

Optimization of Integrated Medical and Elderly Care Spaces Based on Post-Occupancy Evaluation

Zhicheng Yao^{1*}, Zuzhan Chen¹, Cuiling Zong¹, Jiahe Li¹

¹ Solux College of Architecture and Design, University of South China, Hengyang, China

*Correspondence: Zhicheng Yao

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Abstract:

Since China entered an aging society in 2000, the issue of elderly care has become increasingly severe, and “integrated medical and elderly care” has emerged as a core direction in this field. However, existing integrated medical and elderly care facilities suffer from inefficient space utilization and inadequate age-friendliness. On the basis of a review of the connotation and influencing factors of post-occupancy evaluation (POE) of elderly care spaces, this study takes the “Shihe Nursing Home” in Hengyang as a case study. A Likert-scale questionnaire is used to collect data on importance and satisfaction from elderly residents and nursing staff regarding residential units, public activity spaces, medical rehabilitation spaces, and the courtyard environment. Combined with Importance-Performance Analysis (IPA), a POE framework is constructed from four dimensions: spatial distribution, spatial form, spatial organization, and spatial compounding. Key improvement elements are identified based on IPA, and spatial optimization strategies are proposed, aiming to accurately enhance the use efficiency and user experience of elderly care spaces and better meet the medical and care needs of the elderly.

Keywords:

Integrated Medical and Elderly Care, Elderly Care Space, Post-Occupancy Evaluation, Likert Scale, IPA

1. Introduction

Since China entered an aging society in 2000, the aging process has continuously accelerated. By the end of 2025, the national population aged 60 and above reached 323 million (23.0% of the total) [1], more than 75% of the elderly suffer from at least one chronic disease, and the number of disabled elderly exceeds 35 million. “Integrated medical and elderly care” has become a core policy direction, but existing facilities have low spatial efficiency: designs mostly follow general specifications and lack refined consideration of the physiological and psychological characteristics of the elderly; post-construction feedback from users is absent, resulting in unreasonable layouts and complex circulation. Post-Occupancy Evaluation (POE) can systematically assess built environments. Existing studies have established objective efficiency evaluation systems, but insufficient attention has been paid to users’ subjective perceptions. Taking the Shihe Nursing Home in Hengyang as an example,

this study employs the Likert scale and IPA to construct a POE framework, identify design shortcomings, and propose optimization strategies.

2. Theoretical Basis and Evaluation Framework

2.1. Spatial Characteristics of Integrated Medical and Elderly Care

Integrated medical and elderly care spaces must simultaneously accommodate medical and care functions. Core spaces include diagnosis/treatment, nursing, rehabilitation, public activity, and residential areas. The diagnosis/treatment area should be close to the entrance for emergency access; the nursing area should be centrally located to shorten service radii; the rehabilitation area should be adjacent to the public activity area to encourage active participation in recovery training; the residential area requires relative quietness and privacy, balancing medical accessibility with a homelike atmosphere. All functional zones should be organically integrated through accessible corridors, ensuring efficient and convenient medical processes while eliminating the “hospital feeling” and creating a warm, livable elderly care environment.

2.2. Dimensions of Post-Occupancy Evaluation (POE)

This study constructs a POE system from five dimensions: (1) spatial distribution (accessibility, number of POI choice opportunities); (2) spatial form (walking efficiency / average distance coefficient); (3) spatial organization (integration, proportion of circulation area); (4) spatial compounding (functional mix); (5) user satisfaction (comfort, safety, convenience, privacy). The first four dimensions represent objective performance, and the fifth dimension represents subjective experience, forming a dual-track evaluation system combining “objective + subjective” measures.

2.3. Importance-Performance Analysis (IPA)

IPA uses importance as the horizontal axis and satisfaction as the vertical axis, dividing the quadrants into four areas: Quadrant I (high-high) is the advantage zone; Quadrant II (low-high) indicates overprovision; Quadrant III (low-low) is low priority; Quadrant IV (high-low) is the key improvement zone.

3. Research Design

3.1. Research Object

This study selects the cooperation model of “elderly care facility integrated with medical functions” and takes the Shihe Nursing Home in Hengyang as an example. The service recipients include self-care, semi-self-care, and non-self-care elderly. Residential units (privacy, storage space), public activity spaces (social accessibility, seating comfort), medical rehabilitation spaces (circulation convenience, wheelchair turning space), and courtyard environment (accessible design, shading facilities) are examined.

3.2. Evaluation Objects

Based on the functional composition of integrated medical and elderly care spaces and relevant POE studies, the evaluation objects are divided into four categories:

residential units, public activity spaces, medical rehabilitation spaces, and the courtyard environment. For residential units, the degree of demand for privacy and storage space reflects the livability and psychological security of the space. For public activity spaces, a social accessibility indicator is proposed, and the willingness of the elderly to interact is characterized by seating comfort and spatial brightness. For medical rehabilitation spaces, indicators of circulation convenience and wheelchair turning space measure the medical support capability for assisted and bedridden elderly, while equipment completeness reflects rehabilitation service levels. For the courtyard environment, accessible design and shading facilities are used to evaluate spatial comfort and age-friendliness.

3.3. Data Collection

A five-point Likert scale (1 = very unimportant/very dissatisfied, 5 = very important/very satisfied) was designed for the four categories of evaluation objects, comprising 22 items. 80 questionnaires were distributed, and 72 valid responses were returned (32 from elderly residents, 40 from nursing staff), with a response rate of 90%. The Cronbach's α coefficients were 0.874 (importance) and 0.861 (satisfaction), indicating good reliability.

The number of public service resources accessible from the elderly care facility can be used to evaluate the convenience of facility layout and the fairness of spatial distribution. This study uses the Baidu Maps API to obtain POI data. The Shihe Nursing Home was set as the starting point, and based on the walking characteristics of the elderly (statistics of the number of medical facilities, parks/squares, and community centers within a 2 km radius), a larger number of POI choice opportunities indicates richer options for daily medical treatment, leisure, and community services, and thus a better locational advantage of the facility.

3.4. Analytical Methods

Descriptive statistics: means and standard deviations of each item were calculated, and reliability and validity were tested (Cronbach's α). IPA analysis: the overall mean importance of all items was used as the horizontal-axis dividing line, and the overall mean satisfaction as the vertical-axis dividing line, to draw a four-quadrant map and identify key shortcomings with "high importance – low satisfaction." Walking efficiency: taking the center of the public activity hall as the reference point, the shortest path distance to the entrance (or center) of each functional space was measured, and the average distance coefficient ($c_d = \bar{d}/n$) was calculated. Proportion of circulation area: circulation area (corridor area) divided by the ground floor built area, used to evaluate spatial compactness.

These methods form a dual-track analysis system of "objective indicators + subjective evaluation" to ensure the comprehensiveness and accuracy of the evaluation results.

4. Empirical Analysis

4.1. Spatial Distribution Evaluation

Taking the nursing home as the starting point, the number of medical facilities, parks/squares, and community centers within a 2 km walking radius was counted. The results show only 5 effective choice opportunities: two community health service

centers and three community service stations. The nearest large general hospital (the Second Affiliated Hospital of the University of South China) is about 8 km away, beyond walking distance; no parks or squares are accessible. Thus, the external resource support of the facility is weak. The elderly mainly rely on internal spaces for daily medical treatment and outdoor leisure, and the locational conditions impose certain constraints on space use efficiency.

4.2. Spatial Form and Organization Evaluation

Average distance coefficient: taking the center of the public activity hall as the reference point, the shortest path to the entrance of each functional space was measured. There are 9 functional spaces in total, with a total distance of 134.4 m and an average distance $\bar{d} = 14.9\text{m}$. The average distance coefficient $c_d = 1.49$. This value is higher than the 0.60 reported for efficient facilities in Lei Yue et al.'s study [1], indicating that the walking efficiency of the elderly traveling from the activity center to medical rehabilitation and residential units is low.

Spatial integration: Depthmap was used to calculate convex space integration. The public activity hall has the highest integration, followed by the nurse station and rehabilitation training room, while the farthest residential units (fourth floor) have relatively low integration [2]. The floor distribution results in significantly weaker medical accessibility for upper-floor residential units compared to the ground floor, affecting the ability of semi-disabled elderly to independently access medical spaces.

Proportion of circulation area: The total built area is 4000 m², including 3200 m² above ground (4 floors) and 800 m² underground (1 floor). Based on measurements, the total circulation corridor area across floors is about 320 m² (corridor widths varying from 1.8 to 2.4 m, with two stairwells and one medical elevator in the core area), accounting for approximately 10.0%. This value is lower than the recommended optimal value (15%), but the corridors are U-shaped, and some dead-end corridors cause path backtracking, indicating room for improvement in space utilization.

4.3. IPA Results: Key Shortcomings

The overall mean importance from the 72 questionnaires was 4.12, and the overall mean satisfaction was 3.35. The key shortcomings (falling into Quadrant IV, “high importance – low satisfaction”) for the four space categories are summarized in Table 1. All other elements fell into Quadrants I, II, or III and are not priority improvement items.

Table 1. IPA key shortcomings for the four space categories.

Space Category	Key Shortcoming Factors	Importance Mean	Satisfaction Mean
Residential unit	Privacy, storage space	4.65	2.85
Public activity space	Social accessibility, seating comfort	4.48	2.76
Medical rehabilitation space	Circulation convenience, wheelchair turning space	4.72	2.68
Courtyard environment	Accessible design, shading facilities	4.60	2.73

Circulation convenience in medical rehabilitation spaces has the highest importance (4.72) and the lowest satisfaction (2.68), making it the most urgent improvement item. Privacy in residential units (4.65 / 2.85) reflects issues such as only curtain partitions

in multi-bed rooms and high frequency of night care. Accessible design in the courtyard environment (4.60 / 2.73) reflects inadequate age-friendliness of outdoor spaces.

The comprehensive diagnosis is that all four space categories have key shortcomings characterized by “high importance – low satisfaction,” requiring priority optimization. Among these, medical rehabilitation spaces should be the focus of renovation.

4.4. Spatial Optimization Strategies

Based on the key shortcomings identified through empirical analysis, the following five spatial optimization strategies are proposed.

Layout optimization: Adopt atrium-style or “回”-shaped floor plans. Locate medical rehabilitation areas on the ground floor near the entrance [3]. Design circular nursing paths to avoid dead ends. Circulation optimization: Keep circulation area proportion $\leq 15\%$. Combine corridors with public spaces. Add resting seats at corners. Functional compounding: Integrate dining, rehabilitation, socializing, and recreation in the public hall. Provide flexible “ambiguous spaces” of 20–30 m² for interchangeable functions. Healing environment: Use natural lighting, warm color tones, wooden floors, and greenery. Create a five-sense experience (aromatic plants, water features, soft light, skin-friendly materials). Intelligent assistance: Install emergency call systems, smart mattress monitors, and night floor lights (2700K, $\leq 5\text{lx}$) [4].

The coordinated implementation of these five strategies can systematically improve the use efficiency and living quality of integrated medical and elderly care spaces.

5. Conclusions

Taking the Shihe Nursing Home in Hengyang as an example, this study constructed a Post-Occupancy Evaluation (POE) framework using the Likert scale and IPA, combined with empirical analysis from the five dimensions of spatial distribution [5], spatial form, spatial organization, spatial compounding, and user satisfaction. The following conclusions are drawn.

First, the combined application of the Likert scale and IPA can effectively identify design shortcomings in integrated medical and elderly care spaces. By simultaneously measuring users’ importance and satisfaction with spatial elements, each element can be positioned in the four quadrants, precisely identifying key improvement items with “high importance – low satisfaction” and providing clear targets for optimization.

Second, spatial use efficiency is significantly positively correlated with functional compounding, circulation compactness, and atrium-style layouts. Empirical results show that facilities with highly functionalized public halls, circulation area controlled within 15%, and “回”-shaped or atrium-style floor plans exhibit better average distance coefficients and integration than those with dead-end layouts, achieving higher efficiency.

Third, spatial optimization needs to balance medical function efficiency with residential living experience. Overemphasizing medical efficiency tends to produce “hospitalized” spaces, neglecting the psychological needs of the elderly for privacy, social interaction, and a homelike atmosphere. Conversely, excessive pursuit of residential comfort may lead to lengthy medical circulation and delayed emergency

response. Optimization strategies should, under the premise of ensuring medical convenience, achieve a balance between efficiency and experience through modular residential units, compounded public spaces, healing environments, and intelligent assistance.

Limitations: This study is a single-case exploration with a limited sample size and does not distinguish differences among elderly with varying self-care abilities. Future research could expand to multiple types and regions of elderly care facilities and conduct post-renovation evaluations to validate the effectiveness of the strategies.

In conclusion, the POE method provides a scientific basis for precise optimization of integrated medical and elderly care spaces, and its findings offer reference value for both renovation of existing facilities and design of new projects.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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References

- [1] Lei, Y.; Long, H. A study on spatial use efficiency of integrated medical and elderly care facilities in existing communities: post-occupancy evaluation of three facilities in Chengdu. *Architectural Journal*, 2021.
- [2] Yang, Y.Z. Optimization design of medical and elderly care spaces based on physical functions and disease characteristics of the elderly. *Design Horizon*, 2025.
- [3] Chen, Z.; Chen, G.R. Spatial typologies and adaptive development of integrated medical and elderly care facilities. *Architectural Journal*, 2018.
- [4] Martilla, J.A, James J C. Importance-Performance Analysis. *Journal of Marketing*, 1977, 41(1), 77-79.
- [5] Zhou, Y.M. Detailed Design of Elderly Care Facilities. Beijing: China Architecture & Building Press, 2018.



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