

# Architectural Types of Residential Unit in Nursing Homes

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## Abstract

The residential unit, in which the elderly spends most of their time, is an essential component of a nursing home. In order for a nursing home to provide comfortable environment and good architectural appearances, it is mandatory to have well-designed residential units. We undertook this study to define prototypes of residential units and compare their characteristics. We identified the concept of residential unit and analyzed 67 cases of residential units from 62 nursing homes in four different countries (Korea, Japan, U.S., and the U.K). We then classified architectural prototypes of the residential unit into 12 groups based on the shape and function of corridors. Finally, architectural characteristics were compared analytically in terms of such factors as the number of residents per unit, the number of residents per bedroom, the residential unit area per bed, and the proportion of the bedroom area to the unit area. This work may serve as a knowledge base in designing future nursing homes and contribute to the establishment of a standard guideline for nursing home design.

**Keywords:** elderly care facility; nursing home; residential unit; prototype; corridor; shape

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## 1. Introduction

### 1.1 Background and Purpose of the Study

With the rapid growth of very old population, the need for nursing homes for frail older people also increases rapidly. A good plan for future nursing homes is therefore necessary. A good plan will not only lower the financial burden on National Welfare, but also improve life quality of a number of elderly people. Of various spatial components of a nursing home, the residential unit stands out for its importance. It is the place where the elderly spends most of their time and it occupies over half of the entire nursing home area. Therefore, the residential unit is important in terms of function as well as architectural form. Notwithstanding, the concept of the residential unit has not been defined clearly and, in a number of cases, the composition of the residential unit is not appropriate from the point of function and scale. For example, in an over-sized residential unit, the image of interior/exterior of the facility does not look familiar and its boundary tends to be far beyond the mental and/or physical scopes of disabled older people, causing unnecessary circulation of the care staff. In contrast, an extremely small scaled residential unit causes such problems as inefficient management of the facility and limits activities of older people.

Considering these factors, the concept of the residential unit in a nursing home will be defined and basic types of available residential units in architectural design will be identified in this study. By delineating the characteristics of architectural types of residential units, this study is expected to serve as the groundwork for future architectural plans for nursing homes and promote additional studies on this matter.

### 1.2 Content and Method of the Study

This study was based on the residential units of nursing homes in Korea, Japan, U.S., and U.K., which have been built since 1986. These countries were chosen because they had large elderly populations and had undergone many trial-and-errors with respect to elderly care facilities. We also considered the factors that the data on the nursing homes of these four countries could be easily collected and translated, and that elderly welfare systems in these countries were relatively well-developed.

For the analysis of the residential units, 67 architectural floor plans in 62 facilities were collected. The information about architectural floor plans was obtained from periodicals of Korean architectural academy, dissertations, other related architectural drawings, and books on nursing homes as well as by visiting nursing homes. The summary of the annual and regional distribution of analyzed facilities is shown in Table 1. Table 2 shows the outline of the entire facilities analyzed in this study. Excel program of Microsoft Inc. was used for statistical analysis of collected data.

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(Received November 5, 2004 ; accepted March 15, 2005)

Table 1. Distribution of Analyzed Facilities

Country year of opening	Korea	Japan	U.S.	U.K.	Total
1986-1990		1	2	2	5
1991-1995	2	6	5	3	16
1996-2000	7	14	6		27
2001-	7	5	2		14
Total	16	26	15	5	62

## 2. Theoretical Consideration

### 2.1. Definition of the terminology

#### 2.1.1. Nursing Home

A nursing home of Korea belongs to the Elderly Care Facility regulated by the National Elderly Welfare Laws and is defined as “a facility where older people suffering from dementia or paralysis are admitted to get services such as meals, rest and nursing care or other necessary conveniences for daily life free of charge or at a low-charged fee.”<sup>1</sup> On the other hand, a full-fee charging nursing home is “a facility where older people suffering from dementia or paralysis are admitted to get services such as meals, rest and nursing care or other necessary conveniences for daily life and is managed with full payment from elderly residents who are admitted”, and classified differently from the nursing home in the terms of payment.

In this study, the term of ‘nursing home’ includes charge-free, low-fee charging and full-fee charging facilities. The condition and terms of nursing home vary considerably across different countries. It is difficult to define exactly ‘nursing homes’ of Japan, U.S. and the U.K. in a manner similar to Korean nursing home. If the nursing homes of the three countries are defined as that of Korea, it refers to a special elderly care facility or an elderly medical facility in Japan and “Nursing home” in the U.S and the U.K.

#### 2.1.2 Residential Unit

A residential unit refers to a fundamental living unit of a nursing home where older people can spend their daily lives on their own. A basic residential unit consists of a bedroom, a day (living) room, a bathroom, corridors and a restaurant, and some other functional spaces can be added or eliminated depending on the situation. A residential unit greatly influences the care environment for the elderly since it is a place where the residents spend most of their time, and get rests and recuperation services. Moreover, on average, the size of the residential unit occupies 64%<sup>2</sup> of the total nursing home area. It is therefore a major factor in the composition of architectural forms and the building cost.

The residential unit is important since care staff members mainly provide their care services to elderly residents there. The residential unit to a nursing home is a nursing unit to a hospital. A nursing unit is also composed of several residential units. In general, 2-4 residential units make one nursing unit (Table 7). At

Table 2. Outline of Entire Nursing Homes Analyzed

Nation	Name	Opening year	Name	Opening year
Korea	Yeogi	1995	Soonawon	1999
	Joonggye	1995	Kwangmyung	2001
	Jeongwon	1996	Dongmyung(1)	2001
	Youngrak	1996	Dongmyung(2)	2002
	Pyeongang	1998	Taebaek	2002
	Francesco	1998	Hyosung	2002
	Davida	1998	Gamrodang	2002
	Sunwoo	1999	Chamsarang	2003
	Japan	Youwaen	1987	Care Town Takanosu
Ora-Hausu Unazuki		1994	Kirakuen Group Home	1999
Group Home Shisei		1995	Iwauchiwa	2000
Care center Ami		1995	Frères Uzakinakamachi	2000
Care home Sirai		1995	Frères Nishisuma	2000
Taiyo		1995	Kaede & Maple Leaf	2000
Care station Dokorozawa		1995	Shisei-Kiitos Home	2000
Robata no-ie		1996	Nisikasga Group Home	2000
Home Datzoka		1996	Inano Ie	2001
Kikyo		1996	Soyokaje	2001
Komorebi no-ie		1997	Hohoemi	2001
Hiteihime		1997	Sakura Himawari	2003
Nijigaoka Rehabilitation		1997	Yawaragi Yorokobi	2003
U.S		Corinne Dolan	1989	Pathways
	New Perspective	1990	Brewster Place	1998
	Woodside	1991	Lucy Corr Village	1999
	Elderkare	1991	Our Lady of Wisdom	2000
	Stonefield	1991	Bridges Medical Services	2000
	Alexian Village	1992	New York State Veterans Nursing Home	2001
	Parkvue	1995	NJ Masonic Home	2002
	Poydras Home	1998		
U.K	EMI Nursing Home	1990	Minnie Kidd	1993
	The Woodland Center	1990	Woodlands	1995
	Ronald Gibson	1991		

present, the concept of the residential unit in Korea has not been defined clearly; the residential unit has been regarded as a nursing unit.<sup>3</sup> This is problematic because a large size of residential unit weakens the sense of residence. Furthermore, functional spaces such as dayrooms or snack bars, which should be located in one residential unit, tend to be placed sporadically in a

nursing unit or entire nursing home, causing access problems for the elderly who have difficulties in walking and/or perception. Placing these functional areas in one residential unit will help construct a self-sufficient residential unit. Through this way, the sense of residence as well as accessibility to different areas will be increased.

## 2.2 Studies on types of Residential Unit in Nursing Home

In Korea, there have not been in-depth studies on the types of residential unit of nursing home, since the concept of residential unit has not been clearly defined. However, if we analyze an enough number of nursing homes, types of residential unit or typical floor plan will be naturally established. Soonjung Kwon (1999) classified types of residential units according to the connecting mode of bedrooms. Kum-Suek Yang (2002), based on the shape of typical floor plans, and Hye-jeong Song (2001), on the basis of allocation of bedrooms and public spaces, also classified types of residential units. However, such classifications were based on arbitrary intuition of researchers. Hence, an objective basis of classification has not been clearly suggested and, accordingly, considerable differences in the types of classification will result depending on the subjects of classification.<sup>4</sup> Therefore, it is necessary to establish a general knowledge basis that explains types of residential unit of nursing home. This will facilitate future in-depth research and application to architectural designs.

## 3. Types and Composition Mode of Residential Unit.

### 3.1 Compositional elements of residential unit

Classifying types of residential units is a process of understanding how spaces of units are connected in a residential unit. For this, spaces in a residential unit need to be examined analytically.

Table 3. Rate of Establishment of Functional Spaces in a Residential Unit

Rate of establishment (%)	Functional spaces
100	Bedroom
75 - 100	corridor, public living room, staff room
50 - 75	Public bathroom, public restroom, dining room, storage, restroom in bed room,
25 - 50	utility room, laundry
0- 25	linen room, examination room, rehabilitation area, hairdressing room

Analysis of 67 architectural drawings revealed that there are bedrooms, corridors, public spaces, staff rooms, dining rooms & kitchens, bathrooms, storages, restrooms and so on in one residential unit. Among these spaces, bedrooms are established in every residential unit, and corridors and public living rooms are established in 99% and 93% cases, respectively, indicating that these three functional spaces are the major elements composing a

residential unit (Table 3). The area percentage of the sum of the three main spaces to the total area reaches up to 77% (47%, 20% and 10%, respectively), dominantly influencing the type of residential unit. These facts indicate that the type and composition mode of the three functional spaces are major elements in identifying types of residential unit.

### 3.2 Major elements influencing the types of residential unit

Architectural types of residential units are influenced by the combining mode of the major elements. The composition mode of bedrooms, which has high percentage of area, can be considered as a preferential element in the identification of architectural types. Considering that bedroom shapes are similar across different residential units, the combining mode of bedrooms is more important than their shapes in the identification of architectural types. Analysis of 67 examples of architectural drawing revealed that bedrooms are connected through common areas such as a corridor or a public living room. This result indicates that the shape and function of the common area is an important factor in classifying the types of residential unit because it greatly influences the shape of a residential unit. This study will identify the types of residential unit based on the shape and function of the common area such as corridors and public living rooms.

### 3.3 Types of residential unit

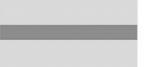
Both corridors and public living rooms (public spaces) in a residential unit function as a path and/or a community place. If a corridor is wide enough, it functions not only as a path but also as a community place. Especially when it is square-shaped rather than linear-shaped, a corridor functions as a community place than a passage. Taking the above into account, the shape of a corridor in the residential unit can be divided into a linear and square shape according to its role. A wide corridor (wide shape) is possible to function both as a passage and as a community place.

Linear corridors are variable in shape and, in many cases, it is difficult to limit them as a single type. For example, linear shape can be presented like — shape, L shape, ⊥ shape, + shape, □ shape, free-curved shape, etc. In particular, □ shape is adopted in many residential units due to its advantage of offering courtyard and wandering path.<sup>5</sup> Moreover, although controversial, the □ shape has been suggested to provide satisfactions to the elderly with dementia. Therefore, in this study, □ shape will be classified as a cloistered shape, not belonging to the linear shape category. On the other hand, L shape, ⊥ shape, + shape, and free-curved shape will be classified into one category since there are a few examples of them and they can be considered as combinations of — shapes, with ambiguous boundaries among them.

In terms of function, corridors are generally divided into single loaded and double loaded corridors. Also mixed corridors<sup>6</sup> are often adopted in many residential units.

Based on the shape and function of the corridor, residential units were divided into 12 basic types; linear single loaded corridor, linear double loaded corridor, linear mixed corridor, cloistered single loaded corridor, cloistered double loaded corridor, cloistered mixed corridor, wide single loaded corridor, wide double loaded corridor, wide mixed corridor, centralized single loaded corridor, centralized double loaded corridor and centralized mixed corridor. (Table 4)

Table 4. Basic Types of Residential Unit

function \ shape	single loaded corridor (1)	double loaded corridor (2)	mixed corridor (3)
linear (A)	 A1	 A2	 A3
cloistered (B)	 B1	 B2	 B3
wide (C)	 C1	 C2	 C3
centralized (D)	 D1	 D2	 D3
composite	AB1, AC1, AD1, BC1, BD1, CD1	AB2, AC2, AD2, BC2, BD2, CD2	AB3, AC3, AD3, BD3, CD3

#### 4. Characteristics of residential unit by types

##### 4.1 Distribution of residential units by types

Table 5 shows the distribution of the types of 67 residential units. In terms of configuration of the corridor, the linear shape comprised 37.3%, and each of the rest types had a similar percentage. Regarding the style (function) of the corridor, double loaded corridors were found in more than half of the cases (59.7%). Mixed corridors ranked the second and the last was single loaded corridors which occupied less than 10% of the entire residential units. These results indicate a tendency to use the space of the residential unit efficiently by designing simple and efficient circulation systems. In particular, there were only a few cases of single loaded corridors, despite the advantage of natural light & ventilation and an open view. It is due to the disadvantage

of occupying a large area and long distance of circulation compared to the other types of corridor.

Table 5. Distribution of Residential Units by Types of Corridor (number, %)

Classification	single loaded corridor	double loaded corridor	mixed corridor	total
linear shape		19	6	25 (37.3)
cloistered shape	5	1	6	12 (17.9)
wide shape		9	1	10 (14.9)
centralized shape		7	2	9 (13.4)
composite shape	1	4	6	11 (16.4)
Total	6 (9.0)	40 (59.7)	21 (31.3)	67 (100)

##### 4.2 Characteristics of residential units with different corridor shapes

It was not easy to analyze the characteristics of all the residential units based on the corridor type because there was no corresponding example of A1, C1 or D1 and were only few examples of B2, C3 and D3 (Table 5). Accordingly, this study shows the characteristics of residential unit based on four different shapes of corridor. Table 6 shows major indices of the four types of residential unit.

Table 6. Major Indices of Residential Units Classified by Corridor Shape (person, m<sup>2</sup>/bed, %), n=67

shapes of corridor	capacity of one residential unit (number)	capacity of one bedroom (number)	residential unit area per bed (m <sup>2</sup> /bed)	100× bedroom area/unit area (%)	100× corridor area/unit area (%)	100× living room area/unit area (%)
linear shape	16.3	1.9	29.2	48.9	20.4	10.7
cloistered shape	29.9	3.2	29.8	38.6	23.1	6.4
wide shape	27.9	2.9	25.2	46.9	20.7	9.4
centralized shape	14.6	1.7	29.9	52.2	17.4	12.6
composite shape	30.5	3.1	26.4	48.0	19.0	10.7
average	22.6	2.5	28.4	47.1	20.3	10.0

The capacity of one residential unit was 14-17 persons for the linear and centralized corridors, whereas it was 27-31 persons for the cloistered, wide, and composite corridors, demonstrating considerable differences between the two groups. The average number of residents per bedroom was planned small (Table 6) due to the small size of the residential unit<sup>7</sup>, indicating that linear corridors were designed to accommodate a comparably smaller number of residents. On the other hand, the residential unit with a centralized corridor was designed as a small, familiar scaled unit with a small number of people in a bedroom for the elderly with dementia. There were a number of bedrooms in residential units with cloistered, wide, or composite corridor. In general, these

corridors occupied large areas and long circumferences. As a result, the number of beds in these shapes of the residential unit was large.

The average area of residential unit per bed was 28.4 m<sup>2</sup>/bed, which was similar across the five basic shapes (29-30 m<sup>2</sup>/bed except for wide and composite shapes). Residential unit area per bed of wide corridor shape represents the smallest figure, probably due to many beds per bedroom or large bedroom area.

In case of cloistered corridor, the bedroom and corridor areas occupied 38.6 and 23.1% of the total residential unit area, respectively, which were the lowest and highest, respectively, among the five types of residential unit. This is because a single loaded corridor with a courtyard was more abundant than a double loaded corridor for the residential unit with a cloistered corridor (Table 5). The residential unit with a centralized corridor had the largest area for public living room. This is because they accommodated relatively small numbers of residents while all of them had public living rooms.

Followings are the characteristics of the four basic types of residential units

#### 1) Linear shape

This type is very common in nursing homes because of its spatial efficiency and simplicity. The area and capacity are generally small, whereas residential unit area per bed is relatively large. Figure 1 illustrates an example of linear shape. It accommodates 40 elderly in four similar units housing ten people each.

Equation (1) shows a simple linear regression model for this type. The independent variable is the number of beds in a residential unit and the dependent variable is the area of a residential unit. Using the estimated regression line (1), the area of a residential unit with linear shape can be easily calculated, when the number of beds in a residential unit is known. This model is expected to predict precisely the area of a residential unit because the coefficient of determination (R<sup>2</sup>) is high enough.

$$y=12.7x+164.6 \quad (R^2=0.7667, n=25) \quad (1)$$

y : area of a residential unit (m<sup>2</sup>)  
 x : number of beds in a residential unit (beds)  
 R<sup>2</sup> : coefficient of determination



Fig.1. Woodlands Nursing Home, U. K. 1995

#### 2) Cloistered shape

The outstanding feature of this type is that it provides an inner courtyard, wandering paths, natural light and ventilation. Usually the capacity of one residential unit, the residential unit area per bed and the corridor area in this type were large because of its long corridor. Therefore, the proportion of bedroom area to residential unit area was very low. Figure 2 shows an example of a residential unit with a cloistered single loaded corridor. The number of residents in this unit was up to 45.

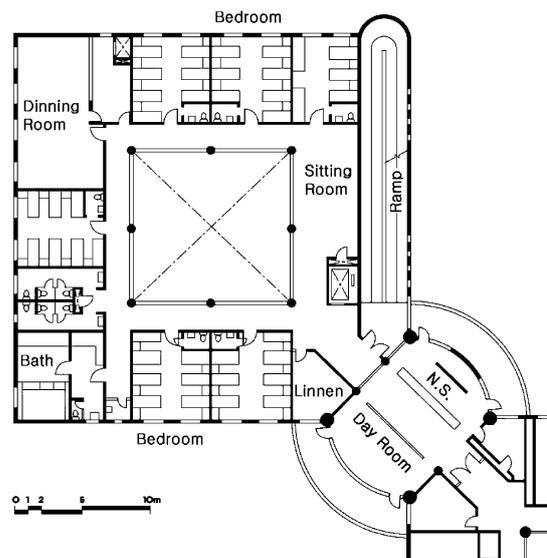


Fig.2. Joonggye Nursing Home, Korea, 1995

Using the equation (2), the area of a residential unit with cloistered corridor can be calculated. The coefficient of determination (R<sup>2</sup>) was high.

$$y=10.5x+320.1 \quad (R^2=0.6129, n=12) \quad (2)$$

y : area of a residential unit (m<sup>2</sup>)  
 x : number of beds in a residential unit (beds)  
 R<sup>2</sup> : coefficient of determination

### 3) Wide shape

This type had the characteristics of both linear and centralized shape. The central living space served as a corridor as well as community space. Statistics in table 6 shows that this type would be useful for those facilities with relatively big residential units and a small residential unit area per bed. Figure 3 shows an example of a wide shape with 46 beds.

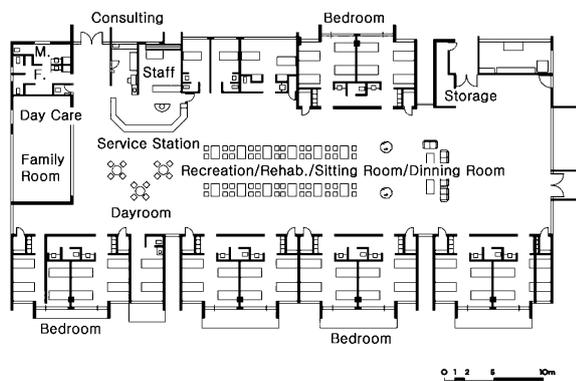


Fig.3. Care Home Sirai, Japan, 1995

Equation (3) helps to estimate the area of a residential unit with wide shape. The coefficient of determination ( $R^2$ ) was very high.

$$y=16.3x+138.7 \quad (R^2=0.8232, n=10) \quad (3)$$

- y : area of a residential unit ( $m^2$ )
- x : number of beds in a residential unit (beds)
- $R^2$  : coefficient of determination

### 4) Centralized shape

This type of residential unit as well as wide shape, which were designed to address the need of those with dementia, had the explicit goal of “compensating wherever possible for the disorientation, memory loss, loss of social skills and sense of self typically demonstrated by organically brain damaged older persons.”<sup>8</sup> The centralized shape tended to have a homelike environment; the number of residents in a unit and the number of a bedroom were small. On the other hand, the residential unit area per bed was very large compared to the other types.

Figure 4 illustrates an example of centralized shape. It contained two residential units with 10 beds each.

The simple linear regression model for this type is not proposed. Because the number of samples was small and the coefficient of determination was low ( $R^2=0.3387$ ).

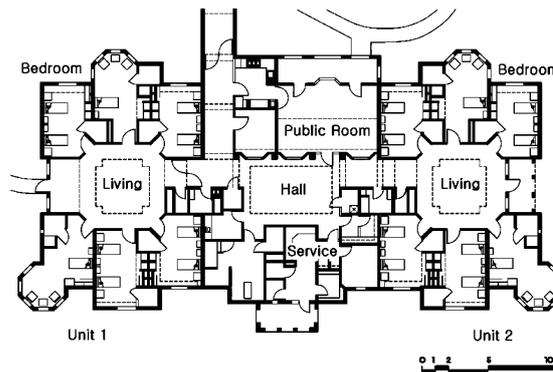


Fig.4. Parkvue Nursing Center, U. S. 1995

### 4.3 Characteristics of residential unit by country

The types of nursing homes varied across countries depending on their social systems and cultural backgrounds. Table 7 shows the characteristics of residential units according to countries. Compared to the other countries, the areas of facility per bed and of residential unit were much smaller in Korea. On the contrary, the number of residents per residential unit and that per bedroom were large, indicating that more residents were housed in a small facility in Korea. It is therefore difficult to provide comfortable care environments to the elderly residents in Korean nursing homes. This is because Korea is currently in a premature stage in welfare service system and the care service for the elderly has not yet been developed enough. Thus, not only welfare of the elderly but also care environments of Korea should be improved and developed in the near future.

Table 7. Characteristics of Residential Unit by Nations

Nation	Area per bed of a facility ( $m^2/Bed$ )	Area per bed of a residential unit ( $m^2/Bed$ )	Number of residential units in a nursing unit	Number of beds in a residential unit	Number of beds in a bedroom
U.S	53.8	38.3	2.6	13.7	1.3
U.K	36.0	23.6	3.2	11.4	1.3
Japan	48.8	32.0	1.5	18.6	1.8
Korea	29.9	15.5	1.4	39.5	4.9
Average	43.7	28.4	1.8	22.6	2.5

The number of residential unit per nursing unit in Korea is much smaller than that of the other countries as shown in Table 7. This is because the residential unit has not yet been completely separated from the nursing unit. In order to improve residential environments of nursing homes, vitalizing residential units is necessary. In Table 7, comparing types of residential unit by countries is omitted due to the limited number of samples. More samples need to be collected in the near future in order to compare and analyze types of residential unit by countries. This type of work will lead to the accumulation of useful references and better ideas for designing good nursing homes.

## 5. Conclusions

This study identified the concept of the residential unit and analyzed 67 cases of 62 nursing homes in four countries (Korea, Japan, U.S. and U.K.). Thereafter, twelve basic types of residential unit were proposed and their characteristics were analyzed. The results of this study can be summarized as the following:

(1) A residential unit is a very important compositional element in a nursing home. The proportion of residential unit area to the total area of nursing home reaches up to 63.5 % (n=48).

(2) According to the composition mode of basic elements such as bedrooms, corridors and public living rooms, the types of residential unit were classified into four corridor shapes (linear, cloistered, wide and centralized corridor), and three styles of corridor (single loaded, double loaded and mixed corridor). As a result, 12 basic types of residential unit were proposed by combining the two terms above.

(3) The linear shape with double loaded corridor was the most preferred among 12 basic types of residential unit. This result shows that simple and efficient plan is common for the residential unit.

(4) The residential unit with linear or centralized corridor shape housed only 14-17 older persons while the others housed 27-31 persons. As for the average bedroom occupancy, the former group had 1.7-1.9 residents and the latter had 2.4-2.9, indicating outstanding differences between the two groups. Thus, it is necessary to set the capacity of facility and bedroom occupancy appropriately according to the types of resident unit.

(5) Simple linear regression models for linear, clustered and wide shape of residential unit were developed. The independent variable was the number of beds in a residential unit and the dependent variable was the residential unit area. Using this model, the area of a residential unit with three different shapes could be precisely predicted.

(6) The density of residents in Korean nursing homes was very high compared to that of Japan, U.S and U.K. Accordingly, the number of residents in a residential unit and bedroom occupancy of Korean nursing home were very large. For the improvement of nursing home environment in Korea, the density has to be reexamined.

This study reveals the importance of the residential unit in nursing homes and identifies their types and characteristics. The outcome of this study can serve as a guideline when designing nursing homes. However, there exist potential errors and limitations because data were collected indirectly by examining architectural drawings or related records, rather than direct surveys. Also cultural differences across different countries and operational systems of nursing homes were not fully investigated. In the follow-up studies, it will be necessary to analyze the relationship between the operating system of the facility and residential unit plan based on field surveys.

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## Notes

- <sup>1</sup> Elderly Welfare Law, article 34, Korea, 2004
- <sup>2</sup> It is the average of 48 facilities. The compositional rate of residential unit can be higher if the day care facility which is operated as an annex in most facilities is not included.
- <sup>3</sup> Kwon, Soonjung, A Study on the Hierarchical Space Organization of Elderly Care Facilities, Journal of Korea Institute of Interior Design, v.34, Korea, p.100, 2002.10
- <sup>4</sup> Kwon, Soonjung(1999) classified residential units into 4 types such as that of group, enlarged corridor, arcade, and linear type. Yang, Kum-suek(2002) classified them into linear double loaded corridor, semi cloistered courtyard, courtyard. Song, Hye-jeong(2001), classified them into 6 types such as corridor with separated public space, corridor including public space, corridor with alcove, butterfly type, public space separated from bedroom, public space

surrounded by bedrooms in units of special facilities for people with dementia. And Choi, Ji-hye (2004) classified them into linear type, cloistered type, and group type, etc..

<sup>5</sup> 12 cases out of 67 examples take □ shaped corridor.

<sup>6</sup> Mixed corridor referring to the mixed shape of single and double

loaded corridor has advantages of natural light and ventilation inside of a building without losing spatial efficiency.

<sup>7</sup> Residential unit area of linear, cloistered, wide, centralized and composite shape is each 394 m<sup>2</sup>, 633 m<sup>2</sup>, 593 m<sup>2</sup>, 438 m<sup>2</sup> and 654 m<sup>2</sup>.

<sup>8</sup> Liebowitz, et al. 1979 ; Weisman, 2003, p.33