Exploring Elderly Housing Needs in Chinese Cities in the Era of Smart Living

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ABSTRACT

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| In the context of an increasingly intelligent society, the needs of the elderly for home environments are changing significantly. This study focuses on analyzing the living space requirements of elderly residents in Chinese cities by combining literature research and semi-structured interviews with 11 elderly participants aged 60–75. Through qualitative data analysis using tools such as Excel and NVivo, this research identifies key needs of the elderly in aspects such as health, safety, social interaction, and smart technology integration. The findings reveal critical problems in kitchen and bathroom design, highlight the need for user-friendly smart home products, and emphasize the importance of health monitoring and emotional support. The study provides practical guidance for aging-friendly housing design and smart home system planning, aiming to improve residential satisfaction and quality of life for the elderly population. |

*Keywords: Intelligent society, elderly care, aging-in-place, smart home, urban China.*

1. INTRODUCTION

With the rapid advancement of digital technologies such as 5G, artificial intelligence, and cloud computing, Chinese cities are witnessing a growing integration of smart home systems into daily life. At the same time, population aging has become a pressing social issue. According to national statistics, China has entered a phase of deep aging, with the proportion of people aged 60 and above exceeding 18.7% in 2023. The convergence of an aging population and the digital transformation of society presents both opportunities and challenges in designing living environments suitable for elderly residents.

Smart homes offer promising solutions for elderly care by enhancing daily convenience, improving health monitoring, and enabling independent living. However, existing smart home technologies are often developed without adequate consideration of the actual needs, preferences, and abilities of older adults. Many elderly individuals face difficulties in using complex interfaces, while important aspects such as safety, emotional support, and social connectivity are often under-addressed.

Prior studies have explored smart home applications and aging-in-place strategies separately, but few have provided an in-depth understanding of how elderly urban residents in China perceive and interact with smart home environments. There is a clear gap in research that combines user-centered design principles with real-life behavioral insights from the elderly population.

This study aims to fill this gap by analyzing the home environment needs of elderly people living in Chinese cities in the context of an intelligent society. Through a combination of literature review and semi-structured interviews with elderly participants, the study investigates their daily life challenges, spatial preferences, and expectations for smart technologies. The findings will contribute to the design of more inclusive, safe, and user-friendly living environments, ultimately enhancing the quality of life and well-being of the aging population in urban China.

2. Literature Review

Based on Maslow's hierarchy of needs theory, the needs of the elderly are interpreted hierarchically, and an information needs model for the elderly is constructed. In 2014,[Myung Eun Cho](https://journals.sagepub.com/doi/pdf/10.1177/1420326X14521229?download=true#con1)And[Mi Jeong Kim](https://journals.sagepub.com/doi/pdf/10.1177/1420326X14521229?download=true#con2)The article points out that with the improvement of global longevity trend, the development of intelligent technology to maintain the independence and quality of life of the elderly in their own homes has brought great challenges. By combining intelligent devices, the elderly's activity range and ability can be expanded. In 2015, shubhangi R. Parkar pointed out in elderly mental health: needs that the overlap of depression and anxiety is very common, and nearly half of the elderly patients reported obvious symptoms of depression and anxiety. The mental state of the elderly deserves more attention. In 2019, according to the analysis of the basic influencing factors of the adaptive design of the home environment for the elderly, Liu Fei constructed the correlation system of the influencing factors of the adaptive design of the home environment for the elderly, so as to provide a basic reference for the adaptive design of the home environment for the elderly. In 2021, Liu Shu believed that the current era is the intersection of population aging and social digitization, and accelerating the digital integration of the elderly is the new demand and important content of promoting active aging in a digital society. In order to bridge the digital divide between the elderly, promote active aging, and empower the elderly through digital integration.

3. Theoretical Basis

Analysis of the demand for home space of the elderly in China,The theoretical basis of the study mainly covers the following aspects:

Maslow's hierarchy of needs theory: The theory categorizes needs into five levels: physiological, security, social, esteem, and self-actualization, aiding researchers in understanding the elderly's hierarchical needs in home environments and guiding the design process to better meet their actual needs.

General design theory: it emphasizes that the design should take into account the needs of all people, including the elderly, the disabled and other special groups, to ensure that the designed products, services or environment are equal, accessible and available to all.

Environmental behavior theory: This theory examines how the environment influences behavior, aiding researchers in understanding how the elderly perceive and use their living space to design environments that meet their needs.

4. Research Methodology

**4.1 Research Design**

This study adopts a qualitative research design to explore the home environment needs of elderly people living in urban China within the context of an intelligent society. The aim is to gain an in-depth understanding of the daily life experiences, spatial preferences, and expectations regarding smart home technologies from the perspective of older adults. Qualitative methods are appropriate for capturing subjective perceptions and behavioral insights, especially in under-researched contexts involving vulnerable groups such as the elderly.

**4.2 Sampling and Participants**

Participants were selected using a purposive sampling strategy to ensure the inclusion of elderly individuals who met the following criteria:

Aged 60 years or above;

Currently living in an urban residential area in China;

Cognitively capable of engaging in interviews;

Have experience or opinions on daily life needs, safety, and smart home environments.

A total of 11 participants (6 females and 5 males), aged between 60 and 75, took part in the study. The demographic details including age, gender, education level, and length of residence in their current homes are presented in Table 1.

**4.3 Data Collection**

Data were collected from February to April 2024 using two methods:

**4.3.1 Literature Review**

A comprehensive literature review was conducted to identify existing findings and research gaps related to elderly housing needs and smart home systems. Sources included peer-reviewed journals, policy reports, and statistical data from academic databases such as Web of Science, CNKI, and ScienceDirect.

**4.3.2 Semi-Structured Interviews**

In-depth, semi-structured interviews were conducted with each participant, using an interview guide comprising 8 open-ended questions. These questions focused on topics such as:

Physical and emotional needs at home;

Accessibility and safety issues;

Preferences for layout, lighting, and noise;

Use and attitude toward smart technologies;

Health and caregiving requirements.

Each interview lasted approximately 30–45 minutes, conducted either face-to-face or via telephone. With participant consent, all interviews were audio recorded and later transcribed verbatim.

**4.4 Data Analysis**

Interview data were analyzed using thematic analysis supported by NVivo 12 and Microsoft Excel. The analytical procedure followed Braun and Clarke’s (2006) six-step framework:

Familiarization with data;

Generating initial codes;

Searching for themes;

Reviewing themes;

Defining and naming themes;

Producing the report.

Key themes were identified around health concerns, spatial design challenges, technology preferences, and social connectivity.

**4.5 Ethical Considerations**

Ethical approval was obtained from the relevant institutional review board. All participants gave informed consent prior to participation. Confidentiality and anonymity were assured throughout the research process. Names and identifiable information were removed from the data to protect participant privacy.

5. Research results

**5.1 Demographic variables of the participants**

In the study, 10 elderly people were interviewed. The male and female participants were 4 and 6 respectively. The participants ranged in age from 60 to 75. More importantly, these participants have been living in the city and the living environment is relatively stable, which is very helpful to study the real needs of the urban elderly in their home life. Table 1 shows the demographic variables of the participants.

**Table 1. Dynamic variables of the participants**

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| --- | --- | --- | --- | --- | --- |
| **No** | **Participants** | **Age** | **Gender** | **Academic stage** | **Time of residence in the current house** |
| 1 | Senior A | 67 | Male | Junior College | 2 |
| 2 | Senior B | 69 | Female | Senior high school | 6 |
| 3 | Senior C | 70 | Female | Senior high school | 5 |
| 4 | Senior D | 73 | Male | Senior high school | 15 |
| 5 | Senior E | 60 | Female | Senior high school | 20 |
| 6 | Senior F | 62 | Male | Bachelor's degree | 6 |
| 7 | Senior G | 68 | Male | Senior high school | 8 |
| 8 | Senior H | 71 | Female | Senior high school | 20 |
| 9 | Senior I | 66 | Female | Bachelor's degree | 18 |
| 10 | Senior J | 75 | Female | Master's degree | 24 |
| 11 | Senior K | 70 | Male | Junior high school | 16 |

**5.2 Main findings**

**5.2.1 The most concerned needs of the elderly in daily life**

In terms of the most concerned needs of the elderly in daily life, the interview found that 7 elderly people (63.63% of the total sample size) need health. Female accounted for 71.43%, male accounted for 28.57%. As an old man said, "good health is fundamental. Without a healthy body, you can't do anything. With a good body, you can live the life you want.". The interview found that two elderly people (18.18% of the total sample size) needed medical treatment. Women accounted for 100% and men accounted for 0%. There are also two elderly people who are concerned about food safety and wealth respectively.

**5.2.2 Existing problems in the kitchen and toilet of the current residence**

In the living space of the elderly, there are 8 people who think that there are design problems in the toilet, accounting for 72.73% of the total number. The problems are that the toilet needs handrails, the toilet has peculiar smell, the space is small, there is no intelligent toilet, the toilet is dark and natural lighting is poor, and the toilet is not heated. An old man said, "the toilet seat needs an armrest. When you are old, your legs are weak, so you can stand up without too much effort.".

There are 6 people who think that there are design problems in the kitchen, accounting for 54.54% of the total number. The main problems are non slip on the ground, relatively hot when cooking, poor smoke exhaust effect of the range hood, narrow space, and low intelligence of the stove. An old man said, "the stove should have safety settings to avoid forgetting to turn off the fire. It should have prompt function. It has networking function to pay attention to family safety issues.".

**5.2.3 Layout, area, sound, etc. of ideal home space**

In the ideal home space, there are 9 elderly people who choose the North-South transparent layout, accounting for 81.82% of the total number. Some elderly people said that "the lighting in the south must be sufficient, and the North-South transparent house type can increase the air flow and make the indoor air fresher". There are 4 people in 60-79 ㎡, 5 people in 80-99 ㎡, and 2 people in 100-200 ㎡. Some old people said that "the spacious and bright big house, three generations can live together, very happy". In terms of noise, all the 11 elderly chose to be quiet and quiet.

**5.2.4 The elderly currently use medical or health care equipment at home**

At present, there are 9 elderly people using medical or rehabilitation equipment at home, accounting for 81.82% of the total number. Most of the tools used during the period are health care and household standing tools. Most of the health care equipment are massage chairs, physiotherapy devices, health buckets, etc. the medical equipment are sphygmomanometers, oximeters, oxygen respirators, blood glucose meters, respirators, etc. One old man said, "if you feel uncomfortable at home, you can check it at any time”.

**5.2.5 The way elderly people socialize**

In daily life, elderly people mainly interact with other elderly people in daily life affairs. Eight people choose to take a walk with their neighbors after meals, accounting for 72.73% of the total number; Six people choose to buy groceries and go shopping together, accounting for 54.55% of the total number of people, with males accounting for 16.67%; 5 people choose to pick up and drop off their children, accounting for 54.55% of the total number of people; Four people choose to play cards, accounting for 36.36% of the total number of people; And males make up 75%. The way they communicate with each other is through WeChat.

**5.2.6 Smart home products and services needed in life.**

Among the smart home products and services in life, 10 elderly people chose to use smart door locks, accounting for 19.91% of the total number, and 5 elderly people chose sweeping robots, accounting for 45.45% of the total number. The number of people who chose emergency call equipment was 3, accounting for 27.27% of the total number. Some old people said, "smart door locks are very convenient. You don't have to think about taking the key when you go out”.

**5.2.7 Physical indicators that should be monitored by intelligent medical monitoring system in daily life**

Among the physical indicators that should be monitored in daily life, 10 elderly people chose to detect blood pressure, accounting for 19.91% of the total number, and 5 elderly people chose to detect blood glucose, accounting for 45.45% of the total number. There were 4 elderly people who chose to test the heart, accounting for 36.36% of the total. There were 2 elderly people who chose to detect blood oxygen, accounting for 18.18% of the total. Some old people said, "when you feel uncomfortable in your life, you should prepare some commonly used blood pressure and blood glucose detection equipment to simply judge the condition and whether you can go to the hospital”.

6 Discussion

**6.1 Analysis of the needs of the elderly**

**6.1.1 The most concerned needs of the elderly**

As the previous data analysis shows, the elderly are most concerned about health. With the growth of age, the elderly pay more attention to their own health status and health management. They hope to maintain good health, prevent and manage chronic diseases, and delay the decline of physical function. According to Maslow's hierarchy of needs theory, the focus on health is actually the first level of the theory's needs. The elderly return to the most basic needs. Only meeting the health needs is an important guarantee for the elderly's pursuit of happiness and a comfortable life.

**6.1.2 Problems in kitchen and toilet**

Through data analysis, elderly people may face many problems when using kitchens and bathrooms. Firstly, safety hazards. The kitchen and bathroom floors are prone to getting wet and slippery, and elderly people are particularly prone to falling. The behavioral ability of elderly people decreases, and there is a risk of burns and fire during the cooking process. Secondly, there is a lack of auxiliary facilities. In residential buildings, there is a lack of auxiliary facilities for the elderly, such as handrails, anti slip mats, intelligent call devices, etc., which cannot provide sufficient living assistance and safety guarantees. Thirdly, the facilities are outdated. Old facilities are prone to accumulating dirt and bacteria, affecting the hygiene environment and posing hidden dangers to the health of the elderly. According to the universal design theory, interior design should have adjustability. As the physical condition of the elderly changes, some auxiliary facilities can be installed later to meet their new physical needs.

**6.1.3 Use of medical or health care equipment**

At present, 9 elderly people use medical or rehabilitation equipment at home, accounting for 81.82% of the total number, indicating that most elderly people will choose one or more medical or health care products according to their physical conditions. According to the relevant research report of the medical device industry in 2023, the scale of China's medical device market is expected to reach 958.2 billion yuan, with a compound growth rate of about 17.5% in the past seven years, and has leapt to become the world's second largest market after the United States. According to Maslow's demand theory, many elderly people buy a lot of medical and health care products, mainly based on the safety needs in this theory, so that the elderly themselves can get medical treatment faster in their daily life, and slow down their physical weakness.

**6.1.4 Social style of the elderly**

According to data analysis, firstly, elderly people's social interactions have strong daily and regional characteristics, and they are more inclined to interact with familiar people around them. This way of communication is often accompanied by trivial matters in daily life. Secondly, there are significant gender differences in certain social activities. For example, in the activity of picking up and dropping off children, although it is not specifically stated who is picking up and dropping off their children, it may imply the traditional concept of division of roles in certain families, and male participation is relatively low. In the activity of playing cards, the proportion of males is as high as 75%, which may reflect the differences in interests and hobbies between genders. Thirdly, social activities among the elderly often have characteristics of collectivity and mutual assistance. They not only enhanced their friendship but also achieved mutual help and support by participating in activities such as walking and shopping together. This collective activity helps elderly people reduce loneliness and improve their quality of life. Fourthly, elderly people are also adopting digital methods for social communication, such as using social media tools such as WeChat. This indicates that elderly people are gradually keeping up with the times in their social habits and adapting to the development of modern society. Digital social media provides older adults with a more convenient and efficient way of communication, helping them overcome geographical limitations and expand their social circles.

**6.1.5 Smart home products and services needed in life**

According to the survey data, the smart home products used and contacted by the elderly are rarely developed and used specifically for the elderly, especially for the elderly's rehabilitation, medical and other smart home products. According to the theory of ergonomics, smart home products should have a simple and top-notch interface and operation mode, so as to reduce the cognitive and operational burden of the elderly.

From the perspective of the overall sales of smart home, according to statista data, the proportion of consumers aged 55-64 in China's smart home products was 9% in 2022. Compared with countries with a high degree of aging such as the United States and Germany, the consumption contribution of China's elderly population to the smart home market was low. In the future, with the acceleration of aging process, the proportion of China's elderly consumers in all smart home markets is expected to increase.

**6.1.6 Detection of physical indicators**

Statistics show that the elderly primarily focus on physical health indicators like blood pressure, blood lipids, and blood glucose. In 2022, the National Health Commission of China introduced standards for assessing elderly health, covering physical, mental, and social health dimensions. Physical health evaluation includes nutritional status, sleep quality, vision, hearing, daily activities, and disease status. Mental health assessment considers cognitive function, anxiety, depression, and life satisfaction. However, there's limited attention to mental and social health, with a predominant focus on physical health alone. A comprehensive, three-dimensional health evaluation for the elderly is lacking.

**6.2 Enlightenment of research results on aging housing design**

The research findings hold significant implications for aging home design, concept of pension life, and pension policies in China. It underscores the imperative of integrating aging design considerations into home space planning, including provisions for intelligent home system interfaces to facilitate future upgrades. Given that over 90% of the population in China will require home-based care, smart home systems are vital in assisting the elderly with daily tasks, communication, medical needs, and healthcare.

**6.3 Test and Validation**

To ensure the reliability and credibility of the research findings, a multi-step validation process was conducted as follows.

**6.3.1 Triangulation of Data Sources**

Findings were triangulated through literature review, interview data, and observational notes. Themes derived from interviews were compared against existing literature and policy documents to ensure consistency and alignment with current knowledge on elderly housing needs and smart home technology.

**6.3.2. Inter-Coder Reliability**

To validate the thematic analysis process, an independent researcher reviewed and cross-coded 25% of the interview transcripts using the same NVivo 12 framework. The coding consistency between researchers reached an agreement level of over 85%, indicating a high level of inter-coder reliability.

**6.3.3. Member Checking**

After transcription and initial theme extraction, three randomly selected participants were invited to review their summarized responses. All confirmed that the interpretations accurately reflected their views and experiences, helping to validate the authenticity of the qualitative data.

**6.3.4. Software Validation**

NVivo 12 was used for systematic coding and theme generation. Word frequency analysis and coding matrices were generated to support the theme structure and identify pattern regularities across cases.

**6.3.5 Expert Review**

A qualitative research specialist and a gerontology expert reviewed the research framework and preliminary results. Their feedback led to adjustments in the theme classification, especially regarding emotional and safety-related needs of the elderly.

These validation steps ensured that the conclusions drawn from the study were grounded, replicable, and aligned with both participant perceptions and theoretical frameworks.

7 Conclusions

**7.1 Conclusions of the study**

This study employs a mixed-method approach, incorporating literature review, semi-structured interviews, and thematic data analysis, to investigate the residential needs of elderly individuals in urban China. The findings offer valuable implications for aging-in-place housing design within the context of smart living. Several key conclusions are drawn from the research results:  
  
First, physical health remains the primary concern for older adults, as it underpins quality of life, independence, and overall well-being. Second, aging-friendly housing design is often overlooked due to economic, cultural, policy, and familial constraints, resulting in compromised residential satisfaction. Third, while healthcare and medical devices are increasingly used, their effectiveness and safety vary. Some older adults rely on wellness products as substitutes for proper medical equipment.  
  
Fourth, elderly individuals engage in daily social activities with noticeable gender-based differences; however, digital platforms such as WeChat are enhancing social connectivity. Fifth, current smart home technologies are not tailored to the specific needs of older users. Most products are designed for younger consumers, leading to perceived high costs and low adoption among the elderly. Sixth, despite the emphasis on physical health, mental and social health are often underappreciated, resulting in challenges such as loneliness, anxiety, and social isolation.  
  
In summary, elderly-friendly housing development in China is hindered by systemic and social limitations. Although smart devices and social apps are widely accessible, they often fail to address the unique needs of aging users. A comprehensive and human-centered approach—one that simultaneously addresses physical, mental, and social well-being—is urgently required.  
  
This research makes substantial contributions to both theoretical and applied domains. By articulating the specific living needs of elderly residents, it supports the development of inclusive, safe, and technology-enabled housing environments. Moreover, the findings inform urban planners, designers, and policymakers seeking to implement responsive and future-ready smart city frameworks that promote active and healthy aging.

This study uses the methods of literature, interviews and data analysis to explore the main needs of the elderly's home life, and provides valuable insights for China's aging design. Based on the above research results and discussions, several key conclusions can be drawn.

First, physical health is the biggest demand of the elderly, which is related to the quality of life, happiness and independence of the elderly. Second, in the actual living environment, due to the influence of economic conditions, traditional consciousness, laws and regulations, residential location, family structure and other factors, the aging residential design of home-based care has not been paid attention to, which affects the quality of life of the elderly. Third, there are many portable health care and medical devices, and the efficacy and safety of some health care devices need to be carefully purchased. At the same time, some elderly people buy health care devices as medical devices. Fourth, The social activities of the elderly run through the trivialities of daily life, and there are differences in the activities that men and women participate in, but they are more closely connected through social software. Fifth, the use of intelligent products is a general product for ordinary families. There is no product specifically designed for the elderly. Most of the products follow the use of young people at home. The elderly feel that the price of intelligent products is high and are not willing to spend. Sixth, while paying attention to physical health, we ignore mental health and social health. They may have psychological problems such as anxiety and loneliness due to physical aging, or they may feel disconnected from society due to the narrowing of their social circle.

In short, due to economic, cultural, legal, and family limitations, elderly friendly housing designs often lack attention and affect their well-being. Social activities vary by gender, but social apps are increasingly providing convenience for them. Although smart products are widely used, they lack design specifically for the elderly and are often perceived by them as expensive. Finally, although physical health is crucial, psychological and social health are often overlooked, leading to issues such as anxiety, loneliness, and social disconnection.

This study offers significant contributions to both academic research and practical implementation. By identifying the specific home environment needs of elderly individuals in urban China, it contributes to the design of age-friendly smart homes that promote safety, autonomy, and improved quality of life. Furthermore, it provides critical insights for urban planners, policymakers, and technology developers aiming to build inclusive, responsive, and human-centered smart city infrastructures. The research not only bridges the gap between aging and technology but also offers strategic directions for integrating smart systems into the daily lives of older adults, thereby supporting aging-in-place and healthy aging in a rapidly evolving digital society.

**7.2 Limitations of this study and future research prospects**

**7.2.1 Limitations of the study.**

Sample limitations: the study may only cover a small part of the elderly and cannot represent the entire elderly group. The sample size, representativeness and diversity may affect the universality and popularization of the research results.

Methodological limitations: there may be limitations in the choice of research methods. For example, the use of questionnaires may be affected by the memory, expression ability and subjectivity of respondents, while observation or experimental methods may be limited by environment and conditions.

Cultural and regional differences: China has a vast territory, and different cities may have differences in culture, living habits, and economic development levels. The research results should consider regional specificity.

**7.2.2 Future research prospects.**

Interdisciplinary research: integrate the knowledge and methods of architectural design, medicine, psychology, sociology and other disciplines to explore the impact of home environment on the physical and mental health of the elderly.

Focus on emerging technologies: study the application and effect of smart home technology and telemedicine in meeting the home environment needs of the elderly, and explore how to use technology to improve the quality of life of the elderly.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

The author hereby declares that no generative artificial intelligence technologies, such as large language models (ChatGPT, COPILOT, etc.) or text-to-image generators, were used in the process of writing or editing this manuscript.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data Availability Statement

The dataset generated and analyzed during the current study is available in the Figshare repository and can be accessed via the following link:

<https://doi.org/10.6084/m9.figshare.28783043>

<https://figshare.com/s/d3c26ed25f7324f95dec>

The dataset includes anonymized transcripts of interviews and coded data used in NVivo analysis. All personally identifiable information has been removed to ensure participant privacy. Researchers interested in reusing the data for academic purposes may contact the corresponding author for further clarification.