

Research on Design of Community Leisure Facilities Based on the Behavioral Characteristics of Middle- and High-Aged Seniors

Hailin Zhao ^{1, a *}

¹ Sangmyung University, Cheonan, South Korea

^a 2580516992@qq.com

Abstract. This paper explores the most important leisure needs of middle- and high-aged seniors based on their daily behavioral characteristics through a design study of community recreational facilities in old residential compound, so as to improve the daily leisure environment for middle- and high-aged seniors. This paper takes Taiyuan Shengliqiao Residential Compound as an example, conducts field survey and questionnaire survey on the existing community recreational facilities in the residential compound, combines Maslow's hierarchy of needs theory, does ANOVA on the questionnaire survey data to arrive at the preliminary transformation plan, and then does another questionnaire survey to arrive at the evaluation results of the transformation plan that has been arrived at, and then compares the conclusions of the two ANOVA data to achieve the purpose of further optimization of the design plan. In the initial renovation program, the problem of satisfaction discrepancies in comprehensive outdoor playgrounds, sports equipment, outdoor resting spaces, cultural landscaping, landscaped pathways and barrier-free facilities was essentially eliminated. Subsequently, in the evaluation data, it was found that middle- and high-aged seniors preferred to gather in venues with open views, use exercise equipment with rehabilitation functions, and prefer resting facilities with high safety and a beautiful green environment. The evaluation data based on the preliminary retrofitting program can better reflect the deep-seated leisure demands of the middle- and high-aged seniors, which can be regarded as the focus of attention for future research on related community leisure facilities.

Keywords: middle- and high-aged seniors; community leisure facilities; leisure needs; behavioral characteristics

1. Introduction

According to the results of the 2024 National Bulletin on the Development of the Aging Career released by the National Bureau of Statistics of China, as of the end of 2024, China's population aged 60 years or older amounted to 310 million, accounting for 22% of the total population, and the population aged 65 years or older amounted to 220 million, accounting for 15.6% of the total population [1]. The criterion for a moderately aging society is that the proportion of the population over 60 years of age in the total population exceeds 20 per cent, or the proportion of the population over 65 years of age in the total population exceeds 14 per cent, which indicates that China has become a moderately aging society. Addressing the health of seniors has long been a major concern of Chinese society, while improving the living conditions of seniors has only begun to mature in the last five years. The focus of the renovation projects of old residential compound carried out in China in recent years is aimed at improving the quality of daily leisure life of community residents. According to statistics, the proportion of the resident population over 60 years of age in the renovation of old residential compound in cities and towns reaches 52.3%[2], which indicates that their renovation projects need to be inclined to the leisure needs of seniors more. Most of the community recreational facilities that have been built in China are currently intended for use only by lower-aged seniors, with little targeted demand consideration for the middle- and high-aged seniors who are more likely to need to use their facilities. Unlike lower-aged seniors, middle- and high-aged seniors, whose physiological functions continue to decline and who are more prone to social alienation, are in greater need of appropriate social interaction and physical exercise through

the use of community recreational facilities in order to build up their self-confidence and enjoy their old age.

2. Literature Review

The United States, Germany, Japan, South Korea and other developed countries on community leisure facilities research on the needs of seniors to the transformation has matured, they will be divided into different types of seniors, such as the elderly living in the city according to the size of the city, gender, age, living status, such as different conditions to do the refinement of the discussion, and to encourage the user and the government, enterprises and other aspects of the transformation of the design of the joint participation.

Ann Forsyth explores new models of community and housing from spatial and social perspectives, such as service-enhanced communities, small-scale intergenerational housing, and innovations in technological means of transportation and communication[3]. Weinhardt, Michael argues that seniors should not be homogenized as a group with different desires and needs and advocates that seniors should be involved in developing design activities[4]. Saito Min clearly explains the gender and regional differences that seniors exhibit in their mobility outside the home and their participation in social activities, and argues that it is important to differentiate the specific ways in which activities for seniors can be developed[5]. Shinpei Ikeda argues that there is a correlation between the state of leisure life of seniors in a given area and the social relations in which they live[6]. Sungmin Son explored the impact of leisure satisfaction on the quality of life of seniors living alone, and found that physical and environmental satisfaction factors are key to improving the quality of life of seniors living alone[7]. Kim Hye-shin identifies the needs of seniors in community facilities based on the extent and size of residential neighborhoods, discusses the status of neighborhoods by area, the concept and components of a senior community, and the categorization of activities for seniors in the community[8].

Research on community environments adapted to the leisure needs of seniors in China in recent years can be divided into theoretical and practical discussions.

On the theoretical side, the first is an exploration of the factors influencing the mental and physical health of seniors: Using evidence-based strategies and mediated effects analysis, YU Yi-fan dissected the support and compensation of the built environment for individual activity functioning in seniors[9]. Using a multilevel regression model, a mediated effects model, and a propensity value matching method, Gao Mengxi found that the coverage, function, and landscape vegetation of green space at the neighborhood level can have a positive impact on the mental health of seniors[10]. The second is on the construction of an objective evaluation system for the suitability of community facilities for the elderly: Based on the facility use needs and characteristics of seniors, JIANG Hong-qing constructed an evaluation system for the aging-appropriate layout of community public service facilities from the dimensions of efficiency and fairness[11]. ZHU Wen-long proposes a comprehensive evaluation system based on KJ method, AHP-entropy weight method and SD method, which provides a theoretical basis and quantitative indexes for the optimization of ageing design of public space facility products in old residential compounds[12]. The third is a study on differences in the daily leisure activities of seniors : By examining the impact of community built environment on the community interaction activities of seniors, Li Jingwei found that 36% of the level of social interaction of seniors in China is determined by the community in which seniors live, and that the accessibility of community places and the walking environment play a key role[13].

On the practice side, the first is an exploration of how to optimize the travel environment for seniors: LIU Zheng-ying identifies the built environment elements that have a significant impact on the travel frequency of seniors' outdoor leisure activities, mainly from the aspects of outdoor places, street network, and land use[14]. LIU Feng proposed the concept of optimal walking distance and its calculation method, and paid attention to categorizing the age groups of seniors and exploring

the objective distribution of resting points of seniors[15].The second is a study on strategies for establishing outdoor recreational spaces for seniors: XU Guang-hui mainly explores how to build new outdoor composite spaces that can integrate the leisure needs of other age groups in the heart of existing old residential compounds, aiming to explore the feasibility of meeting the needs of seniors' home care through the optimal renovation design of multigenerational co-habitation in old neighborhoods[16]. LOU Ying-hao proposed a “neighborhood-type” community public space retrofit program based on three space types: community pathways, community entrances, and community inter-house spaces[17].

In general, existing studies have become more scientific, incorporating observations of user groups, using more of the behavioral characteristics and satisfaction of users as the basis for research, and initially beginning to explore different age groups of seniors differently. However, based on the summary of the existing studies: 1. The fairness and diversity of the results of the studies need to be further improved, and there is an overall lack of more detailed and specialized discussions on seniors groups. 2. There is a lack of further exploration on the design and renovation of the completed community recreational facilities. Therefore, this study attempts to derive a community facility renovation plan that meets the leisure needs of middle- and high-aged seniors based on their behavioral characteristics, and to evaluate and validate the resulting plan, with a view to further exploring the preference characteristics of local middle- and high-aged seniors, so as to provide a reasonable theoretical basis for the renovation plan of community recreational facilities, and at the same time to provide references for the research on the design of community recreational facilities in other old residential compounds.

3. Behavioral Characteristics of Middle- and High-aged Seniors and Community Recreational Facilities for Middle- and High-aged Seniors in Chinese Urban Communities

3.1 Definition of Middle- and High-aged Seniors

In the report on the development of China's aging program, the population aged 60 years and above is included in the category of seniors. The range of older persons can be further divided into three categories, with 60-69 years of age being the lower-aged seniors, 70-79 years of age being the middle-aged seniors, and 80 years of age or older being the high-aged seniors[18]. Therefore, the age range of middle- and high-aged seniors is 70 and above.

3.2 Behavioral Characteristics of Middle- and High-aged Seniors

The daily behavior of seniors consists of three main components: walking activities, community recreational activities, and community interaction activities[19]. Walking activities refer to activities that seniors do within the community or near the outside of the community; community recreation activities refer to activities that seniors do within the community such as physical exercise, landscape viewing, and meditation; and community interaction activities refer to activities that seniors do within the community such as communicating with each other, meeting together, and taking care of each other.

The main daily behaviors of lower-aged seniors, due to their more robust physical functioning, are walking activities, which are also the daily behaviors that mainly affect the health factors of lower-aged seniors, followed by community recreational activities and community interaction activities.;Middle-aged seniors had all three of the major daily behaviors, but the intensity of walking activities declined compared to lower-aged seniors, and most of them took place only within the community;Due to their minimal physical functioning, high-aged seniors are not able to engage in more walking-based exercise behaviors, and their main daily behaviors are community recreational activities and community interactions, which are also the behaviors that mainly affect the health factors of high-aged seniors.

Taken together, the overlapping components of daily behaviors of middle- and high-aged seniors are community recreational activities and community interaction activities, followed by shorter-distance walking activities performed by middle- and high-aged seniors. Therefore, the types of community recreational facilities for middle- and high-aged seniors studied below should be specified under three categories: community recreational activities, community interaction activities, and walking activities conducted within the community.

3.3 Concept and Categorization of Community Facilities

In a community, a community facility is a space for sharing the basic life of the residents, exchanging information, making up for the deficiencies of social life, and a place where the weak, such as children, the elderly, and the disabled, who are alienated and isolated, can experience society. The term “community facilities” refers to the landscape of public buildings located in the same area of common culture. Community facilities are categorized as shown in Table 1.

Table 1. Categorization of Community Facilities[20]

Category	Space and Facilities
Educational facility	High school, Middle school, Complete middle school, Nine-year school, Elementary school, Kindergarten
Administrative facilities	Police stations, Integrated management buildings, Street offices, Community councils, Community chambers
Service facilities	Government service center, Integrated family service center, Starlight home for the elderly, Community service station, Property management
Welfare facility	Welfare institutions, Seniors day care centers, Childcare
Health facilities	Community health centers, Community health stations, Rehabilitation centers for Persons with disabilities
Green space for culture and sports	Cultural stations, Mass sports venues, Public libraries, Community parks, Cultural rooms, Residential fitness facilities, Reading rooms, Residential compounds, Community youth centers
Municipal utilities	Post offices, Refuse compressor stations, Bus terminals, Recycling stations, Taxi stops, Public toilets, Refuse collection points
Commercial services	Wet market

3.4 Leisure Activities for Middle- and High-aged Seniors

The main leisure activities of seniors of all ages differ due to their different physical conditions. Leisure activities for middle-aged seniors are more based on a combination of dynamic and static activities, while those for high-aged seniors are based on static socialization.

Table 2. Categorization of Middle- and High-aged Seniors and the Corresponding Leisure Activities[21]

Category	Age	Leisure activity
Middle-aged seniors	70-79 years	Physical activity (Gymnastics, Walking, Rehabilitation-type fitness)
		Social events (Meeting friends, Visiting relatives, Fellowships)
		Movie and theater watching
		Doing things with family (Eating out, Shopping)
		Watching TV, Listening to the radio, Reading newspapers
		Chorus, Recitation, Speech
		Educational activities (Chess, Calligraphy, Painting, Handicrafts, Crafts)
		Travel (Sightseeing, Fishing)
High-aged senior	80 years and over	Physical activity (Rehabilitation type fitness)
		Socializing (Meeting friends)
		Watching TV, Listening to the radio, Reading newspapers
		Chorus, Recitation, Speech
		Educational activities (Chess, Calligraphy, Painting)

3.5 Leisure Activities for Middle- and High-aged Seniors

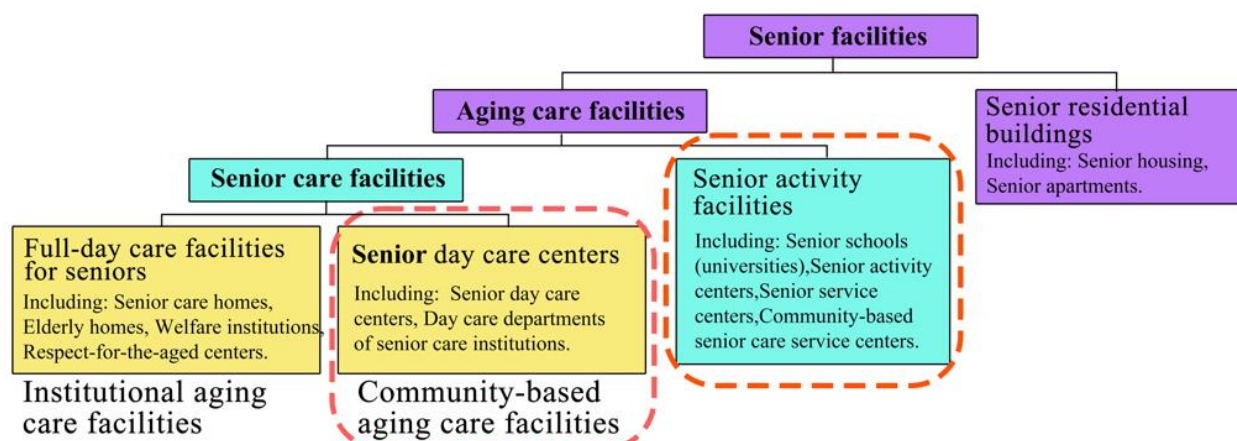


Fig. 1 Categorization of Facilities for Seniors[22]

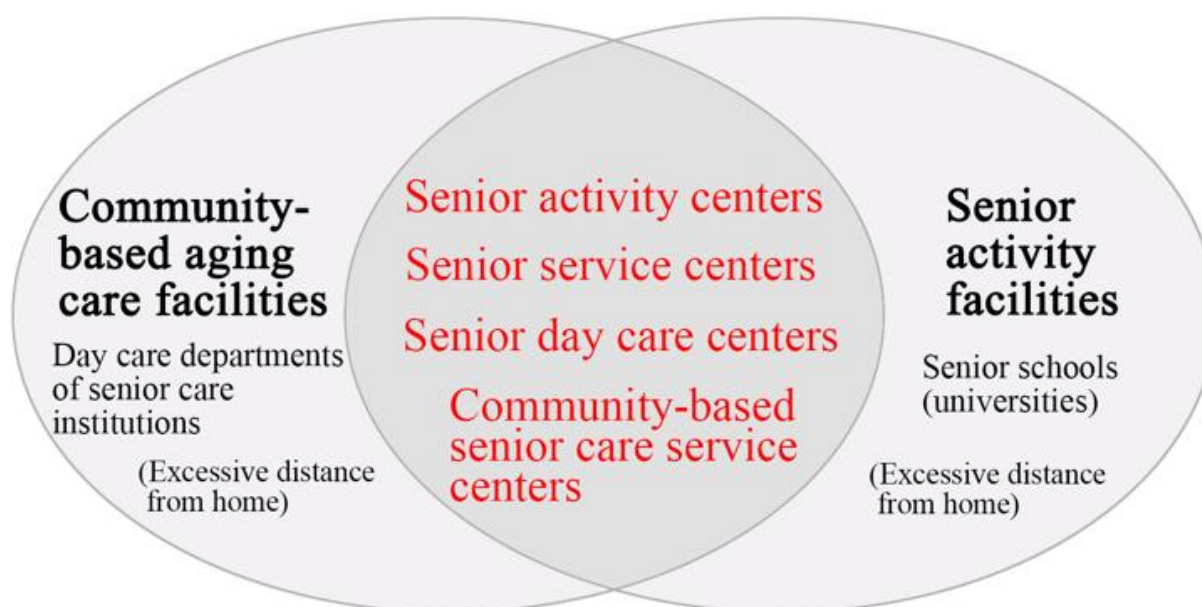


Fig. 2 Intersection Diagram of Community- based Aging Care Facilities and Senior Activity Facilities

The specific breakdown of facilities for seniors is shown in Figure 1, in which activity facilities for seniors are considered to be aging care facilities that do not provide care services and are facilities that primarily provide recreational services for seniors, and day care facilities for seniors fall under the category of community-based aging care facilities, with both of them belonging to the category of community-based services. By combining the two and removing facilities that are beyond the distance of daily activities for middle- and high-aged seniors, the intersection portion can be considered as part of the content of community recreational facilities for middle- and high-aged seniors (Figure 2). Community recreational facilities for middle- and high-aged seniors need to be set up inside the residential compound because of the distance from their homes, and at the same time they need to have both indoor and outdoor spaces to meet their daily needs for socialization, recreation, fitness, etc. The categorization and contents are shown in Table 3.

Table 3. Community Recreational Facilities for Middle- and High-aged Seniors

Category	Space	Facility contents
Outdoor public space	Outdoor exercise spaces	Comprehensive outdoor playgrounds
		Outdoor seniors playgrounds
		Sports equipment
	Outdoor resting spaces	Promenades
		Pavilions
		Seats
	Cultural Landscaping	Landscaping, Cultural columns, etc.
Indoor public space	Indoor recreation spaces	Seniors activity centers, Senior service centers, Party service centers, etc.
	Indoor welfare spaces	Day care centers, Mutual aid elderly care points, Meal assistance points, etc.
Management and service facilities	Landscaped pathways	Landscaping
		Major pathways, Landscaped walkways
	Barrier-free facilities	Installation of external elevators outside residential buildings
		Others

3.6 Elements of Community Recreational Facilities Design for Middle- and High-aged Seniors Incorporating Maslow's Hierarchy of Needs Theory

Maslow put forward Maslow's hierarchy of needs theory in *The Theory of Human Motivation*, in which human needs are divided into five levels, namely: physiological needs, safety needs, social needs, respect needs, self-actualization needs, five kinds of needs from the low to the high level of the progressive relationship, and the satisfaction of the needs of the former is a necessary condition for the latter to be needed[23].

Physiological needs are the most basic survival needs of human beings. For middle- and high-aged seniors, the limitation of traveling range and so on due to the decline of physical functions better reflects the importance of maintaining their physical health, and there are many factors affecting their physical health, such as water quality, air, living environment (landscape environment), living habits (maintaining the habit of exercising) and so on.

Safety needs include the needs of middle- and high-aged seniors for stable living environments, safe facilities and materials, avoidance of disease, and physical and mental health.

Socialization needs include the need for affiliation, such as affection and friendship. For middle- and high-aged seniors, more socialization plays a crucial role in improving their quality of life in their later years, and socialization activities help regulate the mental health of middle- and high-aged seniors.

Respect needs refers to the degree of satisfaction of personal value and self-realization. For middle- and high-aged seniors who belong to the socially disadvantaged group, although they may show constraints such as inconvenience in travelling and deterioration of their physical functions, it is also necessary for them to feel that they can enjoy social resources on an equal footing with other age groups, and they will not regard themselves as the disabled who need special care.

Self-actualization needs refers to the need to be able to realize one's self-worth or to give full play to one's potential. For middle- and high-aged seniors, the satisfaction of the need for self-actualization is manifested in the ability to continue to contribute value in society, which can be stimulated through activities such as performances and exhibitions of their works, in order to stimulate their sense of social participation and their ability to create self-worth.

Taking the embodiment of Maslow's Hierarchy of Needs Theory in the middle- and high-aged seniors group as a basis, and combining it with the community recreational facilities for middle- and high-aged seniors that have been derived from the above, the elements that need to be followed in the design of each type of community recreational facilities can be derived, as shown in Table 4.

Table 4. Design Elements of Community Recreational Facilities for Middle- and High-aged Seniors
Based on Maslow's Hierarchy of Needs Theory

Space	Design elements
Outdoor exercise spaces	Physiological needs: Type, number and layout of plants, comfort (materials, ergonomics), number, type and layout of all types of facilities. Safety needs: Rationalization of spatial scale. Socialization needs: The venue caters for dynamic communication or meditation. Respect needs: Accessibility of all types of facilities within the premises.
Outdoor resting spaces	Physiological needs: Type, comfort of facilities (materials, ergonomics), quantity, style, layout. Safety needs: Rationalization of spatial scale. Socialization needs: The venue caters for dynamic communication or meditation.
Cultural landscaping	Physiological needs: The color scheme is sensible and the shape is aesthetically pleasing.
Indoor recreation spaces	Socialization needs: Organized popular science activities, cultural activities, or spontaneous learning or recreational activities may be conducted. Respect needs: Can serve every seniors of all ages in the community. Self-actualization needs: Platforms for self-expression of seniors can be provided, and cultural activities can be organized to satisfy the emotional identity of seniors.
Indoor welfare spaces	Physiological needs: Healthy meals are available for seniors. Safety needs: Meal assistance and delivery services are available, as well as basic medical services and daily life care services for the physical and mental health of seniors. Respect needs: Can serve every seniors of all ages in the community.
Landscaped pathways	Physiological needs: Landscaping form, plant species richness and level, pavement to meet the middle- and high-aged seniors walking or fitness activities conditions. Safety needs: Organization of pathways, materials, vehicle parking, shading effects. Respect needs: Rationalization of the construction of barrier-free facilities in pathways.
Barrier-free facilities	Safety needs: Secure facilities and materials. Respect needs: The type, number, and reasonableness of barrier-free facilities in the community.

4. Study on the Design of Community Recreational Facilities in Shengliqiao Residential Compound of Taiyuan City

4.1 Field Survey

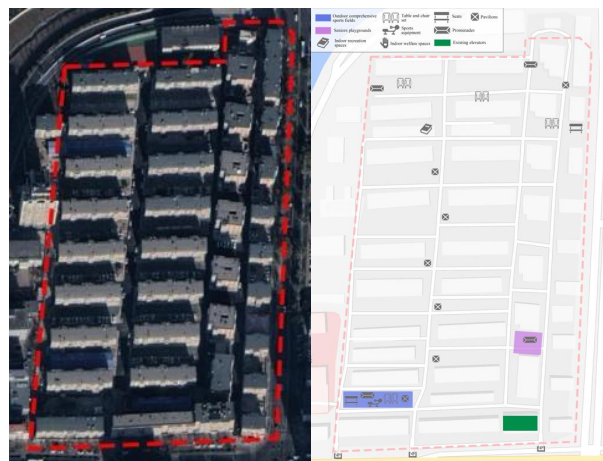


Fig. 3 Shengliqiao Residential Compound Plan

Shengliqiao residential compound was completed in 1995, covering an area of about 0.05 square kilometers, with 38 residential buildings and 3,156 households. The compound is located on the east side of Fenhe River Scenic Area, with complete surrounding infrastructure and beautiful natural landscape. The distribution of various community recreational facilities in the residential compound is shown in Figure 3.

The following is a breakdown of community recreational facilities for middle- and high-aged seniors in the Shengliqiao residential compound and the field survey (Table 5).

Table 5. Categorization of Community Recreational Facilities for Middle- and High-aged Seniors in the Shengliqiao Residential Compound and Field Survey Table

Category		Photographs	General situation
Outdoor exercise spaces	Comprehensive outdoor playgrounds		The interior of the site is planted with tall trees with dense foliage, but in small numbers, and bushes decorate the perimeter; permeable masonry and stone paving; traditional-type sports equipment, in small numbers, is set up around the perimeter of the site; and resting facilities are pavilions and promenades, with wooden structures, and there are a total of three locations, with a layout of the interior of the site and the entrance.
	Outdoor seniors playgrounds		Tall trees with dense foliage are planted around the site, but there is only one of them, and bushes decorate the entrance and exit points; colorful plastic paving; resting facility is a promenade, which is only one, but has a large interior space and wooden structure, and the layout of the site's perimeter.
	Sports equipment		Traditional sports equipment, which is relatively lacking in features suitable for the fitness needs of middle- and high-aged seniors, is fewer in number and is centrally located in integrated sports grounds.
Outdoor resting spaces	Promenades		All are made of wood. Newer unenclosed promenade with integrated sports field layout; traditional form promenade with open space layout between seniors' field and residential building. The overall number is moderate.
	Pavilions		All are made of wood. Large pavilions are located at the entrance and exit of the sports complex; smaller pavilions are located along the main pathways of the residential compound and at unit entrances. The overall number is sufficient.
	Seats		Tables and chairs with timber tops and a combination of tables and benches are set up at the entrance to the residential building in a disproportionately small number of only two locations.
Cultural landscaping			There are two forms of cultural columns and roadside decorative standing signs, the form is more diverse, but the number is small, the shape is older, a single color.
Indoor recreation spaces			Community cultural centers, which have only board and card recreational functions and most users are middle-aged, are not designed to serve seniors.
Indoor welfare spaces			None

Landscaped pathways	Landscaping		Designed to form a small green space, the open space between residential buildings is set up with more species of flowering plants. The green coverage is high, and the green plant collocation is more designed, but it is mostly dominated by medium and low shrubs, lacking tall plants, and the sense of green level is not good.
	pathways		Major pathways are smooth and clean, with clear demarcation, separation of pedestrian and vehicular traffic, parking spaces are well planned, and the street trees are lower trees, fewer in number, with thinner branches and leaves, and a small number of low shrubs adorning the roadside.
			Landscaped walkways are smooth but too narrow in width, the roadside vegetation is overgrown to be mowed and lacks tall trees.
Barrier-free facilities	Installation of external elevators outside residential buildings		There is only one in the residential compound, set near the main gate of the district, the comprehensive sports field, the activity field for seniors, the location selected does not take into account the seniors living in remote areas of the district, but there are barrier-free ramps, handrails and so on, which is safer.
	Others		The entrance and exit of the activity field for seniors are equipped with a barrier-free ramps with plastic paving, low height difference steps and handrails. Residential building entrances with steps are equipped with low-difference steps and handrails.

4.2 Questionnaire Survey

For the community recreational facilities in Shengliqiao District, 100 middle- and high-aged seniors were randomly selected from the residential compound to conduct a corresponding questionnaire survey, which was divided into two parts: a basic information survey and a satisfaction survey. The basic information survey is to understand the seniors gender, age, the number of leisure times in the residential compound, and the time spent on leisure activities in a day. The satisfaction survey questions were differentiated according to the ten types of community leisure facilities: comprehensive outdoor playgrounds, outdoor seniors' activity fields, sports equipment, outdoor resting spaces, cultural landscaping, indoor recreation spaces, indoor welfare spaces, landscaping, landscaped pathways, and barrier-free facilities, with a total of 32 questions. 1 = “very dissatisfied”; 2 = “dissatisfied”; 3 = “fair”; 4 = “satisfied”; 5 = “very satisfied”. The results of the data analysis are presented below:

Step 1: Reliability and validity analysis

1. Reliability analysis: In the reliability analysis, Cronbach's Alpha value greater than 0.9 indicates good scale consistency, between 0.7 and 0.9 indicates good scale consistency, and below 0.7 indicates a high degree of scale inconsistency.

Table 6. Reliability Analysis of the Questionnaire Survey on Community Recreational Facilities in Shengliqiao Residential Compound

Scale	Cronbach's alpha	Item count
Comprehensive outdoor playgrounds	0.930	6
Outdoor seniors playgrounds	0.932	5
Sports equipment	0.851	3
Outdoor resting spaces	0.919	5
Cultural landscaping	0.907	2
Indoor recreation spaces	0.942	2

Indoor welfare spaces	0.865	2
Landscaping	0.975	2
Pathways	0.831	3
Barrier-free facilities	0.820	2
Scale as a whole	0.732	32

Based on the results, it can be seen that the overall Cronbach's Alpha value of the scale is greater than 0.7, which meets the requirements and indicates that the scale has good reliability.

2. Validity analysis: In the validity analysis, a KMO value greater than or equal to 0.9 is ideal and greater than 0.6 is acceptable, and the significance of Bartlett's test of sphericity is ideally less than 0.05.

Table 7. Validity Analysis of the Questionnaire Survey on Community Recreational Facilities in Shengliqiao Residential Compound

KMO and Bartlett test		
KMO		0.699
Bartlett's test of sphericity	Approximate chi-square	3023.783
	Degrees of freedom	496
	Significance	<0.001

According to the results, it can be seen that the KMO value of the scale is 0.699, which is greater than 0.6, while the significance level of the Bartlett's test of sphericity is less than 0.001, which meets the requirements and indicates that the scale has good validity.

Step 2: Analysis of the current situation

Table 8. Analysis of the Current Status of the Questionnaire Survey on Community Recreational Facilities in the Shengliqiao Residential Compound

	N	Minimum	Maximum	Average	Standard deviation
Comprehensive outdoor playgrounds	100	1.67	3.67	2.64	0.67
Outdoor seniors playgrounds	100	1.40	3.00	1.87	0.53
Sports equipment	100	1.00	3.00	1.69	0.56
Outdoor resting spaces	100	1.40	3.60	2.33	0.64
Cultural landscaping	100	1.00	3.50	2.09	0.79
Indoor recreation spaces	100	1.00	2.00	1.34	0.46
Indoor welfare spaces	100	1.00	2.00	1.22	0.39
Landscaping	100	1.50	3.50	2.47	0.76
Pathways	100	1.00	3.00	1.78	0.67
Barrier-free facilities	100	1.50	4.00	2.94	0.69

The fact that indoor leisure spaces are not exclusively used by seniors and that there is a single recreational program and a lack of indoor welfare spaces illustrates where needs of middle- and high-aged seniors lie.

Step 3: Analysis of Variance (ANOVA)

In the ANOVA, a p-value of less than 0.05 is considered to be significantly different for this facility, and p-values of less than 0.01 and 0.001 represent a progression of significance.

1. gender difference:

Table 9. Test of Gender Difference in Questionnaire Survey on Community Recreational Facilities in Shengliqiao Residential Compound

	Male	Female	T	P
Comprehensive outdoor playgrounds	2.71±0.64	2.57±0.69	1.005	0.317
Outdoor seniors playgrounds	1.95±0.56	1.78±0.48	1.577	0.118
Sports equipment	1.62±0.57	1.77±0.55	-1.381	0.170

Outdoor resting spaces	2.20±0.65	2.46±0.61	-2.031	0.045
Cultural landscaping	2.43±0.63	1.72±0.79	4.878	<0.001
Indoor recreation spaces	1.34±0.47	1.34±0.46	0.026	0.980
Indoor welfare spaces	1.23±0.40	1.21±0.38	0.153	0.879
Landscaping	2.50±0.71	2.42±0.81	0.536	0.593
Pathways	1.71±0.70	1.85±0.64	-1.005	0.317
Barrier-free facilities	2.93±0.74	2.94±0.65	-0.109	0.914

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

Based on the results, it can be seen that male seniors are more dissatisfied with outdoor resting spaces, indicating the need to increase recreational facilities preferred by male seniors; female seniors are more dissatisfied with cultural landscaping, indicating the need to increase its aesthetics.

2.Age difference:

Table 10. Test of Age Difference in Questionnaire Survey on Community Recreational Facilities in Shengliqiao Residential Compound

	70-79 years	80 years and over	T	P
Comprehensive outdoor playgrounds	2.72±0.66	2.56±0.67	1.206	0.231
Outdoor seniors playgrounds	1.86±0.56	1.87±0.50	-0.015	0.988
Sports equipment	1.60±0.51	1.79±0.60	-1.746	0.084
Outdoor resting spaces	2.35±0.68	2.30±0.61	0.412	0.682
Cultural landscaping	2.14±0.80	2.04±0.79	0.644	0.521
Indoor recreation spaces	1.34±0.45	1.34±0.47	0.026	0.980
Indoor welfare spaces	1.24±0.40	1.20±0.38	0.407	0.685
Landscaping	2.58±0.77	2.34±0.73	1.605	0.112
Pathways	2.13±0.60	1.40±0.52	6.394	<0.001
Barrier-free facilities	3.16±0.68	2.69±0.63	3.522	<0.001

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

Based on the results, it can be seen that high-aged seniors are more dissatisfied with the pathways, indicating the need to improve safety and shade area; high-aged seniors are more dissatisfied with the barrier-free facilities, indicating that while increasing the number of elevators, the location needs to take into account the seniors living in more remote areas. In addition, there are high steps in the facilities that need to be converted into Barrier-free ramps.

3.Difference in the number of leisure times:

Table 11. Test of Difference in the Number of Leisure Times in Shengliqiao Residential Compound Community Leisure Facilities Questionnaire Survey

	2-3 times a day	1 time a day	4-5 times a week	1-3 times a week	Less than 4 times a month	F	P
Comprehensive outdoor playgrounds	3.02±0.55	2.27±0.60	2.88±0.62	2.58±0.66	2.20±0.50	7.048	<0.001
Outdoor seniors playgrounds	1.89±0.59	1.86±0.53	1.92±0.46	1.77±0.49	1.95±0.60	0.276	0.893
Sports equipment	1.25±0.25	2.01±0.47	1.43±0.31	1.93±0.59	2.08±0.72	13.923	<0.001
Outdoor resting spaces	1.97±0.53	2.63±0.62	2.16±0.60	2.39±0.59	2.75±0.63	5.568	<0.001
Cultural landscaping	2.01±0.65	2.07±0.87	2.21±0.63	2.04±0.91	2.31±0.99	0.329	0.858
Indoor recreation spaces	1.30±0.45	1.30±0.44	1.28±0.44	1.47±0.49	1.37±0.51	0.618	0.651
Indoor welfare spaces	1.21±0.39	1.23±0.38	1.15±0.35	1.25±0.42	1.31±0.45	0.244	0.912
Landscaping	2.82±0.76	2.46±0.64	2.06±0.62	2.34±0.80	2.43±0.86	3.028	0.021
Pathways	2.02±0.69	1.79±0.68	1.64±0.55	1.50±0.62	1.95±0.74	2.254	0.069
Barrier-free facilities	3.14±0.65	2.92±0.68	2.78±0.65	2.88±0.67	2.75±1.00	0.984	0.420

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

Based on the results, it can be seen that seniors who have less leisure are more dissatisfied with comprehensive outdoor playgrounds, indicating the need to improve the attractiveness of the venues to seniors who do not enjoy sports; seniors who had more leisure were more dissatisfied with the sports equipment, indicating a need to replace older styles of sports equipment and a need to improve the fun factor; seniors with a high number of leisure visits were more dissatisfied with outdoor resting spaces, suggesting a need for increased comfort for seniors to stay for longer periods of time; seniors who have less leisure are more dissatisfied with landscaping, suggesting that there is a need for an overall improvement in aesthetics and attractiveness to seniors who travel less.

4. Difference in leisure time during the day:

Table 12. Test of Difference in Leisure Time in Shengliqiao residential Compound Community Recreational Facilities Questionnaire Survey

	Few	Within 1 hour	Within 1-3 hours	Within 3-5 hours	More than 5 hours	F	P
Comprehensive outdoor playgrounds	1.66±0.00	2.66±0.60	2.52±0.64	2.64±0.72	2.94±0.61	2.448	0.051
Outdoor seniors playgrounds	1.50±0.14	1.98±0.54	1.88±0.50	1.91±0.59	1.73±0.49	0.830	0.509
Sports equipment	2.00±0.94	1.83±0.64	1.81±0.57	1.54±0.52	1.56±0.48	1.517	0.204
Outdoor resting spaces	2.10±0.42	2.25±0.65	2.41±0.63	2.29±0.62	2.33±0.74	0.294	0.881
Cultural landscaping	2.00±0.00	2.06±0.83	2.19±0.86	1.98±0.73	2.12±0.79	0.279	0.891
Indoor recreation spaces	1.00±0.00	1.43±0.51	1.36±0.48	1.33±0.45	1.27±0.44	0.559	0.693
Indoor welfare spaces	1.50±0.70	1.06±0.17	1.29±0.44	1.23±0.39	1.20±0.37	1.234	0.302
Landscaping	3.00±0.70	1.75±0.44	2.55±0.63	2.66±0.79	2.57±0.83	5.232	<0.001
Pathways	1.16±0.23	1.45±0.46	1.47±0.62	2.13±0.70	2.15±0.46	8.383	<0.001
Barrier-free facilities	2.00±0.70	2.90±0.63	2.64±0.66	3.23±0.56	3.15±0.72	4.716	0.002

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

Based on the results, it can be seen that seniors with a lot of leisure time are dissatisfied with the landscaping facilities, indicating the need to increase the aesthetics of the landscaping and the shading area near the outdoor resting spaces; dissatisfaction with pathways among seniors with little leisure time indicates the need to improve the variety and interest of pathways; dissatisfaction with Barrier-free facilities among seniors with little leisure time suggests a need to upgrade the age-friendliness of outdoor resting spaces and increase Barrier-free facilities.

4.3 Community Leisure Facility Design Improvement Program and Evaluation

4.3.1 Community Leisure Facility Design Improvement Program

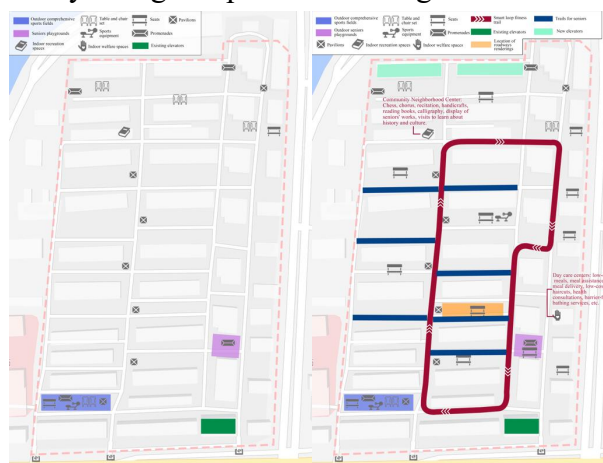


Fig. 4 Before and After Comparison of Shengliqiao Residential Compound Improvement Program Plans

Based on the design elements of community leisure facilities for middle- and high-aged seniors, combined with field surveys and questionnaires conducted in the Shengliqiao residential compound, the following improvement program was derived:

1. Comprehensive outdoor playgrounds (Figure 5): Plant tall trees around the perimeter of the site and add tree pools for sitting benches around the tall trees at the entrance and inside to increase resting spaces and shade areas. In addition, low trees in the site were replaced with tall trees with dense foliage. New streetlights were added at the entrance and at the northwest corner of the site. The entrance to the site retains the original ramps, the ground pavement retains the original large permeable masonry paving, flat and non-slip permeable pavement to ensure the safety of seniors traveling. Replacing traditional sports equipment with new equipment with higher safety performance, adding a small amount of fun sports equipment, such as solar-powered sports equipment that counts the number of times a person exercises, and new rehabilitation equipment that prevents seniors from suffering dementia and mental injuries. New rows of wooden benches have been added around the perimeter of the site, and armrest boosters have been installed in front of each group of benches to serve seniors who have difficulty getting up. Three new table and chair sets for four people have been added to the interior of the venue to make it easier for seniors to gather and communicate with each other. A few of the tables can be set up as chess tables, which can provide space for male seniors to play.



Fig. 5 Before and After Comparison of the Comprehensive Outdoor Playgrounds Improvement Program

2. Outdoor seniors playgrounds (Figure 6): Due to the lack of access to the north and south of the site, a new barrier-free ramps was added to the eastern entrance, corresponding to the barrier-free ramps originally installed at the western entrance, which connects the internal and external access to the site. Streetlights are added to the entrance, new bulbous shrubs are added to the greenbelt in the eastern part of the site, and the street trees therein are replaced with tall trees with dense foliage to enhance the hierarchy and aesthetics of the landscaping. The western edge of the site, which originally had no greenery for shade, was added with a row of tall trees on its perimeter while isolating the exterior driveway space. The ground pavement retains the original colorful

plastic pavement, which plays a decorative role and has the function of anti-skid and anti-drop at the same time. The site is mainly used for seniors to do exercise activities in groups, but the rest facilities are too few, in the northern periphery of the site to add rows of wooden benches, and set up armrest boosters, the southern part of the site to set up two sets of tables and chairs combination, the original promenade within the seats to add backrests, to enhance the comfort and safety. In addition, children's play equipment has been added to the perimeter to serve seniors who need to take care of their children, as the ground is more secure.



Fig. 6 Before and After Comparison of the Outdoor Seniors Playgrounds Improvement Program

3. Sports equipment: In addition to the above-mentioned sports equipment set up in comprehensive outdoor playgrounds, a small amount of conventional sports equipment is also set

up at locations farther away from the playgrounds for the convenience of seniors living farther away.

4.Outdoor resting spaces: In addition to the above-mentioned promenade set up in outdoor resting spaces, the benches in the promenade between residential buildings are fitted with additional backrests, and the combination of benches at the entrance of residential buildings is replaced by a combination of tables and chairs with backrests and the number is increased; at the same time, a small number of wooden benches with armrests boosters are added.

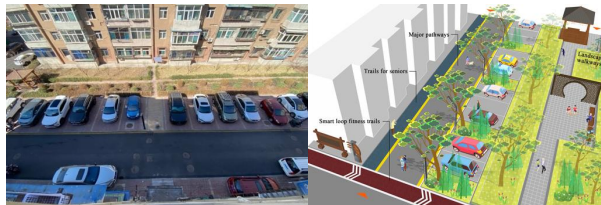


Fig. 7 Before and After Comparison of the Pathways Improvement Program

5.Cultural landscaping (Figure 7): A cultural wall is added to the large green area, and landscaping vignettes are formed with green plants. Replace the community map indicator at the main entrance of the comprehensive sports ground with a large text decorative sign with a sense of design to enhance seniors' familiarity with the living environment and sense of belonging. Replace the original roadside plastic decorative signboards with wooden signboards in soft colors and modern shapes.

6.Indoor recreation spaces (Figure 4):The former community cultural center is transformed into a community neighborhood center with functions of chorus, recitation, handicrafts, reading books, calligraphy, display of seniors' works, and visits to learn historical and cultural knowledge.

7.Indoor welfare space (Figure 4): Transforming unused neighborhood committees into day-care centers, providing low-cost meals, meal assistance and delivery, low-cost haircuts, health counseling, and barrier-free bathing services.

8.Landscaping (Figure 7): Widen the width of green belts on major pathways, increase the planting density of bushes, plant a small number of flowering small trees as decorative street trees, plant flowering ground cover plants at the corners of green belt intersections, or form small landscapes with landscaping stones. Retain the original green space, prune shaped bushes for decoration, plant a small number of tall trees to enhance the sense of hierarchy of greenery, increase the shading area, add a large area of lawn, planting flowering ground cover plants for embellishment. New landscaping between parking spaces to enhance the visual effect of the landscaped walkways and wider distance between vehicles and pathways to improve safety.

9.Pathways (Figure 7): Replace low trees along major pathways with taller trees with dense foliage as street trees and increase their number. The original landscape pathways are too narrow, now basically in a state of abandonment, widen the road width of two meters, trimming the roadside shrubs, to prevent blocking the road vision, roadside planting a small number of tall trees, so that it has the function of shading, because the distance of the landscape walkway is too long, widen the central position, the formation of a rest area, where the cultural wall and benches, retain the entrance to the kiosk, with greenery, flowers and grasses, the formation of a complete small-scale landscape corridors. Due to the small residential compound area, the walkable range is limited, add the smart loop fitness trail within the main pathways, which can record the walking hours and times of each seniors and increase the fun. The original parking space is close to the residential building, which is not conducive to the safety of seniors' travel, and the addition of a special trail for seniors near the residential building, which is connected to the fitness trail, can enhance the safety of the walking environment as a whole. In the comprehensive outdoor playgrounds to add a large stone paved massage trail, and set up handrails, enhance the fitness fun.

10.Barrier-free facilities (Figure 4): the installation of elevators should be considered outside residential buildings with a higher rate of residence of middle- and high-aged seniors, and barrier-free ramps should be added to elevator entrances; steps should be eliminated from the

entrances of public buildings, and they should be designed as barrier-free ramps and handrails should be added.

4.3.2 Community Leisure Facility Design Improvement Program Evaluation

Taking the effect map of the improved community leisure facilities as the content of the survey, 100 middle- and high-aged seniors in the residential compound were taken as the target respondents, and the data analysis was made again with the questionnaire survey procedure mentioned above, and the following results were obtained:

Step 1: Reliability and validity analysis

1. Reliability analysis:

Table 13. Reliability Analysis of the Questionnaire Survey on Community Recreational Facilities Improvement Program in Shengliqiao Residential Compound

Scale	Cronbach's alpha	Item count
Comprehensive outdoor playgrounds	0.933	6
Outdoor seniors playgrounds	0.891	5
Sports equipment	0.886	3
Outdoor resting spaces	0.924	5
Cultural landscaping	0.890	2
Indoor recreation spaces	0.777	2
Indoor welfare spaces	0.934	2
Landscaping	0.862	2
Pathways	0.905	3
Barrier-free facilities	0.872	2
Scale as a whole	0.795	32

Based on the results, it can be seen that the overall Cronbach's Alpha value of the scale is greater than 0.7, which meets the requirements and indicates that the scale has good reliability.

2. Validity analysis:

Table 14. Validity Analysis of the Questionnaire Survey on Community Recreational Facilities Improvement Program in Shengliqiao Residential Compound

KMO and Bartlett test		
KMO		0.678
Bartlett's test of sphericity	Approximate chi-square	2763.978
	Degrees of freedom	496
	Significance	<0.001

According to the results, it can be seen that the KMO value of the scale is 0.678, which is greater than 0.6, while the significance level of the Bartlett's test of sphericity is less than 0.001, which meets the requirements and indicates that the scale has good validity.

Step 2: Analysis of the current situation

Table 15. Analysis of the Current Status of the Questionnaire Survey on Community Recreational Facilities Improvement Program in the Shengliqiao Residential Compound

	N	Minimum	Maximum	Average	Standard deviation
Comprehensive outdoor playgrounds	100	2.50	4.67	3.91	0.69
Outdoor seniors playgrounds	100	2.60	4.60	3.72	0.59
Sports equipment	100	3.33	5.00	4.52	0.55
Outdoor resting spaces	100	3.00	5.00	4.39	0.65
Cultural landscaping	100	2.50	5.00	4.10	0.74
Indoor recreation spaces	100	3.00	5.00	4.28	0.65
Indoor welfare spaces	100	3.00	5.00	3.95	0.78
Landscaping	100	2.50	4.50	3.57	0.62
Pathways	100	3.00	5.00	4.31	0.64
Barrier-free facilities	100	3.00	5.00	4.36	0.62

Compared with the results of the survey before remodeling, the overall satisfaction value increased from 1-2 to 3-4 points, initially meeting the previous demand of seniors for various community leisure facilities. However, the three items of comprehensive outdoor playgrounds, outdoor seniors playgrounds, and landscaping, which were in the top of the satisfaction value before the renovation, dropped to the last three places in the results of the survey after the renovation, indicating that the middle- and high-aged seniors still have unsatisfied needs for them, and that the follow-up needs to be optimized even further.

Step 3: Analysis of Variance (ANOVA)

1. gender difference:

Table 16. Test of Gender Difference in Questionnaire Survey on Community Recreational Facilities Improvement Program in Shengliqiao Residential Compound

	Male	Female	T	P
Comprehensive outdoor playgrounds	3.96±0.70	3.87±0.68	0.649	0.518
Outdoor seniors playgrounds	3.68±0.55	3.77±0.64	-0.786	0.434
Sports equipment	4.53±0.56	4.51±0.55	0.220	0.826
Outdoor resting spaces	4.47±0.65	4.30±0.65	1.293	0.199
Cultural landscaping	4.11±0.70	4.09±0.79	0.144	0.886
Indoor recreation spaces	4.22±0.68	4.34±0.62	-0.932	0.353
Indoor welfare spaces	4.00±0.81	3.88±0.75	0.791	0.431
Landscaping	3.49±0.66	3.66±0.56	-1.416	0.160
Pathways	4.32±0.64	4.30±0.65	0.164	0.870
Barrier-free facilities	4.36±0.62	4.36±0.62	0.006	0.995

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

The improvement program eliminates gender differences in outdoor resting spaces and cultural landscaping: male middle- and high-aged seniors' satisfaction was increased by adding table and chair combinations in outdoor resting spaces and designing chess table tops; and female middle- and high-aged seniors' satisfaction with cultural landscaping was increased by adding cultural walls in the landscaped walkways and replacing the signage and cultural boards with new shapes and harmonious colors.

2. Age difference:

Table 17. Test of Age Difference in Questionnaire Survey on Community Recreational Facilities improvement Program in Shengliqiao Residential Compound

	70-79 years	80 years and over	T	P
Comprehensive outdoor playgrounds	4.15±0.58	3.65±0.70	3.835	<0.001
Outdoor seniors playgrounds	3.82±0.59	3.62±0.58	1.706	0.091
Sports equipment	4.57±0.53	4.47±0.57	0.942	0.348
Outdoor resting spaces	4.41±0.62	4.37±0.68	0.309	0.758
Cultural landscaping	4.03±0.71	4.17±0.78	-0.927	0.356
Indoor recreation spaces	4.17±0.65	4.39±0.64	-1.712	0.090
Indoor welfare spaces	4.07±0.76	3.81±0.78	1.703	0.092
Landscaping	3.48±0.65	3.67±0.57	-1.581	0.117
Pathways	4.29±0.66	4.34±0.63	-0.349	0.728
Barrier-free facilities	4.41±0.58	4.31±0.66	0.808	0.421

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

The improvement program eliminates the age differences that existed in pathways and barrier-free facilities: the satisfaction value of pathways for high-aged seniors was raised by increasing the number of pathways for seniors and replacing street trees with taller, denser trees and increasing the number of them; and the satisfaction of high-aged seniors was raised by installing a

greater number of elevators in more remote residential buildings and also by increasing the number of barrier-free ramps in the outdoor seniors' activity areas.

In the results of the improvement program, the comprehensive outdoor playgrounds have shown an overall improvement in satisfaction through measures such as increasing the number of seats, shading area, replacing new sports equipment, and increasing the number of residential compounds with standing signs. However, a new age difference has emerged, with senior seniors dissatisfied with the comprehensive outdoor playgrounds, indicating that the facilities need to be made safer and more comfortable.

3. Difference in the number of leisure times:

Table 18. Test of Difference in the Number of Leisure Times in Shengliqiao Residential Compound Community Leisure Facilities Improvement Program Questionnaire Survey

	2-3 times a day	1 time a day	4-5 times a week	1-3 times a week	Less than 4 times a month	F	P
Comprehensive outdoor playgrounds	4.11±0.62	3.93±0.68	3.76±0.77	3.82±0.68	3.33±0.72	1.502	0.208
Outdoor seniors playgrounds	3.72±0.52	3.65±0.66	3.78±0.58	3.78±0.64	3.60±0.60	0.209	0.933
Sports equipment	4.53±0.49	4.69±0.49	4.60±0.50	4.37±0.64	3.66±0.33	3.161	0.017
Outdoor resting spaces	4.31±0.69	4.71±0.43	4.27±0.68	4.26±0.69	4.00±0.87	2.498	0.048
Cultural landscaping	4.21±0.69	4.16±0.63	4.05±0.86	3.97±0.80	3.66±1.25	0.645	0.632
Indoor recreation spaces	4.20±0.65	4.18±0.73	4.50±0.53	4.32±0.65	4.33±0.76	0.755	0.557
Indoor welfare spaces	4.00±0.79	4.11±0.78	3.94±0.72	3.69±0.77	4.00±1.00	0.923	0.454
Landscaping	3.61±0.65	3.57±0.61	3.38±0.69	3.63±0.54	3.83±0.76	0.600	0.663
Pathways	4.47±0.57	4.32±0.64	4.25±0.67	4.08±0.71	4.77±0.19	1.653	0.167
Barrier-free facilities	4.31±0.66	4.38±0.59	4.17±0.74	4.50±0.50	4.66±0.57	0.886	0.476

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

The improvement program eliminates the difference in the number of leisure visits to the comprehensive outdoor playgrounds and landscaping: the measures of adding different kinds of rest facilities, replacing new types of sports equipment, and adding new textual signs and stand-ups attracted seniors who do not have the habit of exercising and improved the satisfaction of seniors who have few leisure visits to the grounds; by transforming landscape walkways into small gardens, the number of flowering plants, the area of lawns, and the number of tall trees have been increased, enhancing the overall landscaping aesthetics and shading effect of the residential compound, and the satisfaction of seniors who go out less often for leisure with the green environment.

Although there was a substantial increase in satisfaction with sports equipment and outdoor resting spaces as a whole, the difference in the number of leisure visits remained or shifted.

The tendency for dissatisfaction with sports equipment shifted from seniors with high leisure frequency to seniors with low leisure frequency, suggesting that improvements to sports equipment have been effective but not sufficient, meeting the exercise needs of only those seniors who exercise regularly, and suggesting that subsequent improvements to sports equipment should focus on increasing the fun factor.

The difference in the number of leisure visits to outdoor resting spaces still exists. Although the measures of installing additional benches and armrest boosters, adding new tables and chairs, and adding backrests to the seats in the promenade have resulted in an overall increase in the level of satisfaction, they have not fully met the needs of seniors who love to go out and want to stay outdoors for long periods of time for resting, which indicates that the subsequent improvements need to be made to prolong the resting time of the seniors in terms of visual and resting environments.

4. Difference in leisure time during the day:

Table 19. Test of Difference in Leisure Time in Shengliqiao Residential Compound Community Recreational Facilities Improvement Program Questionnaire Survey

	Few	Within 1 hour	Within 1-3 hours	Within 3-5 hours	More than 5 hours	F	P
Comprehensive outdoor playgrounds	None	3.50±0.71	3.80±0.74	4.15±0.60	3.96±0.60	3.220	0.026
Outdoor seniors playgrounds	None	3.72±0.67	3.66±0.63	3.80±0.61	3.70±0.48	0.329	0.804
Sports equipment	None	4.60±0.51	4.45±0.61	4.59±0.55	4.49±0.49	0.449	0.718
Outdoor resting spaces	None	4.20±0.58	4.50±0.65	4.32±0.67	4.41±0.66	0.785	0.505
Cultural landscaping	None	3.63±0.89	4.21±0.73	4.13±0.78	4.11±0.56	1.757	0.161
Indoor recreation spaces	None	4.50±0.44	4.27±0.71	4.34±0.63	4.07±0.67	1.250	0.296
Indoor welfare spaces	None	3.81±0.87	3.88±0.75	3.84±0.76	4.28±0.76	1.687	0.175
Landscaping	None	3.72±0.64	3.60±0.61	3.42±0.67	3.69±0.53	1.119	0.345
Pathways	None	4.06±0.61	4.36±0.65	4.32±0.64	4.36±0.67	0.665	0.575
Barrier-free facilities	None	4.22±0.84	4.47±0.54	4.31±0.58	4.33±0.69	0.592	0.621

*p<0.05 **p<0.01 ***p<0.001

Note: Facilities in red font indicate significant correlation.

The improvement program eliminates the difference in leisure time between landscaping, pathways, and accessibility: by increasing the area of shade near resting facilities, trimming stylized bushes, and adding benches in the center of small gardens on landscaped pathways, the satisfaction of seniors with longer leisure time is increased; by adding new fitness and massage pathways, the functionality and interest of pathways are improved, so that seniors with less leisure time have their leisure needs are met; by adding backrests to the seats in the promenade and installing handrail boosters in front of the new benches, the age-appropriateness of the resting facilities has been improved, and the satisfaction of seniors with less leisure time with the barrier-free facilities has been increased.

However, differences in leisure time on comprehensive outdoor playgrounds emerged in the data results of the improvement program, with seniors with less leisure time having lower levels of satisfaction, suggesting a need to improve the attractiveness of the venues.

4.3.3 Results

After initially addressing the issues arising from the current state of community leisure facilities in the Shengliqiao residential compound, a comparison of the data from the two questionnaires reveals the following:

I. High-aged seniors and seniors with less leisure time remain dissatisfied with the comprehensive outdoor playgrounds. Among them, the dissatisfaction of senior seniors with the integrated sports grounds is reflected in the lack of security in the facilities within the grounds, which can be replaced by replacing the simple promenade within the grounds with a traditional enclosed promenade with a roof, to provide seniors with a place where they can be sheltered from the sun and the rain, and where they can gather most of the people to chat; In order to make the seniors who have little leisure time stay for a long time, the area of grass and flowering plants should be increased to enhance the beauty of the site, and the calligraphy and handmade works of the seniors should be decorated in the corridor, so as to transfer part of the exhibition function of the indoor recreation space to the outdoor, and to enhance the ornamental nature of the site.

II. Seniors who have little leisure time show dissatisfaction with sports equipment. Rehabilitation equipment to prevent dementia and disability is not only fun and more in line with the physical condition and fitness needs of middle- and high-aged seniors, but needs to be increased in number in comprehensive outdoor playgrounds, and also installed in small quantities in small parks that are farther away from comprehensive playgrounds, to make it easier for seniors living farther away.

III. seniors who have a lot of leisure are still not satisfied with the situation of outdoor resting spaces. In the preliminary renovation program, the focus of landscaping renovation was put on the resting spaces within the landscape pathways, and the renovation of the resting spaces in the comprehensive outdoor playgrounds and seniors' activity fields was lacking, so the greening spaces in the comprehensive outdoor playgrounds and seniors' activity fields are the focus of the subsequent renovation, which echoes the first conclusion.

IV. It is worth noting the invisible leisure needs revealed in the analysis of the current situation after the program improvement. First, the ranking of landscaping facilities remains at the end of the list because the comprehensive outdoor playgrounds and the seniors playgrounds did not take measures to beautify the visual effects in the preliminary improvement program, thus leading to the lowest satisfaction with landscaping, which echoes the first conclusion. Secondly, the satisfaction level of the seniors playgrounds remains low despite the many measures taken in the improvement program. The seniors playgrounds is mainly a place for group activities such as square dancing, but the site cannot accommodate a large number of people gathering due to its small footprint, and even if various improvement measures are done within the site they do not lead to a significant increase in satisfaction, and a landscape walkway should be selected to be designed as an seniors playgrounds with a larger area and a more open view in the subsequent program, and the original site can be designed as a children's playground.

5. Conclusion

To summarize the recurring discrepancies in the evaluation data of the improvement program are: seniors with a high number of leisure visits were not satisfied with the outdoor resting spaces, indicating that the renovation of the outdoor resting spaces was not complete; the emerging discrepancies were revealed in the two types of facilities, namely, the comprehensive outdoor playgrounds and sports equipment; and the differences in the seniors playgrounds, although not revealed, were at the bottom of the list of satisfactions in the analysis of the status quo.

In the case of the overall improvement of facility satisfaction through the improvement measures, deeper core leisure needs were shown in the evaluation data: middle- and high-aged seniors preferred venues that were large in size, had a wide view, and could accommodate a large number of people, and could use rehabilitative sports equipment that was interesting, and the resting facilities in the venues should have a sense of security and comfort, and the surrounding area could have beautiful green landscapes. The rest facilities should be safe, comfortable and surrounded by beautiful landscaping. It is hoped that the conclusions drawn from this study and the research methodology used to evaluate the data can be used as a feasible reference for other studies on community leisure facilities for middle- and high-aged seniors.

However, due to the variability of the research subjects, the results of the study have certain limitations, such as the different size of the residential city of the group of seniors, the residential compound environment will also be different; different living habits, the preference for leisure activities will also be different; different economic status, the demand for leisure life has a high and low difference. Therefore, there is still room for further advancement and improvement in the course of subsequent research. Meanwhile, this study only distinguishes the age group of seniors, and the differentiation of gender and living status of seniors is also a topic that needs to be focused on in the future.

References

- [1] China National Committee on Ageing, Ministry of Civil Affairs. 2022 National Aging Cause Development Bulletin [EB/OL]. (2023-12-14)[2025-04-11]. <http://www.mca.gov.cn/article/sj/tjb/202302/20230200044433.shtml>: Part I. "Overview of population ageing".

- [2] China National Committee on Ageing, Ministry of Civil Affairs. 2022 National Aging Cause Development Bulletin [EB/OL]. (2023-12-14)[2025-04-11]. <http://www.mca.gov.cn/article/sj/tjb/202302/20230200044433.shtml>: Part II. "The development of China's aging program".
- [3] Ann Forsyth, Jennifer Molinsky, Har Ye Kan. Improving Housing and Neighbourhoods for the Vulnerable:Older People, Small Households, Urban Design, and Planning[J]. *Urban Design International*,2020,35(01):8-19.
- [4] Weinhardt M. Älter werden in der Stadt-Altersgerechte Kommunalentwicklung als Querschnittsaufgabe[J]. *KommunalPraxis Spezial*, 2023, 23(4): 211-215.
- [5] Saito Min, Katsunori Kondo, Chiyoie Murata, et al. Gender and Regional Differences in Outing Behavior and Social and Leisure Activities of the Elderly From the JAGES Project [J]. *Japanese Society of Public Health*, 2015, 62(10): 596-608.
- [6] Shinpei Ikeda, Kyosuke Nishimura, Takeshi Suzuki, et al. Leisure Activities and Social Relationships Among Community-dwelling Older Adults [J]. *Occupational Therapy*, 2021, 40(2): 195-203.
- [7] Sungmin Son, Sungwon Kwak, Hyungmin Kim. Effects of the Leisure Satisfaction on Quality of Life of the Elderly Living Alone[J]. *Journal of Korea Entertainment Industry Association*, 2022, 16(6): 283-290.
- [8] Kim Hye-Shin, Park Soobeen. A Study of Senior Community Facility Use and Needs by Place of Residence-Comparing Differences in Large, Medium, and Rural areas- [J]. *The Architectural Institute of Korea*, 2022, 38(5): 15-24.
- [9] YU Yi-fan. Health Effect of the Built Environment on the Older Adults: Fundamental Understanding and Research Approach [J]. *Urban Design International*,2020,35(01):1-7.
- [10] GAO M X, SONG K, KONG J W, et al. Influence Mechanism of Green Space on Older Adults' Mental Health: Taking Old Residential Area of Tianjin as an Example [J]. *Journal of Human Settlements in West China*,2022,37(05):74-80.
- [11] JIANG Hong-qing, YIN Xin-tong, LIANG Wei-yan, et al.Evaluation Study on Aging-Ready Public Service Facilities in Existing Urban Settlements in Yuexiu District, Guangzhou, China [J]. *Urban Studies*,2020,27(10):125-133.
- [12] ZHU Wen-long, HUANG Wei-hao,YUE Di, et al. Evaluation of Elderly-oriented Public Space Facilities in Old Neighborhoods [J]. *Packaging Engineering*,2023,44(08):169-177+200.
- [13] LI Jing-wei, FAN Chen-jing, TIAN Li, et al. Study on The Impact of Neighborhood Built Environment on Social Activities of Elderly [J]. *Human Geography*,2021,36(01):56-65.
- [14] LIU Zheng-ying, YANG Dong-feng. Exploring the Impact of the Built Environment on Outdoor Recreational Activities of the Elderly in the Neighborhood [J]. *Architectural Journal*,2016,(06):25-29.
- [15] LIU Feng, JIANG Liang, TANG Yue, et al. Distribution of Outdoor Activity Rest Spaces for the Elderly in Urban Old Residential Quarters [J]. *Science Technology and Engineering*,2020,20(32):13333-13341.
- [16] XU Guang-hui. Study on the Feasibility of Optimization Design and Renovation of Multi-generational Co-living Old Communities [J]. *Furniture&Interior Design*,2022,29(10):100-105.
- [17] LOU Ying-hao, QIU Zhi, HUA Yi, etc. Explorations on the Renewal Strategy of"Neighborhood-Based" Community Public Space Adaptive for the Elderly-A Case Study of the Old Urban District of Hangzhou City [J]. *Journal of Human Settlements in West China*,2018,33(06):95-99.
- [18] WU Zhong-guan Chief editor. *Dictionary of Population Science* [M]. Chengdu: Southwest University of Finance and Economics Press,1997.
- [19] ZHENG Zhen-hua, PENG Xi-zhe. The impact of community environment on behavior and health of the elderly: Group comparison of different ages [J]. *Geographical Research*,2019,38(06):1481-1496.
- [20] TENG Juan, LIANG Xu-chu, LIN Tai-zhi. The Setting Standard Of Public Service Facilities: A Guangzhou Case [J]. *Planners*,2014,30(S5):170-174.

- [21] Cha Sung-Mee, Lee Jung-Hyung, Kim Jee-Yeop. Current Status and Limitations of Community Facilities in Apartment Complexes from the Perspective of Community Revitalization: Focusing on Yeoksam-dong, Gangnam-gu, Seoul: Focusing on Yeoksam-dong, Gangnam-gu, Seoul [J]. Urban Design: Journal of The Urban Design Insitute of Korea Urban Design, 2014, 15(2): 139-154.
- [22] Ministry of Housing and Urban-Rural Development. Standard for design of care facilities for the aged: JGJ 450-2023[S]. Beijing: China Architecture & Building Press, 2023.
- [23] ZHANG Li-yan,Li Gang. Research on the Community Aging Way under the Perspective of Maslow's Demand Theory [J]. Administration and Law,2019,(01):62-69.