

# Discussion on Inclusive Design of Public Fitness Facilities

Based on Demand Characteristic of the Elderly Who Requires Nursing Care

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**Abstract**—Nowadays so many public fitness facilities in residential quarters are not suitable for the elderly who requires nursing care to use, but their demands of rehabilitation can't be neglected. In this paper, design proposal based on demand characteristic of the elderly who requires nursing care is presented according to previous investigation in the ways of living. The principle of inclusive design is applied to demonstrate the feasibility of design by analysis of design practice, function positioning, easiness to use and the safety, which would provide references for public fitness facilities design for the elderly who requires nursing care.

**Keywords**—public fitness facilities; elderly who requires nursing care; inclusive design

## I. INTRODUCTION

The aging of population raises a claim of “Adaptive Design for the Elderly” to public infrastructure construction in residential area, however, the diversity of life of the elderly population challenges the “Adaptive Design for the Elderly” of public facilities in residential area. In current public infrastructure construction in residential area, the elderly who requires nursing care due to weakening of somatic function and lack of part of somatic function is ignored. This group has a large cardinal number, making up about 12% of the elderly group. Thus, how to satisfy the demand of public infrastructure construction of the elderly who requires nursing care is an emergent problem.

## II. INVESTIGATE AND SURVEY ON CONDITION OF PUBLIC FACILITIES IN RESIDENTIAL AREA

With the subsidization of project fund of Fujian Social Science Planning Office, entrusted by part of nursing homes, the research group developed survey on the public infrastructure construction in residential area based on the social background of aging of population. Through initial survey on 248 old people, we selected 97 old people who require nursing care. We found in the survey that movement disorder is the primary factor that causes old people's lack of part of self-care ability, which makes up 42.2%, next is visual impairment (20.3%) and hearing disorder (12.5%). Paralysis (57.6%), dysgnosia (27.3%) and mental disease (15.1%) are the major reasons that cause total lack of self-care ability of the elderly.

The elderly who requires nursing care basically seldom take part in public activities or use public facilities. Apart from their own physiological reasons, the current public facilities are not suitable for the elderly who requires nursing care to use: 15% of the consideration is the distance; 28% is the safety of facilities; 43% is the inapplicability of the public facilities. Besides, it can known from the demand of the elderly who requires nursing care to public facilities in residential area that the fitness facility is the most important demand. “Fig. 1”, “Fig. 2”, “Fig. 3”, “Fig. 4”.

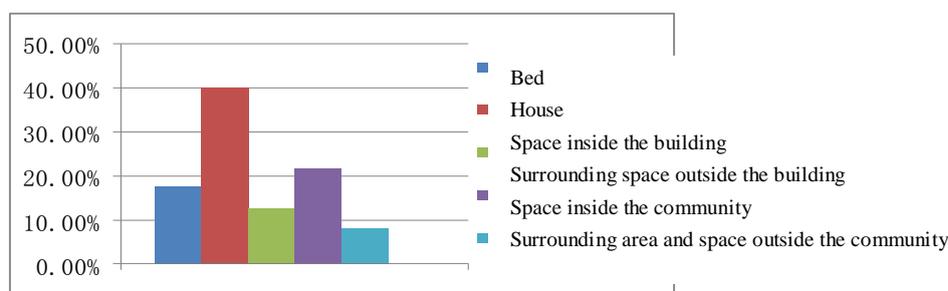


Fig. 1. The Daily Activity Area of the Elderly Who Requires Nursing Care

This topic is the research of Fujian rural elderly health care needs and solutions of product service system, which is the Youth Project achievement of Fujian Social Science Planning in 2015, 2015C071

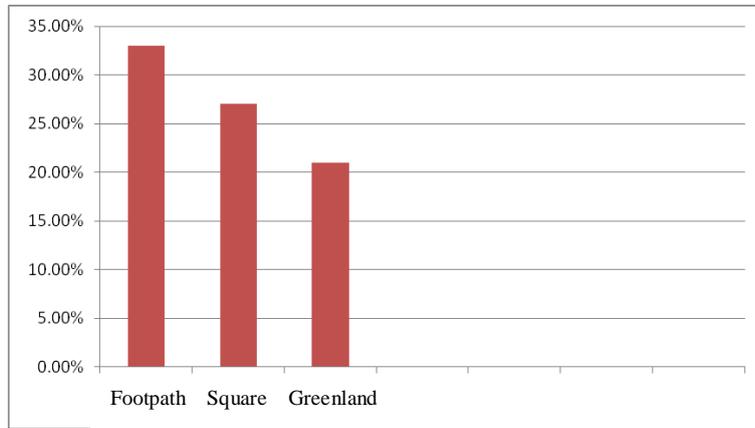


Fig. 2. The Public Facilities in Community Which Are Most Frequently Used by the Elderly Who Requires Nursing care

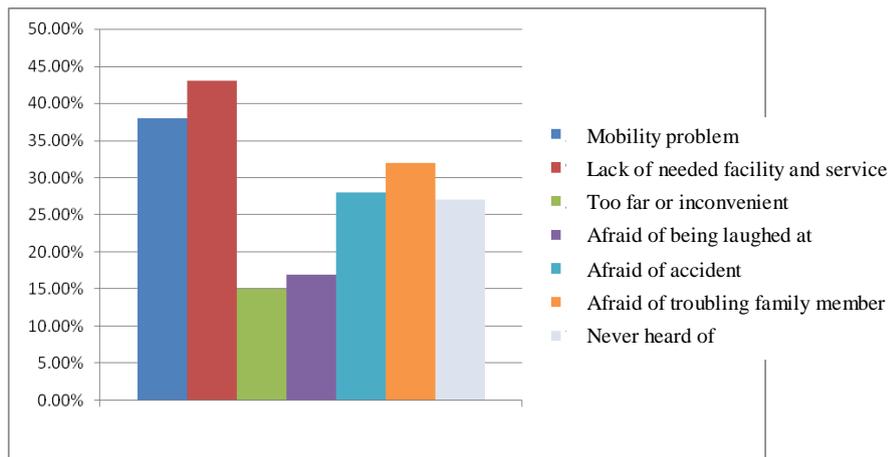


Fig. 3. The Public Facilities in the Community Which Are Seldom Used By The Elderly Who Requires Nursing care and Reason Analysis

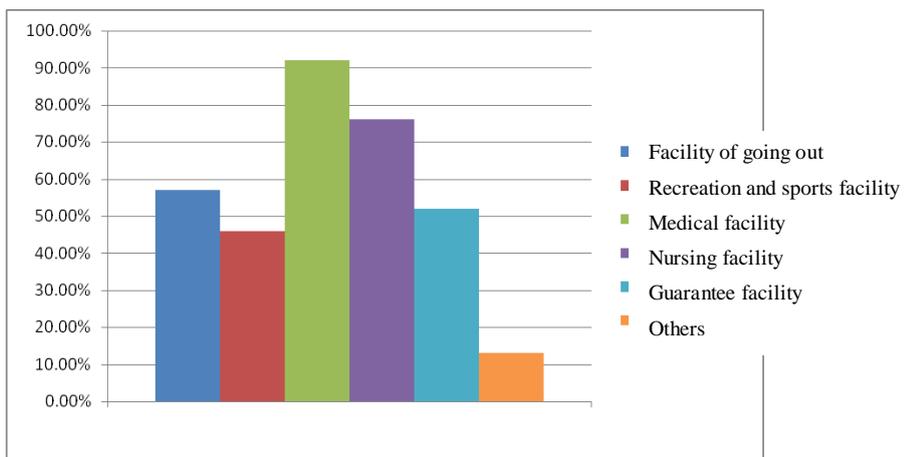


Fig. 4. The Type of Public Facilities in the Community Needed by the Elderly Who Requires Nursing care

### III. DESIGN PROJECT OF PUBLIC FITNESS FACILITIES BASED ON THE ELDERLY WHO REQUIRES NURSING CARE

#### A. Design Positioning and Principle of the Public Fitness Facilities

Based on above data, the research group thinks that the public infrastructure construction focusing on limb rehabilitation is an important method of recovery of somatic function of the elderly who requires nursing care. Based on this, via further research on the condition somatic function of the elderly who requires nursing care in nursing homes, it finds out that the weakening of function of lower limbs or loss of part functions are the main reasons for why it's hard for the elderly to handle their life. The research group initially designs the scheme of four types of public fitness facilities focusing on lower-limb exercise including bicycle for rehabilitation of lower limb, glider of ankle dorsiflexion, stepper and retractor of knee joint to offer exercise which improves the joint motion, muscle force and coordination function of the elderly who requires nursing care. "Fig. 5", "Fig. 6", "Fig. 7", "Fig. 8".



Fig. 5. Bicycle for rehabilitation of lower limbs (designed by students of 2012)

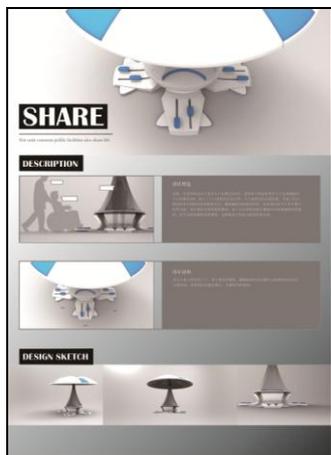


Fig. 6. Glider of ankle dorsiflexion (designed by students of 2012)



Fig. 7. Stepper (designed by students of 2012)



Fig. 8. Retractor of knee joint (designed by students of 2012)

Based on the demand features of the elderly who requires nursing care, the design project of the public fitness facilities in urban residential communities made by the research group based on the concept of inclusive design. The inclusive design is not a kind of design style but a new attitude and approach "designed for the public". Thus, the users position of the public fitness facilities in residential area is the elderly who requires nursing care with certain action capability, namely the elderly who loses part of self-care ability or whose self-care ability weakens, and it starts from this to tolerate other groups; thus, it can avoid excessive specialization due to design of public fitness facilities and making it hard to meet the demand of other people as well as benefiting the elderly who requires nursing care and normal people, maximally realizing the tolerance of users.

### B. Functional Orientation of the Public Fitness Facilities

According to the suggestion of doctors from rehabilitation hospital of DPF, compared to comprehensive and complicated sports equipment, the elderly with partial self-care ability needs targeted single exercise mode more during initial phase of rehabilitation training, mostly exercise of limbs. Thus, the four design schemes of the research group focus on exercise of different parts. For example, the bicycle for rehabilitation of lower limbs can conduct exercise of muscle strength and motion range of joint of the upper and lower limbs at the same time, improve the coordination of them and also conduct exercise of the upper or lower limbs solely; the glider of ankle dorsiflexion stimulates the muscle groups on anterolateral side, back side and inner side of the thigh and exercise the strength of knee joint and ankle joint by sliding the lower limbs forward and backward; the stepper conducts exercise of flexion and extension functions of the ankle joint via tread against proper resistance to promote the flexibility of the flexion and extension of all the parts of the ankle joint; the retractor of knee joint stretches the upper limbs via posture of stoop and drives leg movements, and the sports center focuses on the knee to promote the recovery of function of knee joint.

Add details of application of auxiliary instrument like wheel chair and crutch based on the inclusive design of the above four types of public fitness facilities, and realize general design for healthy groups as well as groups require nursing care.

### C. Distribution and Connection of Public Fitness Facilities

Considering the real living condition of the elderly who requires nursing care, the research group conducts distribution with 300 meters of radius centered on the building, and form the three plates of the public fitness facilities, nursing equipment and medical facility into an orderly, scientific and rational mode, distributing the public fitness facilities within the range of 3-5 minutes of walk "Fig. 9". At the same time, fully consider the physical condition of the elderly who requires nursing care, especially the old people on wheel chair or with crutch in the connection of public facilities, guarantee especially facility connection with free barrier.

Thus, the public fitness facilities need to consider proper distribution as well as improving the coverage rate of support facility. Install monitoring facility in public area, and pay attention to the support facilities like handrail, guard railing and non-slip mat.

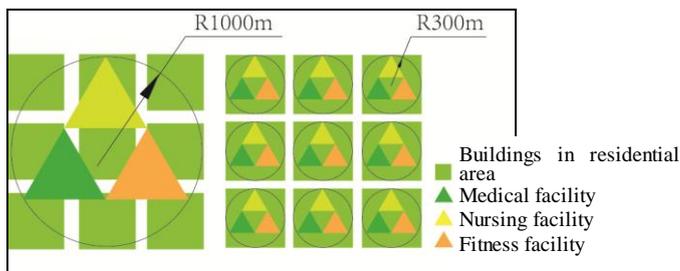


Fig. 9. Distribution of the public fitness facilities

### D. The Ergonomic Design and Interactive Design of the Public Fitness Facilities

In the ergonomic design of the public fitness facilities, the research group fully considers the physical scale of the elderly who uses support tools like wheel chair, crutch and walking aid. For example, in the space dimension of facility distribution, the width of the walking space of single stick and walking aid reaches over 750mm, and the space for double stick users reach over 950mm, the walking width of wheel chair users is 600-650mm, thus the aisle interval shall guarantee the support tools can pass; in operation dimension of the public fitness facilities, consider the transformation between sitting position and standing position, make it convenient for the elderly who requires nursing care to take crutch or walking aid; especially the wheel chair users are limited to operate facilities by the wheel chair, thus the research group design according to the dimension of No.5 percentile old women who use wheel chairs when designing the distance between human and facility.

Considering the particularity of the operation, information reception and feedback form of public fitness facilities of the elderly who requires nursing care, it needs to refine the interactive mode between human and facility. The more diversified the interactive mode is, the more strong tolerance it has. Focusing on the elderly who requires nursing care of vision disorder, the research group adds interactive mode of voice broadcast in the design scheme of all the public fitness facilities and sets signal of voice prompt; as for the elderly who requires nursing care with hearing disorder, it can interact via visual element with strong irritation to make up for the difficulty brought by hearing disorder; the elderly who suffers from Alzheimer needs to have space identity and guidance system with intelligent identifying form to strengthen location indication.

### E. Usability and Safety of the Public Fitness Facilities

It can be known from early survey of the project that the motion extent is too large and the motion frequency is too fast for current public fitness facilities, and the height of facility is fixed, which is hard for the elderly who requires nursing care to control. The design scheme of the research group thinks of this point and pays attention to the usability of the facility. For example, the elderly who use crutch or walking aid can only use both hands when they sit, and the movement is too large for operation of single hand when they stand, which will influence the body balance, and thus it shall make it convenient for the elderly to take the crutch or waling aid when they sit or transform gesture. It sets a location to place the supporting tool on the flank of the product to make it convenient to connect and transform sitting and standing postures. The seat is able to revolve 90 degrees clockwise or counterclockwise to make it convenient for the elderly using crutch or walking aid to sit; it firstly involves the problem of positioning of the relative location of the wheel chair and product before the elderly use the product. Guide the angle and location of the wheel by setting auxiliary line on the ground, remind the elderly who use wheel chair to find a location to better connect to the product and feel more comfortable to operate.

Safety is an important factor when the elderly who requires nursing care uses public facilities, and the research group puts safety in an important location in case design. For example, the four types of public fitness facilities all have stable base to prevent the product from moving forward or turning on one side, and have lock catch of wheel chair to fix it; to improve the stability of the elderly when they exercise the lower limbs, handrails are added on the two sides of the seat; apart from adding the friction between foot and the equipment via special material, the retractor of knee joint and bicycle for rehabilitation of lower limbs can strengthen the grip strength of upper limbs and support fixed equipment via the facility of the motion of upper limbs; all the surface contacting the limbs and the angles of the equipment are wrapped with soft protective material. Some facilities have transparent ceiling and enable the elderly to enjoy sufficient sunlight during outdoor activities, avoid too much sunlight exposure, keep out wind and rain, and shelter the elderly when the climate changes rapidly.

#### IV. CONCLUSION

In conclusion, the elderly who requires nursing care is a vulnerable group among old people. We hope to coordinate the common demand of the elderly who requires nursing care and the self-care elderly via the concept of inclusive design, and then expand to the special demand of the elderly who requires nursing care, enable public fitness facilities in urban communities to offer the elderly who requires nursing care with equal opportunity to join in, interact and share. Of course, we also hope to offer reference for the product of public fitness facilities in the aging society via the analysis and research of public facilities of the elderly who requires nursing care in this project.

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