

The Research on Adaptability-Oriented Modern Residential Renovation Strategies for Elderly People with Alzheimer Disease

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Abstract:

In China, the majority of elderly people primarily reside in family units as their main living arrangements. In the face of the severe challenges posed by population aging in Chinese society, the demand for age-friendly renovations in elderly households has become increasingly prominent. This paper focuses on researching the strategies of adaptability-oriented modern residential renovations for elderly individuals with Alzheimer disease. It explores the characteristics and needs of these patients, principles and strategies of age-friendly modern residential renovations, as well as design principles and practical applications of modern residential renovations specifically tailored for individuals with Alzheimer disease. The aim is to provide convenience, safety, and comfort for elderly patients and their caregiving family members, enhance the quality of life for senior citizens, and create a convenient, safe, and comfortable living environment.

Keywords:

Alzheimer Disease, Age-Friendly, Modern Residential Interior Renovation, Accessible Design

1. Introduction

The modern residential interior renovation design has always been a subject of exploration and research for architects and interior designers. Population aging in China has become an increasingly significant issue in recent, and the number of elderly individuals with Alzheimer disease is also continually rising[1]. Age-friendly renovation design within modern residential interiors is an important component of interior space design. Addressing social issues and caring for the elderly is a responsibility and obligation every contemporary youth. Researching age-friendly renovation strategies in modern residential interior design, creating a favorable living environment for the elderly, and improving their quality of life are meaningful not only for society, but also architects, interior designers, and students in the field of interior design at universities.

2. Analysis of the Current Situation of the Elderly Population in China

2.1. The current status of the elderly population quantity

According to the data from the “Analysis Report on the Aging Population in China 2022,” the current size of our country elderly population has reached 210 million. In terms of age structure, the total population below 60 years old accounts for 81.82%, the 60-64 age group accounts for 4.5%, and those above 65 years old account for 13.68%. The proportion of elderly people above 65 years old is only 0.32% away from the stage defined as an “aged society” by the World Health Organization (14%). The natural population growth rate in 2022 is -0.6%, indicating a significant acceleration in the pace of population aging compared to before.[2]

According to the World Health Organization survey, there are approximately 15 million people in China suffering from dementia, also known as Alzheimer disease. Dementia is predominantly prevalent among the elderly population aged 65 and above. It is a clinical syndrome characterized by significant decline in memory, language, and comprehension abilities, resulting from various underlying diseases. The most common cause of dementia is Alzheimer disease, accounting for 65.3% to 83% of all cases of dementia in the elderly.

Overall, the aging of our population in China is quite severe, and the number of elderly individuals suffering from Alzheimer disease is steadily increasing. Even in the future, the situation is not optimistic and may even worsen.

2.2. Analysis of living patterns for individuals with Alzheimer disease in elderly population

Currently, in China, the living patterns for individuals with Alzheimer in the elderly population mainly consist of home-based care and nursing home care, with the majority opting for the former. Alzheimer patients who choose to stay at home are usually accompanied by family members or receive visits from professional caregivers. Residing in a familiar environment helps slow down the progression of the disease, but it can also place significant mental and financial burden on the caregivers. On the other hand, Alzheimer patients who live in nursing homes are typically those whose children are not available or unable to for them. Elderly individuals living in nursing homes often face challenges such as difficulty adapting to a new environment, anxiety, feelings of insecurity, depression, and reluctance to cooperate with caregivers. This living arrangement requires adequate facilities and skilled caregivers, and it also requires the family to have certain financial capabilities to ensure the quality of life for the elderly.[3]

2.3. Characteristics and needs of individuals with Alzheimer disease

2.3.1. Overview of Alzheimer disease

Alzheimer disease is a progressive neurodegenerative disorder characterized by memory loss and declining cognitive abilities, and is the most common form of dementia in older adults. It is characterized by the gradual degeneration of neurons and impairment in brain function, causing significant impact on an individual daily life and independence.

The progression of Alzheimer disease typically occurs in three stages: early, middle, and late stages. Early symptoms may be relatively mild, initially presenting as subtle memory problems, but over time, they progressively develop into more severe and widespread cognitive impairments, such as confusion, communication difficulties, spatial and navigational challenges. Individuals may encounter difficulties in daily activities, such as getting lost, forgetting family members, and being unable to care for themselves.[4]

2.3.2. Behavioral and cognitive characteristics of elderly individuals with Alzheimer disease

i. Impaired or loss of memory: One of the most prominent features of elderly individuals with Alzheimer disease is impaired or loss of memory. They often forget recent events, have difficulty retaining new information, and struggle to recall important details about their own identity, family members, and other vital information.

ii. Language and communication issues: Elderly individuals with Alzheimer disease may encounter language barriers such as forgetting words, difficulties in articulation, and semantic confusions. Their speaking and comprehension abilities may also decline, making it challenging to accurately express their thoughts or understand others speech.

iii. Spatial and orientation impairment: Patients may feel lost or disoriented even in familiar surroundings. They may not remember the way back home, struggle to recognize landmarks in their surroundings, or have difficulty locating common objects.

iv. Impulsivity and irritability: Due to declining cognitive abilities, patients may become easily agitated, irritable, or impulsive. They may exhibit emotional behavior due to anxiety, confusion, or feelings of frustration.

v. Loss of interest and social withdrawal: Elderly individuals with Alzheimer disease may gradually lose interest in previously enjoyed hobbies or activities, lacking motivation to actively participate in social interactions. They may become isolated and self-isolated.

vi. Decreased attention and concentration: Patients may struggle with maintaining focus and easily become distracted, making it difficult for them to sustain attention on a specific task or activity.

vii. Decline in executive functioning: Elderly individuals with Alzheimer disease may encounter difficulties in carrying out daily activities such as dressing, bathing, and cooking. They may lose the ability to complete complex tasks such as operating appliances or engaging in financial transactions.

viii. Cognitive impairment and decreased judgment: Patients may struggle to make decisions, unable to assess and solve problems. They may become more vulnerable to deception, incapable of properly evaluating risks or making wise decisions.

2.3.3. The demand for residential environment in elderly people with Alzheimer's disease

i. Safety: Ensure a secure residential environment and reduce the risk of accidents. Remove clutter and furniture that may cause tripping, secure carpets and unstable

furniture, incorporate smart home products, use non-slip materials for flooring, and install safety handrails and other facilities.

ii. Simplify the environment: Create a clean, organized, and minimally stimulating environment. Reduce the quantity of furniture and decorations to minimize the potential for clutter and confusion. Utilize bright and soft lighting while avoiding harsh and glaring lights.

iii. Signage and Labels: Use signage and labels to aid elderly people in identifying and remembering important items and rooms. Place labels on each room, wardrobe, and drawer, indicating their contents or purpose.

iv. Easy-to-recognize equipment: Use simple devices, such as easily recognizable switches, and appliances. Choose user-friendly and easy-to-operate household appliances and products, while avoiding overly complicated control panels.

v. Safety locks and theft prevention measures: Install safety locks to ensure that elderly people cannot unintentionally open doors or leave the premises. Additionally, ensure the security of windows and doors to prevent elderly people from venturing outside and minimize the risk of getting lost.

vi. Sound and music: Provide a soothing and enjoyable audio environment for elderly people. Music can help them relax, reduce anxiety, and improve cognitive function.

vii. Smart security door locks and alert systems: Consider using smart security door locks and alert systems to ensure that older adults can receive assistance when needed. These systems can monitor the activities of older adults and alert caregivers of any potential issues.

viii. Creating a familiar environment: Incorporate familiar furniture, photographs, and decorations in their residence. This helps evoke familiar memories as reminders and makes them feel more comfortable and secure.[5]

3. Principles and Strategies for The Renovation of Age-Friendly Modern Residences

3.1. Definition and principles of age-friendly design

Age-friendly design refers to the principles methods that consider and meet the specific needs and capabilities of elderly people in design process of products, environments, or services. Its goal is to provide a more friendly, safe, and user-friendly experience to support elderly people independent living and social participation.

Here are some key principles of age-friendly design:

i. Accessibility: Ensure that elderly people can easily access and use products, environments, or services. This includes avoiding barriers, providing accessible entrances, lowering thresholds, and providing appropriate signage and indications.

ii. Safety: Ensure that products or environments provide safety measures to prevent accidents or injuries. Examples include non-slip flooring, grab bars, home safety devices, etc.

iii. Usability: Ensure that products or services are easy and intuitive for elderly people to operate and interact with. This includes user-friendly interfaces, clear instructions, adjustable font sizes and brightness, legible text, etc.

iv. Adaptability: Provide designs that are flexible, adjustable, and adaptable to accommodate the individual differences and needs of elderly people. This includes adjustable furniture, customizable devices, adjustable lighting, etc.

v. Social participation: Create environments and services that promote social interaction and participation to help elderly people maintain social connections and integrate into the community. For example, providing social activity venues, friendly social space designs, etc.

3.2. Age-friendly design strategies for elderly individuals with Alzheimer disease

The design strategies for aging in place for individuals with Alzheimer disease focus on providing a safe, accessible, and comfortable environment to help them maintain dignity and independence in their daily lives. Through strategic interior layout planning, the provision of easy-to-use facilities, and appropriate labeling, we can improve the quality of life for patients and alleviate the effects of disease. Here are some aging in place design strategies applicable to elderly individuals with Alzheimer disease[6]:

i. Safety and Wayfinding: Provide a sense of safety and guidance to help patients navigate the environment and ensure their security. For example, use flooring with anti-slip materials, install wayfinding signs, and visible exit indicators.

ii. Simplification and Clarity: Simplify the environment and spaces into clear, understandable forms, reducing clutter and elements that may cause confusion. For instance, minimize the number of furniture and decor, creating a clean and tidy environment.

iii. Memory Assistance: Provide tools and support for memory assistance to help patients maintain continuity in their daily routines. For example, place electronic reminders at the entrance, provide cordless phones with saved family members phone numbers, etc.

iv. Clear Labeling and Signage: Use clear and easily comprehensible labeling and signage, such as labeling the name and function on each room door, using recognizable symbols for bathrooms, etc., to help patients distinguish and identify different areas.

v. Avoidance of Hazardous Items and Equipment: Isolate or hide potential hazardous items and equipment to prevent patients from accidental harm. For example, store toxic substances like cleaning agents and medications in locked cabinets, ensure proper functioning of electrical equipment to reduce the risk of fires, etc.

vi. Calming and Soothing Environment: Create a soothing space to alleviate potential restlessness and anxiety in patients. For instance, use gentle lighting and colors, provide adequate natural light, offer clean and comfortable furniture, and play relaxing music.

vii. Daily Activities: Provide simple tasks like folding clothes, tending to plants, etc., to help patients stay active and engaged. These activities can provide cognitive stimulation and enhance self-esteem.

viii. Home Safety Measures: Install safety alarms and monitoring systems, provide emergency call buttons and remote controls. These measures can offer a level of security and reduce the risk of accidents for patients.

3.3. Case study on the application of aging-in-place principles in modern residential renovations.

Case study: “Unforgettable Home” - Aging-in-place residential renovation

Case Overview[7]: This case study revolves around an 89-year-old grandmother residing in a coastal town in Tengzhou City, Shandong Province, China, who suffers from late-stage Alzheimer disease. Currently, she is being cared for by her daughter and son-in-law, both of whom are over sixty years old. The grandmother is currently in the late-stage of Alzheimer's disease, not only does she not know her family, but she also makes trouble running away from home every day, which has caused great trouble and pressure for her caregiver family. The focus of this renovation project is to implement “aging-in-place design” to enhance the safety and comfort of the three elderly individuals involved. That case is to create an “unforgettable home” for the Alzheimer patient, allowing grandmother to know and be willing to stay at home for a longer time.

Design strategies for renovation:

i. Preparation for design: Identify the current issues with the house, observe and document the behavioral problems of the elderly person with Alzheimer, and understand the family lifestyle in order to explore the direction for age-friendly home modifications.

a. The interior layout of the house consists of living spaces on both sides with an open courtyard in the middle, which results in low indoor temperatures during the winter in northern cities.

b. The house has multiple level differences, which can easily lead to safety issues (ensuring safety is one of the key focuses for age-friendly modifications).

c. There is no formal bathroom in the house, making it inconvenient for the elderly person to use the toilet and take showers.

d. The house has poor sound insulation, sometimes causing disturbances for the neighbors.

e. The house lacks adequate natural lighting indoors.

ii. Core difficulties in design

a. How to make the newly designed home more easily recognizable for grandmother with Alzheimer disease.

b. How to extend grandmother's time at home through design, thus reducing the burden on her relatives.

iii. Aging-in-Place Design Strategies

a. Adjusting the layout

Make slight adjustments to the existing house structure, creating a corridor that connects the kitchen, dining area, courtyard, resting area, bathroom, and bedroom in a linear arrangement. This simple and clear spatial division makes it easier for grandmother to navigate and recognize different areas. However, two aspects remain

unchanged in the spatial layout: keeping the main entrance and hallway location and form unchanged, allowing grandmother to easily identify her own front door and prevent getting lost; maintaining the original bedroom and bed location, increasing familiarity with the new home for grandmother, while adding an additional bed inside for the convenience of caretakers.

b. Addressing insulation issues

Due to the cold winters in Tengzhou city, Shandong Province where the renovation takes place, mere adjustments in the layout are not sufficient. The following modifications have been made: adding insulation cotton to the walls, providing both thermal insulation and soundproofing effects; installing underfloor heating systems. Considering the cost-effectiveness preferred by elderly individuals, a gas stove is used, resulting in a 20% reduction in energy consumption.

c. Resolving lighting concerns

The natural light inside the house is often inadequate. To increase the amount of natural light, the designer has included light wells and light tubes, ensuring sufficient light flux inside. Consideration has also been given to the cost-effectiveness aspect, as light tubes introduce natural light, effectively reducing electricity consumption.

Lighting influences our perception of time. Therefore, the designer has chosen smart lighting solutions with four predefined settings (6000K in the morning, 4000K during the day, 3000K the evening, and 2700K for rest), simulating daylight and the progression of day and night, gradually helping correct the perception of time for elderly individuals.

d. Addressing safety concerns

Two main points to consider: adding security measures and minimizing height differences.

The design modifications include: adjusting the scale of stair treads to optimize ergonomic comfort; integrating a bathroom that includes toilet facilities, making it convenient for the elderly to use; adding handrails along corridors and walkways to provide support throughout the home; installing automated night lighting to assist the elderly during nocturnal bathroom visits; minimizing height differences within rooms to improve safety; incorporating smart systems to alert family members if the elderly person wanders.

Moreover, the bathroom door is designed to open from the outside to prevent accidents in case of a fall, allowing family members to enter the bathroom promptly and assist the elderly.

e. Ensuring comfort problems

Comfort is a crucial aspect of residential design, enhancing the emotional attachment to the home and encouraging grandmother to spend more time there.

The following four methods have been implemented: using indirect lighting to prevent glare and discomfort caused by direct exposure to light for elderly individuals; avoiding direct airflow from air conditioning units by using side vents, thus enhancing comfort; utilizing matte-finish flooring to reduce light reflection and improve visual comfort; selecting wall paints with soothing and warm colors that do not strain the eyes, while also considering environmental sustainability.

In order to save indoor space, the designer has also put a lot of effort into the selection of furniture such as doors and mattresses. Foldable doors with adjustable hinges were chosen to occupy less space and provide greater convenience and flexibility in usage. As for the mattress, a new emerging material with better breathability and water permeability compared to traditional foam was selected. Moreover, it can be easily washed, which can be useful in case of incontinence issues in the future.

4. 4.Design Principles and Practices of Modern Residential Retrofit for Elderly Alzheimer Patients

Modern residential renovation designs, aimed at meeting the needs of elderly people with Alzheimer disease, incorporate open layouts based on cognitive and behavioral requirements, integration of wayfinding systems and memory aids, improvements in safety and emergency handling, enhancement of living space environments, and provision of social and activity spaces. This helps to provide a safe, comfortable, and pleasant living environment, contributing to improving their quality of life and autonomy.

4.1. Design Principles of Open Layout based on Cognitive and Behavioral Needs

In modern residential renovation design, open layouts are designed to minimize excessive corridors and aisles, ensuring flat ground surfaces both indoors and outdoors. This is crucial for individuals with cognitive impairments, such as those with disease, as it provides larger and more accessible indoor and helps them identify different functional zones, reducing the likelihood of getting lost or confused and decreasing the risk of falls[8].

4.2. Integration of Wayfinding Systems and Memory Aids

Considering the memory impairments of individuals with Alzheimer disease, the design should integrate wayfinding systems and memory aids. Developing clear and visible wayfinding paths, color contrasts, and signage can assist them in locating and navigating, offering a greater sense of security. Additionally, installing memory aids such as reminder calendars, message boards, or voice assistants through smart home devices can help patients remember important things and daily tasks.

4.3. Improving Safety and Emergency Handling

Due to cognitive difficulties faced by individuals with Alzheimer disease during emergency situations, special attention must be given to safety and emergency measures. For instance, incorporating antimicrobial and slip-resistant safety handrails, as well as easily accessible emergency buttons and switches, can help patients swiftly send out distress signals in unexpected events.

4.4. Enhancement of Living Space Environments

Regarding the physical environment, it is essential to minimize stimulating direct light and noise disturbances, ensuring suitable indoor temperature, humidity, adequate lighting, and fresh air. These improvements can be achieved through the use of smart home systems. The smart home system can adjust temperature, humidity, and lighting automatically based on weather conditions and changes in indoor light, creating a comfortable living environment for patients[9]. Additionally, the use of comfortable

seating and bedding can help improve the quality of rest and sleep for individuals with Alzheimer disease.

Regarding the psychological environment, the use of soft colors, soft materials, non-slip surfaces, familiar furniture, photos, and memorabilia can create a warm, familiar, and emotionally secure atmosphere for patients with Alzheimer disease.

4.5. Provision of Social and Activity Spaces

Within the renovated residence, social spaces such as living rooms or gardens should be designed to encourage patients to engage in activities that they are capable of, such as gardening or pet care, utilizing their remaining skills. Accompanied activities with family members or caregivers on a daily basis help maintain social role relationships, delay the progression of the disease, and enhance overall well-being[10].

5. Conclusions

In summary, elderly individuals with Alzheimer disease are representative of a typical subgroup among the elderly population, and the need for age-friendly renovations is widespread, whether in older housing communities or newly built housing developments. The demand for age-friendly renovations in elderly households in China is especially strong. Practical design renovations within residential spaces require customization and adjustments based on individual needs and budget constraints to ensure a comprehensive consideration of the patients specific needs, future needs, and comfort of living conditions. To promote the pace of age-friendly residential interior design renovations, the following steps can be taken: Firstly, raise awareness among the general public, especially young and elderly individuals, by highlighting the importance of age-friendly and its impact on quality of life; Secondly, government departments should allocate financial budgets and develop supportive policies at both national and local levels, taking into account the characteristics of the elderly population and the demand for home-based age-friendly renovations; Once again, educational institutions should cultivate professionals in the field of age-friendly home renovations. This includes offering relevant courses and programs that equip students with the necessary skills and knowledge to contribute to the industry and address the needs of elderly individuals; Finally, establish a communication platform for knowledge exchange among experts in the age-friendly housing industry. This platform can facilitate information sharing, collaboration, and advancements in technology and best practices. By joining forces with families, society, educational institutions, and the industry, we significantly and upgrade the living environment for elderly individuals in the future. This will result in increased happiness, quality of life for their family members, and ultimately fulfilling society commitment to human care and well-being.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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