**User-centered Participatory Design for Community-based Healthcare**

**Environment: A Pilot Study in Suzhou Industry Park, China**

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ABSTRACT:

*Purpose*: This research aims to explore users’ satisfaction of their healthcare environment at community level. It proposes a model that can be used in the design decision-making process to improve the efficiency of users’ participatory procedures and aspects of social sustainability.

*Method*: A conceptual framework that can guide healthcare design has been developed, based on a literature review and archive study. Using it as a benchmark, a semi-structured interview and a follow-up survey were conducted sequentially. Subsequently, statistical methods were applied for the data analysis.

*Results*: In the interview, design issues that would contribute to the users’ environmental satisfaction were identified. Survey results demonstrated that there were cognitive differences and priority variances of users’ needs within the user group (e.g. between patients and medical staff). The research findings could be used to inform future healthcare design.

KEY WORDS: User-centered; Participatory Design; Community-based; Healthcare Environment; Sustainable Design; Decision-making.

**1. Introduction**

China’s current healthcare reform aims to establish an accessible, affordable, and equitable healthcare system for the whole society [1]. One of the long-term key tasks is to transform the allocation of medical resources in urban areas from a “centralized” to a “decentralized” pattern. It is expected that such a transformation would improve the capacities of primary care delivery and respond to new issues arising from the aging society [2]. According to the statistical results, the percentage of the elderly (e.g. people aged 60 years or above) in China will rise from 12.4% of the total population (168 million) in 2010 to 28% (402 million) by 2040. There is an urgent need to solve the potential problems caused by this demographic trend [3]. It is believed that a high-quality healthcare environment at community level, as a key performance indicator for the social development, is necessary. By 2016, the quantity of community-based healthcare facilities in the urban areas has reached about 34,000, and will continue to grow in the following 10 years in order to meet the demands of the society [4]. However, for now there are no specific design regulations or unified standards in China to assess the design quality of community-based healthcare environment.

Previous research showed that healthcare buildings should be designed as a therapeutic environment that can contribute to the process of healing rather than a place where only medical treatments take place [5]. One of the most important conceptual design trends is to look at users’ satisfaction of the built environment. Such information can effectively inform the healthcare design and thereby improve the overall quality of the healthcare environment and users’ health and well-being [6-8]. To improve users’ satisfaction, a user-centered participatory design process is proposed – by encouraging users to become involved in the design decision-making, such a process would efficiently establish communication between users and professional stakeholders (e.g. architects, engineers, developers, assessors, administrators).

However, some scholars argued that there were concerns that might impact upon the efficiency of the users’ participatory procedures in the design decision-making process [9-11]. First, in the current construction market, some sustainability assessment methods (e.g. LEED, BREEAM, DGNB) are widely used as information sources and design decision-making aids by architects to holistically improve the quality of their design work [12]. It is believed that these methods are appropriate checklists and thereby can serve as a communication platform to involve all stakeholders in design [10]. Nevertheless, the contents of these documents are professional and technical. There is a lack of common language for lay stakeholders (e.g. users) to express their visions and needs by evaluating the design strategies directly. Second, as the peoples’ needs are mainly derived from a consciousness of their previous experiences or dissatisfaction with reality, the different characteristics (e.g. gender, age) of users may cause the cognitive differences that further lead to the priority variances of users’ needs [13]. To comprehensively meet the users’ satisfaction and needs for healthcare environment, it is important for architects to understand the cognitive differences of target users.

This paper aims to explore the users’ needs for community-based healthcare environments. It will provide an insight into the users’ needs and proposes a model that can efficiently use the information to inform the design decision-making of community-based healthcare environment towards a standard of sustainability.

**2. Methods**

2.1 Literature Review and Archive Study

Desktop research, including a literature review and archive study, has been conducted to collect design strategies for the healthcare environment. Users with less professional knowledge of healthcare design often express their satisfaction and needs as “visions to be comfortable” instead of explicit expectation with solutions [14]. By participating in the design decision-making, they can have a better understanding of the outcomes or intentions of the design strategies being applied. Some sustainability assessment methods for healthcare (e.g. *LEED 2009 for Healthcare*, *Evaluation Standard for Green Hospital Building GB/T 51153*) and healthcare design aided tools (e.g. *AEDET Evolution*, *ASPECT*) were reviewed first. Based on that, a conceptual framework for healthcare design was built in line with the structure of *AEDET Evolution,* which was designed to support the participation of different stakeholders. As shown in Table 1, it consists of ten assessment criteria (A – J), providing both design issues in non-technical statements for users and several corresponding design strategies that can achieve these design issues for architects. Lay stakeholders and professionals can use it as a communication platform to facilitate the knowledge exchange in a participatory design process. It also helps them understand each other more appropriately [15].

**Table 1** A conceptual framework for healthcare design

|  |  |  |
| --- | --- | --- |
| Contents | | Mark |
| A: CHARACTER & INNOVATION (e.g. assessment criteria) | |  |
| A.01 There are clear ideas behind the design of the building. (e.g. design issues) | |  |
| * *A clear and coherent vision about its function and aspirations* (e.g. design strategy) | |  |
| A.02 The building is interesting to look at and move around in. | |  |
| * *Plain form without extra decoration for evaluation* | | *♦* |
| * *Artwork for decoration* | | *\** |
| A.03 The building projects a caring and reassuring atmosphere. | |  |
| * *A civic presence for a caring and reassuring atmosphere* | | *\** |
| A.04 The building appropriately expresses the value of the health services. | |  |
| * *Design for inspiration of patients and staff* | | *\** |
| A.05 The building is likely to influence future healthcare designs. | |  |
| * *Current best practice to reflect healthcare provision* | | *\** |
| * *Building Information Modelling* | | *♦* |
|  | |  |
| B: FORM & MATERIALS | |  |
| B.01 The building has a human scale and feels welcoming. | |  |
| * *Welcoming appearance to staff, patients and visitors* | | *\** |
| * *A human scale for windows, indoor heights, doors, and entrances* | |  |
| B.02 The building is well orientated on the site. | |  |
| * *Daylighting level* | | *♦/\** |
| * *Daylighting level for underground space* | | *♦* |
| B.03 Entrances are obvious and logically positioned in relation to likely points of arrival on site. | |  |
| * *Obvious entrances and routes onto the site* | | *\** |
| B.04 The external materials and detailing appear to be of high quality. | |  |
| * *Graceful image without staining or weathering* | |  |
| * *No prohibited materials* | | *♦* |
| * *Concrete structure* | | *♦* |
| * *Premixed concrete* | | *♦* |
| * *Premixed mortar* | | *♦* |
| * *Robust materials* | | *♦* |
| * *Innovative materials* | | *♦* |
| B.05 The external colors and textures seem appropriate and attractive. | |  |
| * *Colors and textures related to adjacent buildings and environment* | |  |
|  | |  |
| C: STAFF & PATIENT ENVIRONMENT | |  |
| C.01 The building respects the dignity of patients and allows for appropriate levels of privacy and company. | |  |
| * *Design for privacy protection* | | *\** |
| * *Design for patient company* | | *\** |
| C.02 There are good views inside and out of the building. | |  |
| * *Good views in wards and consulting rooms* | | *♦/\** |
| C.03 Patients and staff have good easy access to outdoors. | |  |
| * *Land use for greening* | | *♦/\** |
| * *Greening and vegetation diversity* | | *♦/\** |
| * *Open spaces and access to nature for all-weather design* | | *♦/\** |
| C.04 There are high levels both of comfort and control of comfort. | |  |
| * *Light pollution control* | | *♦* |
| * *On-site acoustic environment* | | *♦/\** |
| * *On-site wind environment (outdoor walking in winter; ventilation in summer)* | | *♦* |
| * *Heat island control* | | *♦* |
| * *Indoor noise level* | | *♦/\** |
| * *Indoor glare control* | | *♦* |
| * *Indoor temperature* | | *♦/\** |
| * *Indoor ventilation and fresh air volume* | | *♦/\** |
| * *Shading system in summer* | | *♦* |
| * *Air quality monitoring* | | *♦/\** |
| C.05 The building is clearly understandable. | |  |
| * *Signposting system and humanistic factors* | | *♦/\** |
| C.06 The interior of the building is attractive in appearance. | |  |
| * *Home-like design for interior (light, airy, tidy, and texture-appropriate)* | | *\** |
| C.07 There are good bath / toilet and other facilities for patients. | |  |
| * *Safety facilities (non-slip flooring, seats, handrails, and selves) for bath/toilet* | | *\** |
| C.08 There are good facilities for staff including convenient places to work and relax without being on demand. | |  |
| * *Staff-only space for work and relax* | |  |
|  | |  |
| D: URBAN & SOCIAL INTEGRATION | |  |
| D.01 The height, volume, and skyline of the building relate well to the surrounding environment. | |  |
| * *Sunshine spacing for surrounding residential buildings* | | *♦* |
| D.02 The building contributes positively to its locality. | |  |
| * *A landmark or locality* | |  |
| * *Pleasant spaces outside the building* | | *\** |
| D.03 The hard and soft landscape around the building contribute positively to the locality. | |  |
| * *Therapeutic function for hard and soft landscape* | | *\** |
| * *Safe and clear ground materials* | |  |
| D.04 The building is sensitive to neighbors and passers-by. | |  |
| * *Attractive form and evaluation for neighbors and passers-by* | |  |
|  | |  |
| E: PERFORMANCE | |  |
| E.01 The building is easy to operate. | |  |
| * *Straightforward management of facility* | |  |
| E.02 The building is easy to clean. | |  |
| * *Easy clean for building and materials* | |  |
| * *Easy access to windows for cleaning externally and internally* | |  |
| E.03 The building has appropriately durable finishes. | |  |
| * *Robust and washable finishes for walls, ceiling, and floor for predicted lifespans* | | *♦* |
| * *Control of moisture and mildew on the surface of walls* | | *♦* |
| E.04 The building will weather and age well. | |  |
| * *Graceful image with material junctions after aging* | |  |
| E.05 The location of the building is appropriate and land-saving. | |  |
| * *No protection areas for heritage or ecosystem* | | *♦* |
| * *Location safety* | | *♦* |
| * *Land-saving design* | | *♦* |
| * *Usage of underground spaces* | | *♦* |
| * *Contaminated land recovery* | | *♦* |
|  | |  |
| F: ENGINEERING | |  |
| F.01 The engineering systems are well designed, flexible, and effective. | |  |
| * *Commissioning* | | *♦* |
| F.02 The engineering systems exploit any benefits from standardization and prefabrication where relevant. | |  |
| * *Standardization and prefabrication for engineering systems* | |  |
| F.03 The engineering systems are energy efficient. | |  |
| * *Energy-saving plan for power consumption* | | *♦* |
| * *Renewable energy* | | *♦* |
| * *Energy-efficient air conditioning and air purifier* | | *♦* |
| F.04 There are emergency backup systems that are designed to minimize disruption. | |  |
| * *Emergency backup requirements for the design* | |  |
| F.05 During construction disruption to essential services is minimized. | |  |
| * *Continuity of essential services during construction disruption* | |  |
| F.06 The building has resource-saving design and facilities (water and materials). | |  |
| * *Recyclable materials* | | *♦* |
| * *Water-saving plan and facilities* | | *♦* |
| * *Rainwater recycling* | | *♦* |
|  | |  |
| G: CONSTRUCTION | |  |
| G.01 If phased planning and construction are necessary the various stages are well organized. | |  |
| * *Organization of phased planning and construction* | |  |
| G.02 Temporary construction is minimized. | |  |
| * *Minimal temporary construction* | |  |
| * *Simultaneous works for construction and decoration* | | *♦* |
| G.03 The impact of the construction process on continuing healthcare provision is minimized. | |  |
| * *Segregation between operational areas and contractor’s areas* | |  |
| G.04 The building can be readily maintained. | |  |
| * *Minimal maintenance for components in the construction* | |  |
| * *Clear life-cycles of components* | |  |
| * *Easy replacement for components* | |  |
| G.05 The construction is robust. | |  |
| * *Detailed junctions between materials and components* | |  |
| * *Sufficient strength and integrity for functions and locations of components and finishes* | | *♦* |
| * *Resource-saving types of construction* | | *♦* |
| G.06 The construction allows easy access to engineering systems for maintenance, replacement, and expansion. | |  |
| * *Integration between construction design and engineering systems* | |  |
| * *Easy maintenance and replacement for engineering components* | |  |
| G.07 The construction exploits any benefits from standardization and prefabrication where relevant. | |  |
| * *Standardization and prefabrication for construction* | |  |
|  | |  |
| H: USE | |  |
| H.01 The prime functional requirements of the brief and satisfied. | |  |
| * *Considerations of core purposes of health services* | |  |
| H.02 The design facilitates the care model of the Trust. | |  |
| * *Reflection of Trust’s healthcare philosophy and delivery in the design* | |  |
| H.03 Overall the building is capable of handing the projected throughput. | |  |
| * *Demands at peak times on spaces, circulation and access* | |  |
| H.04 Workflows and logistics are arranged optimally. | |  |
| * *Layout design to minimize distances travelled and lines crossed* | | *\** |
| H.05 The building is sufficiently adaptable to respond to change and to enable expansion. | |  |
| * *Recyclable partition for multifunctional and alterable rooms* | | *♦* |
| * *Flexibility for future change and expansion* | |  |
| H.06 Where possible spaces are standardized and flexible in use patterns. | |  |
| * *Capability of changing spaces’ use as needs change* | |  |
| H.07 The layout facilitates both security and supervision. | |  |
| * *Layout design for security and passive supervision* | |  |
|  | |  |
| I: ACCESS | |  |
| I.01 There is good access from available public transport including any on-site roads. | |  |
| * *Connection with public transport* | | *♦* |
| * *Clear pedestrian routes from public transport points* | |  |
| I.02 There is adequate parking for visitors and staff cars with appropriate provision for disabled people. | |  |
| * *Design for parking (cycles and vehicles)* | | *♦* |
| I.03 The approach and access for ambulances is appropriately provided. | |  |
| * *Adequate segregation and demarcation of ambulance access and drop off points* | |  |
| * *Access and entrance for ambulance* | | *♦* |
| I.04 Goods and waste disposal vehicle circulation is good and segregated from public and staff access where appropriate. | |  |
| * *Segregation between large or noisy vehicles and pedestrian areas* | |  |
| I.05 Pedestrian access routes are obvious, pleasant and suitable for wheelchair users and people with other disabilities / impaired sight. | |  |
| * *Barrier-free design for site and sidewalk* | | *♦* |
| I.06 Outdoor spaces are provided with appropriate and safe lighting indicating path, ramps steps. | |  |
| * *Safety lighting for landscape at night* | |  |
| I.07 The fire planning strategy allows for ready access and egress. | |  |
| * *Integration between fire planning strategy and the design* | |  |
|  | |  |
| J: SPACE | |  |
| J.01 The design achieves appropriate space standards. | |  |
| * *Normal demand and peak demand for technical spaces* | |  |
| * *Uncluttered and spacious entrance areas* | |  |
| * *Consideration for special areas for children* | |  |
| J.02 The ratio of usable space to the total area is good. | |  |
| * *Maximize utilization for possible spaces* | |  |
| * *Effectiveness for dual use of circulation space* | |  |
| J.03 The circulation distances travelled by staff, patients, and visitors are minimized by the layout. | |  |
| * *Layout design to reduce the congestion and circulation* | | *♦* |
| J.04 Any necessary isolation and segregation of spaces is achieved. | |  |
| * *Layout and greenbelt design for infectious segregation* | | *♦* |
| J.05 The design makes appropriate provision for gender segregation. | |  |
| * *Design for gender segregation* | | *\** |
| J.06 There is adequate storage space. | |  |
| * *Adequate storage space in the building* | |  |
|  | |  |
| *Note:* | *♦ - Design strategies collected from Evaluation Standard for Green Hospital Building GB/T 51153 (a mandatory design regulation in China that is designed for sustainable healthcare design for all kinds of healthcare facility typologies);*  *\* - Design strategies with evidence that contribute to users’ health and well-being (patients’ health, recovery, safety, satisfaction; staff’ work efficiency; etc.)* [16]. | |

2.2 A Semi-structured Interview

Research on post-occupancy evaluation of existing community-based healthcare facilities was conducted in Suzhou Industry Park (SIP). The semi-structured interview approach has been used to identify the design issues that are important to a community-based healthcare environment from a user’s perspective. Patients and medical staff are defined as the main users of a healthcare environment [17]. The interview was carried out with a small group of user representatives (sampling size: 10 patient interviewees and 10 staff interviewees). Interviewees were randomly selected from the current customers and workers of community-based healthcare facilities in SIP. They were asked to identify, without the researcher’s guidance, design issues that they considered important when they used community-based healthcare environment, by choosing the related items from the conceptual framework (Table 1).

2.3 A follow-up Survey and Questionnaire Design

The follow-up survey aimed to use questionnaires to identify the relative importance of the selected design issues. A five-point Likert-scale method was applied, and all respondents were asked to evaluate the items with the corresponding options shown in Fig.1. Convenience sampling method was used to recruit the respondents and, finally, 550 self-completed questionnaires were randomly collected from patients of 11 community-based healthcare facilities in SIP (Fig.2). Another 114 valid questionnaires were collected from medical staff who worked in these community-based healthcare faculties. There were, in total, 296 employees of these facilities and the response rate was 38.5%. The survey results could therefore represent the target population (i.e. patients and medical staff in community-based healthcare facilities) in SIP.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Not at all  Important  (1) | Slightly  Important  (2) | Moderately Important  (3) | Very  Important  (4) | Extremely Important  (5) |
|  |  |  |  |  |

**Fig. 1.** Five-point Likert scale method for rating of relative importance



**Fig. 2.** Community-based healthcare facilities for data collection (red dots highlight the residential communities where respondents live).

**3. Results**

3.1 Results of the interview

Table 2 shows the results of the semi-structured interview. Overall, 27 design issues were chosen by interviewees. These design issues can be considered as those relating to users’ satisfaction of the community-based healthcare environment in SIP. It can be seen that with the assistance of the conceptual framework, a close consensus on users’ needs between patient interviewees and staff interviewees can be achieved. Among the assessment criteria (Table 1), users of the healthcare environment paid more attention to the interior environment, accessibility and transport, and space. Using the results achieved from this interview and the conceptual framework as a checklist together, architects can more easily to locate the design strategies that relate to users’ satisfaction and needs for community-based healthcare environment.

3.2 Statistical results of data analysis

As shown in Table 3, the results of the statistical analysis indicate the relative importance of selected design issues from the interview by using mean values and ranks. As the data were not normally distributed, nonparametric statistical techniques, Mann-Whitney U Test and Wilcoxon Signed Rank Test, were used to identify the significant differences of users’ attitudes about these needs according to the related variables, including gender, age, facility location, and career [18-19].

Some results show that: 1) staff have higher demands about design quality of the surrounding environment, including greening and interior materials; 2) females would pay more attention to the planning and layout’s abilities for privacy protection and security than males; 3) aged people wish to improve the disable accessibility of facilities.

**Table 2** Results of the interview

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Code  (27) | Quantity of  patient interviewees | Quantity of  staff interviewees | Rate | Total | Rank |
| A.02 | 6/10 | 10/10 | 6:10 | 16 | 14 |
| A.03 | 10/10 | 10/10 | 10:10 | 20 | 1 |
| A.04 | 10/10 | 10/10 | 10:10 | 20 | 1 |
| B.01 | 9/10 | 10/10 | 9:10 | 19 | 6 |
| B.02 | 8/10 | 9/10 | 8:9 | 17 | 11 |
| B.03 | 8/10 | 8/10 | 8:8 | 16 | 14 |
| B.05 | 5/10 | 8/10 | 5:8 | 13 | 21 |
| C.01 | 10/10 | 10/10 | 10:10 | 20 | 1 |
| C.02 | 8/10 | 10/10 | 8:10 | 18 | 8 |
| C.03 | 7/10 | 10/10 | 7:10 | 17 | 11 |
| C.04 | 10/10 | 10/10 | 10:10 | 20 | 1 |
| C.05 | 9/10 | 9/10 | 9:9 | 18 | 8 |
| C.07 | 9/10 | 10/10 | 9:10 | 19 | 6 |
| C.08 | 4/10 | 9/10 | 4:9 | 13 | 21 |
| D.01 | 4/10 | 8/10 | 4:8 | 12 | 24 |
| D.04 | 5/10 | 6/10 | 5:6 | 11 | 25 |
| H.04 | 0/10 | 10/10 | 0:10 | 10 | 26 |
| H.05 | 6/10 | 9/10 | 6:9 | 15 | 19 |
| H.07 | 10/10 | 8/10 | 10:8 | 18 | 8 |
| I.01 | 7/10 | 10/10 | 7:10 | 17 | 11 |
| I.02 | 5/10 | 8/10 | 5:8 | 13 | 21 |
| I.05 | 8/10 | 8/10 | 8:8 | 16 | 14 |
| I.06 | 7/10 | 9/10 | 7:9 | 16 | 14 |
| J.03 | 10/10 | 10/10 | 10:10 | 20 | 1 |
| J.04 | 7/10 | 8/10 | 7:8 | 15 | 19 |
| J.05 | 8/10 | 8/10 | 8:8 | 16 | 14 |
| J.06 | 0/10 | 10/10 | 0:10 | 10 | 26 |

**4. Discussion**

The comparison between patient group and staff group shows that, in terms of users’ needs, only a general cognitive consensus can be achieved. Cognitive differences still exist in some strategies, affecting the holistic environmental satisfaction of users. On one hand, architects can use this information to choose design strategies for their design work and thereby to improve the design quality from a social perspective; on the other hand, they can think about how to balance these strategies in order to reduce cognitive conflicts that are caused by users’ different characteristics (e.g. gender, age, and career). Some solutions for specific groups’ needs (e.g. females, the elderly) are essential for such priority variances in the healthcare design. It is also important to note that the variable survey location caused a number of cognitive differences. As all current healthcare design regulations in China are designed for hospital-only or mixed use of general hospitals and community-based healthcare facilities (e.g. *Evaluation Standard for Green Hospital Building GB/T 51153*), architects have to identify information relating to community-based healthcare facility design in relatively short time. This finding shows that a design guidance for community-based healthcare environment would be advantageous.

**Table 3** Statistical results of data analysis

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Code | Mean value | |  | Rank | |  | Significant difference | | | | | | |
| (27) | Patient group | Staff group |  | Patient group | Staff group |  | Patients vs. Staff  (9) |  | Patient  group | | |  | Staff  group |
|  |  |  |  |  |  |  |  | Gender  (6) | Age  (7) | Location  (14) |  | Career  (4) |
| A.02 | 2.8855 | 3.2982 |  | 25 | 27 |  | \*\* |  | \* |  | \* |  |  |
| A.03 | 4.2491 | 4.1579 |  | 3 | 10 |  |  |  |  |  |  |  | \* |
| A.04 | 4.2236 | 4.3684 |  | 5 | 4 |  |  |  |  |  |  |  |  |
| B.01 | 4.0727 | 4.1228 |  | 11 | 11 |  |  |  |  | \* | \* |  |  |
| B.02 | 4.1382 | 4.2456 |  | 7 | 5 |  |  |  |  |  |  |  |  |
| B.03 | 4.0200 | 4.1930 |  | 13 | 7 |  |  |  |  | \* | \* |  |  |
| B.05 | 3.3418 | 3.5789 |  | 24 | 24 |  | \* |  | \* |  | \*\* |  |  |
| C.01 | 4.4745 | 4.4912 |  | 1 | 1 |  |  |  |  |  |  |  | \* |
| C.02 | 3.4618 | 3.3860 |  | 22 | 26 |  |  |  |  |  | \*\* |  |  |
| C.03 | 3.5782 | 3.4035 |  | 21 | 25 |  | \* |  | \* |  | \*\* |  |  |
| C.04 | 4.3345 | 4.2456 |  | 2 | 5 |  |  |  |  |  |  |  | \* |
| C.05 | 4.1182 | 4.1930 |  | 8 | 7 |  |  |  |  |  | \* |  |  |
| C.07 | 4.2400 | 4.4386 |  | 4 | 2 |  | \*\* |  |  |  | \*\* |  |  |
| C.08 | 3.7618 | 4.1053 |  | 19 | 13 |  | \*\* |  |  |  | \*\* |  |  |
| D.01 | 3.3945 | 3.8772 |  | 23 | 19 |  | \*\* |  |  |  | \*\* |  |  |
| D.04 | 3.8473 | 3.7895 |  | 17 | 21 |  |  |  |  |  | \* |  |  |
| H.04 | - | 4.1930 |  | - | 7 |  |  |  |  |  |  |  |  |
| H.05 | 3.9018 | 3.9298 |  | 16 | 17 |  |  |  |  |  |  |  |  |
| H.07 | 4.2109 | 4.4211 |  | 6 | 3 |  | \*\* |  | \*\* |  | \*\* |  |  |
| I.01 | 4.0782 | 3.9298 |  | 10 | 17 |  | \* |  |  | \* |  |  |  |
| I.02 | 4.0382 | 4.0702 |  | 12 | 15 |  |  |  |  | \* | \*\* |  |  |
| I.05 | 4.1073 | 4.1228 |  | 9 | 11 |  |  |  |  | \* |  |  |  |
| I.06 | 3.9982 | 3.8596 |  | 14 | 20 |  |  |  | \* | \* | \*\* |  |  |
| J.03 | 3.8236 | 3.6316 |  | 18 | 23 |  | \*\* |  |  | \* |  |  |  |
| J.04 | 3.7564 | 3.7544 |  | 20 | 22 |  |  |  |  |  |  |  |  |
| J.05 | 3.9436 | 4.1053 |  | 15 | 13 |  |  |  | \*\* |  |  |  |  |
| J.06 | - | 4.0526 |  | - | 16 |  |  |  |  |  |  |  | \* |

\*: significant difference at the p<.05 level; \*\*: significant difference at the p<.01 level

Some evidence-based design strategies that have been proven by previous research did not receive relatively good mean values or ranks in this study – for example, artwork for decoration (patient group: mean value 2.8855 and rank 25; staff group: mean value 3.2982 and rank 27), access to outdoor (patient group: mean value 3.5782 and rank 21); staff group: mean value 3.4035 and rank 25), good views (patient group: mean value 3.4618 and rank 22); staff group: mean value 3.3860 and rank 26). It implies that, currently, such academic information does not have a widespread understanding or consideration by users. They need some general education to help them find the links between their environmental satisfaction and the true needs – therapy and recovery. This gap will be further researched in future work. Moreover, according to the statistical results, some issues that are considered very important by respondents are not included in the Chinese mandatory healthcare design regulation *Evaluation Standard for Green Hospital Building GB/T 51153* – for example, “user’s dignity and privacy protection”, “safety-aided facilities” and “staff-only space”. To a certain extent, this result verifies that this design regulation pays more attention to ecosystem and resource utilization and its consideration about social aspects of sustainability should be enhanced in the near future [14].

**5. Conclusion**

This pilot study explored and identified the cognitive differences that may impact the holistic environmental satisfaction between the main users of healthcare environment – patients and staff. As a demonstration case, this research can serve as a model that is able to facilitate the user-centered participatory design in healthcare design decision-making and to improve the efficiency of communication and knowledge exchange. The results achieved in the research can also be used as evidence to inform community-based healthcare design. Architects can choose the appropriate design strategies in the conceptual framework with comprehensive consideration and improve the quality of their design work from a social perspective.

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