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EXPLORING ELDERLY-ORIENTED ACCESSIBLE RESIDENTIAL DESIGN FEATURES IN CHINA: A CONCEPTUAL STUDY

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Abstract— China is experiencing a rapidly ageing population, creating an urgent need for elderly-oriented residential design that prioritises accessibility and safety. This study aims to develop a conceptual framework for the elderly-oriented accessible residential design features in China. This study utilises a desktop analysis, mainly through collecting and analysing previous scholars' conceptual frameworks and referring to applicable information to achieve the objectives. The proposed conceptual framework emphasised analysing the key points of the

Conceptual Framework, China	design of age-friendly residential areas from the actual needs of the elderly. The conceptual framework will guide the future ageing-friendly design of senior living facility projects and serve as a reference for developing relevant industry standards.

I. Introduction

The world is ageing, with the elderly (over 60 years old) expected to double globally, from 841 million in 2013 to more than 2 billion in 2050 [1]. The number of people aged above 65 years globally is expected to double, from only 8% (524 million) in 2010 to 16% (1.5 billion) in 2050 [2]. China is also experiencing a high rate of ageing as tabulated in Table 1. Thus, with the substantial increase in the elderly population, there is a need to establish universal elderly living model in China.

Table 1: Projections on Population Aging Projections (2022 Year)

Year	Total population	60+years old	Percentage of total population	65+years old	Percentage of total population	80+years old	Percentage of over 60 years old
2000	12.70	1.28	10.1	0.87	6.9	0.114	8.9
2005	13.13	1.44	11.0	1.00	7.6	0.154	10.7
2010	13.52	1.69	12.5	1.13	8.4	0.195	11.5
2015	13.89	2.10	15.1	1.34	9.6	0.243	11.6
2020	14.21	2.43	17.1	1.69	11.9	0.285	11.7
2025	14.46	2.90	20.1	1.97	13.6	0.328	11.3
2030	14.58	3.48	23.9	2.36	16.2	0.416	12.0
2035	14.58	3.93	27.0	2.86	19.6	0.573	14.6
2040	14.09	4.07	28.1	3.22	22.2	0.667	16.4

In recent years, China has paid more attention to the elderly-oriented and accessible construction of buildings. Since 2009, China has published various supplementary standards and atlases on elderly-oriented construction, such as Design

Code for Buildings of Elderly Facilities, Standard Design Sample Drawing of Community Day Care Center for the Elderly, Technical Codes for the Retrofitting of Existing Residential Buildings on Using Function, Codes for Accessibility Design, etc. [3], which have provided background support for the accessible and elderly-oriented design of residential buildings.

After the reform and opening-up policy was put forward in the 1970s, residential buildings in China got an opportunity for development, and the scale of residential buildings increased significantly to accommodate the housing problem caused by the explosive population growth [4]. According to statistics, China built 5.8 billion housing units between 1980 and 2000 alone (EB/OL, 2019). However, with the ageing of China intensifying year by year, the people who first moved into these old neighbourhoods have changed from a youthful state to an elderly state. Statistics show that two-thirds of people over 60 in China live in older homes built for over 20 years [5]. The design of this part of the housing initially did not consider the age structure, ageing needs, and physical and mental conditions of the elderly group. The problems existing in the residential buildings now are pronounced under the development of the times. Many residential buildings look relatively simple and unsuitable, and most do not have facilities such as elevators and accessible ramps, which cannot meet the requirements of accessible passage for the elderly [6].

Therefore, this study aims to develop a Conceptual Framework for Accessible Residential Design for the elderly in China with derived outdoor and indoor space elements.

II. Methodology

This paper presents the desktop research analysis for this study. The analysis is used to collect and analyze the established works of literature by selecting, drawing, and referring to the applicable information to achieve the study's research

objectives. By utilizing this data, this study saved time and resources efficiently by not repeating the same study conducted which secondary research analyses available data sources. The desktop study was designed to make the best use of the available resources [7] and thus can be regarded as a low-cost technique [8].

Table 2: The Review of Previous Research to Key Terms

Elements Authors	Elderly People	Elderly-Oriented Residential Areas	Residential Environment	Spatial Requirements	The Accessible Residential Design
[17]	√	√	√		
[5]	√	√	√		√
[4]		√	√	√	√
[6]		√	√	√	
[18]	√		√	√	
[19]	√		√	√	
[16]	√	√	√	√	
[3]	√	√		√	
[10]		√	√	√	√
[20]	√	√		√	
[21]		√	√	√	
[22]		√	√	√	
[23]	√		√	√	√
[24]					
[25]	√	√	√	√	√

The desktop research relies on data from previous relevant literature that will provide the conceptual framework for this study. The Google Scholar database was used to search for literature on ageing in place transformation and to screen out articles related to the current situation and issues in the relevant fields; keywords such as "happy life", "elderly care facilities", "ageing friendly environment", "ageing in place", "ageing at home", "ageing at home in the community" as well as the research literature were comprehensively collected,

organized, and analyzed. Research literature involving multiple disciplines, such as social security, sociology, demography, urban planning, and architecture, was also referenced. The conceptual framework was derived from the matrix of the works of literature and visually represented the variables' components and structure. The headings of each column show the concepts derived from the problem statement of the research project as stated in Table 2 with a tick placed in the corresponding cell for each idea discussed. This way, the researcher can critically compare the literature review of all references listed under each concept [9].

III. Results and Discussion

A. Classifying the living capacity of the elderly

To study the needs of the elderly in different health conditions of the period of residence, "Building Design Code for the Elderly" (JGJ122-99), according to the behavioural ability of the elderly is divided into I) self-care (self-helping), refers to the behaviour of life is entirely self-care, do not need to rely on others to help; II) device-helping, refers to the behaviour of life needs to rely on the assistance of handrails, crutches, wheelchairs and lifting facilities; III) under nursing, refers to life cannot take care of themselves, need to rely on others to care. IV) device-helping refers to the life behaviour needs to rely on handrails, crutches, wheelchair lifting facilities and other assistance. This study aims to create a more age-friendly and livable environment for the elderly based on their housing needs.

B. Relationship between self-care and residential needs

Disabled older persons would like to receive care and attention services at home when needed [11]. People prefer "Aging in Place" to maintain independence, autonomy, and connections to social support (including friends and family) [12]. Keeping people in their homes and communities for as long as possible can avoid costly institutional care options.

Policymakers, health care providers, and many older adults, therefore, favour it [13][14].

The Elderly with different levels of self-care will have different living characteristics and form different interactive relationships in the home environment as shown Figure 1. The elderly in the self-care period can participate in facility activities and expand their life behaviours independently and selectively; elderly under nursing are mainly confined to the micro space of their residence; the elderly in the device-helping period usually live a more monotonous life, and their daily behaviours are confined to their beds. The elderly involved in this study are self-helping and device-helping.

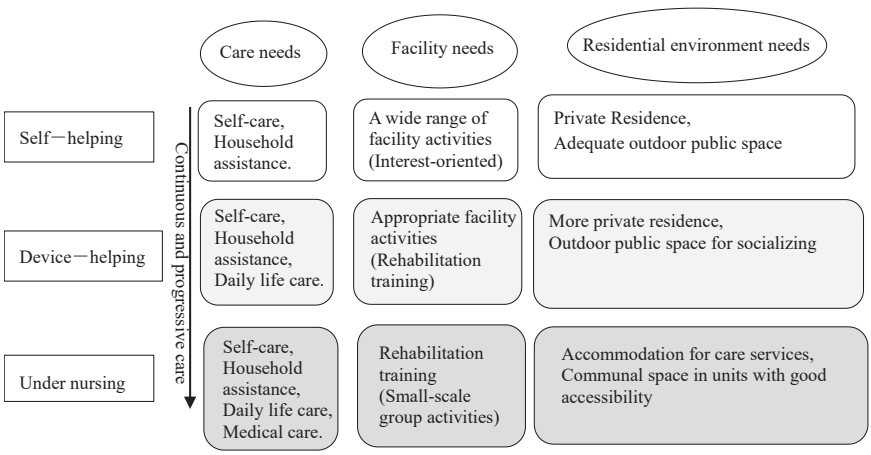

Figure 1: Relationship Between Residential Needs and the Environment of the Elderly

C. Theory of Universal Housing Design for The Elderly

Universal design theory establishes basic design principles for the research and practice of elderly-oriented residential areas. The concept of universal design was first embodied in the 1963 book by British architect Goldsmith [15].

The seven (7) fundamental principles of the Universal Design (UD) are (1) fair use, (2) flexibility, (3) simplicity, (4) accessibility, (5) conservation,

(6) effort saving, and (7) space size for easy access and use. Current practices of age-friendly design, especially in-built environments, will adopt the basic seven (7) principles of Universal Design. The principle of universal residential design requires the needs of residential users of all ages and physiological stages in design. To meet the needs of people's lifelong residence, the ageing-adaptive design of residential buildings should also provide reserved development space for the follow-up while meeting the current stage instead of adding all elements at the beginning.

D. Conceptual framework

The literature review matrices led to the development of a set of residential environmental characteristics. These outdoor and indoor spaces are vital to the health and well-being of the elderly as tabulated in Table 3. The framework presents a table with each characteristic and cites relevant literature sources that support including these features.

Table 3: Conceptual Framework of Elderly-Oriented Accessible Residential Design Features

Outdoor Spaces Features of Accessible Residential Design		
Main Elements	Sub Elements	Literature Source
Adaptation of activity venues for ageing	① Community/ social areas for ageing	[26], [21], and [27]
	② Play areas	[28], [26], [21], and [27]
Green landscape suitable for ageing	① Increasing green space	[29], [30], [31], [32], and [27]
	② Rich Plant Configurations	[29], [30] [33], [31], [21], and [27]
Outdoor facilities for ageing	① Information Signage	[29], [31], [21], and [34]
	② Elderly-oriented public toilets	[29], [26], [35], [21], and [36]
	③ Seating areas	[29], [21], [32], and [35]
Transportation system in the community	① Pedestrian Road design for ageing	[31], [29], [21], [34], [37], and [32]
	② Pedestrian-vehicle separation	[31], [29], [21], [34], [32], and [37]
	③ Rationalisation of car parking	[31], [21], and [34]

Indoor Spaces Features of Accessible Residential Design		
Main Elements	Sub Elements	Literature Source
Accessible Entrance to indoor space for ageing	① Steps of building entrances for ageing	[29], [38], and [26]
	② Ramps for ageing	[29], [38], [26], and [31]
Accessibility to the spaces in the building for ageing	① Accessible elevator design for ageing	[29], [39], [31] and [21]
	② Staircase design for ageing	[40], [3], and [39]
Adaptation of indoor space for ageing (individual units)	① Living room design for ageing	[29], [41], [40], [3], and [32]
	② Bedroom design for ageing	[29], [40], [3], and [32]
	③ Bathroom space design for ageing	[29], [28], [40], [3], [39], and [32]

IV. Conclusion

The ageing population in China presents significant challenges and opportunities for the design of residential areas. This study has derived a conceptual framework for elderly-oriented accessible residential design features from outdoor and indoor spaces in China with the scoping review method. The developed conceptual framework includes critical indoor and outdoor accessible residential design features, such as accessible entrances, vertical transportation systems, green landscapes, outdoor facilities, etc. Next, the willingness of the elderly to participate in residential design will be investigated through questionnaires to determine the appropriate design strategies. By adopting this framework, architects, developers, and policymakers can create living environments that promote independence, safety, and well-being for the elderly population to age in place. Additionally, the future focus is on implementing these design features in real-world settings and evaluating their impact on the overall quality of life for elderly populations in the housing context.

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