pathway was tested separately based on the outcome of PWB and depressive symptoms. Figure 7.1 presents the conceptual model of age-friendliness and PWB. Two primary research questions included: (1) How did sense of community mediate the relationship between significant age-friendliness (i.e., outdoor spaces, housing, social respect, and employment) and PWB of older adults? (2) How did intergenerational relationships moderate the indirect effects of age-friendliness and PWB in the second stage, namely the link between sense of community and PWB. It needs to be noted that in this thesis, the moderation effect of intergenerational relationships was not hypothesised on the direct effects of age-friendliness. Because as a relationship quality at the family level, an intergenerational relationship is unlikely to generate impacts on the direct path of environmental components and older people's well-being outcomes. Instead, the relationship quality with adult children may reinforce or reduce the strength of the link between the community psychology and PWB.

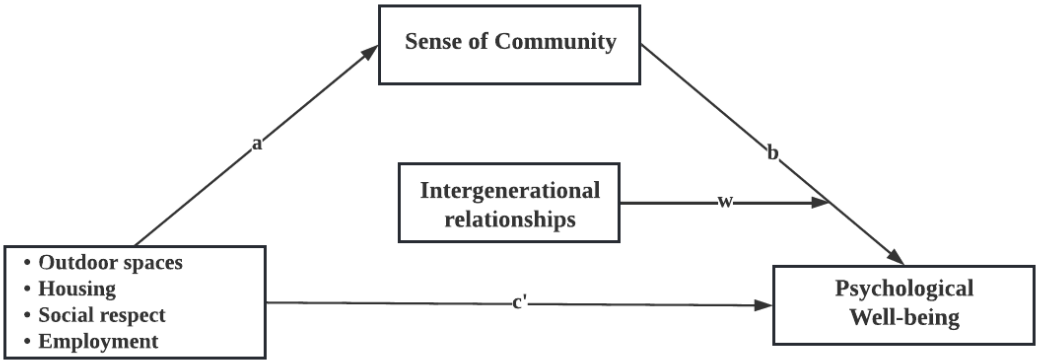

Figure 7.1 *Conceptual framework of psychological pathway linking age-friendliness to PWB*

Note. ab is indirect effects of age-friendliness on PWB, and c' is direct effects. w presents moderation effect of intergenerational relationships on the link between sense of community and PWB.

Figure 7.2 presents the conceptual model of age-friendliness and depressive symptoms. Similarly, research questions included: (1) How did sense of community

mediate the influence of age-friendliness (i.e., outdoor spaces, housing, community-based support and services) on depressive symptoms. (2) How did the indirect effects of age-friendliness was moderated by intergenerational relationships in the second stage of the mediation process, that is, the link between sense of community and depressive symptoms.

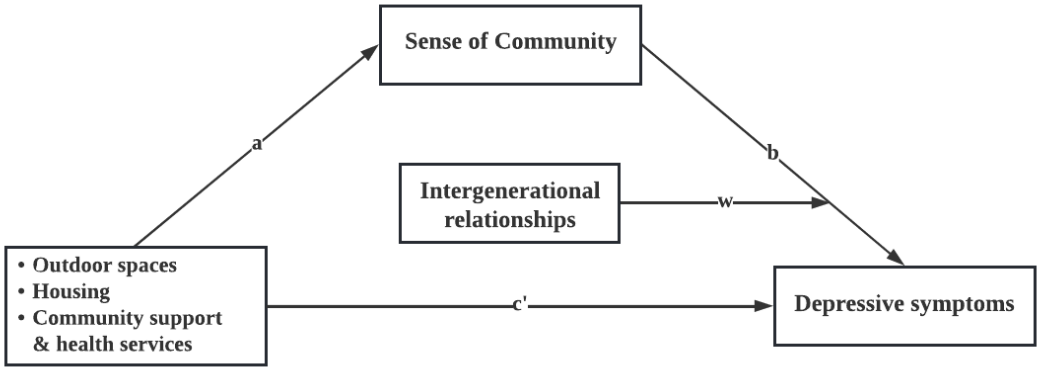

Figure 7.2 *Conceptual framework of psychological pathway linking age-friendliness to depressive symptoms*

Note. ab is indirect effects of age-friendliness on depressive symptoms, and c' is direct effects. w is for moderation effect of intergenerational relationships on the connection between sense of community and depressive symptoms.

7.4 Statistical Analysis

This research initially used Pearson correlation to present the basic correlations among the key variables. Subsequently, there were two steps of analytical procedures to examine the moderated mediation. Firstly, a path analysis was performed to inspect the mediating role of sense of community in linking age-friendliness to late-life PWB and depressive symptoms, respectively, controlling for covariates. Results of path analysis will further validate the robustness of the identified salient age-friendliness in chapter 6. Secondly, an interaction term of sense of community and intergenerational relationships was added to the path analysis models to probe the moderating effect. All continuous variables of interaction terms were centred to alleviate micro multicollinearity (Iacobucci et al., 2016). Once the moderating effect was significant, a simple slope analysis (1SD below and above the mean of the moderator) was conducted.

The model was estimated by robust maximum likelihood (MLR) with corrected

chi-square as well as standard error. MLR was a robust estimator to correct the moderate violations of assumption, and it is able to handle random missing data (Li, 2015; Wang & Wang, 2012). Model fit was examined by the following criteria: the chi-square test statistic, CFI and TLI >.90 (Hu & Bentler, 1999), RMSEA <.08, and SRMR <.08 (Browne & Cudeck, 1993; Hopper et al., 2008). M*plus* allowed to involve multiple independent variables, mediators, and moderators (Stride et al., 2015), so the software of M*plus* Version 8.0 (Muthén & Muthén, 2017) was used for path analysis.

7.5 Results

7.5.1 Correlational Analysis

Table 7.1 displays the Pearson correlation among the key variables. It shows that all age-friendliness domains were positively correlated with participants' sense of community and PWB. Except for employment, the remaining age-friendliness were significantly correlated with depressive symptoms and intergenerational relationships.

Table 7.1 *Pearson correlation analysis of key variables within psychological pathway*

	M (SD)	1	2	3	4	5	6	7	8
1.Outdoor spaces	3.679 (.649)								
2.Housing	3.759 (.675)	.536 ***							
3.Social respect	3.746 (.570)	.377 ***	.420 ***						
4.Employment	2.751 (.764)	.034	.061	.270 ***					
5.Community support and health services	3.772 (.714)	.395 ***	.451 ***	.425 ***	.245 ***				
6.Sense of community	28.112 (5.070)	.478 ***	.459 ***	.507 ***	.274 ***	.616 ***			
7.PWB	28.976 (4.045)	.433 ***	.454 ***	.357 ***	.218 ***	.342 ***	.476 ***		
8.Depressive symptoms	4.464 (4.140)	-.317 ***	-.382 ***	-.348 ***	-.040	-.359 ***	-.457 ***	-.583 ***	
9.Intergenerational relationships	47.188 (6.010)	.172 **	.227 ***	.174 **	.008	.244 ***	.244 ***	.177 **	-.368 ***

Note. M = mean; SD = standard deviation; PWB = psychological well-being; ** $p < 0.01$; *** $p < 0.001$.

7.5.2 Testing for Mediating Model

Firstly, the mediating model was tested for the outcomes of PWB and depressive symptoms, respectively. Both models showed satisfactory model fit. For the outcome of PWB, $\chi^2(1) = 2.023$, $p = .154$, RMSEA =.045, CFI =.998, TLI =.950, SRMR =.007. Outdoor spaces, social respect, and employment were positively related to sense of community, and in turn significantly predict PWB, keeping the covariates as constant. Table 7.2 shows that the indirect effects of outdoor spaces ($\beta = .060$, $SE = .020$, $p < .01$), social respect ($\beta = .049$, $SE = .016$, $p < .01$), and employment ($\beta = .027$, $SE = .022$, $p < .05$) on PWB were significant via sense of community. The mediating ratio of indirect effect to total effect from the aforementioned age-friendliness were 21.66%, 50.52%, and 20.93%, respectively.

Table 7.2 *Indirect, direct and total effects of age-friendliness on PWB and DS via sense of community (N = 495)*

Associations	Indirect effects (path a*b)			Direct effects (path c')			Total effects		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Outdoor spaces - PWB	.060	.020	.003	.151	.050	.003	.211	.045	.000
Housing – PWB	.020	.012	.096	.186	.048	.000	.206	.047	.000
Social respect – PWB	.049	.016	.002	.048	.044	.273	.097	.043	.023
Employment – PWB	.027	.012	.025	.102	.038	.007	.129	.035	.000
Outdoor spaces – DS	-.092	.022	.000	-.013	.070	.850	-.106	.066	.111
Housing – DS	-.023	.018	.189	-.191	.064	.003	-.214	.065	.001
Community support and health services - DS	-.128	.028	.000	-.042	.056	.452	-.170	.051	.001

Note. PWB = psychological well-being; DS = depressive symptoms; *β* = standardised coefficient; *SE* = standard error.

The model fit for the outcome of depressive symptoms was also satisfactory: $\chi^2(1) = 0.403$, $p = 0.526$, RMSEA = 0.000, CFI = 1.000, TLI = 1.032, SRMR = 0.003. Among the three age-friendliness, the mediating effects were significant for outdoor spaces and community-based services. The indirect effect of outdoor spaces was -.092 ($SE = .022$, $p < .001$), with the mediating ratio of 86.79%. The mediating effect of community support and health services was -.128 ($SE = .028$, $p < .001$). It needs to be noted that the total effect of outdoor spaces ($\beta = -.106$, $SE = .066$, $p > .05$) on depressive symptoms was insignificant, indicating the prominence of outdoor spaces was not robust to predict

depressive symptoms in path analysis. However, if the research interest lies in mediation effect only, as suggested by Kenny and Judd (2014), people still have adequate power to probe a significant indirect effect even if the total effect was statistically insignificant in psychological research. In other words, a significant exam of the total effect could not be viewed as a premise for the presence of the indirect effect (Loeys et al., 2014). Hence, in this study, the indirect influence of outdoor spaces on depressive symptoms should be statistically significant and valid.

7.5.3 Testing for Moderated Mediating Model

The results of the moderated mediation of age-friendliness and PWB were shown in Table 7.3. The overall model fitted well with the data: $\chi^2(2) = 5.268$, $p = .072$, RMSEA = 0.057, CFI = 0.993, TLI = 0.903, SRMR = 0.019. The interaction term of "sense of community ×IR" was significant (β = -.126, *SE* =.039, $p < .01$), indicating that intergenerational relationships moderated the link between sense of community and PWB. In other words, in this chapter, the magnitude of the link between sense of community and PWB differed by the quality of intergenerational relationships. Figure 7.3 is the simple slope analysis of sense of community and PWB at different levels of intergenerational relationships. It shows that the improvement of intergenerational relationships attenuated the strength of the link between sense of community and PWB. More particularly, the association between sense of community on PWB became insignificant (*B* =.062, *SE* =.048, $p = .116$) when a strong intergenerational relationship (M + 1SD) was reported.

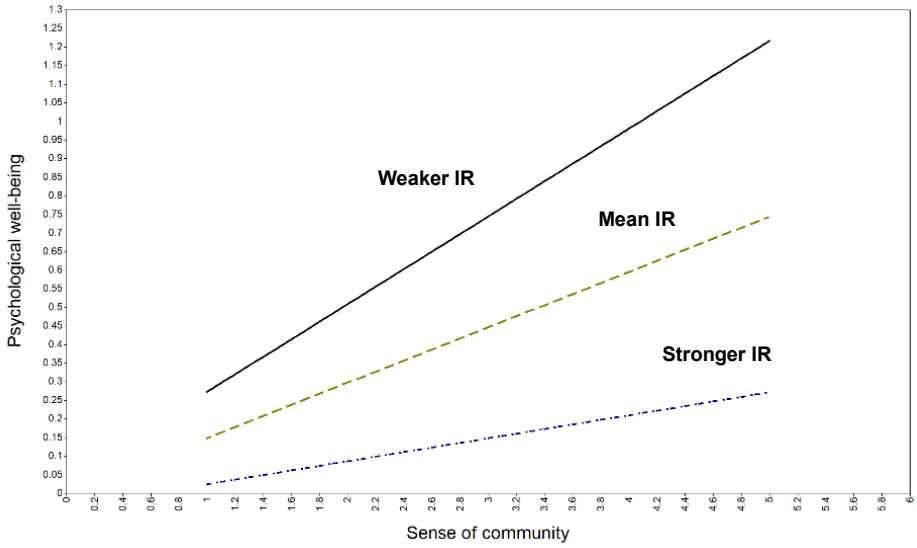

Figure 7.3 *Slope analysis between sense of community and PWB at different levels of IR*

Note. stronger IR = 1SD above mean; weaker IR = 1SD below mean.

Table 7.3 *Standardised coefficients for moderated mediation between age-friendliness and PWB through psychological pathway (N = 495)*

Independent variables	**Sense of community**			**PWB**		
Age-friendliness	*β*	*SE*	*p*	*β*	*SE*	*p*
Outdoor spaces	.304	.045	.000	.152	.051	.003
Housing	.112	.050	.026	.186	.048	.000
Social respect	.270	.046	.000	.037	.045	.404
Employment	.155	.039	.000	.101	.039	.010
Covariates						
Age	-.001	.037	.978	.015	.038	.687
Female	-.059	.032	.067	-.004	.035	.908
Registered household in Shanghai	.267	.037	.000	.014	.044	.748
Education (Ref. middle school or less)	.051	.035	.147	.109	.040	.006
Occupation (Ref. clerks or self-employed)	.084	.036	.021	.131	.039	.001
Monthly income (Ref. low)	-.069	.037	.060	.019	.041	.638
Retired	.133	.039	.001	-.096	.042	.022
Good health status	.057	.033	.080	.156	.038	.000
Mediator						
Sense of community				.188	.056	.001
Moderator						
IR				-.009	.041	.824
Sense of community × IR				-.126	.039	.001
R-squared	.514			.413		

Note. PWB = Psychological well-being; IR = intergenerational relationships; *β* = standardised coefficient; *SE* = standard error.

As Hayes (2018) suggested, if intergenerational relationships moderated either the first or second phase of the mediation path, then the mediation effect was moderated by intergenerational relationships. Correspondingly, conditional indirect effects analysis (Table 7.5) showed that the indirect effects of age-friendliness on PWB became lower with the increase in intergenerational relationships. Specifically, the indirect effects of outdoor spaces (B =.146, SE =.114, p =.199), social respect (B =.146, SE =.113, p =.190), and employment (B =.063, SE =.055, p =.256) on PWB were insignificant in the case of a strong intergenerational relationship (M +1SD). It indicated that the mediating effect of sense of community connecting age-friendliness and PWB did not persist among those who had high-quality relationships with their adult children.

Table 7.5 *Conditional indirect effects of age-friendliness on PWB and DS via sense of community at weak IR (M-1SD), mean, and strong IR (M+1SD)*

	Weak IR			**Mean**			**Strong IR**		
	B	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Outdoor spaces – PWB	.560	.154	.000	.353	.116	.002	.146	.114	.199
Social respect – PWB	.569	.149	.000	.359	.112	.001	.149	.113	.190
Employment – PWB	.241	.089	.007	.152	.066	.021	.063	.055	.250
Outdoor spaces – DS	-.807	.188	.000	-.506	.128	.000	-.206	.112	.066
Community support and health services - DS	-1.049	.212	.000	-.659	.154	.000	-.267	.147	.070

Note. PWB = psychological well-being; DS = depressive symptoms; IR = intergenerational relationships; The coefficients of conditional indirect effects were unstandardised.

Table 7.4 shows the results of moderated mediation for the link between age-friendliness and depressive symptoms. The overall model fit was satisfactory: $\chi^2(2)$ = 2.790, p = .248, RMSEA = .053, CFI = .998, TLI = .976, SRMR = .016. The interaction of "sense of community ×IR" was significant (β = .196, SE = .044, p < .001), revealing the association of psychological mediator and depressive symptoms was moderated by intergenerational relationships. Simple slope analysis in Figure 7.4 shows that sense of community was negatively linked to depressive symptoms, and the association became weaker with the increase of intergenerational relationships quality. Particularly, when reported high quality of intergenerational relationships (M + 1SD), the significant link of sense of community and depressive symptoms (B = -.093, SE = .051, p = .066) did not preserve. This indicated that if older people reported harmonious relationships with

their adult children, the mediating function of psychological mediator was not valid in linking age-friendliness to PWB.

Table 7.4 *Standardised coefficients for moderated mediation between age-friendliness and depressive symptoms through psychological pathway (N = 495)*

Independent variables	**Sense of community**			**Depressive symptoms**		
Age-friendliness	*β*	*SE*	*p*	*β*	*SE*	*p*
Outdoor spaces	.283	.046	.000	-.018	.062	.774
Housing	.073	.050	.145	-.156	.056	.005
Community support and health services	.403	.043	.000	-.007	.046	.877
Covariates						
Age	-.029	.037	.422	.036	.039	.363
Female	-.059	.033	.074	.013	.039	.728
Registered household in Shanghai	.237	.039	.000	-.047	.046	.309
Education (Ref. middle school or less)	.047	.034	.175	.044	.043	.302
Occupation (Ref. clerks or self-employed)	.057	.036	.110	-.001	.041	.989
Monthly income (Ref. low)	-.021	.037	.566	-.022	.044	.609
Retired	.075	.040	.059	.032	.047	.488
Good health status	.034	.034	.318	-.153	.041	.000
Mediator						
Sense of community				-.289	.057	.000
Moderator						
IR				-.189	.043	.000
Sense of community × IR				.196	.044	.000
R-squared	.527			.356		

Note. IR = intergenerational relationships; *β* = standardised coefficient; *SE* = standard error.

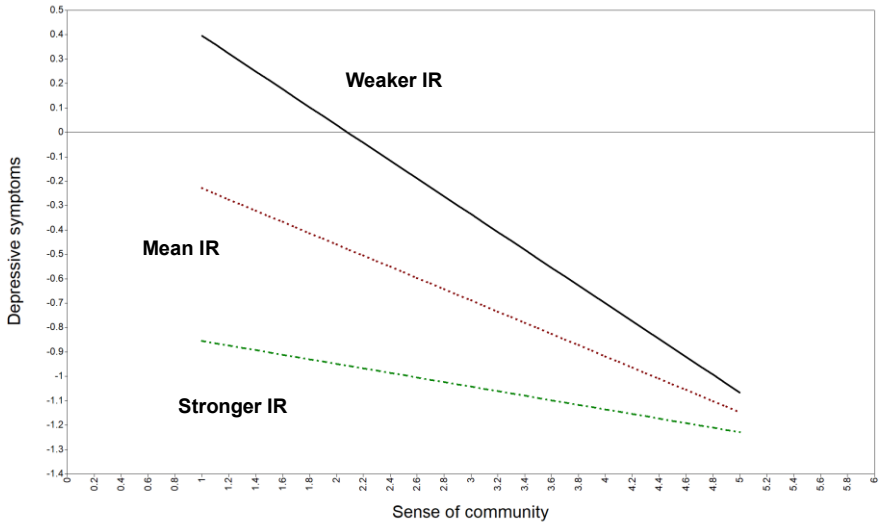

Figure 7.4 *Slope analysis between sense of community and depressive symptoms at different levels of IR*

Note. Stronger IR = 1SD above mean; weaker IR = 1SD below mean.

Correspondingly, conditional indirect analysis shows (Table 7.5) that the indirect effects of outdoor spaces (B = -0.807, -0.506, -0.206) and community services (B = -1.049, -0.659, -0.267) on depressive symptoms gradually decreased with the augment of intergenerational relationships from weaker, mean, to stronger level. Particularly, the indirect effects age-friendliness were not valid among older adults with high-quality intergenerational relationships.

7.6 Discussion

The study in this chapter revealed the psychological pathways linking age-friendliness and well-being outcomes among older adults in Shanghai. It was found that the effects of outdoor spaces, social respect, and employment on PWB were mediated by sense of community. With respect to depressive symptoms, its associations with outdoor spaces and community services were also mediated by sense of community. In addition, it uncovered that these mediation effects within the community were moderated by intergenerational relationships within the family. Specifically, the influence of sense of community on PWB and mental health, which means the indirect effects of age-friendliness, became decreased with the improvement of intergenerational relationships.

7.6.1 Age-Friendliness, Sense of Community, and Well-being Outcomes

The results of this study supported the belonging process of person–environment interplay. It is comprehensible that favourable environmental characteristics could reinforce people's attachment to and emotional connection with a residential community or neighbourhood, thus promoting the general PWB and mental health of older community dwellers. The linking function of sense of community was also documented in the relationship between living environment and subjective well-being (Zhang & Zhang, 2017). Therefore, as a critical socio-psychological factor within the realm of neighbourhood or community, sense of community is important in affecting mental health and PWB. Moreover, Perkins and Long (2002) further argued that such community psychology is a pivotal construct of social capital and is highly related to social participation and neighbouring. Together with previous literature, findings in this study provided evidence for conducting interventions to strengthen sense of belonging

or connection at community level to boost PWB and mental well-being of older residents.

Clearly, instead of focusing on general environmental conditions, this study analysed the mechanism of specific age-friendliness, which could advance our understanding that how older people feel, utilise, and interplay with different environmental aspects. In this study, the influences of outdoor spaces on both PWB and mental disorders were mediated by sense of community. This result stressed the social attributes of outdoor spaces, although normally considered as built environments. Resonating with the findings of Huang and Li (2019), neighbourhood outdoor spaces were primary places for residents to socialise, bridge networks, and reconstruct identities. Additional social aspects of age-friendliness, such as social respect, and employment were positively related to sense of community. This is understandable that being respected, valued, and cared for from outside sources could strengthen older people's feeling of connection and belonging. Moreover, echoed with the study of Au et al. (2020), the relationship between community-based support and services and older people' mental health was linked by sense of community.

7.6.2 Substitution Effect of Intergenerational Relationships to Sense of Community

This study further expanded the belonging process in the person–environment model by adding intergenerational relationships as moderator. It presented how parents-adult children's relations within the family interact with psychology at the community level to jointly influence PWB and mental health. Specifically, the significant moderating effect proved the substitution effect of intergenerational relationships to sense of community. That is, the enhancement of intergenerational relationships attenuated the link between sense of community and well-being outcomes, as well as the indirect effects of age-friendliness. Specifically, the mediating role of sense of community cannot be sustained if older adults report high-quality relationships with their adult children. In alignment with the hierarchical compensatory theory (Cantor, 1991; 1979), harmonious kinship is the most potent social tie that is conducive to people's psychological and emotional well-being. Simultaneously, the sense of belonging at the

community level effectively influences well-being only when kinship is too poor to fulfil its role. This finding illuminated the significant implications of community interventions for those older people with poor relationships with their family members, or empty nested older residents. In the background of the erosion of traditional filial obligations in modern Chinese society, conducting community interventions to provide a sense of belonging and connection with neighbourhoods is increasingly meaningful for community-dwelling older adults.

Chapter 8 Behavioural Pathway Linking Age-Friendliness to PWB and Mental Health: A Moderated Mediation of Activity Engagement and Urbanisation Degree

8.1 Brief Introduction

Based on the agency process of person–environment interplay, the study in this chapter aims to examine the behavioural pathway linking the significant age-friendliness and well-being among older adults. Activity engagement was utilised as a potential behavioural mediator. More specifically, it was hypothesised that the association between age-friendliness and well-being might vary at different degrees of urbanisation. Therefore, the urbanisation degree of districts in Shanghai, grouped as central places and second-ranked districts (i.e., relatively lower urbanisation), was employed as a moderator in this study. Hypotheses 3.1 to 3.4 were examined in this chapter.

The current study has found that the influence of social respect and employment on PWB were significantly mediated by activity engagement. In addition, the mediation effect of activity engagement was only significantly in higher urbanised areas, whilst the direct influence of age-friendly employment on PWB was larger in higher urbanised districts. Concerning with depressive symptoms, only the impact of community support and services were significantly mediated by activity engagement. Moreover, the connection of activity engagement and depressive symptoms was also moderated by different degrees of urbanisation.

8.2 Moderated Mediation Through Behavioural Pathway

8.2.1 Mediating Role of Activity Engagement

The agency approach in the person–environment model is a behaviour-driven process, underlining the proactivity and goal-oriented behaviours in the interplay between older residents and their immediate surroundings (Wahl & Oswald, 2010; 2003). The extended model of the ecological theory of ageing postulated that older residents could take intentional actions to modify their environments to fit their personal needs (Lawton,

1989). Therefore, people may take advantage of age-friendliness through various behaviours and actions, thus gaining cognition and a sense of control over the environment (Wahl & Oswald, 2016). This agency process is particularly critical for older people's well-being because of declined functional ability and cognitive impairment at old age.

In light of the behavioural attributes of person–environment interplay, activity engagement could be viewed as the behaviour mediator linking age-friendliness and the PWB and mental health. The conduciveness of engaging in activities have been well established in older population. For instance, gerontologists detected that increased engagement in physical activities (Yen & Lin, 2018), outdoor group activity (Zhang, 2019), community participation (Chen & Zhang, 2021), and social participation (Zhang & Zhang, 2015) were related to a higher quality of life and less depression at old age. Meanwhile, neighbourhood environmental characteristics will greatly affect older adults' frequency of engagement. For instance, accessibility and walkability of outdoor spaces would increase the likelihood that older people with chronic diseases participate in physical activity (Barnett et al., 2016). Therefore, it is reasonable to hypothesise that age-friendliness domains were positively associated with activity engagement, which in turn reinforced older people's well-being. In addition, it is worth noting that there was no unanimous agreement in the existing literature on the measurement of social participation or activity engagement. In this study, activities that were closely relevant to older residents' community life will be involved, including physical, leisure or recreational, and voluntary activities.

8.2.2 Moderating Role of Urbanisation Degree

Empirical evidence for the association between urbanisation and subjective well-being is robust and exhaustive (Chen et al., 2015; Navarro et al., 2020; Winters & Li, 2017). Research findings generally supported the conclusion that urbanisation lowers happiness, especially in areas with high population density and metropolitan cities (Okulicz-Kozaryn & Mazelis, 2018; Winters & Li, 2017). However, Lenzi and Perucca (2020) argued that the impacts of urbanisation might not be directly constrained to the

urban-rural boundary but spread to the neighbourhood environment and human activities. As suggested by the central place theory (King, 1985), the intensity and nature of various productivities, public services, and amenities, as well as externalities, are highly different due to the rank of urbanisation or distance to urban centres (Lenzi & Perucca, 2020). Therefore, it could be further assumed that the benefits people gained from these environments, activities, or services may differ because of the urbanisation rank.

Shanghai, the biggest megacity and most populous city in China, has experienced unprecedented urban sprawl and urbanisation since the late 1970s. Nevertheless, like most large cities in China, Shanghai's urbanisation process is uneven and unbalanced (Jiang et al., 2021). According to the indicators of urbanisation, encompassing population density, land use, and land cover, urbanisation degree and its environmental effects showed significant heterogeneity between core and second-ranked districts in Shanghai (Cui & Shi, 2012). Specifically, the population density was greater in core districts (e.g., Jing'an, Huangpu, Hongkou) than in second-ranked areas (e.g., Pudong, Minhang, Baoshan) (Shanghai Bureau of Statistics, 2020). Similarly, with respect to land use, building land, including town, residential, and construction areas, is more intensively aggregated in central places (Cui & Shi, 2012). Therefore, central districts in Shanghai may experience a higher urbanisation degree than suburban districts, which further modifies the impacts of environments and activities on older residents' PWB and mental health.

8.3 Conceptual Model and Research Questions

This chapter aimed to inspect the mediating role of activity engagement in linking various age-friendliness to PWB and mental health, and how the urbanisation degree moderates these relationships. Significant age-friendliness domains identified in chapter 6 were used as independent variables for PWB and depressive symptoms, respectively. Figure 8.1 shows the conceptual model linking age-friendliness and PWB, with two primary questions to be addressed: (1) How did activity engagement mediate the influences of age-friendliness (i.e., outdoor spaces, housing, social respect,

employment) on PWB of older adults? (2) How did the degree of urbanisation moderate the direct effects, and indirect effects (second stage of mediation process) of age-friendliness on PWB? Correspondingly, the moderating effects will be examined in both direct effects (w2) and indirect effect (w1) of age-friendliness because it is suggested that urbanisation influences not only the environments that people are exposed to but also the activities and received services.

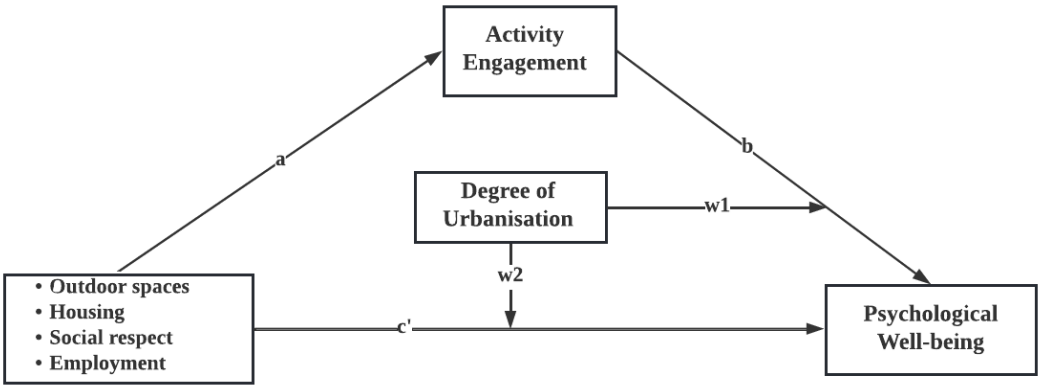

Figure 8.1 *Conceptual framework of behavioural pathway linking age-friendliness to PWB*

Note. ab path denotes indirect effects of age-friendliness on PWB, and c' path presents direct effects. w1 is for moderating effect of urbanisation degree between activity engagement and PWB (i.e., moderate the indirect effects of age-friendliness), and w2 is moderating effect on the direct effects of age-friendliness on PWB.

Figure 8.2 displays the conceptual model connecting age-friendliness and depressive symptoms of older adults. Similarly, it consisted of two research questions: (1) How did activity engagement mediate the association between age-friendliness (i.e., outdoor spaces, housing, community support and services) and depressive symptoms? (2) How did the degree of urbanisation moderate the direct effects (w2), and indirect effects (w1) (second stage of mediation process) of age-friendliness on depressive symptoms?

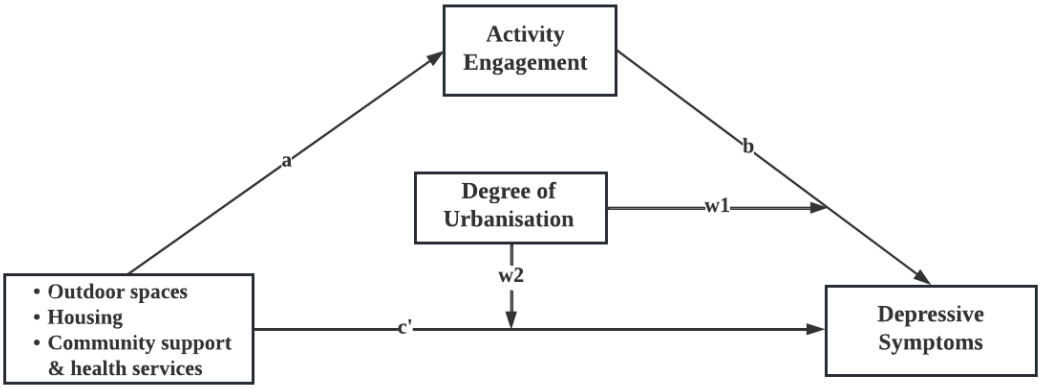

Figure 8.2 *Framework of behavioural pathway linking age-friendliness to depressive symptoms*

Note. ab path denotes indirect effects of age-friendliness on depressive symptoms, and c' path presents direct effects. w1 is for moderating effect of urbanisation degree between activity engagement and depressive symptoms (i.e., moderate the indirect effects of age-friendliness), and w2 is moderating effect on the direct effects of age-friendliness on depressive symptoms.

8.4 Statistical Strategy

Correlational relationships among the key variables were explored by conducting a Pearson correlation analysis. To examine the mediating effect, multiple linear models were established between age-friendliness, activity engagement, and outcome variables. Direct, indirect, and total effects of age-friendliness were analysed with maximum likelihood estimation using M*plus* Version 8.0 (Muthén & Muthén, 2017). In this process, the age-friendliness domains that were mediated by behavioural pathways could be identified. Next, interaction terms for direct path and indirect path (the second stage) were added to the model to test whether associations vary with different urbanisation degrees. Particularly, data analysis in this chapter did not use the path analysis model as in Chapter 7 because this study involved more interaction terms on the direct path, which will increase the number of parameters (Streiner, 2005). Therefore, due to a limited number of clusters and to avoid unstable estimation, this study used traditional multiple regression models to test mediating and moderating associations. All continuous variables in interaction terms have been centred to alleviate micro multicollinearity (Iacobucci et al., 2016). A simple slope analysis will be provided to present clear coefficients of the associations when the moderating effects were significant. Bootstrapping with 5,000 replications was applied to estimate with 95%

confidence intervals (MacKinnon et al., 2004).

8.5 Results

8.5.1 Correlational Analysis

The results of the Pearson correlation of the key variables were shown in Table 8.1. Social support (r =.176, p <.01), community support and services (r =.277, p <.001), and employment (r =.192, p <.001) were significantly correlated with activity engagement. Activity engagement was further significantly correlated with PWB (r =.300, p <.001) and depressive symptoms (r = -.198, p <.001). Urbanisation degree was significantly correlated with most age-friendliness domains except community support and health services.

Table 8.1 *Pearson correlation analysis of key variables within behavioural pathway*

	M (SD)	1	2	3	4	5	6	7	8
1.Outdoor spaces	3.679 (.649)								
2.Housing	3.759 (.675)	.563 ***							
3.Social respect	3.746 (.570)	.378 ***	.420 ***						
4.Community support and health services	3.772 (.714)	.395 ***	.451 ***	.425 ***					
5.Employment	2.751 (.764)	.034	.061	.270 ***	.245 ***				
6.Activity engagement	6.095 (1.843)	.084	.050	.176 **	.277 ***	.192 ***			
7.PWB	28.976 (4.045)	.433 ***	.454 ***	.358 ***	.342 ***	.218 ***	.300 ***		
8.Depressive symptoms	4.464 (3.140)	-.317 ***	-.382 ***	-.348 ***	-.359 ***	-.040	-.198 ***	-.583 ***	
9.Higher urbanisation		-.278 ***	-.226 ***	-.097 *	-.015	.183 ***	.230 ***	.014	.137 ***

Note. M = mean; SD = standard deviation; PWB = psychological well-being; ** p < 0.01; *** p< 0.001.

8.5.2 Testing for Mediating Effects

As shown in Table 8.2, controlling for older adults' demographic, socioeconomic, and health characteristics, the indirect effects of social respect (β =.024, SE =.011, p <.05) and employment (β =.021, SE =.010, p <.05) were significant on PWB via activity

engagement, with the ratio of 24.24% and 16.8% of total effects, respectively. The direct influence of social respect, however, was insignificant (β =.075, *SE* =.043, *p* =.083). With respect to the outcome of depressive symptoms, only the effect of community support and health services was significantly mediated by activity engagement (β = -.030, *SE* =.012, *p* <.05), accounting for 17.34% of total effect.

Table 8.2 *Indirect, direct and total effects of age-friendliness on PWB and DS via activity engagement*

Associations	Indirect effects (path a*b)			Direct effects (path c')			Total effects		
	β	*SE*	*p*	β	*SE*	*p*	β	*SE*	*p*
Outdoor spaces - PWB	.020	.012	.105	.184	.045	.000	.205	.046	.000
Housing – PWB	-.023	.012	.051	.239	.046	.000	.216	.047	.000
Social respect – PWB	.024	.011	.024	.075	.043	.083	.099	.044	.028
Employment – PWB	.021	.010	.032	.105	.036	.004	.125	.037	.001
Outdoor spaces – DS	-.010	.008	.226	-.095	.065	.142	-.105	.066	.117
Housing – DS	.018	.009	.052	-.231	.062	.000	-.212	.064	.001
Community support and health services - DS	-.030	.012	.014	-.142	.052	.006	-.173	.052	.001

Note. PWB = psychological well-being; DS = depressive symptoms; β = standardised coefficient; *SE* = standard error.

8.5.3 Testing for Moderating Effects

Mediation effects identified that the direct effects of outdoor spaces, housing, and employment were significant on PWB. Hence interaction terms were added in these direct paths to PWB, as well as the indirect path through activity engagement to PWB. As shown in Table 8.3, the interactions for both "employment × urbanisation degree" (β = -.098, *SE* =.043, *p* <.05) and "activity engagement × urbanisation degree" (β =.185, *SE* =.052, *p* <.001) were significant. It indicated that the urbanisation degree significantly moderated the direct impact of employment, and moderated the indirect effects of social respect and employment on PWB via activity engagement. The slope analysis of Figure 8.3 presents that the direct influence of employment on PWB was stronger in districts with higher urbanisation (*B* = 1.743, *SE* =.590, *p* <.01) than in lower urbanisation (*B* = 0834, *SE* =.231, *p* <.001). In terms of the moderating effects between activity engagement and PWB, Figure 8.4 shows that engaging in activities was positively associated with PWB at a higher urbanisation degree (*B* =.731, *SE* =.119, *p*

<.001). The examination of conditional indirect effects revealed that the indirect influences of social respect (*B* =.286, *SE* =.124, *p* <.05) and employment (*B* =.182, *SE* =.081, *p* <.05) on PWB were only significant in higher urbanised districts.

Table 8.3 *Standardised coefficients for mediation and moderation between age-friendliness and psychological well-being through behavioural pathway (N = 506)*

Independent variables	**Activity engagement**			**PWB**		
Age-friendly Predictors	*β*	*SE*	*p*	*β*	*SE*	*p*
Outdoor spaces	.100	.058	.085	.199	.044	.000
Housing	-.113	.054	.034	.277	.060	.000
Social respect	.119	.048	.013	.090	.059	.121
Employment	.101	.042	.015	.150	.044	.001
Covariates						
Age	.033	.044	.452	.008	.037	.309
Female	.055	.041	.182	-.057	.036	.120
Registered household in Shanghai	.101	.045	.022	.042	.041	.313
Education (Ref. middle school or less)	.113	.047	.013	.068	.039	.093
Occupation (Ref. clerks or self-employed)	.046	.050	.360	.160	.037	.000
Monthly income (Ref. low)	.122	.052	.017	-.019	.041	.645
Retired	.163	.043	.000	-.095	.043	.027
Good health status	.049	.042	.240	.168	.036	.000
Mediator						
Activity engagement				.057	.025	.031
Moderator						
Urbanisation degree (Ref. lower degree)				.102	.040	.010
Outdoor spaces × Urbanisation degree				.100	.059	.092
Housing × Urbanisation degree				-.096	.062	.125
Employment × Urbanisation degree				-.098	.043	.021
Activity engagement × Urbanisation degree				.185	.052	.000
Conditional direct effect of employment on PWB at different urbanisation degree						
Lower urbanisation degree	.834	.231	.000			
Higher urbanisation degree	1.743	.587	.003			
Conditional indirect effect of social respect on PWB at different urbanisation degree						
Lower urbanisation degree	.046	.053	.386			
Higher urbanisation degree	.286	.124	.021			
Conditional indirect effect of employment on PWB at different urbanisation degree						
Lower urbanisation degree	.029	.034	.390			
Higher urbanisation degree	.182	.081	.025			
R-squared	.171			.440		

Note. PWB = psychological well-being; Urbanisation degree is a binary variable (higher urbanisation = 1, lower urbanisation = 0); The coefficients of conditional direct and indirect effect were unstandardised.

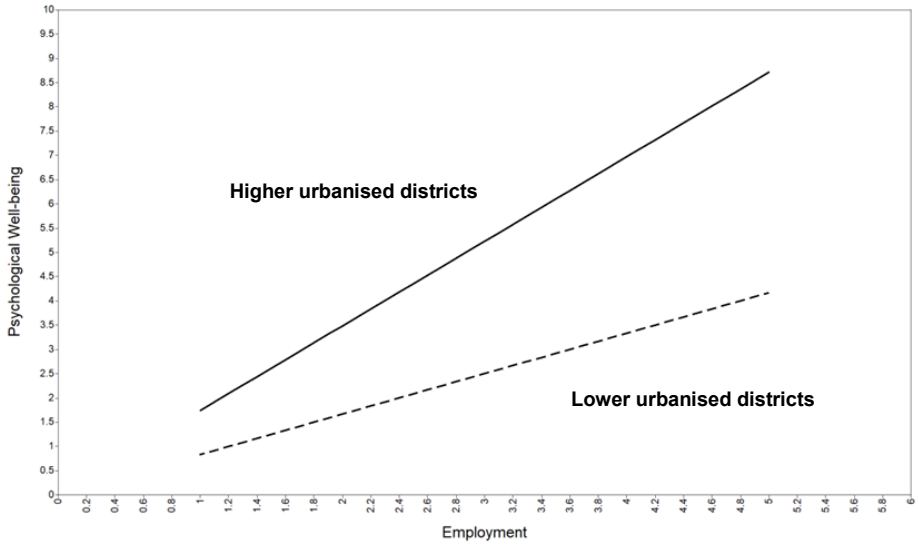

Figure 8.3 *Slope analysis of direct association between employment and PWB at higher and lower urbanisation degrees*

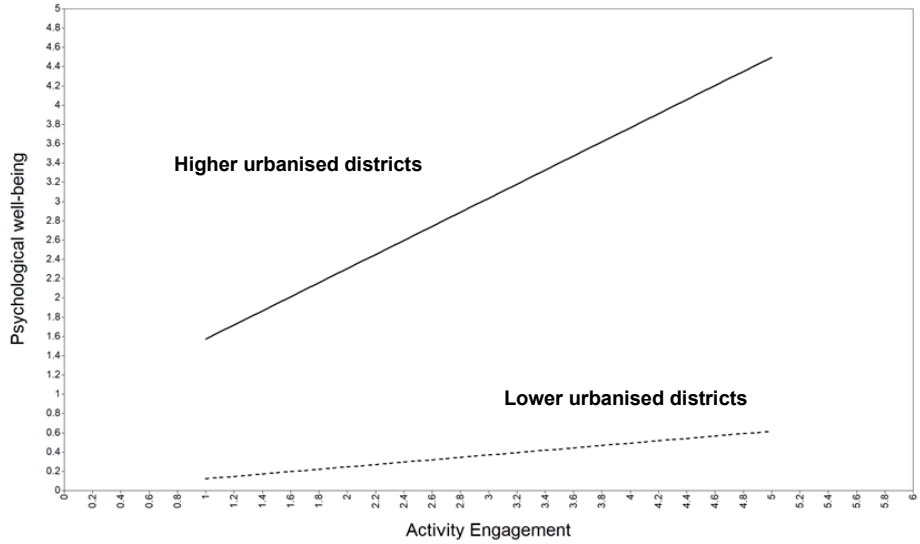

Figure 8.4 *Slope analysis of activity engagement and PWB at higher and lower urbanisation degrees*

Concerning the outcome of depressive symptoms, the mediation analysis found that the direct effects of housing, community support and services were significant. Therefore, interaction terms were added to the direct paths and the indirect path through activity engagement to depressive symptoms. As shown in Table 8.4, the interaction of "activity engagement × urbanisation degree" was significantly (β = -.144, *SE* =.057, p <.05), implying that urbanisation degree moderated the link between activity engagement and depressive symptoms. Slope analysis in Figure 8.5 presented a conditional effect of activity engagement on depressive symptoms, which was only

significant in higher urbanised districts (B = -.554, SE =.154, p <.001). Accordingly, the indirect influence of community support and health services on depressive symptoms merely significant in higher urbanised districts (B = -.332, SE =.121, p <.01). However, interactions of "housing × urbanisation degree" (β = -.025, SE =.069, p =.722) and "community support × urbanisation degree" (β = -.075, SE =.073, p =.302) were insignificant, so moderating effect of urbanisation was not observed in the direct influence of housing and community support on depressive symptoms.

Table 8.4 *Standardised coefficients for moderated mediation of age-friendliness and depressive symptoms through behavioural pathway (N = 506)*

Independent variables	**Activity engagement**			**Depressive symptoms**		
Age-friendly Predictors	*β*	*SE*	*p*	*β*	*SE*	*p*
Outdoor spaces	.077	.056	.177	-.081	.067	.222
Housing	-.142	.052	.007	-.207	.061	.001
Community support and health services	.232	.047	.000	-.087	.073	.232
Covariates						
Age	-.017	.043	.693	.004	.039	.909
Female	.055	.041	.179	.014	.042	.743
Registered household in Shanghai	.082	.045	.067	-.100	.045	.028
Education (Ref. middle school or less)	.106	.046	.021	.041	.046	.376
Occupation (Ref. clerks or self-employed)	.033	.047	.483	-.001	.045	.098
Monthly income (Ref. low)	.109	.052	.037	-.029	.049	.556
Retired	.153	.049	.002	-.011	.049	.218
Good health status	.034	.043	.430	-.189	.043	.000
Mediator						
Activity engagement				-.038	.054	.044
Moderator						
Urbanisation degree (Ref. lower degree)				.105	.045	.019
Housing × Urbanisation degree				-.025	.069	.722
Community support × Urbanisation degree				-.075	.073	.302
Activity engagement × Urbanisation degree				-.144	.057	.011
Conditional indirect effect of community support on depressive symptoms at different urbanisation						
Lower urbanisation degree	-.052	.075	.491			
Higher urbanisation degree	-.332	.121	.006			
R-squared	.181			.269		

Note. Urbanisation degree is a binary variable where higher urbanisation = 1, lower urbanisation = 0; The coefficients of conditional indirect effect of community support and health services on depressive symptoms were unstandardised.

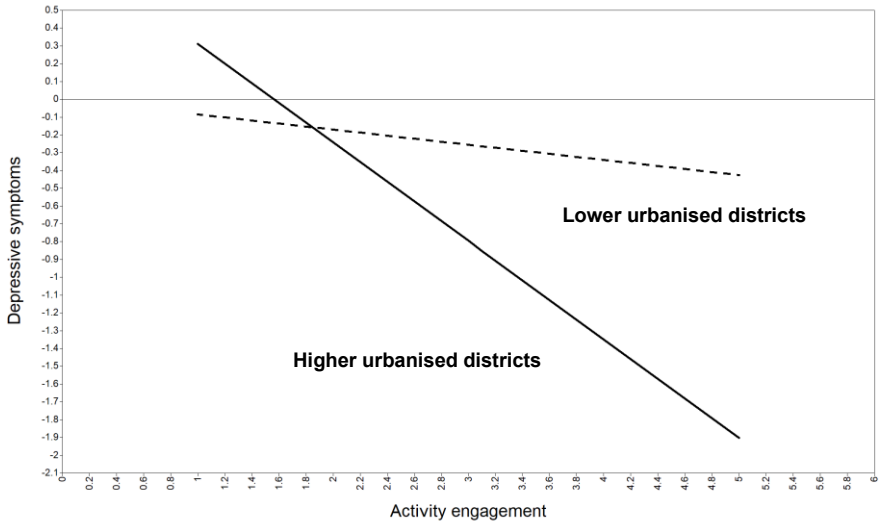

Figure 8.5 *Slope analysis between activity engagement and depressive symptoms at higher and lower urbanisation degrees*

8.6 Discussion

The study in this chapter probed the behavioural pathway of activity engagement in linking age-friendliness and older adults' well-being. It has been found that the influences of social respect and employment on PWB were significantly mediated by activity engagement. In addition, it was found that the direct and indirect impacts of employment on PWB were moderated by urbanisation degree. Particularly, the mediating effect of activity engagement was only significant in higher urbanised areas, whilst the direct influence of age-friendly employment on PWB was stronger in higher urbanised districts. Pertaining to depressive symptoms, only the effects of community-based support and services were significantly mediated by activity engagement. Moreover, the connection of activity engagement and depressive symptoms was also moderated by the degree of urbanisation.

8.6.1 Age-Friendliness, Activity Engagement, and Well-being

The mediating function of activity engagement in connecting age-friendliness and well-being approved the agency process of the person–environment interplay model (Wahl & Oswald, 2003, 2010). The proven mediator of activity engagement addressed the gap in existing literature investigating behaviour patterns in linking environmental attributes and well-being. Older adults could use the immediate environment effectively by taking actions to fit their behavioural needs. It revealed that the implications of the

environment on well-being outcomes were not only straightforward but also indirectly mediated through various behaviours and interactions. Favourable social environments such as social respect and age-friendly employment could advance older people to engage in more vigorous activities, thus improving PWB. On the other hand, community support and health service were additional motivators for older adults' activity engagement, further alleviating the risks of depressive symptoms.

It is worth noting that in this chapter, the significantly mediated age-friendliness domains (i.e., social respect, employment, community-based support and services) were primarily social aspects instead of physical components of AFEs. This is different from previous findings since most prior research (Barnett et al., 2017; Buffel et al., 2014; Lu & Liu et al., 2021; Woolrych et al., 2021; Zheng et al., 2019) documented that it was the physical dimensions of the environment (e.g., sports facilities, tree shades, traffic safety) that predicted the activity engagement of older adults. Nevertheless, the results in this chapter emphasised the efficacy of supportive social services and a friendly social atmosphere in promoting participation in activities, further augmenting PWB and the mental health of older people. One of the possible reasons may be attributed to the adequate functional ability of participants; hence built environment did not pose a block to their participation in activities. Rather, older adults required more respect and inclusion provided by community-based services, programmes, or policies to encourage them to come out and engage in a variety of social activities.

8.6.2 Moderating Effects of Urbanisation Degree

This study revealed that the relationship between activity engagement and late-life PWB and mental health was conditional on the urbanisation degree. This result was identical to the central place theory, postulating that the nature and intensity of various human activities, productivity, and services are intrinsically different, varying with the distance to central places (King, 1985). Therefore, urbanisation influences not only the environment that people can attach to but also the participated activities and received services (Lenzi & Perucca, 2020). In this study, the associations between activity engagement and older adults' PWB and depressive symptoms were only significant in

higher urbanised districts, which was consistent with previous studies indicating that engaging in leisure or physical activities were more important for older residents in urban places (Arnadottir et al., 2009; Parks et al., 2003). Research in Taiwan also reported that the older population in urbanised places was more inactive in terms of physical activity (Huang et al., 2018).

In addition, in this chapter, the direct effect of employment on PWB was also moderated by urbanisation degree, from which the association was stronger in higher urbanised districts. This may be explained by higher urbanised districts providing more opportunities for work, training, or education (Mouratidis, 2021); thus, employment opportunities would be more effective for promoting older people's PWB in central places. This result provided evidence for policy-makers that the policy regarding delaying retirement or age-friendly employment could bring more benefits to older adults' well-being in urban regions.

Chapter 9 Overall Discussion and Conclusions

9.1 Primary Findings and Examination of Hypotheses

9.1.1 Conclusion of Primary Findings

Chapters 5 to 8 presented the primary results and findings of this thesis. Chapter 5 adopted and validated the AFEs scale in the Chinese context, covering the slightly modified eight domains of WHO's framework of age-friendly community. For example, the initial age-friendliness domain of "respect and social inclusion" evolved to "social respect", and "civic participation and employment" turned to "employment", which were more contextually appropriate in mainland China. Specifically, community-dwelling older adults in Shanghai were most satisfied with public transportation, followed by community-based support and services, whilst people were least satisfied with the domain of social participation. Known groups' validity by the urbanisation degree indicated that the scores of public transportation and employment were significantly higher in districts with higher urbanisation. Conversely, the scores of outdoor spaces, housing, social participation, and social respect were significantly higher in districts with lower urbanisation.

Chapter 6 found that, overall AFEs was positively associated with late-life PWB and negatively related to the severity of depressive symptoms. With respect to specific age-friendliness, among the full sample, the results showed that outdoor spaces, housing, social respect, and employment were significant contributors to promoting PWB in older people. For the outcome of depressive symptoms, better perceived housing, outdoor spaces, community-based support and services were detected to be significant in preventing the severity of mental disorders. In examining the competence-press model, the association between AFEs and PWB was stronger among people who reported good health. This indicated that the influence of AFEs was greater in promoting PWB among older people with strong competence. The magnitude of the association between AFEs and depressive symptoms was equivalent in good or poor health status. Particularly, older people living with poor or fair health depend more on service environments, in preventing depressive symptoms.

In Chapter 7, the evidence proved the mediating function of sense of community in linking significant age-friendliness domains, except housing, to older people's PWB and depressive symptoms. The psychological process of belonging within the person–environment interplay model has been supported in this chapter. Further, the study in this chapter revealed that intergenerational relationships significantly moderated the indirect effects of age-friendliness through moderating the link between sense of community and PWB and depressive symptoms. Particularly, the indirect effects of age-friendliness gradually became weaker with the increase in intergenerational relationships. This result justified the substitution effect of sense of connection at the community level to intergenerational relationships at the family level.

Chapter 8 found that the influences of social respect and employment on older adults' PWB were significantly mediated by the frequency of engaging in activities. In addition, activity engagement also mediated the association between community services and depressive symptoms of older community dwellers. These results partially supported the behavioural process of agency within the person–environment interplay model. In addition, the study in this chapter also uncovered that urbanisation degree moderated the connection of activity engagement and older people's PWB and depressive symptoms. Results presented that the indirect effects of age-friendliness (the mediating process at a second stage) were only significant in higher urbanised districts. Moreover, the direct influence of employment on PWB was also moderated by urbanisation degree, from which the direct effect was stronger in central places.

9.1.2 Examination of Hypotheses

Table 9.1 summarises the results of examining the research hypotheses. Overall, this thesis has fully or partially supported the majority hypotheses proposed in the theoretical framework of person–environment interplay.

Table 9.1 *Summary of the results of testing research hypotheses*

NO.	Research questions and hypotheses	Results
RQ1	To what extent are overall AFEs and age-friendliness associated with the PWB and mental health of community-dwelling older adults in Shanghai?	
H1.1	Overall AFE and age-friendliness are positively associated with the PWB and its six dimensions of older adults.	●
H1.2	Overall AFEs and age-friendliness are negatively associated with the depressive symptoms of older adults.	●
H1.3	The influence of AFEs on the PWB and depressive symptoms of older adults is greater among older group with poor or fair health status than group with good health status.	○
RQ2	How does the age-friendliness of AFEs influence the PWB and mental health of older adults through the psychological pathway under different levels of intergenerational relationships?	
H2.1	Sense of community mediates the associations between age-friendliness and the PWB of older adults.	◐
H2.2	Sense of community mediates the associations between age-friendliness and the depressive symptoms of older adults.	◐
H2.3	The quality of intergenerational relationships moderates the indirect effects of age-friendliness on the PWB of older adults through sense of community (the second stage of indirect path).	●
H2.4	The quality of intergenerational relationships moderates the indirect effects of age-friendliness on the depressive symptoms of older adults through sense of community (the second stage of indirect path).	●
RQ3	How does the age-friendliness of AFEs influence the PWB and mental health of older adults through the behavioural pathway under different degrees of urbanisation?	
H3.1	The frequency of activity engagement mediates the relationship between age-friendliness and PWB.	◐

Table 9.1 *Continued*

NO.	Research questions and hypotheses	Results
H3.2	The frequency of activity engagement mediates the relationship between age-friendliness and depressive symptoms.	◐
H3.3	The urbanisation degree moderates the direct and indirect effects of age-friendliness on the PWB of older adults through activity engagement (the second stage of mediation process).	●
H3.4	The urbanisation degree moderates the direct and indirect effects of age-friendliness on the depressive symptoms of older adults through activity engagement (the second stage of mediation process).	●

Notes. RQ = Research Question; H = Hypothesis; ● indicates fully supported by the findings; ◐ indicates partially supported by the findings; ○ indicates not supported by findings.

9.2 Contributions of Thesis

9.2.1 Theoretical Contributions

The theoretical lens for this thesis is environmental gerontology, which assists in explaining the proposed connection between AFEs and late-life PWB and mental health. This thesis contributed to expanding and deepening the theoretical framework of person–environment interplay in later life. Specifically, the psychological and behavioural assumptions in linking AFEs and older adults' outcomes, for the first time, were simultaneously proposed in empirical studies. In alignment with such assumptions, this thesis successfully linked specific age-friendliness domains to PWB and depressive symptoms through a sense of community and activity engagement. These findings provided novel insights for the behaviour-driven process of agency and complemented the well-established psychological pathway of belonging in the interaction between people and environments. In this way, a more comprehensive picture of the relationship between older people and AFEs was developed.

Second, this thesis also contributed to the theoretical development by integrating the perspective of a multi-layered ecological system into the person–environment interplay model. In this thesis, new dynamics at the family level (intergenerational relationships) and structural factors at the macro-level (urbanisation degree) were added to the previous theoretical framework, which was primarily positioned at the

community level. By doing so, this thesis not only proved the mechanism of the influence from AFEs but also identified the contextual conditions that the mechanism was valid. In this way, the theory's range of application was re-established in intergenerational and structural contexts. Therefore, incorporating components from micro and macro systems, this thesis advanced our understanding regarding how the direct and indirect impacts of AFEs on PWB and mental health altered under different intergenerational and urbanisation conditions.

Third, the diverse age-friendliness of AFEs adopted in this thesis extended the scope of environments in the theoretical framework. The eight domains of the AFEs scale extensively covered multiple domains of environments, encompassing physical, social, and service aspects. Rather than highlighting a singular type of environment, this thesis attempted to address multiple domains of AFEs with equal merits. This adoption was in line with the conception of environments from Dannefer (1992) that environments are the totality of outside phenomena, events, and forces.

9.2.2 Empirical Contributions

Firstly, in terms of assessing AFEs, this thesis contributed to validating a more precise and contextually appropriate AFEs scale to be used in mainland China. The freshly developed scale was generally consistent with the previous factor structure, with subtle modifications of specific factor patterns. This result, on the one hand, reflected the robustness and rigour of WHO's original framework. In addition, it also presented the uniqueness of older people's perception and application towards several age-friendliness domains (e.g., employment, social respect) in the Chinese context. The validated scale could be further applied in measuring AFEs for empirical research in mainland China.

Secondly, unlike previous research that mainly considered older people's life satisfaction or quality of life as target outcomes, this thesis examined PWB and mental health in association with AFE, which have been seldom probed. The eudaimonic perspective of PWB and increasing interest in mental health have made these two outcomes of great importance to be tested with AFEs. Specifically, this thesis specified

which age-friendliness domains were significant contributors to enhance PWB and mental health among older community dwellers in Shanghai. For example, it found that favourable outdoor spaces and housing were both significant in promoting PWB and preventing severity of depressive symptoms, providing empirical evidence for further practical interventions. In addition, the assumption of the competence-press model that older people with less competence may rely more on immediate environments was refuted by the results in this thesis. This finding was intriguing because it encourages us to reconsider the influence of AFEs on older people with different competence statuses. This finding indicated that older people with more competence may receive more environmental influence since they can have more interactions with AFEs through psychological or behavioural processes.

Thirdly, to bridge the limitation of lacking multi-layered systems in previous research, this thesis purposively added components from family- and macro-levels as moderators within the psychological and behavioural pathways, respectively. In this way, this thesis provided the first evidence that how direct and indirect effects of age-friendliness interacting with intergenerational relationships and the urbanisation degree in determining late-life PWB and mental health. Particularly, it revealed that the indirect effects of age-friendliness became weaker with the increase in intergenerational relationships, confirming the substitution effect of a sense of community in intergenerational relationships. This finding was particularly meaningful in contemporary society since filial obligation gradually eroded by modernisation in Chinese cities.

Pertaining to the behaviour pathway, this thesis uncovered that the indirect effects of age-friendliness through activity engagement were no longer salient for PWB and mental health in districts with lower urbanisation degrees. Moreover, the direct effect of employment on PWB also turned out to be weaker in lower urbanised districts. This finding highlighted the necessity to develop AFEs for older adults with the continuous urbanisation process in China. All these results suggest that the associations of age-friendliness and older people, or the pathways within such associations, should not be

inspected within a singular-layer system. Rather, the nature or strength of the associations is inevitably shaped by micro and macro factors such as intergenerational relationships within the family or the structural force of urbanisation. Overall, the complex psychological and behavioural pathways between AFEs and older people reflected the joint dynamics of family, community, and structural factors contributing to older people's PWB and mental health.

9.2.3 Policy and practical Implications

The results of this thesis provided evidence that policy-makers and practitioners can promote people's late-life PWB and mental health through the means of environmental improvement. For instance, in terms of specific age-friendliness, this thesis underscored the significance of outdoor spaces and housing in improving PWB, and in the meanwhile, in preventing depressive symptoms. In view of this finding, estate developers and urban designers are suggested to install or update more barrier-free facilities, including elevators, handrails, and ramps in old buildings to facilitate the movement of older people. In addition, more public spaces for resting or recreation (e.g., resting benches, greenness, corner parks, exercise spaces) should be created for older people in outdoor spaces since our study indicated that outdoor spaces was positively related to a sense of community, which was an important place to perform socialisation and improve autonomy among older residents. In terms of indoor housing design and adaptation, government may consider systematically conducting elderly-oriented housing renovations in old communities. For example, installing non-slip tiles and handrails in the bathroom, as well as sensor light in corridor to guarantee elderly safety and avoid the falls of frail older people.

In addition to the built environments, this thesis also proved the necessity to foster social respect, age-friendly employment and workplace for older people in Shanghai. Historically, respecting older people is the conventional social norm in Chinese society. Nevertheless, with the process of modernisation, respectful attitudes towards older people may have weakened in recent decades. Given this phenomenon, more public education regarding active ageing process, positive image of older people, and

conventional cultures should be enhanced in public discourse, especially among students in school and university. For instance, social workers could conduct community-based or university-based intergenerational programmes to foster social respect towards older adults. This study also supported the implications of age-friendly employment for older people's PWB, which has been seldom captured by previous research. To improve age-friendliness in the workplace, as suggested by Eppler-Hattab et al. (2020), flexible employment, training and learning, equal opportunities in recruitment, and reliable information for reemployment should be provided and redesigned for older employees or retirees in the future.

Furthermore, improving community-based support and services was found to be useful in preventing mental disorders in older residents. It is suggested that government and community should provide a variety of services for older residents, including integrated care services, personal care, home-delivered meal programme, housework support, and escort services, which were in great demand by older adults. In addition, the results indicated that social workers should provide more necessary interventions such as psychological counselling and spiritual comfort. When providing these services, it is worth noting that special attention should be focused on those frail older people with poor health status, as result in this thesis revealed that community services were more potent in preventing the severity of depressive symptoms among older people with weaker competence.

Moreover, inspired by the mediating effect of psychological (i.e., sense of community) and behavioural (e.g., activity engagement) pathway, a variety of community-based activities should be designed and organised to attract the engagement of older people. Enhancing the sense of community and activity engagement will not only exert positive influence on well-being of older adults but also indirectly make good use of the potential of AFEs. To achieve this, neighbourhood committee and social workers are suggested to explore more attractive community-based leisure activities, including group exercise classes, gardening or other interest clubs, intergenerational programmes, and field trips.

Last but not least, the above-mentioned community-based interventions were particularly suggested to be provided for those older people with poor relationships with their adult children or living alone. These interventions would be more potent in improving PWB and the mental health of these older groups because they have considerable needs for receiving health care and social support at the community level. More importantly, with the persistent process of urbanisation and population ageing in China, policy-makers should realise the need to develop age-friendliness with respect to physical, social, and service environments. This thesis found that the indirect effect of age-friendliness through the behavioural pathway was only significant in higher urbanised districts, indicating an increasing importance of developing AFEs in places with the consistent urbanising trend. Thoughtful leadership of policy institutions and collaborative partnerships with multiple stakeholders (e.g., urban designers, social workers, care providers, research institutions) should be established in the future. Given that China is a large territory with uneven developmental stages, guided by the National Standards of Age-friendly Communities, different cities should prioritise the pressing domain of AFEs and create tailored age-friendliness among local older adults.

9.3 Limitations and Future Directions

Several limitations of this thesis should be noted so as to better guide future research directions accordingly. First, this thesis used a moderate sample size in one case city, which may limit the generalisation of the results of significant age-friendliness to other research sites. For example, in this thesis, public transportation was not a significant predictor of older people's PWB and mental health because public transportation has been well developed in Shanghai. However, this cannot yield the conclusion that transportation was unimportant for older adults in other places in China, where cities are substantially different from each other in terms of social and economic conditions. Moreover, this study did not interview participants within home, which may lead to the possibility of sample bias that older adults who were physically healthier and more socially active would have higher chance to participate in this research. To address this limitation, future research may recruit more older participants from indoor and outdoor

spaces, and considerations of specific demographic, social, and economic contexts of research sites should be taken into account.

Second, in this thesis, the measures of AFEs were grounded on subjective perceptions of surrounding environments. Subjective instead of objective assessments may influence the accuracy of measurements, although previous studies indicated that the congruence between subjective and objective assessments was good (Menec et al., 2016). To more accurately reflect the ratings of AFEs, especially built environments (e.g., outdoor spaces and transportation), it is suggested that technical assistance such as Geographic Information Systems or Google Maps could be used in future research.

Third, the cross-sectional trait of the research design in this thesis requires that the causal inferences be interpreted cautiously. The one-time environmental exposures and outcomes measurement made it difficult to conclude causal relationships from cross-sectional research. In view of this limitation, more scientific and rigorous research designs such as research with longitudinal data, randomised control trials, and quasi-experimental research could be further employed to investigate the causality of the relationship between older people and environments.

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Appendix

Appendix I. Ethical Approval

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

To	Bai Xue (Department of Applied Social Sciences)		
From	Siu Yu Kwan, Delegate, Departmental Research Committee		
Email	kaxton.siu@	Date	06-Mar-2021

Application for Ethical Review for Teaching/Research Involving Human Subjects

I write to inform you that approval has been given to your application for human subjects ethics review of the following project for a period from 22-Feb-2021 to 31-Aug-2022:

Project Title:	Age-friendly environments and psychological well-being among Chinese older people: A mixed-method study in Shanghai
Department:	Department of Applied Social Sciences
Principal Investigator:	Bai Xue
Project Start Date:	22-Feb-2021
Project type:	Human subjects (non-clinical)
Review type:	Expedited Review
Reference Number:	HSEARS20210113001

You will be held responsible for the ethical approval granted for the project and the ethical conduct of the personnel involved in the project. In case the Co-PI, if any, has also obtained ethical approval for the project, the Co-PI will also assume the responsibility in respect of the ethical approval (in relation to the areas of expertise of respective Co-PI in accordance with the stipulations given by the approving authority).

You are responsible for informing the PolyU Institutional Review Board in advance of any changes in the proposal or procedures which may affect the validity of this ethical approval.

Siu Yu Kwan

Delegate

Departmental Research Committee (on behalf of PolyU Institutional Review Board)

Appendix II. Consent Form

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

参与研究同意书

老年友好城市和长者心理健康

本人_____同意参与由香港理工大学应用社会科学系白雪副教授负责统筹开展的老年友好城市和长者心理健康研究。

本人知悉此研究所得的资料会被严格保密，仅通过编码用于日后的研究及发表。

研究人员已向本人清楚解释列在所附资料卡上的研究程序，本人明了当中涉及的利益及风险，本人自愿参与研究项目。

我明白本人有权就访谈或问卷调查的任何部分提出疑问，并有权随时退出而不受任何惩处。

参与者姓名 _____ 参与者签署 _____

研究员姓名 _____ 研究员签署 _____

日期 _____

Hung Hom Kowloon Hong Kong 香港 九龍 紅磡
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Appendix III. Questionnaire of Thesis

“老年友好环境与长者心理健康”研究问卷

Section A 个人基本信息 Individual Characteristics

A1. 性别	男（1）	女（0）	
A2. 出生年月			
A3. 婚姻状态	从未结婚（1） 分居（4）	同居（2） 离异（5）	结婚（3） 丧偶（6）
A4. 居住地	区/街道/社区		
A5. 居住地属于城市还是农村	农村（1）	城市（2）	郊区（3）
A6. 上海户口	是（1） 否（0）		
A7. 最高学历	未上过学（1） 高中（4） 大学（7）	小学（2） 高职/中专（5） 硕士及以上（8）	初中（3） 大专（6）
A8. 目前工作状态	待业（1） 退休（4）	兼职（2）	全职（3）
A9.1 月收入（退休-城镇职工）	<1000 (1) 3000-3999 (4)	1001-1999 (2) 4000-4999 (5)	2000-2999 (3) >5000(6)
A9.2 月收入（退休-城镇居民）	<500 (1) 1300-1600 (4)	500 - 800 (2) 1600-2000 (5)	800 -1300 (3) >2000(6)
A9.3 月收入（在职）	<3000 (1) 7000-8999 (4) >15000 (7)	3001-4999 (2) 9000-11999 (5)	5000-6999 (3) 12000-14999 (6)
A10. 您目前或退休前所从事的职业	政府部门、企事业单位领导（1） 专业技术人员（如教师、医生、金融、工程技术人员等）（2） 职员（从事一般性事务工作或服务业人员）（3） 个体从业者（4） 农民（5） 家庭主妇（6） 其他（7）		
A11. 您有几个子女	无（1） 一个（2）	两个（3）	三个及以上（4）
A12. 总体来说，您怎样评价您目前的健康状况			
非常差（1） 较差（2） 一般（3） 较好（4） 健康非常好（5）			

Section B 老年友好环境 Age-friendly Environments

请您对以下描述做出**主观满意度评价**，用数字选项表示不同项目的环境友善度，数字越大，表明您对该项目越满意 （*表示经过验证后包含在老年友好环境量表中的条目）

非常不满意（1） 不满意（2） 一般（3） 较满意（4） 非常满意（5）	
B1 户外空间和建筑	
B1.1 *公共区域干净舒适	
B1.2 *绿化空间充足，维护良好	
B1.3 *人行道保养良好，人行道和车道分开，没有障碍物	
B1.4 *建筑外有可直达的电梯、坡道、栏杆扶手，以及防滑楼层方便老人出行	
B1.5 *室外有充足的公共座椅或休闲设施	
B1.6 小区外公共厕所数量充足，干净	
B1.7 社区道路安装路灯	
B1.8 *小区内有充足的停车场	
B2 交通	
B2.1 *小区附近有公共交通线路经过	
B2.2 *公共交通费用在可负担范围	
B2.3 *公共交通班次时间间隔合理，周末、节假日皆可运行	
B2.4 *可通过公共交通到达大部分地点（如医院，银行，公园，超市等）	
B2.5 *交通站点离居住地较近，标识清晰，有遮蔽处	
B2.6 车辆清洁有序，有长者优先座位，不拥挤	
B2.7 *交通指引明晰，能够指导我自主乘坐公共交通工具	
B2.8 小区附近行车道路维护良好，道路安全性较好	
B3 住房	
B3.1 *目前的住房成本没有给生活造成很大负担	
B3.2 *房屋结构良好，安全舒适	
B3.3 *无障碍性：住房内设置了防滑地板、卧室或淋浴室有扶手	
B3.4 *安全性：老化的水管、电线、煤气管、热水器得到更换，没有安全隐患	
B3.5 *整洁性：墙面粉刷，有储物柜、衣柜	
B4 社会参与	
B4.1 *社区有专门为老年人举办活动的场所（如老年活动室），且位置便利	
B4.2 *社区或村委会定期为长者组织活动	
B4.3 *参加活动是免费的	
B4.4 *社区或村委会向长者提供有关活动的详细信息	
B4.5 *活动种类多样，如体育、文化、教育、亲子活动，对长者有吸引力	
B5 敬老（与社会融入）	
B5.1 附近的公共和商业服务能够提供适合长者需求和偏好的服务和产品	
B5.2 当地开展代际互动、邻里互助活动，使长者具有文化融合和社会认同	
B5.3 *附近人们对长者态度谦和，彬彬有礼	
B5.4 *社会媒体对长者的形象描述是积极的	
B5.5 *长者的贡献得到周围人们的认可和尊重	
B6 （公民参与和）工作	
B6.1 长者能参与到当地社区居民代表会议或村委会的决策和投票过程	
B6.2 长者有很多机会参与社区建设、社区自治，为社区发展建言献策	

B6.3 *长者退休后可获得灵活的工作机会	
B6.4 *退休后长者可获得职业介绍相关的信息或职业技能培训	
B7 沟通和信息	
B7.1 *长者可以通过布告栏、广播、媒体等途径接触到有关福利、社会服务、文体活动等信息	
B7.2 *当地居委会向长者普及老年人权益保护法和防诈骗信息	
B7.3 当地社区通过老年教育学习点等平台，帮助老年人学习电脑、智能手机等智能产品和智能技术的使用，促进长者线上沟通交流	
B7.4 *电脑浏览器或手机应用中的文本，可调整字体大小，以适应长者视力	
B7.5 *手机、电视机或公共场所的广播设置了大按钮、大屏幕和大音量	
B8 社区和医疗服务	
B8.1*当地社区提供医疗服务，如急救、常见病治疗、护理病床等	
B8.2 *当地社区定期提供健康管理服务， 如体检、健康状况评估、健康讲座等	
B8.3 *社区提供上门护理服务，如基本生活照料、家务支持、辅助餐食和出行	
B8.4 *当地社区提供社会工作服务， 如心理疏导、精神慰藉、关系调节	
B8.5 *社区工作人员或志愿者定期探访独居、空巢、失能失智等特殊困难长者	
B8.6 *附近护理院或社区医院位置便利、交通方便	
B8.7 *服务价格合理，可以负担	

Section C 社群意识 Sense of Community

请回答您在多大程度上同意以下表述，数字由 1 至 5 依次表示同意的程度增加。 非常不同意（1） 不同意（2） 一般（3） 同意（4） 非常同意（5）	
C1. 在社区或村镇里我的需求能够得到满足	
C2. 这个社区能帮助满足我的需求	
C3. 我感到我是这个社区中的一员	
C4. 我属于这个社区	
C5. 我对社区里发生的事情有发言权	
C6. 社区里人们能够互相影响彼此	
C7. 我感觉和这个社区联系在一起	
C8. 我和社区里的人们连结在一起	

Section D 活动参与 Activity Engagement

过去的一周内，您参加以下活动的频率是什么： 几乎不参加-1　　很少参加（一至两次）-2　　有时候参加（三至四次）-3 经常参加（五次以上或几乎每天参加）-4	
D2. 体育活动 （如利用小区健身器材锻炼、公园散步、郊游等）	
D3. 休闲娱乐活动（如打麻将、打牌、下棋、跳广场舞等）	
D8. 以社区为范围的志愿者活动（如维护社区治安、卫生清洁、调节邻里矛盾等）	

Section E 精神健康 Psychological Well-being

请回答对于以下陈述，您在多大程度上同意或者不同意： 强烈同意-1　　有些同意-2　　有点同意-3　　既不同意也不反对-4 有点不同意-5　　有些不同意-6　　强烈不同意-7	
E1. 我不害怕发表我的观点，即使我的观点和大多数人不一样	
E2. 对我来说，生活是一个不断改变、学习、成长的过程	
E3. 总体来说，我觉得我能掌控生活的局面	
E4. 人们认为我是个慷慨的人，乐于和别人分享	
E5. 我对那些拓展视野的活动不感兴趣	
E6. 我喜欢为未来制定计划，并使之成为现实	
E7. 大多数人认为我是有爱心的、热情的	
E8. 在很多方面，我对自己的人生成就感感到失望	
E9. 我每天得过且过，并没有真正思考未来	
E10. 我倾向于担心别人对我的看法	
E11. 当我回顾我的人生时，我对很多事情很满意	
E12. 我很难把我的生活安排满意	
E13. 我的决定通常不会受到其他人行为的影响	
E14. 很久以前我就放弃了对生活做出重大改善的努力	
E15. 我经常对日常生活感到沮丧	
E16. 我从未与亲人或朋友经历过温暖、信任的关系	
E17. 我认为经历一些新体验，去改变如何认识自己和这个世界是很重要的	
E18. 对我来说维持与亲人或朋友的亲密关系是困难的	
E19. 我对自己的态度可能不像大多数人对自己的感觉那么积极	
E20. 我有生活的方向感和目标感	
E21. 我判断自己的标准是我认为什么是重要的，而不是别人的价值观	
E22. 总体来说，我觉得自己很自信，很积极	
E23. 我已经能够为自己建造一个我喜欢的生活环境和生活方式	

E24. 我容易被那些观点鲜明的人所影响	
E25. 我不喜欢进入新的环境，因为要改变之前熟悉的行为方式	
E26. 我对周围的人和社区不太合群	
E27. 我知道我可以信任我的朋友，他们也知道他们可以信任我	
E28. 我认为这么多年我并没有真正进步多少	
E29. 有些人在生活中漫无目的地徘徊，但我不是这样的人	
E30. 我经常感到孤独，因为我很少有亲密朋友来分享我的担忧	
E31. 当我把自己与朋友和熟人比较时，我自我感觉良好	
E32. 我没有很好的意识到我想要在生活中实现什么	
E33. 我有时候觉得我已经做完了人生中所有该做的事情	
E34. 我觉得很多我认识的人从生活中得到的比我多	
E35. 我对自己的观点有信心，即使它和普遍共识相悖	
E36. 我很擅长管理日常生活中的许多责任	
E37. 随着时间地推移，我觉得自己成长了很多	
E38. 我喜欢与家人和朋友进行互动的交谈	
E39. 我的日常活动经常是琐碎且不重要的	
E40. 我喜欢自己性格的大部分	
E41. 面对有争议的问题，我很难发表自己的意见	
E42. 我经常被我的责任压垮	

Section F 抑郁症状 Depressive Symptoms

以下是你可能会有的感觉或行为，请告诉我在**过去一周**你有多少次有这种感觉： 很少或从不（少于一天）**-0**　　偶尔（一至二天）**-1** 有时候（三至四天）**-2**　　大部分时间（五至七天）**-3**	
F1. 我被那些看似很普通平常的事情烦扰着	
F2. 我感觉我无法摆脱忧郁的情绪，即使有家人朋友的帮助	
F3. 我很难把注意力集中到我正在做的事情上	
F4. 我觉得我做的每件事都是努力的结果	
F5. 我认为我的人生是失败的	
F6. 我难以入睡	
F7. 我说话比平时少	
F8. 我认为人们不友善	
F9. 我有时会哭	
F10. 我觉得人们不喜欢我	

Section G 代际关系质量 Intergenerational Relationship Quality

我们想了解您**与子女的相处情况**，请回答以下问题。
G1. 您和他（她）家的**距离**有多远？ 住在不同城市（1）　住在同一个城市但不同区域（2）　同一个区域但在不同社区/街道（3）　住在同一个社区/街道但不住在一起（4）　和子女住在一起（5）
G2. 过去一年内，您和他（她）**面对面接触**的频率是？ 没见面或一年一次（1）　一年数次（2）　每月数次（3） 每星期数次（4）　一天一次或多次（5）
G3. 过去一年内，您和他（她）以**电话、微信、书信等方式接触**的频率是？ 没联系或一年一次（1）　一年数次（2）　每月数次（3） 每星期数次（4）　一天一次或多次（5）
G4. 您觉得和他（她）**亲近**吗？ 非常不亲近（1）　不太亲近（2）　一般（3）　较亲近（4）　非常亲近（5）
G5. 您和他（她）**相处融洽**吗？ 非常不融洽（1）　不太融洽（2）　一般（3）　较融洽（4）　非常融洽（5）
G6. 您有多大频率感到与他（她）的**关系紧张**？ 从不（1）　几乎从不（2）　偶尔（3）　经常（4）　总是（5）
G7. 您有多大频率感到他（她）对您**要求太多**？ 从不（1）　几乎从不（2）　偶尔（3）　经常（4）　总是（5）
G8. 他（她）有多常对您或您所做的事情**不满**？ 从不（1）　几乎从不（2）　偶尔（3）　经常（4）　总是（5）
G9. 他（她）有多常给您**金钱或礼物**？ 从不（1）　几乎从不（2）　偶尔（3）　经常（4）　总是（5）
G10. 他（她）有多常协助您**处理家务**？ 从不（1）　几乎从不（2）　偶尔（3）　经常（4）　总是（5）
G11. 整体而言，您和他（她）的**意见及想法相似**吗？ 非常不相似（1）　不相似（2）　一半（3）　相似（4）　非常相似（5）
G12. 您和他（她）就**社会议题**的意见相似吗？ 非常不相似（1）　不相似（2）　一半（3）　相似（4）　非常相似（5）
G13. 就家庭和政府在**照顾老年人的责任**而言，您和他（她）的意见相似吗？ 非常不相似（1）　不相似（2）　一半（3）　相似（4）　非常相似（5）