

A Study on Appropriate Plan Forms for Retirement Facility Layouts

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Abstract: With the rapid increase in the aging population, the construction of retirement facilities has become an increasingly crucial topic in the field of architecture. The Subpar layout of retirement facilities not only decreases their spatial utilization efficiency, leading to wastage of spatial resources, but also significantly impacts the quality of life of elderly residents. The aim of this study is to investigate appropriate plan forms for retirement facilities of varying scales, utilizing methods such as literature analysis and empirical research in the field of architectural design for elderly care facilities. The results of our study indicate that retirement facilities of diverse scales necessitate distinct plan forms that can better meet the diverse needs of elderly residents for daily living and retirement. These findings have significant implications for future planning and design of retirement facilities in the field of architecture for elderly care.

Keywords: Retirement Facilities, Plan Forms, Plan Design

1. Introduction

As the global population ages, the construction of elderly care facilities has become an increasingly critical issue^[1]. The foremost challenge in constructing these facilities is determining a suitable floor plan that meets the functional requirements of facilities of varying sizes. While research on elderly care facility construction, both domestically and internationally, primarily focuses on architectural spatial function layout, building performance, and interior spatial environmental design, there is a relative dearth of research on floor plan design. Foreign research, predominantly conducted in Europe, America, and Japan, covers topics such as functional requirements, floor plan layout, and design standards of elderly care facilities. Conversely, domestic research primarily focuses on the spatial function layout and interior spatial environment of elderly care facilities^[2]. Therefore, it is necessary to explore appropriate floor plan designs for elderly care facilities of different scales to address this gap in research.

1) The aim of this study is to provide theoretical references for the construction of elderly care facilities by investigating appropriate floor plan designs for facilities of varying scales. This research focuses on:

2) Exploring design principles and constraints associated with floor plan designs for elderly care facilities of different sizes;

3) Analyzing the impact of different floor plan designs on functional aspects of elderly care facilities;

4) Studying the appropriate floor plan designs for elderly care facilities of different scales and providing recommendations.

During the research process, we take into account the influence of building performance, area indicators, and interior decoration on floor plan design.

This study employs an empirical research method and literature analysis approach, combining knowledge and methods from the field of architecture to investigate and discuss suitable floor plan designs for elderly care facilities of varying scales^[3].

2. Summary of the Relationship between Scale and Shape in Elderly Care Facilities

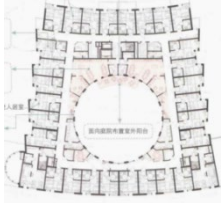
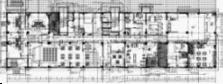
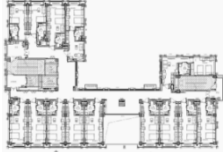

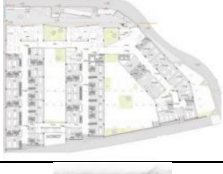

2.1 The definition of scale and shape in elderly care facilities

In the field of architecture, the term "scale" pertains to the physical dimensions of a building, including its total volume, area, and capacity to accommodate occupants. It is a fundamental attribute that determines a building's spatial and functional qualities. Conversely, "form" refers to the geometric shape of a building's floor plan, which plays a critical role in determining its spatial organization, circulation patterns, and the distribution of functional spaces. The scale and form of a senior care facility are essential factors that significantly influence its functional performance, operational efficiency, and overall quality of life for residents. Therefore, the appropriate floor plan design must take into account these factors to ensure that the facility meets the specific needs of elderly residents and enhances their well-being.

Table 1: Classification table of elderly care facility scales.

Classification	Capacity M(Bed)	Comprehensive Building Area Index(m ² /bed)
Small-scale elderly care facilities	≤100	50.0
Medium-sized elderly care facilities	100 < M ≤ 200	46.5
	200 < M ≤ 300	44.5
Large-scale elderly care facilities	300 < M ≤ 400	43.5
	400 < M ≤ 500	42.5
	> 500	≤42.5

Table 2: Classification Table of Plan Layout Shapes.

Table of Plan Layout Shapes	Plan Shape Name	Site plan
Ring-shaped	Stockholm Senior Apartments	
Rectangular/Rectangular-shaped	Poly He Ti and Xi Hui Nursing Home	
U-shaped	Bright Photovoltaic Nursing Home	
L-shaped	Pont-sur-yonne Care Home	
E-shaped	Olyros Care Home	
Distributed	Ge Chou Dam Retirement Home in Yin Chang	

Typically, the scale of elderly care facilities can be measured based on indicators such as the number of beds, the total building area, and the number of floors^[4]. For instance (Table 1), in China, the

scale of elderly care facilities is commonly categorized into five groups of 500, 400, 300, 200, and 100 beds, with comprehensive building area indicators of 42.5 m²/bed, 43.5 m²/bed, 44.5 m²/bed, 46.5 m²/bed, and 50.0 m²/bed, respectively. In this study, facilities with less than 100 beds are classified as small-scale elderly care facilities, those with 100 to 300 beds as medium-scale elderly care facilities, and those exceeding 300 beds as large-scale elderly care facilities in the field of architecture for the elderly care sector .

In the context of architecture and elderly care, the shape of elderly care facilities holds a significant role in determining their spatial functions and utilization efficiency^[5]. The floor plan of an elderly care facility can take on various forms, including circular, rectangular, U-shaped, L-shaped, E-shaped, decentralized, and others (Table 2). The specific design of the floor plan layout necessitates consideration of various factors, such as functional requirements, utilization efficiency, construction cost, and compliance with building codes and standards, and the overall living environment for the elderly.

2.2 The relationship between size and shape

When planning and designing elderly care facilities, the scale and layout of the building are closely related. Scale refers to the size of the building and the number of people it can accommodate, while form refers to the external appearance of the building^[6]. In elderly care facilities, the choice of scale and form should not only meet relevant regulations and standards, but also meet the needs of function and human environment to achieve the best results.

According to related research, there is a certain relationship between scale and form. In terms of scale, it is generally believed that the larger the volume of the building, the corresponding increase in the area of the building, and its form is relatively fixed. For the form, different forms of buildings will affect the internal layout and spatial form of the building. Therefore, in the early planning and design of elderly care facilities, it is necessary to consider the relationship between scale and layout comprehensively, in order to provide a comfortable, safe and convenient living environment for the elderly.

3. Design Principles and Limitations of Scale and Shape

3.1 Design Principles

1) Humanization principle. The building scale and form should be designed according to the needs and living habits of the elderly to provide a comfortable, safe and convenient living environment for them. For example, set up barrier-free access for the elderly, easy-to-use furniture, lighting facilities that meet the visual needs of the elderly, etc.

2) Functionality principle. The scale and form of the building should meet the functional needs of the elderly facilities. For example, to provide comfortable living environment for the elderly, convenient living services and health care facilities, rich recreational activities, etc.

3) Sustainability principle. Building scale and form should be sustainable, not only to meet the current needs, but also to consider future development and expansion. For example, the architectural design should take into account the needs of the elderly and the future development trend, and provide flexible space design and expandable building forms.

3.2 Design Limitations

1) Site conditions constraint. The design of building scale and form should consider the actual situation of the site, avoid being too large or high, and lead to unreasonable use of the site or violate relevant planning requirements.

2) Cost constraint. The design of building scale and form should comply with the budget and economic conditions, avoid cost overruns, and increase the construction cost of the elderly care facility.

3) Building technology constraint. The design of building scale and form should comply with the current level of building technology, avoiding being too complex or difficult to implement^[7].

4) Planning and regulation constraint. The design of building scale and form should comply with the requirements and standards of relevant planning, such as urban planning, building planning, etc.

5) Elderly people's demand constraint. The design of building scale and form should comply with the needs and living habits of the elderly, avoid being too unfamiliar or not meeting the lifestyle needs of the elderly.

In summary, the design of building scale and form should comply with the principles of humanization, functionality, and sustainability, and meet the requirements of site, cost, technology, planning and regulation, and the needs of the elderly.

4. Study on the Planar Shape of Elderly Care Facilities of Different Sizes

4.1 Study on the Planar Shape of Small Elderly Care Facilities

When devising a floor plan for small-scale elderly care facilities, it is crucial to consider the size of the facility and its various requirements. The layout should be concise, clear, and adaptable to satisfy the residents' essential daily needs while minimizing land use.

For small-scale elderly care facilities, the main emphasis should be on the residential and service areas, which should be independent of each other for convenient management and maintenance. In the design of the residential area, it is imperative to provide single rooms as much as possible to safeguard the privacy and security of the elderly. In the design of the service area, facilities such as dining rooms, living rooms, medical rooms, and entertainment rooms should be provided to cater to the daily needs of the elderly.

Furthermore, the floor plan of small-scale elderly care facilities should pay attention to the building's permeability to ensure the comfort and health of the elderly residents. Open spaces should be included between buildings for outdoor activities and landscaping to improve the quality of outdoor and social spaces for the elderly^[8].

4.2 Study on the Planar Shape of Medium-Sized Elderly Care Facilities

When designing medium-sized elderly care facilities, it is crucial to consider the functional requirements of the facility, while taking into account the building code regulations and standards to ensure that the facility meets the safety and accessibility requirements for the elderly. The floor plan layout of medium-sized elderly care facilities should be designed with a focus on the functional areas, while optimizing the spatial organization and circulation to create a comfortable and efficient living environment for the elderly.

The living units in the care unit area should be designed to provide a comfortable and private living space for the elderly, while taking into account the accessibility and safety requirements of the building. The service spaces should be equipped with necessary facilities to ensure efficient and convenient service delivery to the elderly, such as dining rooms, living rooms, and medical rooms. Additionally, the public area of the medium-sized elderly care facility should be designed to provide a range of services and activities to meet the diverse needs of the elderly residents, such as multi-functional halls, rehabilitation therapy rooms, and recreational and fitness rooms.

Moreover, the design of medium-sized elderly care facilities should pay attention to the integration of natural elements, such as daylight, ventilation, and outdoor views, to enhance the quality of the indoor environment and the well-being of the elderly residents. The floor plan layout should also allow for flexibility and adaptability in the future, to accommodate changes in the needs of the elderly population and the facility's operational requirements.

4.3 Study on the Plan Shape of Large Elderly Care Facilities

When designing large-scale elderly care facilities, a more sophisticated and complex floor plan is required to accommodate the larger number of elderly residents and meet their housing and living needs. To achieve this, the facility should be divided into several main areas, including care units, public areas, and medical areas.

The living area should provide a range of room types, such as single rooms, double rooms, suites, and other types, while also considering the special needs of elderly residents, such as barrier-free facilities, professional nursing beds, and emergency equipment. The care unit should be similar to that of medium-sized facilities, but more sophisticated.

In addition to the living and care units, the public area should include spaces for activities such as a library, music room, movie theater, and open activity space for social and leisure activities for the elderly. The medical area should be equipped with various medical equipment, nursing stations, and rehabilitation rooms to provide comprehensive medical services, including physical examinations, nursing, and rehabilitation^[9].

Furthermore, a fitness area should be provided, including indoor gyms and yoga rooms, to help elderly residents maintain good health and engage in rehabilitation exercises. In summary, a large-scale elderly care facility requires a comprehensive consideration of Housing needs of the elderly, living, medical care, and health maintenance, providing more comprehensive and thoughtful services.

5. Study on the Suitable Floor Plan Shape Based on Scale

5.1 Suitable Floor Plan Shape for Small Elderly Care Facilities

When designing the layout for small-scale elderly care facilities, it is crucial to consider the needs of the elderly and their limitations. The principles and limitations of the layout should be designed with the convenience for the elderly, safety, and health in mind. The spatial layout should be simple and compact to facilitate the exercise and care for the elderly, with indoor traffic routes that are easy to navigate. Public areas, courtyards, and activity areas should be designed to provide sufficient sunlight and ventilation, and indoor lighting should be soft, even, and adequate.

To address the decline in the physical function of the elderly, main living facilities should be set in fixed locations for their convenience, and indoor decoration should be simple, comfortable, and safe. Air purification measures should also be considered to ensure indoor air quality.

Three suitable layout forms for small-scale elderly care facilities are the rectangular, U-shaped, and L-shaped layouts. The rectangular layout is compact and flexible, while the U-shaped layout provides good privacy and a humane layout. The L-shaped layout is more flexible in space utilization and also has good privacy.

In summary, the layout of small-scale elderly care facilities should be designed to meet the needs of the elderly and their limitations while promoting their well-being and quality of life. The suitable layout form should be simple, compact, and humane, providing the necessary facilities and amenities to support their daily lives.

5.2 Suitable Floor Plan Shape for Medium-sized Elderly Care Facilities

In the field of architectural design for elderly care facilities, the appropriate floor plan for a medium-sized facility should be carefully considered. This requires a comprehensive evaluation of various factors to ensure optimal functionality, efficiency, and service quality. Firstly, the site's full utilization should be prioritized to provide sufficient space for various services and activity areas. For instance, designing outdoor gardens and activity squares can enhance the quality of life of the elderly residents.

Additionally, the zoning and layering of the facility are important considerations that can help to improve its overall functionality and service efficiency. To achieve optimal service effects, the facility should be divided into different zones and levels, such as residential, activity, medical, and office areas. Moreover, a range of supporting facilities such as medical services, fitness rooms, and libraries should be provided to cater to the varying needs of the elderly. To enhance mobility, the design of easily accessible corridors and elevators should also be included.

Furthermore, the functional layout of the facility should be based on the specific needs and habits of the elderly residents. This includes locating the dining room and lounge close to the residential area for the convenience of the elderly in eating and resting. Also, the activity area and fitness room should be easily accessible, preferably located in the center of the facility^[10].

Finally, flexibility and scalability in design should be considered to meet future changes in demand. This can be achieved by incorporating detachable and re-configurable walls and partitions, which will facilitate easy adaptation to changing needs. A medium-sized elderly care facility should adopt a suitable layout such as a circular, "L"-shaped, or "U"-shaped layout, which integrates all the aforementioned considerations to ensure the highest quality of care for its elderly residents.

5.3 Suitable plan shape for large elderly care facilities

When designing the floor plan for large-scale elderly care facilities, various factors must be considered to ensure that the facilities meet the needs of the elderly population. To accomplish this, the layout should provide a variety of functional areas that are accessible and offer easy traffic flow. Multi-functional spaces should be designed with consideration to the safety and comfort of elderly residents.

To ensure a safe and comfortable living environment, it is necessary to provide adequate safety measures such as fire protection systems, emergency alarm systems, and proper lighting and ventilation systems. Sustainable design strategies such as energy conservation and consumption reduction should also be considered to minimize environmental impact.

Open public spaces are an essential component of large-scale elderly care facilities, and should be designed to encourage social interaction and outdoor activities. Barrier-free channels and elevators should be provided to facilitate the mobility of elderly residents.

When designing the appropriate floor plan for large-scale elderly care facilities, a circular, "E"-shaped or dispersed layout can be employed to maximize the use of indoor and outdoor space, and provide more service facilities and activity venues. Adjustments and optimizations can be made based on specific site and environmental conditions to ensure that the needs of the elderly population are met while improving the efficiency of the use of the facility.

6. Conclusions

After conducting an in-depth analysis of floor plans of various sizes of senior care facilities, this study has arrived at the following insightful conclusions:

Simple "L-shaped," "U-shaped," rectangular or square floor plans are well-suited for small-scale senior care facilities. These designs can include courtyards or gardens to provide additional activity and green space.

Medium-sized senior care facilities are better suited for "L-shaped," "U-shaped," or circular floor plans. Such layouts can help to meet the requirements for different functional areas while also increasing natural lighting and ventilation.

Large-scale senior care facilities are most effectively designed with multi-level, complex circular, "E-shaped," or dispersed floor plans. Such designs can create a connection between different functional areas via main entrances and corridors, while incorporating internal landscapes and greenery to enhance the living experience and quality of life for seniors.

These conclusions and suggestions provide valuable guidance for future senior care facility planning and design, but they still require further verification and testing to ensure that they accurately reflect the needs of the elderly population. With continued research and practice, senior care facilities can be designed and constructed to meet the unique requirements and preferences of elderly individuals, providing them with an environment that is both comfortable and supportive.

References

- [1] Zhou Yanmin et al.(2018) *Architectural design for elderly facilities 1*. Beijing: China Construction Industry Press, 04.
- [2] Zhou Yanmin et al.(2018) *Architectural design of elderly facilities 2*. Beijing: China Construction Industry Press, 05.
- [3] Zhou Yanmin.(2020) *Architectural design of elderly facilities 3*. Beijing: China Construction Industry Press, 09.
- [4] Lin Jingyi, Wang Yuanming & Zhou Yanmin. (2022). *Study on the scale of construction and spatial allocation characteristics of community elderly service facilities*. *Beijing Planning and Construction* (03), 85-90.
- [5] Shi M. (2022). *A prospective study on the spatial design of elderly care facilities*. *Residence* (08), 37-38+156.
- [6] Li Tingjie. (2021). *Exploration on the design of public space of elderly facilities in northwest China under the perspective of regional culture*. *Jushe* (29), 95-96.

- [7] Fu Yao, Wang Shuwen & Wang Zitong. (2021). *Quantifying the spatial configuration of home care facilities under the demand of all ages. Architectural Techniques (03), 110-113.*
- [8] Zhang Chen, Qu Tianxu & Chen Yao. (2021). *Exploring the design of living space environment of elderly facilities based on the behavioral characteristics of cognitive elderly. China Hospital Architecture and Equipment (01), 122-124.*
- [9] Chen Yu. (2020). *An analysis of the functional configuration of the auxiliary service space in the care group of elderly facilities: An example of nine elderly facilities in Japan. Architectural Creation (05), 32-39.*
- [10] Zhou Yanmin & Chen Yu. (2019). *A summary of practical experience in spatial design of elderly facilities. Journal of Architecture (02), 38-43.*