

Research on age-friendly garden design in China based on the case study of WANSHOU Park

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Abstract. The rate of population aging has reached a high level in China that age-friendly design should be concerned when designing gardens in urban place. Although the generation-skipping guardianship phenomenon always exists in present situation of elderly people in China that grandchildren are taken with the elderly and are involved in their daily activities in most family, the needs of children are neglected in urban garden design. The paper generalized guidelines of age-friendly garden design according to LEED, Chinese garden design standard, and the guideline of global age-friendly cities in Europe. Children-friendliness have also been included based on the above-mentioned new guidelines. 29 reports have been collected in the case study of WANSHOU Park which can be characterized as an age-friendly garden involving basic information and scoring records on its environment and facilities. Through the increasement of children-friendly features and installments in the park, the design will have great potential to deal with aging problems.

1 Introduction.

1.1 The severity of population aging in China (Beijing).

The judgement of an aging society is whether the population of elderly people over 60 years old is more than 10% of the whole population (or people over 65 years old take up more than 7% of urban population) in a country or a region. (WHO) Chinese elderly people over 60 years old in 2016 were 0.231 billion and accounted for 16.7% of Chinese population, based on the date of population given by National Bureau of Statistics of China. The number of elderly people in China in 2025 will exceed 0.3 billion by prediction.

The aging process in China can be generalized in 4 features: the largest number of elderly people, the fastest aging process, the greatest differences among elderly people, and the toughest task to solve the problem of aging [1].

China is a developing country with the largest population in the world and the aging process is way too faster than the development of economy and society, compared to those developed countries.

Beijing, as a classic modern city in China, has its own particular issue in the aging process. 4 regional classifications of elderly population fluxion are being pointed out to illustrate the severity of aging in centric area (from the second ring road to fifth ring road) where the aging level has increased approximately 0.95%. Population of elderly people has expanded to 180.7%, faster than the growing speed of the whole population

(59.57%). The special distribution of elderly people in Beijing can be put into 3 regions. The centric area which is inside the 5th ring road has the most serious aging problem in these 3 areas [2].

In conclusion, China is now facing a severe situation of aging population and have many tough problems to be solved. Issues of aging in Beijing, especially in the centric area inside the 5th ring road, has deeply affected the quality and experience of life for elderly people and needs to be addressed in many aspects.

1.2 The importance of age-friendly design used in gardens

《*National New Urbanization Plan (NNUP)*》 has emphasized the people-oriented idea of development to meet the needs of elderly groups and has attached the importance to municipal public services and facilities. The NNUP regulated that the urbanization plan should be based on the need of municipal services, public facilities and housing in group of the elderly. The construction of elderly-based municipal-public services and facilities should be suited for elderly people according to their physical need, psychological traits, and the patterns of travel behaviour [3].

Recent research highlighted the importance of having a green land around the buildings. In highly urbanized societies, up to 90% of the population reside in urban areas, and in cultures such as the UK, 87% of households have access to a domestic garden [4] However, the lack of available green land and private garden in present situation in centric area in Beijing has prioritized the construction of domestic gardens and parks in Beijing.

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The city garden is the most frequently used space for old people among all kinds of public spaces, which has rich forms of use. Research demonstrated the demand of green land gardens for elderly groups to walk, relax and keep a health condition. Also, in psychological aspects, the separation between the elderly and their children can lead to old people's isolation and frustration [5]. Additionally, with the practice of high technology like smart phones or all kinds of internet communication platforms and disability of adaptation for elderly people, more and more elderly people are losing their chances to show their opinion and participate in society. Green land garden can be seen as a place for elderly people to promote social engagement, physical activity, relaxation and interaction with nature.

Based on the fact that people over 60 years old are in worse body condition, have many diseases (dementia, recession of body parts, arthritic, trauma, etc.), and get higher rate of disability, elderly groups in outside environment can possibly have the flexibility to travel through garden. Age-friendly designs can, to the maximum extent, improve the walkability and accessibility to places in garden.

The overall aim within this paper is to begin exploring strategies of age-friendly garden design on the basis of particular conditions in China. In this paper, we use "citespace" tool to find out the current Chinese condition of age-friendly garden design on the key word "age-friendly garden" on CNKI database, contrasted with the same keyword in "web of science" database. By literature review on healing garden and Chinese particular situation, we discuss the possible development of age-friendly design. We also generalize several Chinese particular situation-based strategies by contrasting guidelines in several domains (children, sustainability, the elderly, healing garden, and so on). The case study section provides some practical experiences to verify the strategies we concluded.

2 Literature review of healing landscape & healing garden

2.1. Background of healing landscape

Research on healing landscape can be divided into 3 stages: ancient, age of scientific research and modern medical [6]. Healing landscape originated from healing consciousness. When collecting the samples of patients who are suffered from same type of disease, Nightingale found it unreasonable that the mortality of hospital-treated patients was higher than the mortality of patients who were treated outside the hospital as the more sustainable and professional medical services in the hospital can conveniently be offered to the patients who lived in hospital. Through her paired observation, patients treated in the sickroom with good air condition and natural illumination were less likely to be infected or die. According to patients' need, Nightingale refined the environment of sickroom for promotion of rehabilitation and invented the "Nightingale-style" hospital plan [7].

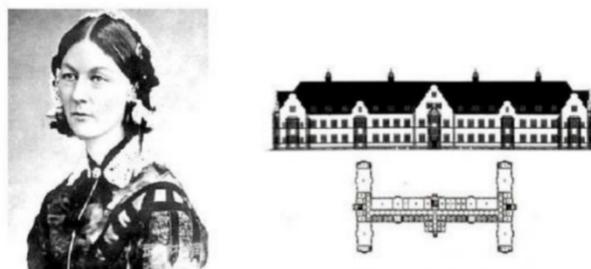


Fig. 1. Nightingale and the ward she invented

The first research of healing environment that had practical value was written by Ulrich. Through evidence-based experiment in which contrast between patients who lives in sickroom facing natural scene with patients who lives in sickroom only facing white wall of the room, Ulrich found that less dose of pain medicine was used by patients live in sickrooms who can see green natural scene through the window than those patients who cannot. Proving that the natural elements have therapeutical effect on patients' recovery by quantitative research, Ulrich initiated the era of Evidences-Based Design (EBD) [8].

2.2 Conversions from therapeutical environment to public space.

With the development of medical technology and promotion of public sense of health, therapeutic environment has been broadened its internal meaning and extension, and the range of applying has been broadened from medical use to daily environment of living, working and studying. Therapeutic landscape design is the prior practice of healing environment, which leads to the prevalence of green urbanism and green city facility construction. A variation of therapeutic gardens is to combine with social gardens to create a green nature of community that offers chances for neighbors' healing. The advantages can be generalized as 4 points: body building, spirit purifying, mood regulating and hobby developing [9].

The therapeutical garden has been practiced in China and research has proved its effectiveness. Micro-rehabilitation by Liu Yuelai covers more than 600 places of garden from which the "Chuangzhi" garden and "Hundreds of Herbs" park offer great healing opportunity and places for people in community [10].

He Yanling, Liu Juanjuan, and Chen Longqing used lotus for example, extracting the 5 domains of human senses that appear in Quan Tangshi to describe lotus, to strengthen visual experience of lotus, increase the effectiveness of 5 senses therapy, and promote body strength [11].

2.3 Importance of therapeutical landscape for elderly people

In [12], the author generalized physical and mental situation for elderly people and elaborated activities situation and needs of elderly with sensational degeneration or mental diseases

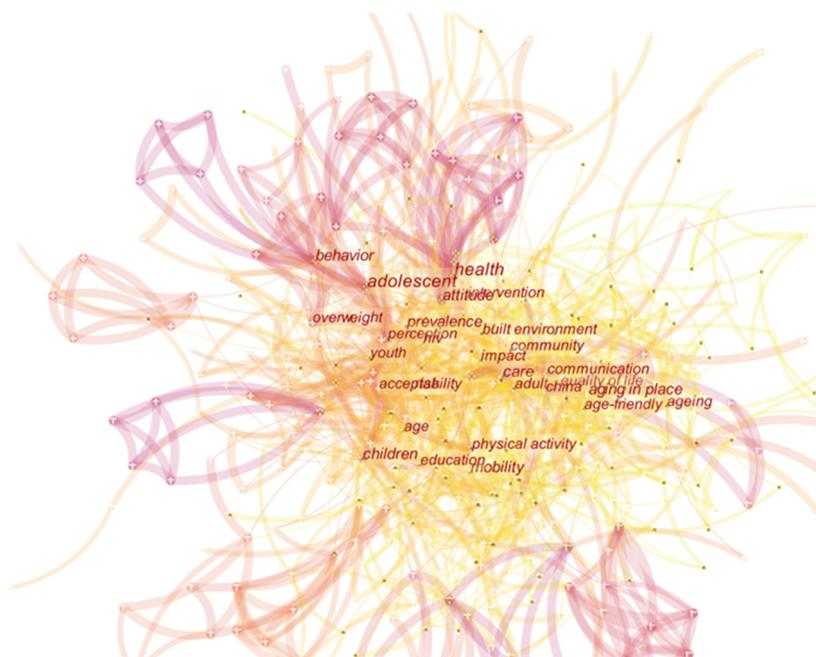


Fig. 2. term analysis on “age-friendly”

The classifications of scenes from natural landscape are the mount, sea, lake, forest, grassland, sand pool, and fountain. By seeing above-mentioned natural elements in therapeutic landscape, the effectiveness will prevent diseases, protect health, and cure sickness [13] In the process of landscape appreciation, elderly people can be relaxed by senses. In a mental aspect, good natural view will regulate the cerebral cortex activity and will ease the elderly’s mentation to promote body’s metabolic function, immunologic function, and adaptability to outside environment [14].

In conclusion, the design of therapeutical landscape, in physical level and mental level, will promote the elderly’s health and should be used to the practical construction of age-friendly designed garden.

3 Chinese situation

3.1. Explanations of high frequency of generation-skipping guardianship phenomenon in China from society vision and cultural vision

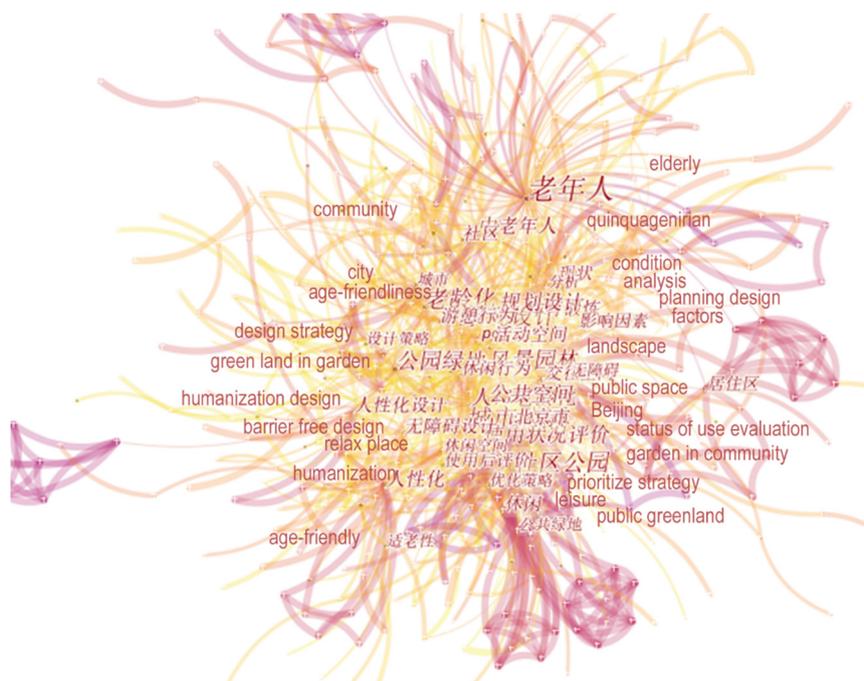


Fig. 3. “elderly garden” term analysis

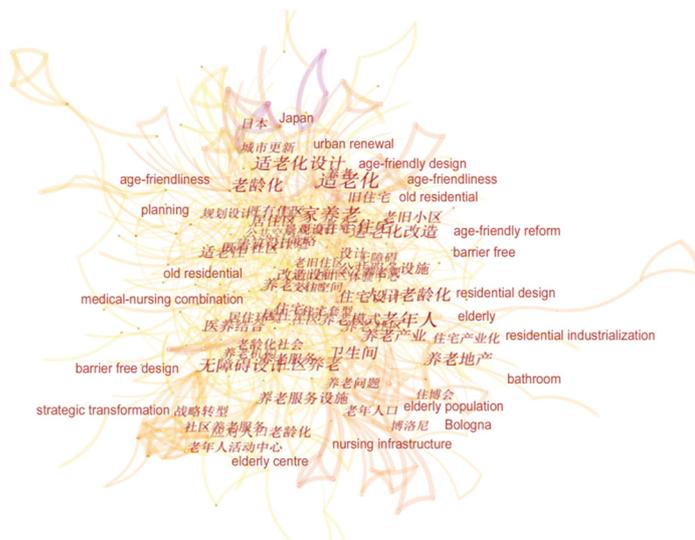


Fig. 4. “age-friendly” term analysis

With multiple situations of rapid population aging, social transformation and urbanization in China, intergenerational parenting has been a universal social trend in big cities. According to research, financial pressure and incapability of parenting have become 2 major contributions that impede people’s second child producing [15] An important prerequisite that determines whether a family could raise child or raise more than one child is the competence of intergenerational parents taking care of their grandchildren. Based on the number given by China Aging Research Center that 66.47% of elderly people would like to participate with their children to take care of their grandchildren [16] and the intergenerational

parenting is popular by now and the rate of the intergenerational parenting will keep raising in the future.

In the background of culture and society in China, grandparents are more intimate with their grandchildren than others who are in foreign countries. Traditions like having a reunion diner in grandparent’s house, and naming grandchildren have shown the cultural status of intergenerational parenting. In special Chinese culture, intergenerational education and participation are involved on children’s life.

In conclusion, both social causes and cultural causes explain the high rate of elderly people participating in children’s education and parenting.

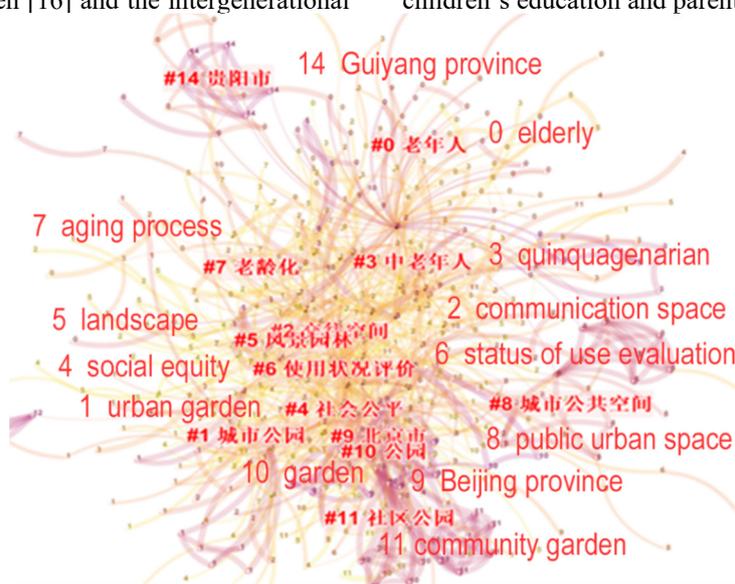


Fig.5. The cluster demonstration of “elderly garden” in CNKI database.

3.2 the condition of age-friendly designed gardens in china

Citespace has been used to analyze the whole terms of a certain field and receive the general information of this field. Citespace is a java application that could identify

and illustrate new trend of science development based on the given scientific paper in the database.

Through respective analysis on age-friendly designed garden in China and in foreign countries (basically US/UK), it can be seen that Chinese age-friendliness and European age-friendliness diverge from policy to practice.

3.2.1 Frequency of terms of uses

The consequence of terms analysis comes from searching keywords “age-friendly” and “elderly garden” on CNKI (figure 2&3&4)

Demonstration on figure1 shows the general terms that were used in the field of age-friendliness.

In the illustration, the most frequent terms of use in research of “age-friendly” are “age-friendly design”, “provision of the aged”, “community”, “pension industry” and so on.

The major terms of use basically are involved in the policy aspect that represents strategies of government to address the aging issue. Quite a few terms are used in papers of age-friendly design topic. It is clear that China uses strategies of policy to meet elderly’s needs of age-friendliness and mainly works on community issues and pension policy on a governmental level.

According to the above-mentioned analysis of “age-friendly” terms, we refined the accuracy of terms to analyze to know better about the age-friendly design in gardens. We collected data of “elderly garden” on CNKI and the demonstration on figure 3 gives more accurate information.

The demonstration on figure3 shows the general terms that were used in the field terms of “elderly garden”

The most frequent terms of use in research of “elderly garden” are “green land”, “human design”, “public space” “communication”, “Beijing”, “urban planning & design”, and so on. The major terms show the present situation of parks that designs are supposed to create a public place for the elderly to communicate with other park visitors. The design of an age-friendly garden will increase the experience and feeling when the elderly travels in the garden. The appearance of term “Beijing” gives the proof that the elderly-friendly garden is a big topic in urban constructions in Beijing. Greenland construction is also a consideration to the elderly’s feeling increasement, which would also be mentioned in the following healing garden literature review.

Comparing with the term frequency analysis, we also find out the differences of current situation between Chinese and European research. The “web of science” database-based demonstration (figure4) of term “age-friendly” shows us more details.

“Adolescent”, “children”, “education”, “overweight”, and so on are mentioned on papers about age-friendliness.

The variety of topics is distinctive to the current research in China. In addition, the policy or strategies are less talked in papers, compared to Chinese research.

3.2.2 Terms that can be integrated as clusters in Chinese condition

Through cluster analysis, the terms of use will be divided to a few groups based on the citespace algorithm to show clusters in which the belonged terms were used as integrity.

The cluster demonstration of “elderly garden” (figure 5) shows domains of “middle-aged and elderly people”, “city garden”, “landscape”, “public communicating space” and so on, which is strongly related to the term analysis of the same term “elderly garden”. Urban public spaces are added within research which is not only in the topic of garden. Middle-aged people are considered with elderly people. Moreover, Beijing is discussed as a big integrity, which proves the importance of park design in Beijing.

Status of use evaluation and social equities are pointed out, which is noted as an increasement of participation and importance of elderly people.

In this section of term & cluster analysis, the existence of the topic of children-friendliness in garden has not been pointed out to be studied as an integrity. Based on the above-mentioned high rate of intergenerational parenting in China and data of appearance of children with elderly people, the importance of the complexity of children-elderly friendly garden design strategies should be strengthened.

4 Discussion

To generalize the design guidelines of the “age-friendly” garden, guidelines of LEED, Chinese park design standard and global age-friendly cities guideline are contrasted to sum up a compositive guideline (figure2) that could be used in the design which combines children-friendliness with age-friendliness.

LEED (leadership in energy and environment design) is a tool to evaluate the environmental protection of architecture in which guidelines are listed for sustainability. LEED guidelines related to age-friendliness are put in order: site adaptiveness, community connection, green lands protection, water control, heat island effect reduction, illustration control, water conserved landscape (sustainable water sight), conservation and collection, extension of material limitation of use, introduction of local material of construction and creative design.

The guidelines of Chinese park design list many specific details, including water control, construction of eco-environment, illustration control, convenience of facilities, vertical design, green lands protection, culture protection, drainage control, plantation, waste disposal, electric safety, facilities safety, natural landscape safety and space that gives shade. The children site designs are particularly pointed out and can be generalized as 4 tips below.

- children safety that includes above-mentioned electric, facilities, natural environment safety and landform control (gentle slope, smooth-riding surface)
- educational design that includes intelligence development, children dimension, color and design adapted to children mental characteristics.

Table 1. sum up

consideration	LEED	CHINESE GUIDELINE	The age-friendly city guideline in Europe	Tips combination of children-friendliness and age friendliness
Green lands	protection	Protection Increase	increasement	Plantation should consider children’s dimension and safety.
Children friendliness	x	Children’s play space design, children safety, educational design and facility design	x	Combination of supervision and children-education
Community Connection	√	x	√	Close to the community in which children and the elderly live
Resource reservation and collection	√	√	x	
safety	x	Electric safety Facility safety Natural-environment safety Landform safety Children safety	Pavement safety, Environment safety	
Site adaptiveness	√	√	x	
Facility convenience	x	Sinks and water drinking pool; Rain shelter; shadow shelter	Sufficient toilet, Information notice board, Accessible help	Combination of children’s facility and the elderly’s facility
Area distribution	x	For children: Divide children activity space by age, Separate children area from green lands, and dense and arterial street	For the old: Rest space availability	Add place for the elderly into children’s activity place

- facilities which includes sinks and water drinking pools, rain shelters and shadow shelters.
- activity place design which includes inter-children group division according to children’s age, separation from green lands, dense area, and arterial street. The ground where children playable facilities are is also regulated to be abrasion resistant, soft and dustproof.

which domains of outdoor spaces and buildings, community support, and health services are deeply related to park design.

The age-friendly cities guide provides considerations to address issues of the elderly’s activity in garden, which include clean environment, green lands, availability of rest space, pavement, safe way, accessibility, safe environment, age-friendly building (facilities), sufficient toilets, services for elderly group, culture, isolation addressing, information notice, and accessible help.

Lots of commonalities are pointed out in 3 guidelines, which shows the relevance of age-friendliness, and sustainability. According to the above-mentioned tips, the design strategies that are more related to elderly-children compound sites are listed below.



Fig. 6. 8domains on global age-friendly cities: a guide.

The global age-friendly cities guideline in Europe is also used to replenish the lack of age-friendly considerations on the above two guidelines. 8 domains are pointed out on the “global age-friendly cities: a guide” in

5 CASE STUDY: ANALYSIS ON THE PRESENT SITUATION OF WANSHOU PARK

5.1. Introduction of Wanshou Park



Fig. 7. location of WANSHOU garden

Wanshou Park was first built in Xicheng district, Beijing in 1617 and had been reconstructed respectively in 1995 and 2014, aiming to create a garden that is suitable for the elderly. Communities are situated near by Wanshou Park where the elderly are the major users. Subway line 4, Taoranting station are about 1km far from Wanshou Park. Market, school and all variety of buildings for public service are sufficient around the circle of the community.

5.2. Research Methodology

Considering the high elderly population density in communities near Wanshou Park and the current condition that the elderly group would likely to travel with their grandchildren, Wanshou Park becomes a necessary place for the elderly to take care of their kids. According to this consideration, the prediction of the elderly's behavior in Wanshou Park should be in a special situation that they will be involved in activities which the kids are included in. As both children and the elderly group will be main participants in Wanshou Park, children's experience in garden will be an important consideration for elderly.

The whole research process was divided into two steps

- Evaluate Wanshou Park according to guidelines summarized before by observation.
- According to guidelines, it was found that Wanshou Park can satisfy most of the aging-friendly demands, such as site adaptiveness, community connection, However, Wanshou Park didn't take children's satisfaction into account.
- Collect occupants' using experience by using questionnaires.

The questionnaire design strategy was based on the use effectiveness from elderly people who carries children to evaluate the current situation in Wanshou Park and give

evidence to our age-friendly guidance. To collect old people's comments and demands when carrying children, the questionnaires are designed with children's needs, garden's suitability for both the elderly and children, and the elderly's experiences of use.

15 questions were designed in the questionnaire and can be classified into 3 aspects: user's basic information, user's activities in Wanshou Park and subjective evaluation.

User's basic information contains the age of elderly users, distance between community and Wanshou Park, frequency of activities that users participate in the Park, age of interviewee's grandson/granddaughter, etc.

User's activities are inquired to have a basic grasp on general activities that elderly would like to do, which involved the elderly's daily activities in Wanshou Park, children's daily activities in Wanshou Park, etc.

Subjective evaluation contains 5 questions related to the park's facilities and installment for the elderly and children. Interviewee can score those questions from 1 to 5, which shows the subjective effectiveness of users.

6 Results analysis (29 Feedbacks were received and the consequences can be concluded below)

6.1. Considering children's demand is essential for Wanshou Park

Most of the elderly always travel to Wanshou Park (4.5 average times per week) and frequently go with children (2.93 average times per week).

Considering that the distance between the living area and Wanshou Park are extremely short or very short for

24 interviewees in 29 reports, the distribution of group of users is circled and contracted around the Wanshou Park. It is because old people prefer a life of “ten minutes pedestrian-scale neighborhood”

The frequency of elder user and children participating Wanshou Park shows that Wanshou Park play an important role in daily life of those residents both elderly and children living nearby the garden and give evidence to the essential need for elderly to visit with their children when using an age-friendly garden especially when relating to community-Wanshou Park distance judgement.

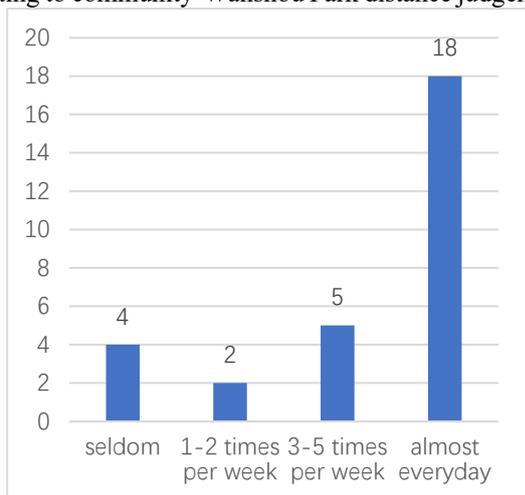


Fig. 8. Frequency of elderly visiting Wanshou Park.

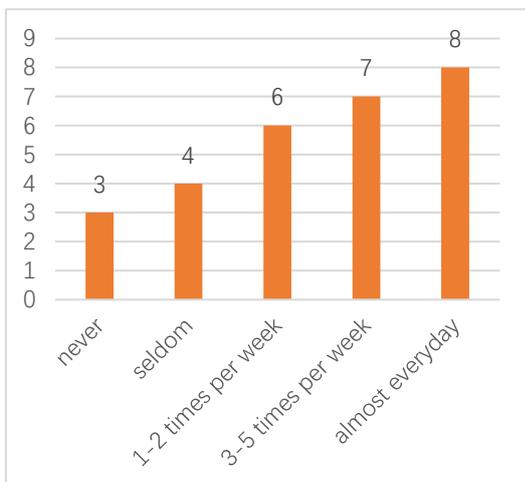


Fig. 9. Frequency of elderly visiting Wanshou Park with kid(s).

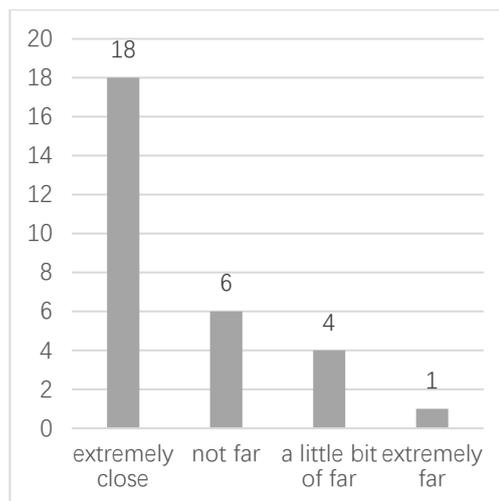


Fig. 10. Judgement of distance between Wanshou Park and user's community.

6.2. Half of the children are between 3 to 6 years old.

The age of most child users ranges from 3 to 6 years old (14/30). 8 children are below 3 years old in 30 interviewed children and children who aged 6-12 years old take up 6/30 in whole sample. There are no children older than 12 years old travel to garden with the elderly.

The experts pointed that children in this age range have a growing social demand and increasing curiosity. In particular, they have flexibility in action, intense physical activity, and a strong interest in studying new things. Therefore, the ambient environment is important to the healthy growth of children in the Wanshou Park.

6.3. The major activity of old people supervising their children in Wanshou Park

Most parts of children play with other children and there are many cases that elderly are with children while they are playing. For the elderly, options like sitting and watching nearby their kids are aiming to have a better care about kids when they are playing with each other. (Question 7) In Question 8, which inquires interviewees about their basic activities in garden, the consequences show that walking, taking care of children, and using sport facilities are the three most frequent choices for interviewees. In addition, the situation that old garden visitors travel without kids by their side, the strategy should consider about the private space for the elderly who is not carrying children in its design.

6.4. Occupants are unsatisfied on performance of Wanshou Park in children's demands

The elderly scores the sufficiency of facilities that are friendly provided to children and themselves, as well as the safety of facilities and plantation.

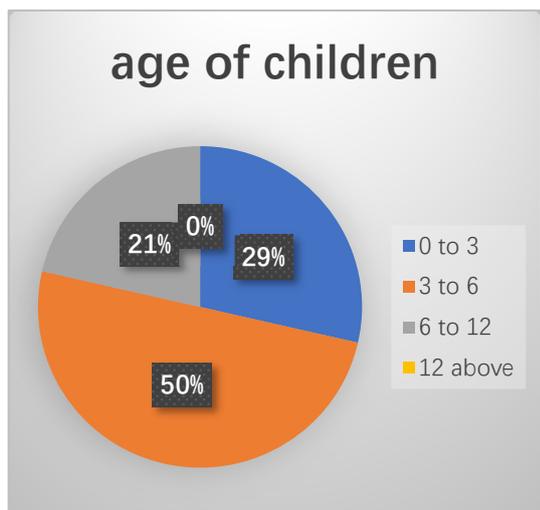


Fig. 11. Children age composition

The consequences of questions 11-15 can be concluded that the whole garden is in a good age-friendly condition. (13 interviewees score 5 points in 26 reports to the sufficiency of facilities for the elderly). However, the lack of facilities for children is a serious problem in garden, no matter the number or the variety of facilities for kids. (Average score on quantity of children facilities are 2.54

points, and 2.19 points are given to the sufficiency judgement of the variety of children’s facility, in which 5 points are “pretty good”, 3 points are considered as “no comment” and 1-point shows “extremely bad”).

The grade on vegetation friendliness and children’s safe facilities are higher than above-mentioned numbers. Vegetation friendliness gets 4.46/5 and children facility safety gets 4.04/5. Wanshou Park environment is enjoyable for both children and elderly’s use.

On Question 14, the availability of facility that parents can get when children are playing is sufficient, which shows that the friendliness to parents and the elderly can be predicted that the children’s spaces are closely attached to the spaces for the elderly to relax.

7 Design strategy

The research gives a practical work based on above-mentioned sums-up of guidelines (LEED, Chinese guideline and age friendly city guideline in Europe) and Wanshou Park surveys. A brief analysis are presented to show Wanshou Park situation.

7.1 Community Connection is excellent due to its location

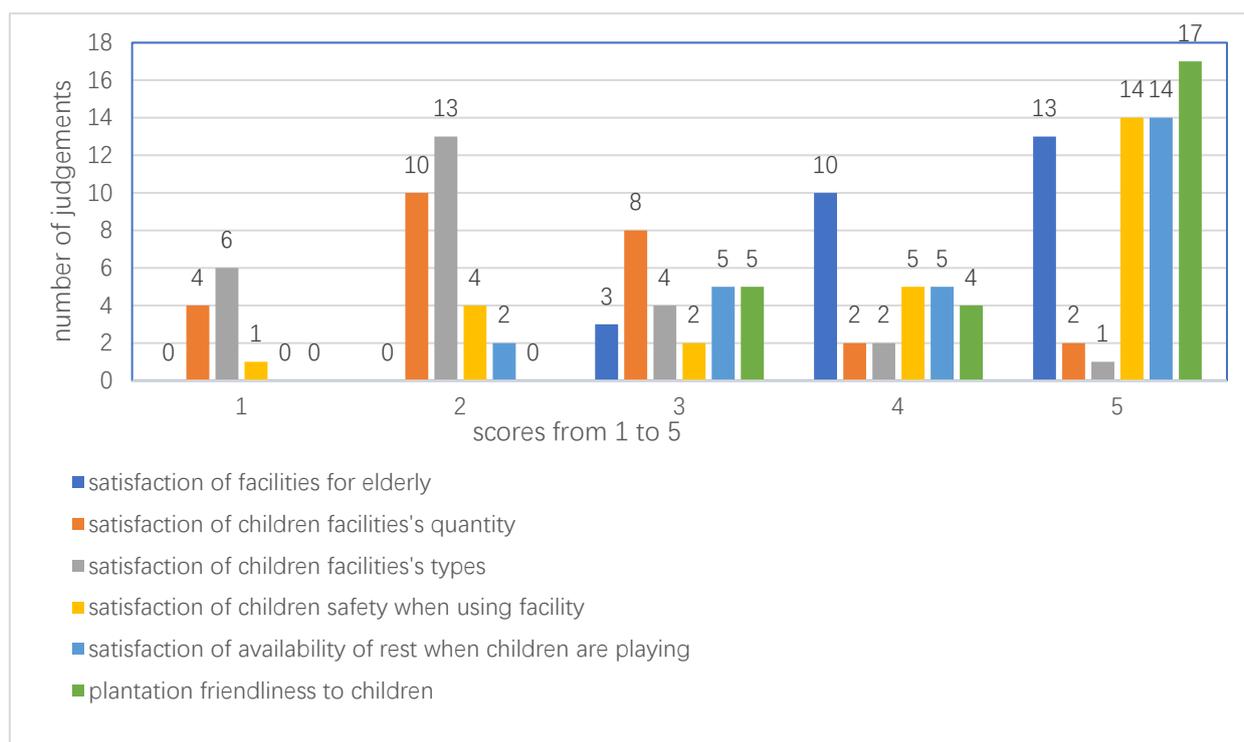


Fig. 12. Scores on 5 domains

In Community Connection, Wanshou Park is pretty close to the community in which children and the elderly live, who carry or not carry children are using this garden. The availability is high due to the short distance between community and garden, construction of subway nearby, and compatible other services construction like school, market and restaurant. Wanshou Park provides a suitable place for the elderly who lives nearby and improves the living condition.

7.2 Children friendliness are insufficient for an age-friendly garden and should be improved.

For children friendliness, the consideration of children friendliness is regardless, the quantity and variety of children’s facilities are low. Based on the fact that the elderly often travels to Wanshou Park with kids, the children’s facility should be increased. In Wanshou Park,

kids are likely to play fit installments which were designed for adult and it will be bad for children safety while using it. The supervision from elder parents is insufficient. While children are playing in a group, the play space are way much opened and hard for parent to supervise. The huge playground filled with so many children playing together is uncomfortable for parents that they need to follow their children to keep them safe instead of sitting in chairs when there are some small and private spaces provided to children's play.

7.3 Green lands are friendly to children and the elderly, but still can be improved.

In sums-up, the consideration that "Plantation should consider children's dimension and safety" was issued. Wanshou Park has a great condition of green lands, in aspects of numbers and variety, creating a natural environment for the elderly and children. Dimensional considerations are involved in Wanshou Park's design, most of the plantation are lower than children's sight. The plantation of pine tree on garden grass still looks unsafe to children for the spine could hurt children's fingers while they are exploring.

7.4 Facility for the elderly and for children should be respectively reconsidered.

In the questionnaire survey, Wanshou Park shows the sufficient use of facilities for the elderly. fitness facilities are installed for elderly exercising, many flat grounds are made for the elderly to dance or do exercise. Some spaces are perfectly designed to meet the need of the elderly: the DISHU ground, create an indentation to place water for the elderly writing on the ground using brushes with water. However, the consideration of children's convenience is sort of ignored. The set of the indentation can easily trip children when they are playing, for instance. Bronze sculptures that are set to show age-friendliness culture have pointed finger to what is dangerous to children, for example, some stairs are too high for children to step on. The current situation of Wanshou Park should combine age-friendliness with children convenience.

The expected outcomes will be stressed out based on above mentioned domains to improve the experiences of the elderly and children's visiting.

- Community Connection. Communities are highly connected to Wanshou Park. Wanshou Park provides a rare space for residents nearby, who live in an area of high-density popularity to do outside activities. Wanshou Park opens only one entrance that allows visitors to go in, which is probably affected by COVID-19 special situation. The sets of 2-3 entrances will improve the efficiency of visiting.

- Children friendliness and Facility conveniency. 2 domains should be improved mutually by changing the plan of Wanshou Park and increasing types of entertaining and relaxing facilities and installments to improve the safety of children and the comfort experience when visiting.

- Green lands. Although the outcomes of the questionnaires are positive when asking the friendliness of vegetations to children, the plantations of pine trees will likely be hurtful because of the spine and the set of high brushwood will impede kids exploring.

8 Conclusion

The Wanshou Park exemplifies the practice of age-friendliness in Beijing, which is beneficial to its counter-users. The purpose of age-friendliness of parks or gardens is to improve the experience of visiting for people who is aging. A fact of Chinese special background is inter-parenting that old people take care of their grandchildren as the parents are working outside. The conflicts between the elderly and kids using garden together should be eliminated by blending children-friendliness with aging-friendliness. Raising installations for children and redefining age-friendliness in garden for both the elderly and children are important to create a better age-friendly garden due to the Chinese special situation of increasing phenomena of old people carrying their grandchildren. Child-friendliness is also important for developing age-friendliness of gardens in China.

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