

The Accessible Residential Features Framework for Elderly Residential Environment in China: A Pilot Study Findings

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ABSTRACT

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The rapid growth of the elderly population worldwide, particularly in China, has intensified the demand for residential environments that effectively support ageing in place. Inadequate accessibility within housing and surrounding communities can limit independence, reduce quality of life, and increase safety risks for older adults. Addressing these challenges requires a comprehensive understanding of both indoor and outdoor residential features that accommodate age-related needs. This study aims to develop and preliminarily validate an Accessible Residential Features Framework tailored to the elderly residential environment in China. The framework seeks to identify key environmental features that enhance accessibility, safety, and daily functioning for older residents. This study utilises quantitative survey data to test and refine the various components of the framework. Conducted as a pilot survey, it aims to evaluate the feasibility and effectiveness of the proposed framework. Findings confirmed two primary dimensions of accessible residential facilities: indoor and outdoor amenities. Indoor facilities encompass barrier-free entrances, accessible circulation within building interiors, and environmental adaptations for older adults. Outdoor amenities cover activity spaces and landscaped green areas suitable for older adults, outdoor facilities, and community transport systems. Overall, this pilot study provides empirical support for the proposed framework and demonstrates its potential applicability. The findings lay a solid foundation for future large-scale empirical research and further refinement of accessible housing design strategies to support home-based ageing for older adults in China.

Contribution/Originality: This study contributes to existing literature by developing an elderly-oriented accessible residential framework for China. This study uses a new

estimation methodology through pilot-based reliability testing. This study originates new measurement dimensions for indoor–outdoor accessibility which is one of very few studies investigating pilot validation of age-friendly housing frameworks.

1. Introduction

The global population is undergoing a rapid shift toward ageing at a scale never seen before. The share of people aged 60 and older is anticipated to rise dramatically, increasing from 841 million in 2013 to more than 2 billion by 2050 (Hamid, 2015; United Nations, 2024). In China, the pace of ageing is particularly striking, as seniors are projected to comprise nearly one-third of the population by 2035 (United Nations, 2024). Such demographic changes bring significant implications for social systems, economic development, and environmental sustainability.

One of the most critical aspects of ageing lies in the living environment of the elderly. While "aging in place" has emerged as the dominant and preferred mode for the elderly worldwide (Ismail, Muhamad Halil, et al., 2020), its realization depends heavily on whether residential environments are safe, comfortable, and accessible (Chen & Zhang, 2022). Features such as age-appropriate greening, barrier-free public facilities, and accessible indoor layouts directly determine whether older adults can maintain independence, mobility, and dignity in their daily lives. However, a large proportion of China's elderly population still resides in residential buildings constructed more than 20 years ago, many of which lack essential features such as elevators, ramps, or accessible bathrooms. These outdated designs fail to address the physical and psychological needs of older residents, thereby hindering their quality of life (Arias-Merino et al., 2022).

Although the Chinese government has issued multiple guidelines and technical codes since 2009 and launched pilot projects for age-friendly communities since 2017, the implementation remains uneven, particularly in existing multi-story and high-rise neighborhoods (Long, 2019). The gap between policy intentions and practical residential conditions underscores the urgent need for a systematic framework to retrofit and transform existing housing stock. Without such an intervention, the rapidly growing elderly population will continue to face mobility barriers, safety risks, and reduced social participation within their residential environments (Yanmin & Xiaoyi, 2023). Therefore, this study addresses the pressing problem of how to establish an accessible, elderly-oriented residential design framework that can guide the transformation of existing residential areas in China, ensuring that older adults can age in place safely and with dignity.

1.1. Research Objectives

The objective of this study for this paper is to examine the reliability and preliminary validity of the proposed framework through a pilot questionnaire survey, focusing on indoor and outdoor accessibility features.

2. Literature Review

2.1. SDG (SDG 3 & 11)

Ageing societies are usually accompanied by an increase in chronic and non-communicable diseases, requiring more health resources and long-term care services. This can put enormous pressure on public health systems. Meanwhile, cities also need to provide accessible facilities and services for the elderly, including transportation, housing, and medical care, which places new design requirements on urban planning. This coincides with the Sustainable Development Goals (SDGs) proposed by the United Nations in 2015 (Mohd Yusof & Mat Yasin, 2023).

The Sustainable Development Goals are a set of 17 global goals established by the United Nations in 2015, aimed at addressing a wide range of global challenges, including poverty, inequality, health, education, and environmental sustainability (Figure1) (UNESA, 2015). The World Health Organization plays a key role in several of these goals, particularly those related to health and well-being. Population ageing presents both challenges and opportunities for the realization of the SDGs, which ensure equal rights and opportunities for the elderly through the development and implementation of age-friendly policies. Regions are more inclusive and sustainable in realizing the SDGs, which are guiding goals that apply globally. As the actual situation varies from country to country and region to region, different regions need to take into account the actual situation and needs of the local community and formulate policies and development strategies that are in line with the regional level. Zhou Quan, et al (2019) sorted out the assessment methods for constructing the SDGs index and indicator board. Suggestions were made for China to carry out the assessment of SDGs (Zhou et al., 2019). Shao Chaofeng, et al (2021) put forward the design principles and ideas for constructing the SDGs of China localized evaluation index system (SHAO et al., 2021). Guo Ru, et al (2022) analyzed the shortcomings of the existing SDGs evaluation research and proposed the future development direction of China's SDGs evaluation research (GUO Ru et al., 2022).

Figure1: The Sustainable Development Goals (SDGs)



Source: UNESA (2015)

Urban residential environments often lack the infrastructure and services to meet the needs of the elderly, such as accessible transportation, housing and public spaces.

Elderly-oriented transformation of urban residences is consistent with SDG3 (Good Health and Well-being) and SDG11 (Sustainable Cities and Communities) and their sub-goals (Figure 2).

The rise of ageing populations creates substantial obstacles for achieving SDG3 (Good Health and Well-Being). Beyond the prevention of illness, healthy ageing also depends on sustaining functional ability across the life course. The elderly are particularly susceptible to environmental hazards and emergencies. To address these challenges, health and long-term care systems must provide integrated services that preserve the intrinsic capacity of older individuals. Consequently, population ageing has direct implications for targets such as SDG3.4 (Reduce mortality from non-communicable diseases and promote mental health) and SDG3.8 (Achieve universal health coverage) (Jarzebski et al., 2021).

Similarly, an ageing population can offer both opportunities and challenges for SDG11 (Sustainable Cities and Communities). Since older adults tend to spend more time at home, housing plays a key role in developing age-friendly cities (Tine et al., 2020). Research indicates that many current homes do not adequately meet the diverse needs of the elderly (Brown et al., 2019). As most of the existing housing stock in ageing regions is expected to remain in use by 2050, many homes will need to be modified to accommodate the needs of older adults, enabling them to continue living there (Tine et al., 2020). Thus, an ageing population offers both challenges and opportunities for meeting SDG11.1 (access to adequate, safe and affordable housing and basic services and upgraded slums).

Figure 2: SDG3, SDG11 and the Sub Targets

SDG3	Good Health and Well-being
SDG3.1	Reduce maternal mortality
SDG3.2	End all preventable deaths under 5 years of age
SDG3.3	Fight communicable diseases
SDG3.4	Reduce mortality from non-communicable diseases and promote mental health
SDG3.5	Prevent and treat substance abuse
SDG3.6	Reduce road injuries and deaths
SDG3.7	Universal access to sexual and reproductive care, family planning and education
SDG3.8	Achieve universal health coverage
SDG3.9	Reduce illnesses and death from hazardous chemicals and pollution
SDG3.10	Implement the who framework convention on tobacco control
SDG3.11	Support research, development and universal access to affordable vaccines and medicines
SDG3.12	Increase health financing and support health workforce in developing countries
SDG3.13	Improve early warning systems for global health risks
SDG11	Sustainable Cities and Communities
SDG11.1	Safe and affordable housing
SDG11.2	Affordable and sustainable transport systems
SDG11.3	Inclusive and sustainable urbanization
SDG11.4	Protect the world's cultural and natural heritage
SDG11.5	Reduce the adverse effects of natural disasters
SDG11.6	Reduce the environmental impact of cities
SDG11.7	Provide access to safe and inclusive green and public spaces
SDG11.8	Strong national and regional development planning
SDG11.9	Implement policies for inclusion, resource efficiency and disaster risk reduction
SDG11.10	Support least developed countries in sustainable and resilient building

Source: UNESA (2015)

A growing elderly population will probably lead to a greater need for policies that create accessible and secure public areas. This will have significant consequences for SDG 11.7 (universal access to safe, inclusive, and accessible green and public spaces) and SDG 11.2 (affordable and sustainable transport systems) (Jarzebski et al., 2021). Green spaces can encourage older adults to be more physically active and can improve their overall physical and mental well-being (Kemperman & Timmermans, 2014). This, in turn, offers clear benefits for other Sustainable Development Goals. However, numerous barriers prevent older adults from accessing green spaces, such as safety concerns or designs that often prioritize other users, like children.

Current residential environment should be designed to accommodate old people who choose to age in place, even if they encounter physical or social challenges, by fostering social inclusion and ensuring equal opportunities. SDG11 and its detailed sub-objectives are selected to improve the urban development index, and to construct a framework for analyzing the degree of existing residential elderly-oriented. It is important to study the contribution of SDG3 and SDG11 to elderly-oriented transformation to guide the construction of a framework for residential ageing in place transformation.

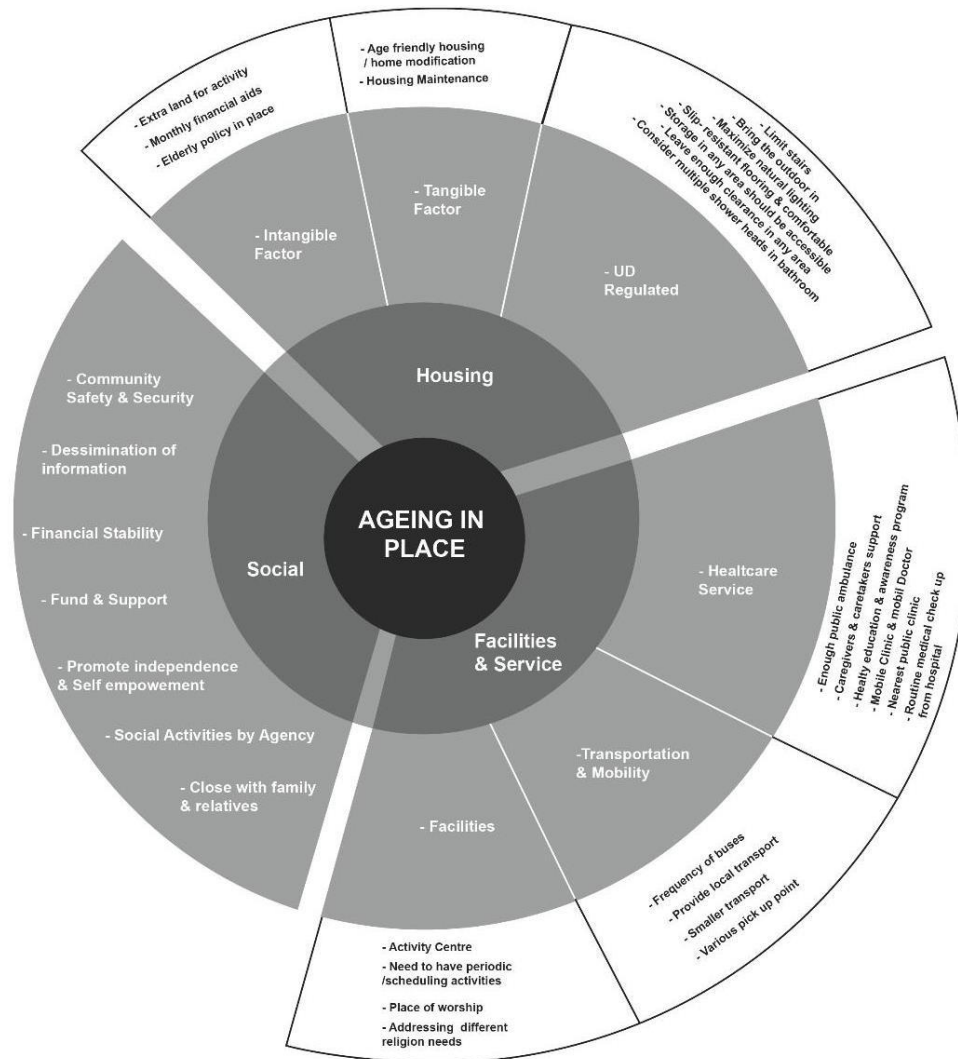
2.2. Quality of Life for Elderly

As acknowledged by the WHO, housing can contribute to a plethora of positive health outcomes, especially in the context of urban growth, ageing populations, and climate change (World Health Organization, 2018). The physical and social environment of housing units (such as apartments, flats, and houses) and their surrounding neighborhoods can influence the well-being of the elderly by impacting their functional status, according to related studies (Ralston, 2018; Wadu Mesthrige & Cheung, 2020). Therefore, a well-designed living environment can support ageing in place and lessen the financial strain of institutional care and medical support (Wadu Mesthrige & Cheung, 2020). However, poor design can lead to serious health issues. The rapid ageing of the population poses challenges in ensuring adequate housing.

With rising life expectancy, housing preferences among older adults have emerged as an important research focus. This group is far from homogeneous, showing wide variation in physical capacity, cognitive function, and lifestyle. Mulliner et al., (2020), for example, distinguished three elderly cohorts and noted that individuals aged 65–74 and those 75 and above often value “single-level dwellings without stairs” and “bathroom modifications,” reflecting both the likelihood of living alone and mobility limitations. Among those over 75, factors such as “access to nature views,” “walkable environments,” and “closeness to relatives and friends” become more prominent, influenced by greater time spent indoors, fall risks, and social isolation (Mulliner et al., 2020). Examining these intergroup differences not only highlights the heterogeneity of older populations but also informs strategies for intergenerational cohabitation and provides evidence-based guidance for improving housing design and policy.

Tobi et al. (2018) proposed a comprehensive framework of ageing in place as reference guide for housing. The developed framework includes key themes and sub-themes that are interconnected and complementary (Figure 3). These can serve as a reference and guide for policymakers and implementers before undertaking any development related to the ageing community.

Figure 3: Framework for Ageing in Place as Reference Guide for Housing



Source: Tobi et al. (2018)

2.3. Universal Design (Accessible Residential Housing)

Universal Design Theory Establishes Basic Design Principles for the Research and Practice of Transformation of Elderly-Oriented Residential environment. The concept of universal design was first embodied in British architect Goldsmith's Book "Designing for the Disabled" published in 1963 (Goldsmith, 1967). In 1974, the American architect Mace coined the term "Universal Design" to denote "the design of products and environments that can be used by all people to the greatest extent possible without specialized adaptation" (Preiser & Smith, 2011). On this basis, the Center for Universal Design at the University of North Carolina School of Design (CUD, NCSU) developed it into the seven basic principles shown in Table 1, which builds the theoretical framework of universal design.

Up to now, the theory of universal design has been widely applied in the fields of architectural design, product design, engineering design and environmental design, etc. Among them, accessible design, age-friendly design and all-age-friendly design, which are often mentioned in the field of architecture, belong to the scope of universal design.

Specifically for ageing in place transformation, universal design, as the most basic design guiding principle, is commonly used to guide architects, interior designers and others to carry out the design practice of home environment transformation, so that on the one hand, it can satisfy the needs of the elderly in the event of physical deterioration, and on the other hand, it does not interfere with the daily use of other members of the family.

Table 1: Seven Basic Principles of Universal Design

No.	Principle	Connotation
1	Fair Use	Available to users with different ability states.
2	Flexibility	Accommodate a wide range of personal preferences and abilities.
3	Simplicity	Easy to understand how to use, regardless of the user's experience, knowledge, language skills or current level of concentration.
4	Accessibility	Communicate necessary information to the user regardless of environmental conditions and the user's perceptual abilities.
5	Conservation	Minimize hazards and adverse consequences that may result from accidental or unintentional actions.
6	Effort Saving	Can be used comfortably and effectively with minimal physical exertion.
7	Space size for easy access and use	Suitable space dimensions for access, reach, maneuvering and use, regardless of the user's size, posture and mobility.

Source: Preiser & Smith (2011)

Universal design, also known as pervasive design, has two meanings: first, it can meet the housing needs of elderly individuals at different ages. According to the United Nations World Health Organization, 60 to 70 years of age for the young elderly this stage of life and activities of the elderly can take care of themselves, and healthy adults are almost the same, 75 to 89 years of age for the elderly, 90 years of age or older for the long life of the elderly, most of the elderly will be experienced in turn or due to changes in the jump through these phases, therefore, the theory of universal housing design requires that the design of the future users of the residence before the whole age, physiological stages should be considered into; on the other hand, to meet the needs of people throughout their lives to live in the residence. Therefore, the theory of universal residential design requires that the whole age and physiological stages of future residential users should be considered before design; on the other hand, in order to meet the needs of people's lifelong residence, the ageing-adaptive transformation of residential buildings should also provide reserved development space for the follow-up while meeting the current stage, instead of adding all possible elements at the beginning, to enhance the residential buildings to adapt to the different characteristics of people's lifelong residence, so that the residential buildings can be changed in stages, i.e., to let the residential buildings have the ability to change with age. The residence has the ability to change as the age stage changes. Universal design generally includes the following seven principles: the principle of fair use, the principle of flexible use, the principle of simplicity, the principle of ease of understanding, the principle of protection, the principle of labor-saving, and the principle of the use of dimensions and space, and on the other hand, it embodies the principle of applicability, which can also satisfy the different needs of different elderly people in housing. Each elderly person has his or her own specific situation, including education level, hobbies, economic conditions and other differences, which leads to their diversified needs for the actual renovation of the old existing residential environment, and therefore requires a certain degree of

flexibility in the way and content of the renovation to adapt to the different needs of individuals (Bouzarovski, 2015).

2.4. The indoor and outdoor spaces feature for Accessible Residential Housing

Creating accessible residential housing requires a holistic approach that integrates both outdoor and indoor spatial features to ensure safety, inclusivity, and comfort for older adults.

For outdoor spaces, essential elements include the adaptation of community and activity venues, such as community squares and play areas, with level, non-slip surfaces, wide pathways, ramps, and barrier-free access to amenities to promote social participation and reduce accident risks (Peng et al., 2022; World Health Organization, 2007). Enhancing green landscapes plays a key role in well-being, with accessible garden paths, resting pavilions, diverse plantings, and shaded seating areas that foster relaxation, sensory engagement, and interaction with nature (Salmistu & Kotval, 2023). Outdoor facilities, such as clear information signage, elderly-friendly public toilets, and strategically placed seating, ensure usability and comfort for those with reduced mobility (Lu et al., 2020). The transportation system must be pedestrian-oriented, with wide, slip-resistant walkways, safe crossings, curb extensions, dedicated pedestrian zones, and accessible parking solutions (Hoof & Marston, 2021).

For indoor spaces, accessible entrance designs are crucial, including steps with low risers, deep treads, and dual handrails, combined with ramps featuring gentle slopes, adequate widths, and intermediate landings (van Hoof et al., 2021). Accessibility within buildings emphasizes the provision of spacious elevators with wide doorways, handrails, and emergency communication systems, as well as staircases with ergonomic handrails and non-slip materials (Bamzar, 2019). Furthermore, indoor living environments, such as living rooms, bedrooms, bathrooms, and kitchens, should be adapted to the functional needs of older adults by incorporating features like anti-slip flooring, grab bars, lever handles, and accessible storage, thereby ensuring safety, ease of movement, and independence in daily activities (Ismail, Nordin, et al., 2020; World Health Organization, 2007).

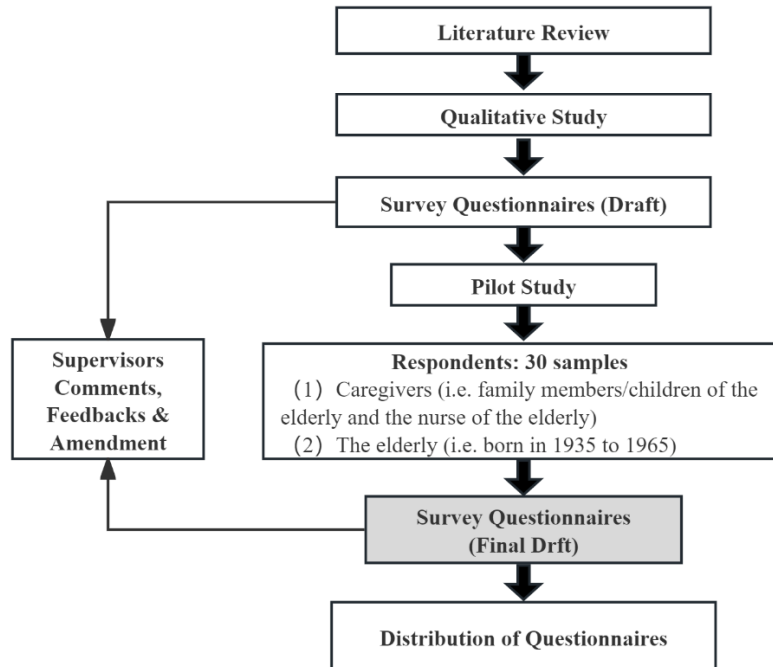
Taken together, these elements underscore that accessible residential design is not limited to single modifications but requires an integrated approach to indoor and outdoor spatial planning. Such designs support the principle of “aging in place,” enabling older adults to remain within their homes and communities safely and with dignity.

3. Research Methods

A pilot study with 30 respondents was conducted to assess its clarity, feasibility, and comprehensiveness. The pilot study was conducted earlier before the actual questionnaire (quantitative data collection) started. A pilot survey is done to test the instrument using a smaller size of the sample. This phase utilizes subjective and objective measurements as the primary procedures for data collection, which will impede and reduce the potential for research bias and increase the optimal accuracy of the data collected (Taherdoost, 2021). The purpose of this pilot study is to test the reliability and validity of the questionnaire before distributing the actual questionnaire (Bujang et al., 2024). As for the pilot study, according to previous scholars, the small samples (5-15 participants) common in questionnaire pre-testing may not be able to

identify common problems. It is recommended that the default sample size be 30 respondents (Perneger et al., 2015), They have a similar demographic background to the study participants.

Figure 4: The Process of Piloting Questionnaire



3.1. Study Population

The target population for this pilot study comprised older adults and individuals directly involved in elderly care within residential environments in China. Specifically, the population included: (1) the caregivers (i.e. family members/children of the elderly and the nurse of the elderly) and (2) the elderly (i.e. born in 1935 to 1965). This population was selected because both groups possess direct experience and practical knowledge of residential accessibility issues affecting ageing in place.

3.2. Sample Size

A total of 30 participants were involved in this pilot study.

Table 2: Number of the Respondents for Pilot Study

Respondents	Number
Family	11
Son/Daughter	8
Nurse	2
The elderly	9

3.3. Sample Size Justification

The sample size of 30 respondents was determined based on established methodological recommendations for pilot studies. Previous research suggests that a sample size of approximately 30 participants is sufficient for questionnaire pre-testing and reliability

assessment, particularly for evaluating internal consistency using Cronbach's alpha. Smaller pilot samples (e.g., 5–15 participants) may fail to detect common issues in survey instruments, whereas a sample of 30 allows for more stable reliability estimates and feasibility testing. Therefore, the selected sample size was considered appropriate for the objectives of this pilot phase.

3.4. Sampling Method

A purposive sampling method was employed. Participants were intentionally selected based on their relevance to the study objectives, namely their experience as elderly residents or as caregivers involved in elderly daily living and housing environments. This method is suitable for pilot studies and exploratory research where the aim is to test instruments rather than to generalize findings to the wider population.

3.5. Data Collection

Data was collected using a self-developed structured questionnaire, designed specifically for this study based on an extensive literature review and qualitative expert interviews. The questionnaire measured two main domains:

(1) Indoor space features, including: accessible entrance and accessibility within buildings, and adaptation of indoor spaces (living room, bedroom, bathroom, kitchen) for ageing.

(2) Outdoor space features, including: activity venues and green landscapes suitable for ageing, outdoor facilities for ageing, and transportation systems within the residential community.

All questionnaire items were measured using a five-point Likert scale, ranging from "Least important" to "Most important." The initial item pool was generated from established literature on universal design, age-friendly housing, and ageing in place, and refined through expert feedback to ensure content relevance and clarity. The pilot survey was conducted to assess the clarity, feasibility, reliability, and preliminary validity of the instrument before large-scale data collection.

3.6. Data Analysis

Quantitative data analysis was conducted using SPSS version 16.0. Descriptive statistics were used to summarize respondent characteristics and item responses. Reliability analysis was performed using Cronbach's alpha coefficient to assess the internal consistency of the questionnaire, including overall reliability as well as reliability for indoor and outdoor feature sub-dimensions. Cronbach's alpha values above 0.70 were considered acceptable, while values above 0.80 indicated high internal consistency.

4. Results

Table 3 outlines the detailed structure of the Likert scale questions and corresponding items used in the pilot study. The analysis of this pilot test will be described in detail in the next section, "Reliability and validity analysis".

Table 3: The two Likert scale questions in the questionnaire

Features	Sub-features	Questions	Items (Sub Elements)
Indoor Space	1. Accessible Entrance and Accessibility to the spaces in the building for Ageing	Q1	(i)Steps of building entrances for ageing
		Q2	(ii)Ramps for ageing
		Q3	(i)Accessible elevator design for ageing
		Q4	(ii)Staircase design for ageing
	2. Adaptation of indoor space for ageing (individual units).	Q5	(i)Living room design for ageing
		Q6	(ii)Bedroom design for ageing
		Q7	(iii)Bathroom space design for ageing
		Q8	(iv)Kitchen space design for ageing
		Q9	(i)Community/social areas for ageing
Outdoor Space	1. Activity venues and green landscape suitable for ageing	Q10	(ii)Play areas
		Q11	(i)Increasing green space
		Q12	(ii)Rich Plant Configurations
	2. Outdoor facilities for ageing	Q13	(i)Information Signage
		Q14	(ii)Elderly-oriented public toilets
	3. Transportation system in the community	Q15	(iii)Seating areas
		Q16	(i)Pedestrian road design for ageing
		Q17	(ii)Pedestrian-vehicle separation
		Q18	(iii)Rationalization of car parking

4.1. The Reliability Analysis for Indoor and Outdoor Accessible Residential Features - Overall

Pilot data collected from 30 respondents were tested and analyzed (to assess feasibility) using SPSS. These steps were used prior to the main data collection. According to Creswell (2014), reliability suggests that the study was able to produce stable and consistent results across different research areas. In addition, to some extent, (Piaw, 2016) found that the reliability of a study is the ability of the study to obtain the same value on repeated measurements. It is also the ability of all items in a research instrument to consistently measure a concept, known as internal consistency reliability.

In this study, reliability analysis in SPSS was used, which was assessed by comparing the correlation values between items. To interpret the reliability analysis, Cronbach's alpha was used as a guideline. According to the recommendation of Shrestha, values above 0.7 are acceptable, but values above 0.8 are more desirable (Shrestha, 2021). In this study, the overall Cronbach's alpha coefficient is 0.903 and the standardized alpha value is also 0.903 (Table 4), indicating that the scale has extremely high internal consistency reliability (well above the benchmark of 0.7). This suggests that all items are highly correlated and yield stable results when measuring the same construction.

Table 4: Reliability Analysis for Features – Overall

Features	Number of items	Cronbach's α	Cronbach's Alpha based on Standardized Items
Overall features	18	0.903	0.903

4.2. The Reliability Analysis for Indoor Features

Indoor Space characteristics comprises two sub-features: "Accessible Entrance and Accessibility to the spaces in the building for Ageing" and "Adaptation of indoor space for ageing (individual units)." First, for the sub-feature "Accessible Entrance and Accessibility to the spaces in the building for Ageing," which includes four related items, the Cronbach's α coefficient reaches 0.825. This indicates that these items exhibit high internal consistency in measuring this sub-feature (Bujang et al., 2024). Additionally, the standardized Cronbach's α is 0.823, very close to the original value, further confirming the stability of reliability for this sub-feature (Bujang et al., 2024). Next, regarding the sub-feature "Adaptation of indoor space for ageing (individual units)," which also consists of four items, the Cronbach's α coefficient is as high as 0.845, demonstrating very strong internal consistency in measuring indoor space adaptation for aging. Moreover, the standardized Cronbach's α remains identical at 0.845, further validating the reliability and stability of this sub-feature. Finally, when combining these two sub-features into an overall reliability assessment, the total Cronbach's α coefficient for the eight items reaches an exceptionally high value of 0.911 (see Table 5). This indicates that all items exhibit outstanding internal consistency in comprehensively measuring aging-friendly design. The standardized Cronbach's α also matches the original value at 0.911, once again confirming the excellent stability of overall reliability.

Table 5: Reliability Analysis - Indoor Space Characteristics Features

Sub-features	Number of items	Cronbach's α	Cronbach's Alpha based on Standardized Items
Accessible Entrance and Accessibility to the spaces in the building for Ageing	4	0.825	0.823
Adaptation of indoor space for ageing (individual units)	4	0.845	0.845
Indoor Space Characteristics Features	8	0.911	0.911

4.3. The Reliability Analysis for Outdoor Features

Outdoor Space Characteristics includes three sub-features: "Activity venues and green landscape suitable for ageing," "Outdoor facilities for ageing," and "Transportation system in the community." The sub-feature "Activity venues and green landscape suitable for ageing" consists of four related items, with a Cronbach's α coefficient of 0.829. This value indicates that these items exhibit high internal consistency in measuring activity venues and green landscapes suitable for aging. Additionally, the Cronbach's α based on standardized items remains the same at 0.829, further confirming the stability of reliability for this sub-feature. This means that these items can consistently reflect the actual conditions when evaluating the suitability of activity venues and green landscapes for aging (van Teijlingen & Hundley, 2002). Next, the sub-

feature "Transportation system in the community" includes three items, with a Cronbach's α coefficient of 0.808. Although slightly lower than the previous sub-feature, this value still demonstrates reasonably high internal consistency, indicating that these items are reliable in measuring the transportation system in the community. The standardized Cronbach's α shows a slight increase to 0.812, suggesting that the correlations among the items improved marginally after standardization. As for the sub-feature "Outdoor facilities for ageing," which also consists of three items, its Cronbach's α coefficient is notably high at 0.855, reflecting very strong internal consistency in measuring outdoor facilities for ageing (van Teijlingen & Hundley, 2002). The standardized Cronbach's α similarly increases slightly to 0.856. This suggests that these items can very reliably and consistently assess the quality of outdoor facilities for ageing. Finally, when combining these three sub-features into an "overall" reliability assessment, the total Cronbach's α coefficient for the 10 items reaches an exceptionally high value of 0.932 (see Table 6). This indicates that all items exhibit outstanding internal consistency in comprehensively measuring outdoor space characteristics for ageing. The standardized Cronbach's α remains identical at 0.932, once again confirming the excellent stability of the overall reliability.

Table 6: Reliability Analysis - Outdoor Space Characteristics Features

Sub-features	Number of items	Cronbach's α	Cronbach's Alpha based on Standardized Items
Activity venues and green landscape suitable for ageing	4	0.829	0.829
Outdoor facilities for ageing	3	0.808	0.812
Transportation system in the community	3	0.855	0.856
Outdoor Space Characteristics Features	10	0.932	0.932

5. Conclusion

This pilot study confirms the validity of the draft survey questionnaire on indoor and outdoor features outlined in the Accessible Residential Features Framework for elderly-oriented housing in China. The findings first underscore two critical dimensions of indoor environments: (i) accessible entrance and accessibility to the spaces in the building for ageing, and (ii) adaptation of indoor space for ageing (individual units). For outdoor environments, three dimensions were highlighted as essential: (i) activity venues and green landscape suitable for ageing, (ii) outdoor facilities for ageing, and (iii) transportation system in the community. These outcomes indicate that the draft questionnaire effectively captures both indoor and outdoor priorities, and that the identified features align with the lived experiences of older residents, consistent with findings from qualitative research. Although based on limited pilot data, this study provides a solid foundation for the forthcoming large-scale quantitative survey. Future research will incorporate wider empirical testing and comparative international standards to enhance the robustness and applicability of the framework.

Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Ethics Committee of Universiti Teknologi Mara. All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee under reference number REC/06/2025 (PG/MR/315). Informed consent was obtained from all participants according to the Declaration of Helsinki.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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