FACTORS OF OLD NEIGHBOURHOOD ENVIRONMENT AFFECTING THE PHYSICAL AND MENTAL HEALTH OF THE ELDERLY LIVING IN SKIPPED-GENERATION HOUSEHOLDS IN GUANGZHOU, CHINA

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by

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LIST OF SYMBOLS

$\boldsymbol{A_N}$	Numbers of built environment indicators related to the health of the elderly
U	Universe set of RST
A	Certain attribute set of RST
	Upper approximate boundary of RST
	Lower approximate boundary of RST
Φ	Condition attribute of RST
Ψ	Decision attribute of RST
$\boldsymbol{Y}$	The non-negative value direct influential relation matrix in DEMATEL
y_{ij}	Influence degree from rule *i* to rule *j*
$\boldsymbol{Z}$	The normalized direct-relation matrix of DEMATEL
$\boldsymbol{T}$	The total influence relationship matrix of DEMATEL

LIST OF ABBREVIATIONS

RST	Rough Set Theory
INRM	Influence Network Relationship Map
OR	Operations Research
MCDM	Multiple Criteria Decision Making
MODM	Multiple Objective Decision Making
MADM	Multiple Attribute Decision Making
MRDM	Multiple Rule-based Decision Making
IAQ	Indoor Air Quality
DEMATEL	Decision making trial and evaluation laboratory
AHP	Analytical Hierarchy Process
DANP	DEMATEL based Analytical Hierarchy Process
VIKOR	VlseKriterijuska Optimizacija I Komoromisno Resenj
DDANPV	DEMATEL, DANP and VIKOR
RFID	Radio frequency identification
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution
QOL	Quality of Life

LIST OF APPENDICES

FAKTOR-FAKTOR PERSEKITARAN KEJIRANAN LAMA YANG MEMPENGARUHI KESIHATAN FIZIKAL DAN MENTAL WARGA EMAS YANG TINGGAL DI ISI RUMAH GENERASI TERLANGKAU DI GUANGZHOU, CHINA

ABSTRAK

Dengan pendalaman pembandaran, strategi pembangunan bandar banyak bandar besar di China telah berubah daripada pengembangan di luar bandar kepada pembaharuan dalam bandar. Penyelidikan menunjukkan bahawa kawasan kejiranan lama di bandar sudah pasti berubah menjadi kawasan kejiranan yang semakin tua. Di satu pihak, sebilangan besar komuniti lama perlu dikemas kini untuk memperbaiki keadaan persekitaran dalaman mereka. Sebaliknya, dengan perkembangan masyarakat yang semakin tua, masalah kesihatan warga emas semakin mendapat perhatian masyarakat perlu diingatkan bahawa dalam kalangan warga emas, keadaan fizikal warga emas merentas generasi selalunya lebih rapuh dan. lebih terdedah kepada jangkitan impak alam sekitar. Dalam pelan pembaharuan komuniti lama, cara menggunakan sumber secara saintifik sentiasa menjadi masalah yang menyusahkan pembuat dasar dan pereka bentuk. Oleh itu, matlamat kajian ini adalah untuk mewujudkan satu set model penilaian yang berkaitan dengan kesihatan warga tua

merentas generasi dan digunakan untuk menilai elemen persekitaran komuniti dalam rancangan pembaharuan komuniti lama, supaya dapat mengelakkan pembaziran sumber semasa proses pembaharuan. Selepas menjalankan tinjauan soal selidik mengenai status kesihatan dan persekitaran komuniti warga tua antara generasi di Komuniti Chebei Guangzhou, model penilaian awal telah diwujudkan menggunakan model Rough Set Theory (RST)-Decision Testing and Evaluation Laboratory (DEMATEL), dan 384 respons telah dinilai. Data dianalisis untuk mengira hubungan antara pelbagai elemen persekitaran dalam komuniti. Hasil kajian menunjukkan reka bentuk ruang hijau merupakan faktor teras yang mempengaruhi kesihatan fizikal dan mental warga emas SGH. Selain itu, reka bentuk ruang biru, reka bentuk ruang pelbagai fungsi, kemudahan rehat awam dan sambungan pengangkutan awam serta kebolehcapaian merupakan faktor penting dalam kesihatan fizikal datuk dan nenek. Hasil kajian ini boleh memberikan asas teori untuk penyelidikan seterusnya dan memberikan cadangan kemas kini komuniti yang sepadan.

FACTORS OF OLD NEIGHBOURHOOD ENVIRONMENT AFFECTING THE PHYSICAL AND MENTAL HEALTH OF THE ELDERLY LIVING IN SKIPPED-GENERATION HOUSEHOLDS IN GUANGZHOU, CHINA

ABSTRACT

With the deepening of urbanization, the urban development strategy of many large cities in China has changed from expansion to the outside of the city to renewal within the city. Studies have shown that old neighbourhoods in cities are inevitably transforming into aging neighbourhoods. On the one hand, a large number of old neighbourhoods need to be updated to improve the internal environmental conditions. On the other hand, with the development of an aging society, the health problems of the elderly have attracted more and more attention from the society. It should be noted that among the elderly population, the physical condition of the elderly live in Skipped-Generation Household (SGH) is often more fragile and more susceptible to environmental influences. In the renewal plan of old neighbourhoods, how to use resources scientifically has always been a problem that has plagued decision makers and designers. Therefore, the objective of this study is to establish a set of evaluation models related to the health of SGH, which are used to evaluate community

environmental elements in the renewal plan of old neighbourhoods, so as to avoid the waste of resources in the renewal process. After conducting a questionnaire survey on the health status and community environment of SGH in Chebei Community, Guangzhou, this study applying a Rough Set Theory (RST) - Decision-Making Trial and Evaluation Laboratory (DEMATEL) model to establish a preliminary evaluation system. The model can calculate the relationship between various environmental elements in the community. The results of the study show that green space design is a core factor affecting the physical and mental health of SGH elderly. In addition, blue space design, multifunctional space design, public rest facilities, and public transportation connections and accessibility are important factors in the physical health of grandparents. The results of the study can provide a theoretical basis for subsequent research and put forward corresponding community renewal suggestions.

CHAPTER 1 INTRODUCTION

1.1 Background of study

This study will explore the relationship between the physical and mental health of older adults across generations and the community environment in which they live. With the aging of the world gradually deepening, the health problems of the elderly have become more and more important. Research shows that the health conditions of old people living in Skipped-Generation Households (SGH) are often more fragile (Laughlin, 2013), and their health problems require more attention from society. Nowadays, more and more elderly people choose the way of aging in place, and the built environment of the community has a direct impact on the outdoor activities of the elderly (Crimmins & Saito, 2000). It should be noted that there are many components of the built environment, and the impact mechanisms of these factors on the physical and mental health of the elderly are not the same. Understanding the relationships among them is the key to promoting successful aging of the SGH elderly.

1.1.1 Aging Society

The world is facing the development trend of varying degrees of declining birth and aggravating aging society. China, 18 percent of the world's population, now has nearly 200 million elderly people. According to the data survey, by 2050,

China’s elderly population will reach more than 365 million (World Population Prospects 2022, https: //population.un. org/wpp/). Furthermore, within this demographic of elderly individuals, it is projected that 115 million will reach the age China is experiencing rapid ageing and is now the fastest-aging developing nation. As individuals age, the physiological functions of the human body gradually decline, leading to a growing concern for the physical and mental well-being of the elderly during their latter years (Wu et al., 2019).

The majority of individuals choose to age in place due to the perception that it allows older folks to preserve their independence and autonomy, while also facilitating their ability to keep social connections with friends and family (Marek et al., 2005). This, in turn, helps to alleviate social isolation and loneliness (Coleman et al., 2016). The surrounding habitat in the vicinity of a neighbourhood frequently influences the physical and mental well-being of older individuals (Garin et al., 2014). Currently, in China, there is a prevalence of old neighbourhoods that have remained from the previous century, primarily due to historical, policy, and economic factors. The senior population in these neighbourhoods generally constitutes a significant share due to factors like as the early housing structure, the one-child policy, and the transfer of the youthful labour (Zhou et al., 2015).

It is worth noting that due to the long construction time, old neighbourhoods often have problems in building performance, public facilities, road traffic, building appearance, safety management, community culture, environment, etc. (Cai et al., 2017; Wu, 1991) , these problems have seriously affected the quality of life of residents in old neighbourhoods (Wang et al., 2014; Wu & He, 2005). According to data analysis from the National Bureau of Statistics and the Ministry of Housing and Urban-Rural Development of China, there are approximately 160,000 old neighbourhoods in China, with a residential construction area of 800 million square meters, affecting more than 4,200 households (Zhu, Li, Feng, & Gu, 2019). Therefore, the Chinese government regards the regeneration of old neighbourhoods as one of the national urban development strategies (Li et al., 2019). In order to narrow the gap between older neighborhoods and other areas, China is undertaking urban redevelopment of old urban areas in the city centre. Zou (2015) proposed the concepts of stock planning and incremental planning. The renewal and transformation of old neighbourhoods are an important part of this policy.

1.1.2 Elderly living in Skipped-Generation Household (SGH)

Elderly living in Skipped-Generation Household (SGH) refer to the elders in families whose resident population is only grandparents and grandchildren (Cong & Silverstein, 2008). The children of these elderly people have moved to other places.

They are usually unable to take care of their children due to work and other reasons, so they can only send them to their parents' homes for upbringing. Previous studies on ageing have indicated that older individuals have been assuming greater levels of responsibility in recent times. This may be observed both at the societal level, with some nations raising the retirement age, and at the familial level, with more support being provided to the education of the next generation (Hank & Buber, 2009).The idea of multi-generational cohabitation is often seen as the best living arrangement in many parts of East Asia. The concept of "cohabitation and common wealth" refers to the establishment of a system of mutual assistance and trust among family members without a formal agreement. It has been observed that an increasing number of young people in China choose to entrust the regular care of their children to their grandparents (Laughlin, 2013). The health condition of senior individuals at SGH becomes increasingly delicate due to the combined effects of the demanding task of education and the deterioration in physical function (Ren & Treiman, 2015). Hence, conducting research on the health and well-being of this demographic is of utmost importance. Prior studies conducted in the United States have documented negative health consequences associated with the act of caring for grandkids (Blustein, et al., 2004). According to Szinovacz et al. (1999), it has the potential to diminish the overall happiness and physical capabilities of older individuals, as stated by Minkler

and Fuller (2001). Conversely, current research conducted in the Chinese Mainland, Hong Kong, and Taiwan consistently demonstrates the health benefits experienced by grandparents who provide intermittent, prolonged, or even full-time care to their grandchildren. Compared to individuals who are not carers, grandparents who provide care enjoy a decrease in depression symptoms (Cong & Silverstein, 2008; Silverstein et al., 2006; Tsai et al., 2013). However, in many developing countries, especially in certain parts of China, the rapid progress of urbanisation has led to the depletion of population and resources in both urban and rural areas outside of central cities. As a result, the older population living in these areas bear a greater burden of taking care of their children.

The influence of the physical infrastructure in older neighbourhoods on the well-being of senior citizens has recently emerged as a significant area of study. As physical function deteriorates, walking has increasingly been the preferred activity for older individuals, and the local outdoor area has become their primary place for engaging in physical activity (Zhao & Chung, 2017). The elderly benefit from engaging in outdoor sports since it provides them with essential physical activity, opportunities for natural interaction, and social engagement (Li et al., 2021). Prior research has indicated a possible correlation between the local surroundings and the well-being of older individuals (Lawton, 1983). Moreover, the influence of parenting

behaviour on SGH intensifies the intricacy of this association, encompassing both cognitive and physical aspects (Leake et al., 2019, Gerard et al., 2006, Landry & Newman, 2004).

1.2 Problem Statement

In previous studies in the fields of aging, health, and environment, scholars' research focus has often been on the broad group of elderly people (Beckett et al., 2002, Gardener & Lemes de Oliveira, 2020). However, the SGH elderly group among the elderly has been ignored. Although the phenomenon of SGH elderly families has become more and more common in recent years, the number of SGH elderly people has grown increasingly obvious (Yilmaz et al., 2018). It is worth noting that the living patterns of SGH elderly people are different from those of ordinary elderly people. These differences mean that previous research results cannot be simply applied to this group of people. Also, the guardianship of grandchildren by the SGH elderly will have an impact on the travel choices, social status and daily behavior patterns of this group. The responsibility for raising grandchildren will increase the life and psychological pressure of them. In addition, the elderly and children are relatively vulnerable groups in society, and they are often more vulnerable when faced with poor living and safety environments. The elderly represent the past of the society, and children represent the future, and in the

relationship between the two groups, the elderly are the party responsible for leading parenting. Therefore, the health status of SGH elderly who living in old neighbourhoods should be more concerned than ordinary elderly. Therefore, the health status of elderly people in elderly neighbourhoods deserves more attention than that of ordinary elderly people. Research on this target population is very necessary.

In contrast, older neighbourhoods are typically constructed over a significant period of time, resulting in physical environmental circumstances that may not adequately meet the needs of the elderly. At the same time, the demographic makeup of these neighbourhoods is often complex. The affordability of land in these areas attracts large numbers of low-income people, exacerbating safety concerns prevalent in these neighbourhoods. Environmental problems and safety risks are often highly concentrated in these neighbourhoods, and the impact mechanisms of different environmental factors on the health of the elderly are also different. Hence, it is crucial to enhance the existing neighbourhood atmosphere.

China's urban planning strategy is evolving in response to the ageing society, and it is now more inclined to adapt existing neighbourhoods rather than demolish them to make way for new ones (Yi et al., 2017). More and more old community renewal plans are appearing on the government's urban renewal list. However, the

environmental challenges faced by old cities are complex, and the cause of the problem needs to be analyzed based on specific circumstances. The environmental challenges in the old neighbourhoods are intricate, and it is necessary to analyse the cause process of these problems in conjunction with unique circumstances. Refrain from creating solutions based just on the surface-level presentation of problems. Nevertheless, empirical evidence suggests that the previous approach to revitalising neighbourhoods placed unrealistic expectations on its ability to swiftly address environmental issues. The sustainability of old renovation projects that have been examined in an unsystematic manner has been subject to scrutiny by numerous academics (Kamari et al., 2017, Huang et al., 2022, Li et al., 2023). They believed that it was simple to calculate the average results and disregard the fundamental problems that impact the health environment of older neighbourhoods. Hence, it is frequently more advantageous to investigate the underlying reasons behind the issues in the old neighbourhood and implement focused changes and improvements based on the interdependent connection among different influential aspects. The aim of this study is to develop a novel assessment framework for the well-being of elderly families residing in old neighbourhoods. Additionally, it seeks to comprehend the interrelationships between various indicators in order to mitigate inefficiencies across all domains, in preparation for forthcoming transformations in these regions.

Previous research has focused more on clarifying the relationship between one or several environmental factors and the health of the elderly (Guida & Carpentieri, 2021, Siira et al., 2022, Shi et al., 2022, Lam et al., 2020, Gardener & Lemes 2020), and environmental problems in old neighbourhoods are usually very complex, and the impact mechanisms between different environmental elements are still unknown. It is obviously not enough to evaluate the environmental system in the community. Therefore, in order to achieve the research goals of this study, the analysis method of multi-attribute decision-making is introduced. This method belongs to the branch of decision science and has unique advantages in solving multi-factor problems with complex internal relationships. It is widely used in disciplines such as sociology, management, and urban planning (Zavadskas et al., 2014, Alinezhad & Khalili, 2019 , Keshavarz et al., 2017)

1.3 Research Gap

Previous scholars have done a lot of research on the issue of social aging. Lawton (1983) discussed the definition of the quality of life of the elderly, and took the community environmental elements as an important indicator that affects the well-being of the elderly in their later years. Some scholars believe that the community walking environment can help increase the intensity of physical activity of the elderly, thereby affecting their health (Mota et al., 2005, Inoue et al., 2011).

The increase in walking frequency also helps to increase the participation of the elderly in community activities, thereby improving the cognitive level of the elderly (Ferreira et al., 2010). In addition, Parra et al. (2010) believed that the active green space in the community is beneficial to the physical and mental health of the elderly. Cerin et al. (2013) believed that safe, beautiful, low-pollution neighbourhoods and convenient entertainment and public facilities will promote the frequency of physical activity in the elderly. This type of research links community settings to older adults' physical and mental health and well-being in later life.

However, it should be noted that as the degree of social aging continues to increase, research on the elderly in a broad sense is obviously not enough. Scholars are increasingly inclined to study the diversity of the elderly population (Warnes, 1991, Hayes- Bautista, 2002, Noh et al., 2018). With the acceleration of urbanization, the number of SGH families is gradually increasing, and this phenomenon is common around the world. Elderly people in these types of families spend their later years with the responsibility of caring for their grandchildren. Current research believes that although the impact of caregiving behavior on the health of SGH elderly people has not yet been clarified and is still under discussion, compared with the elderly in ordinary families, the health status of this group is more likely to be affected by the community environment (Thonglor et al. al., 2022, Teprungsirikul &

Luvira, 2022). In addition, compared with general neighbourhoods, older neighbourhoods have a higher degree of aging (Zhou et al., 2015), and the community environment is usually worse. When updating old neighbourhoods, more attention should be paid to the health status of older people across generations. However, there are still few studies on the health and community environment of this population. The renewal of old neighbourhoods is an extremely complex topic. The causes of environmental problems in different neighbourhoods are different, and the impact mechanisms of various environmental factors on the health of older people across generations are also different (Huang et al., 2020). Clarifying the causes of current environmental problems and the influencing mechanisms between various environmental factors, so as to avoid the waste of human and material resources, is an important challenge faced in the current process of updating old neighbourhoods.

In addition, previous studies have focused more on the relationship between a single or several relevant environmental factors and the health of the elderly. This is obviously not enough on the topic of old community renewal. In this context, only focusing on the problems caused by one or a few environmental factors, while ignoring other environmental factors and their interaction, can easily lead to misunderstandings about old neighbourhoods. The nature of environmental problems in old neighbourhoods (Lin et al., 2021). Therefore, new technologies need to be

introduced to solve such problems from a new perspective. In order to fill the above research gaps, this study adopts the research method of multi-attribute decision-making, examines the environmental element system in old neighbourhoods from the perspective of overall decision-making, and clarifies the interrelationship of various environmental elements in the system. In this way, the overall environment of the old community can be assessed, the efficiency of economic investment can be maximized, and the waste of human and material resources during the renovation process can be avoided. To this end, it is necessary to establish a dynamic model that can be used to evaluate the relationship between environmental factors in different old neighbourhoods and the health of older people across generations. In order to fill the above research gaps, this study proposes the following research objectives and research questions.

1.4 Research Objectives

The objective of this study is to establish a new evaluation system that can be used to monitor the health of elderly families in old neighborhoods, and to understand the impact relationship among the indicators to avoid waste of time, money and manpower in response to the future transformation of old neighborhoods.

1.4.1 Objective 1

To determine the environmental indicators related to the health of the elderly in the old neighborhood and select the core indicators related to the health of the SGH elderly.

1.4.2 Objective 2

To explore the interplay between these core indicators related to the health of SGH elderly.

1.4.3 Objective 3

To evaluate the weight of each core indicator related to the health of the SGH elderly in the old neighborhood in the environmental system to establish the model

1.5 Research Questions

In order to achieve the purpose of the study, this study proposes three research questions:

What are the environmental indicators associated with the health of SGH elderly?

What is the mutual influence between these environmental indicators?

How to use the relationship between various environmental indicators to evaluate the impact of the environment and health of the SGH elderly in old neighborhood?

1.6 Research Methodology

This study employs the methodology of quantitative research. Creswell (1994) provided a succinct description of quantitative research as a research approach that seeks to elucidate phenomena by gathering numerical data and employing mathematical techniques, particularly statistics, for analysis. The methodology of this study is structured in the following manner: Firstly, construct an assessment framework about the health status of the elderly residing in SGH and the surrounding community, utilising existing literature on ageing research. Secondly, the Mental Health Inventory - 5 (MHI-5) questionnaire and the Physical Activity Scale for the Elderly (PASE) questionnaire were used to measure the physical and mental health of the SGH elderly in the old community and their description of the community environment elements. The sample collection adopts simple random sampling, and the target of sampling is set to the elderly who have lived in the community for more than ten years, are over 60 years old, and live with their grandchildren. The reliability and validity test was carried out on the returned questionnaires to meet the

requirements of Rough Set Theory (RST) technology for result analysis. Then, the RST technology is employed to examine the questionnaire outcomes with the purpose of identifying the fundamental environmental variables that impact the physical and mental well-being of the elderly residing in the old neighbourhood. A questionnaire based on these core environmental indicators is designed according to Decision-Making Trial and Evaluation Laboratory (DEMATEL) technology to explore the interrelationship of each indicator under the evaluation system. The collection of samples adopts simple random sampling. Since this is an expert questionnaire, the sampling targets are policymakers, investors, and scholars with relevant academic backgrounds and work experience. The reliability and validity of the questionnaires received were tested and analyzed using DEMATEL technology, and the INRM was drawn to clarify the relationship between the indicators. The detailed introduction of RST and DEMATEL will be introduced in Chapter 3.

1.7 Scope of Research

This study is about the relationship between the health of the SGH elderly living in the old neighborhood and the neighborhood's built environment. Therefore, the research site of this study is the old neighborhood. According to the definition of the Chinese government, the old community here refers to the community built

before 2000. This kind of community has been built for more than 20 years. Due to the long construction time and inadequate management, the old community is prone to problems such as aging facilities and damage. According to the definition of Zhou et al. (2015), when the proportion of elderly people over 65 in a community exceeds 7%, the neighborhood is an aging neighborhood. Notably, most old neighborhoods belong to the aging neighborhood category. Zhou et al. (2015) argue that the concept of ageing in place is an essential element in the development of an ageing neighbourhood. In certain neighbourhoods, as the resident population ages and increases, many factors such as economic conditions, living environment, and career opportunities impact the decision of some young individuals to relocate.

Conversely, the majority of elderly individuals will opt to remain. This tendency has been influenced by a familiar living environment and social networks. The neighbourhood has had a progressive shift in its main demographic component towards elderly individuals, which has contributed to the ageing of many older neighbourhoods. The degradation of the environment and amenities in a neighbourhood is an unavoidable occurrence that is frequently imperceptible to the senior residents. It is undeniable that these environmental influences have a substantial influence on the physical and mental well-being of older individuals (Davey et al., 2004).

1.8 Significance of Research

With the intensification of the aging society process, more and more scholars have paid attention to the research in related fields of aging. Most of the previous scholars' research focused on the life and health of ordinary elderly people. This study targets the SGH elderly population. Compared with the general elderly, SGH elderly need to take on more responsibilities for education and raising grandchildren (Gerard et al., 2006) and need more social and economic support (Sakai et al., 2011). All these have an impact on the living habits of the SGH elderly and pose challenges to their health status and quality of life in their later years. In addition, since the elderly and children are relatively vulnerable groups in society, they are incredibly vulnerable to the influence of the surrounding environment. Therefore, it is essential and meaningful to pay attention to the health status of SGH elderly living in old neighbourhoods.

The present study introduces a novel dynamic model for assessing the influence of neighbourhood building components on the health of elderly individuals in SGH, using operations research (OR) and the theory of multi-criteria decision making (MCDM). Previous research have identified various physical environmental markers in older neighbourhoods that are associated with the health and well-being

of older persons. To enhance the physical environment of the old neighbourhood, it is crucial to identify the fundamental design characteristics that might have a substantial impact on the physical and emotional well-being of the elderly. Simultaneously, it is crucial to gather the elderly's perception and behavioural patterns about the material environment indicators of the neighbourhood, as well as their understanding of the behavioural norms that contribute to their health improvements. Prior research concentrated on the examination and discourse of the outcome data. The development of the environmental factor system and the examination of its impact connection mostly relied on expert expertise (expert domain knowledge) as the foundation for decision-making (Zhu et al., 2017; Li et al., 2021; Mei et al., 2021). Only a limited number of research take into account the inherent behavioural patterns (behavioural laws) that underlie survey data in real-world settings. This study posits that both entities possess distinct qualities and serve unique purposes. Assume that the knowledge from both domains can be seamlessly combined. Consequently, this will enhance the insight of policymakers on the revitalization of ageing neighbourhoods, enabling them to develop more effective and efficient plans and programmes for optimising resource allocation.

1.9 Organization of Thesis

This paper is divided into the following five parts. Chapter 1 introduces the research background on social aging, the built environment, and the health of SGH elderly and presents a problem statement for this study, thereby discovering research gaps. Because of the gaps in current research, this study proposes three research objectives and corresponding research questions. The research design and research scope of this study are briefly described. The second chapter is a literature review. This chapter first reviews the previous literature on aging theory, built environment elements, and the health of the elderly. Next, it reviews the theoretical research related to the methodology of this study. Finally, the literature review establishes the basis for this study. The study's conceptual framework clarifies the independent and dependent variables of this study. Chapter 3 is the methodology part of this study, which introduces the research process of this study in detail, including the introduction of RST and DEMATEL research methods, the sample selection of the research population, the design of the research questionnaire, and the application process of RST and DEMATEL technology. Chapter 4 is the results and discussion. This chapter will objectively state the final results of this research and discuss the results in conjunction with previous scholars' research. Chapter 5 is the conclusion of this article. In this chapter, the research results of this study are summarized in both

theoretical and practical aspects, the current research limitations of this study are pointed out, and future research directions are proposed based on the research limitations.

At the end of this section, the definitions of the keywords of this study are explained:

Old neighbourhood: The term "neighbourhood" commonly refers to the subdivisions of urban or rural areas, such as cities, villages, and towns. The definition of the old neighbourhoods adopts the official Chinese definition in 2020, that is, the neighbourhood that has been built for more than 20 years. Such neighbourhoods generally have the characteristics of aging public facilities and degraded built environment quality. The definition of an aging neighborhoods in this paper uses the definition of Zhou et al. (2015) study, and a neighbourhoods with a proportion of more than 7% of the population over the age of 65 is an aging neighbourhoods. Zhou et al. (2015) believe that aging in place is one of the essential reasons for forming an aging neighborhood. In some neighborhoods, with the growth of the age and number of the resident population, under the influence of economic, living environment, employment, and other factors, some young people are more inclined to choose to leave. On the contrary, most of the elderly population will choose to stay, a familiar living environment and social networks have contributed to

this phenomenon. Elder people who remain in the neighborhood have gradually become the main demographic component of the neighborhood, which also explains the aging of many old neighborhoods.

Elderly living in Skipped-generation households: Elderly living in Skipped-Generation Household (SGH) refer to the elders in families whose resident population is only grandparents and grandchildren (Cong & Silverstein, 2008). The children of these elderly people have moved to other places. They are usually unable to take care of their children due to work and other reasons, so they can only send them to their parents' homes for upbringing.

Environment factors: In this study, environmental factors refer to those community built environment factors that have an impact on the health of the elderly. Previous studies have examined the correlation between specific environmental factors in neighborhoods and the well-being of older individuals. These factors include traffic and street safety (Doyle et al., 2006), green space design (Maas et al., 2006), blue space design (McDougall et al., 2021), and Walking environment (Lak et al., 2020, Storms et al., 2018), multifunctional space design (Frank et al., 2004), social relationship (Scopelliti & Giuliani, 2004), public transport connectivity, and accessibility (Kweon et al., 1998, Sugiyama & Thompson, 2007). Many studies have additionally emphasised the beneficial impact of a favourable neighbourhood

environment on the well-being of older individuals. These benefits include heightened levels of physical activity (Cohen et al., 2007), decreased levels of stress and depression (Berke et al., 2007), expanded social interaction networks (Milligan et al., 2004), and an increased sense of belonging to the community (Lund, 2002).

1.10 Summary

This chapter is the introductory part of this study, which proposes the research background, problem statement, research gaps, research objectives, research questions and research methods of this study. In the context of global aging and urbanization, the health problems of the elderly have attracted more and more attention. Thanks to the promotion of the AGING IN PLACE strategy, most elderly people choose to spend their later years at home. Research shows that the environment of the community has an important impact on the health status of the elderly. With the deepening of urbanization, China's urban planning strategy has gradually shifted from incremental to stock, and the renewal of old neighbourhoods has become increasingly important. The proportion of the elderly in the population structure of old neighbourhoods is gradually increasing, and the environment in some old neighbourhoods can no longer meet the living needs of the elderly and even has a negative impact on their health. What is even more noteworthy is that among the elderly, the number of SGH elderly families has been increasing, and their health

conditions are often more fragile than those of ordinary elderly people. Therefore, when carrying out old community renewal plans, it is very necessary to pay attention to the health status of the SGH elderly.However, the problems faced in the process of updating old neighbourhoods are often complex. How to improve the health of the elderly across generations by creating a better built environment is a major challenge faced by designers. In order to solve this problem, the goal of this study is to establish a set of assessment models for the built environment of old neighbourhoods. In the model, RST technology is used to screen those core indicators that can affect the health status of the elderly across generations, and DE technology is used to analyze these core indicators. The internal correlation of environmental indicators, identify the mutual influence between them, find out the operating mechanism of the old community environmental system, thereby formulating an update strategy for the community, improving investment efficiency and reducing the waste of manpower and material resources.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter is the literature review part of this study, which systematically reviews previous studies according to the research content of this study. Initially, this study encompasses several studies on aging, such as local aging, the well-being of senior individuals at SGH, the quality life that is experienced by the elderly, and the physical and mental health issues commonly faced by older adults. Furthermore, this paper examines the research conducted in the field of environmental gerontology, specifically focusing on the aspects of the neighborhood environment that have an impact on the well-being of older people. In the following part, we specifically examine the influence of different aspects in the built environment on the health of older people. In addition, this chapter presents the research theory and methodology model used in this study, as well as the instruments utilized for data analysis. Ultimately, a theoretical structure for this investigation is suggested, drawing upon the components of the community's constructed surroundings identified in the literature analysis.