

# How to Improve the Performance of Elderly Care facility Embedded in Communities? —Case Study from Two Districts of Hangzhou, China

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**Abstract.** China's population is ageing, and urban centres have high densities of older people. The Zhejiang Provincial Government has proposed that 'institutions should follow the elderly', requiring that not only the number of beds per 1,000 elderly persons should be counted, but also the distance between the facilities and the homes of the elderly should be taken into account. Applying both the new supply capacity calculations and the old calculations shows that the number of beds in elderly care facility (ECF) in Up-town District is well below the planning requirements. However, the occupancy data collected from the actual research shows that there are many elderly care facilities with a certain percentage of vacancies. This paper provides a comprehensive assessment of six of these facilities and finds that facility location, space quality, and quality of operational services, all affect occupancy rates. The study reminds the government to pay attention not only to the location of facilities, but also to the service quality of existing facilities. Finally, two dimensions of coping strategies are proposed.

**Keywords:** Elderly facility; Occupancy rate; Accessibility; Catchment Areas Analysis

## 1. Introduction

In recent years, the topic of how elderly care facilities are supplied has received unprecedented attention. The latest policy in Zhejiang Province suggests that the provision of elderly care facilities requires not only the control of the total number of beds, but also the consideration of accessibility (the proximity of space to the original home).

Due to the government's emphasis on the construction of bed targets and the tight land use for urban construction, a large number of large-scale elderly care facilities are actually built in suburban areas. In our 19-year research [1], half of the 18 Community Aged Care Facilities (CACF) surveyed had both daycare and short- and medium-term residents. And numerous studies have shown that in areas where it is difficult to find a bed in ECF and where the conflict between supply and demand is prominent, there is still a high vacancy rate in the ECF. All these phenomena show a trend that elderly people prefer to age in place close to their own community and do not want to go to more distant ECFs. The theoretical background of this phenomenon stems from ageing in place and active ageing.

This is why the policy of 'institutions following the elderly' will be introduced in 2021. Originally, there were two types of facilities: daycare services in CACFs and ECFs (very sophisticated ECFs), with CACFs built close to the community, and ECFs usually set up one in each district. Now, they are being integrated into embedded elderly care facilities (embedded -ECF), which are embedded in the community.

In this context, the rationality of the allocation of embedded ECFs is an important research issue. Based on statistical data and field survey data, this paper discusses two issues, the first is the rationality of the allocation of ECFs, and the second is the occupancy rate of beds in ECFs.

Therefore, the methodology of this paper is divided into two parts, the first part is to calculate the theoretical value of the relationship between supply and demand of ECFs. The second part is to understand the real supply and demand relationship through field survey and explain the reasons for the deviation between the theoretical and actual values. Finally, the strategy is proposed.

## 2. Evaluation of the Allocation of ECFs Based on "Capacity and Location"

### 2.1 Data Acquisition

The data of the ECFs come from the Hangzhou Data Open Platform and combined with the data of the Hangzhou Civil Affairs Department. The data are cleaned to retain valid data such as facility name, location, and number of beds, and then the location information is transformed into geographic coordinates. The process of obtaining data on the elderly population at the sub-district level is more complicated. The data from the Seventh Population Census in 2020 only disclosed data on the elderly population at the district level, and at the sub-district level only the 2010 census data was provided. Therefore, the current sub-district -level elderly population aged 60 years and above was estimated through the following four sources: the natural growth model [2] , combined with data from the Hangzhou Annual Statistical Yearbook, the Hangzhou Elderly Services Statistical Bulletin, and 2010 sub-district-level elderly population data.

### 2.2 Statistical Data Algorithm and Analysis Eesults

By district level, based on the 2020 policy target of 40 beds per 1,000 population. As shown in Table 2-1, Up-town District clearly falls short of the target, while the Riverside District meets it. The calculations by sub-district level are the same for Up-town District as they are by district, and different for Riverside District. Every sub-district in the Up-town District has a shortage of beds and there is a huge difference between sub-districts; Two sub-districts in the Riverside District have a shortage of beds and one sub-district has a significant surplus of beds. There is one ECF in Riverside District that is so large that it inflates the supply of the entire district and masks the supply and demand of the actual sub-district. It shows that the calculation according to the proportional method of statistical data has different results depending on the resolution of the analysed object.

Table2- 1 The Gap of Beds in District and Subdistrict Elderly Care Facilities

	Name	Capacity (bed)	Elderly Population (people)	Value (bed/1000 people)	Actual Demand (bed)	Bed Gap (bed)
Up-town District	Hubin	0	8804	0	352	352
	Qingbo	0	8057	0	322	322
	Xiaoying	251	23280	10.8	931	680
	Wangjiang	78	17370	4.5	695	617
	Ziyang	704	18159	39	726	22
	Nanxing	54	9144	6	366	312
Sum		1087	84814	13	3393	2306
Riverside District	Puyan	16	9373	2	375	359
	Changhe	1480	9400	157	376	-1104
	Xixing	31	6354	5	254	223
Sum		1527	25127	61	1006	-521

### 2.3 Service Radius Algorithm and Analysis Results

Simple Catchment Areas Analysis (SimCA) calculates catchment areas from simple buffers, walk or drive times to the location, and even mobility pattern data to paint a vivid picture of where people are accessing the facility from. It gets a picture of the area that is served, and the area that is not. As shown in Figure 2-1, a threshold distance of 1800 metres was used for this calculation. The results show that for distance, 56.1 % of Up-town District meets the standard, while only 9.1 % of Riverside District meets the standard. The results of this analysis are opposite to those of the traditional scaling method. The reason behind this is that they reflect problems in two separate categories of ECF supply. Older urban areas tend to suffer from inadequate supply, while suburban areas suffer from a substandard service radius.

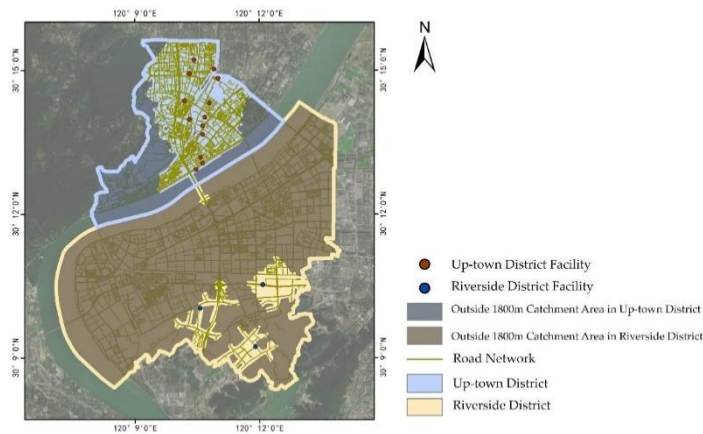


Figure2- 1 SimCA Analysis Results for 1800m Catchment

### 3. Facility Survey and Space Review

In the previous section two districts with huge differences in population density were selected for the assessment of the allocation and configuration of ECFs. The analysis found that the main problem in Up-town District is the insufficient supply of beds, and the main problem in Riverside District is that the distance between facilities is too large, or the total number of facilities is too small, which are the dominant problems faced by urban and suburban, respectively. Logically, the problems in suburban are more difficult to resolve at the implementation level, but their causes are simple and do not need to be explored further. In contrast, the problem in urban is more complex, and theoretically the occupancy rate of bed-constrained facilities in Up-town District should be high. This section therefore focuses on a detailed review of the facility situation.

#### 3.1 Research Conception and Case Selection

In order to understand the facility's architectural space, location, operations management and services, and the needs of the elderly in the neighbourhood, this research survey was divided into three phases. The first stage is to conduct a preliminary census to judge the feasibility of the research on 13 ECFs in Up-town District of Hangzhou. In the second stage, 13 facilities were numbered as Y1, Y2, B1, B2, B3, B4, B5, B6, J1, J2, J3, J4, J5. Then exclude some ECFs that have recently been in the process of renovation and upgrading, relocated, ceased operations, and do not exist in reality. Due to the large amount of research effort required for structured interviews, six ECFs were selected for census in this paper. The third stage is to select from the analysis of the results of the census, the facilities with dissatisfied occupancy rates to conduct questionnaires to the neighbouring residents interviews with neighbouring residents to conduct an in-depth investigation into the reasons for occupancy rate dissatisfaction.

#### 3.2 A review on the Space of ECFs

##### 3.2.1 Composition of Influencing Factors and Measurement Methods

Factors affecting the utilisation rate of facilities include the attractiveness of the facilities and the external environmental factors of the facilities. The attractiveness of the facility, which includes service content, operational management and spatial quality, is more widely recognised by academics, while the influence of external environmental factors, which include the facility's peripheral accessibility, walkability and proximity to healthcare resources, has not yet been confirmed by sufficient empirical research.

Since this paper is based on the study of allocation and space, it is subdivided into the facility architectural space and the facility location factors, while the service content, operation and management are combined into one dimension for analysis. It will be divided into three dimensions,

and they will be measured quantitatively through the scoring method, as shown in Table 3-1. The ECFs were scored through the research, with 1 being the worst, 2 being worse, 3 being average, 4 being better, and 5 being the best.

Table3- 1 Evaluation Index and Factor Source

Dimension	Sub-index	Factor Source
1. Facility Location	1.1Near Hospital	(GAO Xiao-lu[3], 2013) ; (SONG Shan, et al [4], 2016) ; (Ward Thompson C, et al[5]. 2014); (HUANG Yi, et al [6], 2018)
	1.2Number of Surrounding Residents	Customize after research
	1.3Located in the Community/Along the City Road	(Handy,S.L. et al[7],2008) ; (Rosso,A.L[8],2011)
	1.4Walkability Around 20m	Jack L Nasar et al[9].,2007
	1.5Tours are available around 200m	(DAI Wei, et al, 2012);(Chen,Y.J.,et al, 2015) ; (YU Yifan, et al [10],2017)
2. Architectural Space	2.1The Identifiability of Building Entrances	Customize after research
	2.2Integral Lighting	Customize after research
	2.3Accessibility	DAI Wei, et al, 2012
	2.4Indoor Public Leisure Space	(DAI Wei, et al [11], 2012) ; (SONG Wan-ting, et al [12], 2021) ; (JI Feixia, et al [13], 2021)
	2.5Outdoor Public Leisure Space	(DAI Wei, et al, 2012) ; (SONG Wan-ting, et al, 2021) ; (JI Feixia, et al, 2021)
	2.6Scale of Building	JI Feixia, et al, 2021
3.Service Content , Operation and Management	3.1Price	(DAI Wei, et al, 2012) ; (GAO Xiao-lu, 2013) ; (SONG Shan, et al, 2016)
	3.2Medical and Nursing Service	(Baosheng Zhu, et al [14], 2018) ; (JI Feixia, et al, 2021) ; (GAO Xiao-lu, 2013)
	3.3 The Charisma of the Care Team	(DAI Wei, et al, 2012) ; (SONG Shan, et al, 2016)
	3.4Closed Management or not	Customize after research
	3.5Group Scale	SONG Wan-ting, et al, 2021
	3.6Linkage or not	Customize after research

### 3.2.2 The Results of Assessment

Several of these indicators need to be explained. Too large or too small a facility is not conducive to efficient operation, and social news has shown that ECFs with a scale size of 50-80 beds are the most efficient to operate. Proximity to hospitals looks at whether the elderly can be rescued in the event of an emergency, so proximity to three hospitals is best. Located in a small neighbourhood/alongside a city road examines how easy it is for the facility to be found.

Table3- 2 Facility Space Characteristics Evaluation Form

Dimension	Sub-index	Y1	B1	B2	B3	J1	J2
1. Facility Location	1.1Near Hospital	1	3	5	1	5	3
	1.2Number of Surrounding Residents	3	5	5	3	1	3
	1.3Located in the Community/Along the City Road	4	2	3	1	3	2
	1.4Walkability Around 20m	3	5	5	1	2	2
	1.5Tours are available around 200m	1	3	5	4	3	3

2. Architectural Space	2.1The Identifiability of Building Entrances	5	3	4	1	4	3
	2.2Integral Lighting	5	2	3	3	4	4
	2.3Accessibility	5	3	4	3	3	4
	2.4Indoor Public Leisure Space	5	3	2	2	4	1
	2.5Outdoor Public Leisure Space	5	3	2	2	4	1
	2.6Scale of Building	1	2	2	2	1	4
3.Service Content , Operation and Management	3.1Price	1	3	3	4	2	3
	3.2Medical and Nursing Service	5	1	1	1	3	1
	3.3 The Charisma of the Care Team	5	3	5	4	3	2
	3.4Closed Management or not	1	1	4	5	3	1
	3.5Group Scale	5	2	1	1	4	3
	3.6Linkage or not	3	5	5	5	1	1
Gross Score		58	44	59	43	50	41

## 4. Explanation of Facility Occupancy Rates

### 4.1 General Findings From the Facility Survey

#### 4.1.1 The Gap Between Statistics and Reality

As a result of the survey, it was found that there is a large discrepancy between the statistics on ECFs and actual operation. It shows that there are a lot of results from geography and planning studies on the allocation of ECFs, based on basic data that may be problematic.

In this paper, two kinds of data are used for ECFs. Both data have coordinate point information, when processing data, if the name and coordinate point are consistent, only one place is selected; If the information of coordinate points is inconsistent, take the union. After investigation, there are actually three kinds of errors in the information of 13 ECFs. First, two ECFs with different names are actually in one facility, such as B6 and J5. The location of the facility is within a facility, and the data coordinate points and the number of beds given are not the same. This is especially complicated in practice, and the data is even more confusing. Second, there are facility allocations in the data set, but there are no facilities at all when you actually look for them, such as B5. Third, the number of beds obtained from the actual investigation is inconsistent with the number of beds reported by the nursing institutions.

#### 4.1.2 Insufficient Supply Still Exists Vacancy Rate

Up-town District is theoretically in short supply of facilities, and every facility has a waiting list of seniors. According to the interviews with facility managers, the vacancy rate of 4 of the 6 facilities exceeds 50%, and the vacancy rate is severe when demand exceeds supply.

Table4- 1 Basic Information of Facilities Table 1

Number	Registered bed (bed)	Actual bed (bed)	Actual occupancy (people)	Occupancy Rate	Queue occupancy (people)
Y1	189	224	97	43.30%	0
B1	32	32	10	31.25%	0
B2	20	14	14	100%	2-3
B3	24	21	9	42.85%	0
J1	202	181	112	61.87%	0
J2	94	88	40	45.45%	0

#### 4.1.3 Facilities are Isolated Outside the Community

Through the structural interviews with facility managers and the understanding of facility location, it is found that the overall embedding of facilities into the community is not complete. Facilities are only geographically embedded in the community, while service content and space are not fully extended to the community. The management of facilities often adopts closed management, restricting the free access of the elderly to the ECF, on the one hand, for the convenience of management, on the other hand, it is more efficient to ensure the safety of the elderly.

Table4- 2 The Current State of the Facility Embedded in the Community

Number	Management Mode	Positional Embedding	Service Opening	Space-sharing
Y1	Minimalliberty	Yes	No	No
B1	Complete Closure	Yes	No	No
B2	High Degree of Freedom	Yes	No	No
B3	Complete Freedom	Yes	No	No
J1	Minimalliberty	Yes	No	No
J2	Complete Closure	Yes	No	No

## 4.2 Explanation of Occupancy Rates

### 4.2.1 By Chance

According to interviews with facility managers, the low occupancy rate at some facilities is due to chance. For example, the price of Y1 facilities is 3 to 4 times higher than other ECFs, and the high standard of construction of the facilities is to cater to high net worth clients, and high net worth people are a minority group. As a result, the facility has a high rating and low facility occupancy.

For example, B1 with low occupancy due to epidemic factors. Judging from the scoring results, B1, B3 and J2 facilities are all between 40-45 points, which belongs to the same level. The same quality of supply theoretically corresponds to the same level of occupancy, and the occupancy rate of B1 facilities is much lower than that of B3 and J2 facilities. The manager of the facility told that the occupancy rate of the facility was not always so low, but because of the epidemic, many elderly people did not survive the epidemic, so the occupancy rate dropped.

Table4- 3 Facility Evaluation and Occupancy

Name	Occupancy Rate	Location	Sub-Index Space	Operation	Gross Score	Note
B1	31.25%	18	16	15	43	Accidental Phenomena
B3	42.30%	10	13	14	43	Location Restriction
Y1	43.30%	12	26	20	58	Exorbitant Prices
J2	45.45%	13	17	11	41	
J1	61.87%	14	20	16	50	
B2	100%	23	17	19	59	

### 4.2.2 The Impact of Facility Supply Quality: Architectural Space

The J1 facility has the highest architectural space score except for the Y1 facility, and its better architectural space is the facility's advantage, making an important contribution to its higher occupancy rate. In the dimension of architectural space, J1 facilities have four advantages: building entrance, overall ventilation and lighting, indoor leisure space and outdoor leisure space.

Moreover, through the interviews with the informed residents of the six facilities, it is found that 70-80% of the elderly living in ECFs are self-care and assisted elderly, and these elderly people are extremely eager for public space. The interview question of 6 facilities "Which space do the elderly

most like to be in and where do they like to be indoors?" What's your favorite place outside?" It is found that unless the weather is bad, the elderly like to go to the outdoor site of the building for a walk, and the indoor activity room with TV set and mahjong room are the most popular.

#### 4.2.3 The Impact of Facility Supply Quality: Facility Location

B3 affects the supply quality due to the restriction of location, and low quality leads to land occupancy rate. The location of B3 facilities shows that the area is surrounded by railways and high-grade roads, forming a closed triangle, and it is difficult for the elderly to go out of the area. During the investigation, it was found that the facility was indeed difficult to find. This also points to a very key principle of site selection. Under the premise that the distribution calculation method of urban planning public facilities has not reached the fine calculation, some public facilities located in inaccessible areas will mislead the decision-making.



Figure4- 1 B3 Facility Location

It can be seen from the rating table that the facility location score of B2 facility is the best among the 6 facilities, and a good location provides certain competitiveness for the facility. B2 facilities have the following four advantages: there is a hospital nearby; There's a lot of demand from the surrounding residents; Walkability within 20m; Tours are available within 200m .

#### 4.2.4 The Impact of Facility Supply Quality: Medical Care Services

First of all, there is a lack of overall medical care services in ECFs. Only 2 of the 6 facilities have medical and nursing services, of which the Y1 facility has a more specialized nursing and a rehabilitation , and the J2 facility has a small clinic. Other facilities do not contain medical care related services but have medical care related building functions. B2 and B3 facilities are equipped with simple auxiliary instruments for the elderly. B1, B2 facilities community hospitals will do door-to-door inspection, Y1 facilities have famous doctors regularly.

Secondly, among the institutional needs of the elderly, the need for medical care is particularly important. A structural interview was conducted with the surrounding residents to try to find out the factors, willingness and attitude of the elderly to stay in ECF. A total of 24 questionnaires were received. As shown in Table 4-4, the results of the question "What do you value most if you want to live in a nursing home?" show that the elderly attach more importance to medical care services. At the same time, in response to the question "If you have long-term (more than three months) care/rehabilitation needs, which of the following options will you choose?" Go to a nearby 3A hospital/ Go to a ECF closer to home /Employ helpers to take care of the home/live with children, let children take care of/other, please add "" Go to a nearby 3A hospital" the most options.

Table4- 4 Results of Interviews with Residents Around the Facilities

Option	Synthesis Score	First	Second	Thirdly	Sum
Rehabilitation nursing	2.38	10 (41.7%)	13 (54.2%)	1 (4.2%)	24
Near Home	2.13	11 (45.8%)	5 (20.8%)	8 (33.3%)	24
Cost Effective	1.5	3 (12.5%)	6 (25%)	15 (62.5%)	24

However, medical and nursing services have two dilemmas. First, there are few professional nursing and rehabilitation services in public and private facilities (such as J1, which has but is not professional). In particular, old residential areas are transformed into ECFs, which are small in size and precious in elderly care rooms, making it difficult to guarantee complex medical functions. Second, the construction and operation cost of civil and private facilities is huge, the charging standard is high, and the medical fees such as nursing and rehabilitation are strictly controlled by the state, coupled with the pressure of medical insurance, the operation of medical and nursing services is difficult, and the occupancy rate is low (such as Y1). This makes it difficult for existing ECFs to meet the needs of the elderly, and the facilities that can meet the needs face operational difficulties.

## 5. The Coping Strategies of Facilities From "Embedding" to "Integration"

### 5.1 Architectural Design: Open Medical Care and Leisure Space

The medical care service function and leisure space of the facility are extended to the community. On the one hand, the surrounding elderly can enjoy scarce medical care resources as a supplement to the community and home care facilities. On the other hand, more users are attracted, profits are generated, and the operation dilemma of the ECF is difficult to maintain is broken.

The Y1 facility service functions are located on several floors, where 7F is medical rehabilitation center and the top floor is a roof garden. Therefore, the entire floor of the 7F medical rehabilitation center and the top garden can be opened to the community residents. The J1 facility has an outdoor leisure space rich in landscape resources, and the medical and nursing service function is set on the first floor near the gate. Therefore, a door can be set up between the function of medical care and other functions to separate it for convenient management. Outdoor leisure Spaces are also open.

### 5.2 Operation Management: Learn From the Experience of CACF

For the closed management of facilities, the main challenges that are not truly embedded in the community come from three aspects: the design of facility functions, the guidance of residents' opinions, and the expansion of service objects [15] . In order to open and extend to the community, we can learn from the experience of CACFs. On the one hand, the purpose of opening up is to better serve the community residents and maximize the utilization of resources; on the other hand, it is to increase more income and reduce the pressure of organization operation.

First of all, in the process of "integration", ECFs should integrate the investigation of residents' opinions into the project transformation planning stage. Secondly, the construction experience of multiple facilities shows that strengthening the "home-based" and "de-institutionalized" atmosphere of ECFs allows the elderly and residents in the community to have a sense of psychological identity and acceptance. Finally, in order to increase revenue, facility operators can also actively try to change the business strategy and expand the scope of services, in order to improve the utilization rate of facilities and the sustainability of operations.



## 6. Summary

Based on the new requirements, this paper evaluates ECFs in the downtown area of Hangzhou. In order to maximize the utilization of resources and improve the utilization rate of ECFs, under the new trend of advocating the embedded -ECF into communities, the current situation of architectural space, facility location, operation management and service of ECFs are investigated and analyzed.

In addition to the three general findings, the results also show that the quality of facility supply has an important impact on the utilization rate of facilities, including three aspects: architectural space, facility location, operation management and service. At the same time, this also needs more empirical research verification. Finally, this paper expounds the coping strategies of the embedded -ECFs based on community integration in architectural design and operation management, in order to provide references for the embedded -ECFs to better integrate into the community.

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