A Study on the Characteristics of Patients Deceased at Convalescent Hospitals

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Abstract

Background/Objectives: This study seeks to provide a basic set of data for developing welfare policies for the elderly population. **Methods/Statistical Analysis:** A total of 1,537 deceased patients among admitted patients in convalescent hospitals in Daejeon, Chungnam, Chungbuk and Sejong were selected as study subjects. For analysis, the statistics program R was used. A total of 1,537 deceased patients among admitted patients in convalescent hospitals in Daejeo, Chungnam, Chungbuk and Sejong were selected as study subjects. For analysis, the statistics program R was used. A total of 1,537 deceased patients among admitted patients in convalescent hospitals in Daejeo, Chungnam, Chungbuk and Sejong were selected as study subjects. **Findings:** In terms of main diagnosis, Pneumonia, organism unspecified (J18) was ranked the highest, followed by Dementia in Alzheimer's disease (F00) and Malignant neoplasm of bronchus and lung (C34) but when looked at by gender, there was a difference in the ranking. This difference was also statistically significant. This study sought to analyze the general characteristics, admission characteristics, characteristics of the treatment department, main diagnosis, and the average length of hospital stay and treatment cost and to identify the significance behind these categories. **Improvements:** The findings of these studies are expected to provide a more realistic and meaningful set of data.

Keywords: Convalescent Hospitals, Characteristic of Patient, Main Diagnosis, Patients Deceased

1. Introduction

Since the year 2000s, an aging population has emerged as a serious social issue in Korea. The country passed the threshold of an aging society in 2000 and is expected to become an 'aged society' in 2018 where those aged 65 or older account for over more than 14% of the total population. Moreover, there were 961 senior citizens aged 100 or older in 2005, but in 2015 this figure reached 16,000, marking an increase by 15 fold in a decade¹. The rate at which the Korean society is aging is one of the highest around the world, ushering in an 'era of the centennials'. Aging is in fact the result of progress made by mankind. But there is a need to realize that ageing and the process of how we accept death cannot be separated. Aging is a negative process of the body becoming weaker over a long time, and the concept causes fear and anxiety in people. Everyone wants to live long, but in reality a longer life expectancy has become a disaster. One of the challenges in an aging society is to ensure that the elderly come to

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a 'peaceful death' while overcoming isolation and loneliness after retirement and physical weakness. Along with an aging population, another big population shift since the baby boom is the increase in one person households².

The share of such households has already exceeded 25% of total households in Korea, or one in every four household. The share is expected to reach 34% in 2035. There are various reasons behind this. More senior citizens prefer to live alone. But since they are likely to have acute or chronic physical issues, the increase in one person households among the elderly brings about social issues such as the elderly dying alone. Baby boomers preferred using convalescent facilities for the care-taking of the elderly (36.1%). The preference for convalescent hospitals was followed by spouse (28.9%), convalescent hospitals (21.1%) and rehoming services (10%). Very few respondents selected son and daughter in law (2.7%) or daughter and son in law (1.1%). The report pointed out that "baby boomers have higher expectations for public services compared to their parents' generation" and that there needs to be policies that synchronize services while taking into account the role-sharing by public services and the spouse³.

Even in one-person elderly households or senior citizens living with their family, if care-giving is required, they need to seek the help of other people or facilities. This has led to a drastic increase in convalescent hospitals. According to the data from the National Statistical Office, medical health and welfare facilities for the elderly in Korea (including convalescent facilities, convalescent joint community homes, and specialized hospitals for the elderly) increased from 4,585 in 2013 to 4,841 in 2014. The capacity, too, increased from 139,939 to 151,200, showing an aspect of an aging society⁴. The purpose of this study is to analyze the general characteristics, admission characteristics, characteristics of diagnosis department, type of diagnosis, number of hospital stays and the average of total cost for treatment in patients who passed away during their hospital stay. In doing so, the study seeks to provide a basic set of data for the development of policies for the elderly population and their social welfare.

2. Study Methodology

2.1 Study Subjects

A total of 1,537 deceased patients among admitted patients in convalescent hospitals in Daejeon, Chungnam, Chungbuk and Sejong were selected as study subjects.

2.2 Study Method

For analysis, the statistics program R was used. General characteristics consist of gender, age, region, four items on the type of insurance, while admission characteristics consist of the three items of month and season of admission and month of death. The characteristics of the diagnosis department consist of internal medicine department and two items of surgery departments. The main diagnosis of the subjects were categorized in three levels, the top 15 of the ranking were extracted to compose the item of the length of hospital stay and total cost of treatment. General characteristics, admission characteristics, characteristics of the diagnosis department and top 15 of the diagnosis underwent a chi-square test. The length of hospital stay and total treatment cost were analyzed using an independent sample t-test. General characteristics and the top 15 diagnosis underwent a canonical correlation analysis to see if there was linear correlation. The Wilks' value was used to verify the fitness of the analysis model.

3. Study Results

3.1 General Characteristics of the Study Subjects

The general characteristics of the study subjects were as follows. Of the total of 1537 subjects, there were 785 males (51.1%) and 752 females (48.9%). In terms of age, the 80~89 bracket took the lead with 627 people (40.8%), followed by 70~79(31.0%), 69 or younger (16.9%), and 90 or older (11.4%). This appeared to be statistically significant (P<0.001). In terms of region, Chungnam took the top at 758 people (49.3%), followed by Chungbuk at 399 people (26.0%) and Daejeon at 359 people (23.4%). In terms of insurance type, health insurance was selected by 1,283 subjects (83.5%), and public health insurance was selected by 254 subjects (16.5%). However, neither region nor insurance types were statistically significant shown in Table 1.

3.2 Admission Characteristics of Study Subjects

The number of patient deaths among subjects can be charted into the graph as follows: For male patients, January

Category	Male	Female	Total	p-value
	(N=785)	(N=752)	(N=1,537)	
Age				0.000**
69 or younger	180(22.9)	79(10.5)	259(16.9)	
70~79	259(33.0)	217(28.9)	476(31.0)	
80~89	299(38.1)	328(43.6)	627(40.8)	
90 or older	47(6.0)	128(17.0)	175(11.4)	
Region				0.091
Daejeon	169(21.5)	190(25.3)	359(23.4)	
Chungnam	409(52.1)	349(46.4)	758(49.3)	
Chungbuk	199(25.4)	200(26.6)	399(26.0)	
Sejong	8(1.0)	13(1.7)	21(1.4)	
Insurance type				0.537ª
Health insurance	660(84.1)	623(82.8)	1283(83.5)	
Public medical insurance	125(15.9)	129(17.2)	254(16.5)	
Total	785(51.1) (100.0)	752(48.9) (100.0)	1537(100.0) (100.0)	

Table 1.	General characteristics of the study subjects
	Unit : N(%)

**p<0.001

a: Based on the accurate test of Fisher

Unit : N(%)

saw the lowest number at 46 patients, while February saw the highest at 82 patients. For female patients, January and June were the lowest at 48 patients, while July saw the highest number at 73 patients shown in Figure 1. In terms of admissions characteristics, February saw 149 of the patients (9.7%) admitted, a figure followed by April (9.4%) and July and December (8.9%). When categorized by gender, 83 (10.6%) male patients were admitted most in February, ranking it the month with most admissions, but for female patients it was July with 73 patients (9.75%).In terms of admission season, the admissions were equally distributed across four seasons. Spring saw the most admissions at 390 patients (25.4%), followed by summer (25.1%), fall (24.8%), and winter (24.7%). When categorized by gender, 200 female patients (26.6%) were admitted in the spring, making it the top-ranking season for admissions, but for male patients it was summer with 210 patients (26.8%). Given the equal distribution in admission month and season, these two factors were identified as not greatly affecting the death of a patient at a convalescent hospital shown in Table 2.

3.3 Characteristics of Admission Department in Accordance with Gender

Characteristics of the study subjects by diagnosis department are as follows. There were more patients of internal medicine at 1,063 subjects (69.2%), versus 474 subjects (30.8%) of surgery. Within internal medicine, general internal medicine was ranked the highest with 471 subjects (30.6%), followed by family medicine 304 subjects (19.8%), neural system 145 subjects (9.4%). The pattern was the same for both genders. Within the



Figure 1. Number of deaths by month.

Category	Male	Female	Total	p-value
Admission month				0.229
January	46(5.9)	48(6.4)	94(6.1)	
February	83(10.6)	66(8.8)	149(9.7)	
March	63(8.0)	63(8.4)	126(8.2)	
April	74(9.4)	70(9.3)	144(9.4)	
May	53(6.8)	67(8.9)	120(7.8)	
June	69(8.8)	48(6.4)	117(7.6)	
July	64(8.2)	73(9.7)	137(8.9)	
August	77(9.8)	55(7.3)	132(8.6)	
September	67(8.5)	62(8.2)	129(8.4)	
October	56(7.1)	68(9.0)	124(8.1)	
November	59(7.5)	69(9.2)	128(8.3)	
December	74(9.4)	63(8.4)	137(8.9)	
Season				0.166
Spring	190(24.2)	200(26.6)	390(25.4)	
Summer	210(26.8)	176(23.4)	386(25.1)	
Fall	182(23.2)	199(26.5)	381(24.8)	
Winter	203(25.9)	177(23.5)	380(24.7)	
Total	785(51.1) (100.0)	752(48.9) (100.0)	1537(100.0) (100.0)	

Table 2. Admission characteristics of study subjects

surgery department, general surgery patients counted 287 subjects (18.7%), followed by orthopedic surgery 87 subjects (5.75%) and neural surgery 56 subjects (3.65%). Here, too, the pattern was similar across genders. However, the characteristics of admission department were not statistically significant across the two genders shown in Table 3.

3.4 Top 15 Diagnoses of Study Subjects

The top 15 diagnoses of the study subjects were extracted to analyze their characteristics. The results were as follows. Among the total of 1,537 patients, 872 had a diagnosis that was ranked among the top 15. The largest share at 141 subjects (16.2%) died of Pneumonia, organism unspecified (J18). The diagnosis that had the second largest share wasDementia in Alzheimer's disease (F00) with 105 subjects (12.0%), followed by Malignant neoplasm of bronchus and lung (C34) with 99 subjects (11.4%) and

Category	Male	Female	Total	p-value
Diagnosis department				0.581ª
Internal medicine	548(69.8)	515(68.5)	1,063(69.2)	
General medicine	2(.3)	-	2(.1)	
Internal medicine	229(29.2)	242(32.2)	471(30.6)	
Neurology	89(11.3)	56(7.4)	145(9.4)	
Psychiatry	14(1.8)	14(1.9)	28(1.8)	
Anesthesia and pain	6(.8)	10(1.3)	16(1.0)	
Pediatrics	1(.1)	-	1(.1)	
Dermatology	4(.5)	3(.4)	7(.5)	
Rehabilitation medicine	19(2.4)	23(3.1)	42(2.7)	
Family medicine	160(20.4)	144(19.1)	304(19.8)	
Emergency medicine	3(.4)	8(1.1)	11(.7)	
Vocational environment	12(1.5)	10(1.3)	22(1.4)	
Preventive medicine	-	1(.1)	1(.1)	
Surgery department	237(30.2)	237(31.5)	474(30.8)	
General surgery	148(18.9)	139(18.5)	287(18.7)	
Orthopedic surgery	39(5.0)	48(6.4)	87(5.7)	
Neural surgery	27(3.4)	29(3.9)	56(3.6)	
Cardiothoracic surgery	5(.6)	3(.4)	8(.5)	
ENT	5(.6)	-	5(.3)	
Urology	4(.5)	4(.5)	8(.5)	
Ob/gyn	18(2.3)	18(2.4)	36(2.3)	
Total	785(51.1) (100.0)	752(48.9) (100.0)	1,537(100.0) (100.0)	

Table 3.	Characteristics	of admission	department in
accordanc	e with gender		nit : N(%)

lung(C34) took the lead (17.0%), indicating that there is a difference in the main diagnosis across genders. This difference was also statistically significant (P<0.001) shown in Table 4.

Unit : N(%)

Category	Male (N=453)	Female (N=419)	Total (N=872)	p-value
Main diagnosis				0.000**
Pneumonia, organism unspecified(J18)	65(14.3)	76(18.1)	141(16.2)	
Dementia in Alzheimer's disease(F00)	36(7.9)	69(16.5)	105(12.0)	
Malignant neoplasm of bronchus and lung(C34)	77(17.0)	22(5.3)	99(11.4)	
Cerebral infarction(I63)	29(6.4)	49(11.7)	78(8.9)	
Essential hypertension(I10)	21(4.6)	34(8.1)	55(6.3)	
Other sepsis(A41)	23(5.1)	28(6.7)	51(5.8)	
Sequelae of cerebrovascular disease(I69)	28(6.2)	18(4.3)	46(5.3)	
Chronic kidney disease(N18)	20(4.4)	25(6.0)	45(5.2)	
Malignant neoplasm of stomach(C16)	27(6.0)	16(3.8)	43(4.9)	
Malignant neoplasm of liver and intrahepatic bile ducts(C22)	34(7.5)	9(2.1)	43(4.9)	
Bacterial pneumonia, NEC(J15)	21(4.6)	17(4.1)	38(4.4)	
Malignant neoplasm of colon(C18)	17(3.8)	19(4.5)	36(4.1)	
Heart failure(I50)	14(3.1)	21(5.0)	35(4.0)	
Parkinson's disease(G20)	18(4.0)	12(2.9)	30(3.4)	
Other chronic obstructive pulmonary disease(J44)	23(5.1)	4(1.0)	27(3.1)	

**p<0.001

a :Based on the accurate test of Fisher

Cerebral infarction(I63) with 78 subjects (8.9%). As for female subjects, Pneumonia, organism unspecified(J18) had the largest share with 76 patients (18.1%), but for male subjects, Malignant neoplasm of bronchus and

3.5 Average of Total Treatment Cost and Length of Hospital Stay

The characteristics of the subjects in terms of length of hospital stay and total treatment costs across genders showed that the hospital stay was an average of 9.14 days. For male subjects it was an average of 9.02 days and for female subjects it was on average 9.26 days, showing women to have a longer stay.

The total treatment cost was 703,353.92 Won. For male subjects it was 694,704.37 Won, while for female subjects it was 712,383.05 Won, with male subjects having a higher treatment cost. But neither length of hospital stay nor total treatment cost was statistically significant shown in Table 5.

Table 5.Average of total treatment cost and lengthof hospital stayUnit :Mean±S.D

Category	Male	Female	Total	p-value
Length of hospital stay	9.02±6.72	9.26 ± 6.96	9.14 ± 6.84	0.489
Total treatment cost	694,704.37± 524,254.72	712,383.05 ± 548,360.51	703,353.92 ± 536,082.24	0.519

3.6 Cannonical Correlation Analysis of the Top 15 Diagnoses and General Characteristics

A canonical correlation analysis between the general characteristics and the top 15 diagnoses, eight canonical functions were concluded. Among them, three of them were statistically significant (p<0.001, p<0.05). In canonical function 1, when the value of chi-square was 350.222 and the degree of freedom was 112, it was significant at a level of p<0.001. In canonical function 1, the canonical coefficient showed a high correlation at age bracket 80~90 or older, Malignant neoplasm of bronchus and lung (C34), Malignant neoplasm of stomach (C16) and Malignant neoplasm of liver and intrahepatic bile ducts (C22). In canonical function 2, there was correlation found in gender, age bracket 80~89, Chungnam region, Cerebral infarction (I63), Essential hypertension (I10), Chronic kidney disease (N18) and other chronic obstructive pulmonary disease (J44). In canonical function 3, correlation was found in age bracket 70~79, Chungbuk region, Dementia in Alzheimer's disease (F00), Malignant neoplasm of bronchus and lung(C34), Cerebral infarction(I63), Essential hypertension (I10) and Malignant neoplasm of stomach (C16) shown in Table 6.

 Table 6.
 Cannonical correlation analysis of the top 15 diagnoses and general characteristics

	Category	Stand c	ard cano oefficien	nical t	cano	onical loa	d age	Canonic	cal cross	load age
		1	2	3	1	2	3	1	2	3
	Gender	333	774	.082	534	733	.076	223	213	.016
	70~79	395	026	.625	.384	253	.271	.160	073	.059
	80~89	892	.417	.534	350	.284	.090	146	.082	.020
General	90 or older	939	.283	.117	647	.021	216	270	.006	047
characteristics	Chungnam	199	.597	.206	016	.415	.641	007	.120	.138
	Chungbuk	226	.398	671	165	.049	773	069	.014	167
	Sejong	051	132	158	.009	252	148	.004	073	032
	Insurance type	140	019	.398	100	071	.320	042	020	.069
	Dementia in Alzheimer's disease (F00)	343	-159	601	641	003	290	268	001	063
Main diagnosis	Malignant neoplasm of bronchus and lung (C34)	.555	240	795	.382	.443	517	.160	.129	112
	Cerebral infarction (I63)	.123	441	494	078	333	210	033	091	045
	Essential hypertension (I10)	.038	453	469	136	359	225	057	104	048

(Continued)

	Othere are a $(A 41)$	150	1(7	074	002	057	100	001	017	0.40
	Other sepsis (A41)	.158	16/	074	002	057	.186	001	01/	.040
	Sequelae of cerebrovascular disease (I69)	.342	082	257	.200	.028	021	.084	.008	004
	Chronic kidney disease (N18)	.388	508	.086	.251	423	.338	.105	123	.073
	Malignant neoplasm of stomach(C16)	.419	146	448	.286	044	229	.119	013	049
	Malignant neoplasm of liver and intrahepatic bile ducts(C22)	.466	.048	163	.335	.160	.070	.140	.047	015
	Bacterial pneumonia, NEC (J15)	.078	.044	005	064	.149	.221	027	.043	.048
	Malignant neoplasm of colon(C18)	.326	331	280	.199	245	072	.083	071	016
	Heart failure(I50)	058	110	266	199	016	060	083	005	013
	Parkinson's disease (G20)	.335	240	.149	.219	158	.355	.091	046	.077
	Other chronic obstructive pulmonary disease(J44)	.068	.422	.028	051	.522	.219	021	.151	.047
		1		2			3			
Canonical Correlation		.417		.290		.216				
Wilk's Lamda		.665		.806		.880				
Chi-square		350.222		185.693		110.185				
df		112.000		91.000			72.000			
p-value		.000**		.000**			.003*			

Table 6. Continued

*p<0.05, **p<0.001

4. Conclusion

This study was conducted to analyze the general characteristics, admission characteristics, characteristics of the treatment department, main diagnosis, and the average length of hospital stay and treatment cost and to identify the significance behind these categories. In doing so, the study seeks to provide a basic set of data for developing welfare policies for the elderly population.

Analysis findings were as follows. Deceased patients had a larger share of male patients than female patients. The largest share was taken up by the age bracket 80-89; indicating that aging of the population of admitted patients at convalescent hospitals had progressed since the study⁵⁻⁷ where there were more patients in their 70s. Chungnam was the region with the highest number of deceased patients. There was no significant correlation between admission month and season with the patient's death. Deceased patients had been admitted mostly due to internal medicine-related illnesses. Both male and female subjects received treatment most frequently from the department of internal medicine. In terms of main diagnosis, Pneumonia, organism unspecified (J18) was ranked the highest, followed by Dementia in Alzheimer's disease (F00) and Malignant neoplasm of bronchus and lung (C34) but when looked at by gender, there was a difference in the ranking. This difference was also statistically significant. The length of hospital stay and the total treatment cost were higher in female patients than in male patients. A canonical correlation analysis of the top 15 diagnoses and general characteristics showed that there was a strong correlation in those aged 80~90 or older, Malignant neoplasm of bronchus and lung (C34), Malignant neoplasm of stomach (C16) and Malignant neoplasm of liver and intrahepatic bile ducts (C22). This was statistically significant.

Medical technology has been fast progressing, extending life expectancy of mankind. Just until 1980, the life expectancy of Korean women was 76 years and for Korean men it was 68 years. This means that when one retires at the age of 55, men have only about 10 years left to live. But over the course of a mere three decades, the life expectancy for women and men in Korea exceeded 84.6 years and 78 years, respectively⁸. By year 2020, the age at which deaths most frequently occur is likely to reach 90 years, ushering in the era of the centennials. This means there is a whopping 35-40 years left to live even after professional retirement.

Rapid aging will undermine the economic vibrancy, causing a drop in a nation's potential growth rate over the mid to long term. The increase in the elderly population can also pose a burden on welfare costs borne by the government, leading to issues of financial stability in the nation's budget. On a personal level, if preparation has not been made for one's later years, a longer life doesn't necessarily mean a happier life. A longer elderly period means a larger gross living expense, leading to a serious social issue where basic living expenses are short among a large number of elderly people. Moreover, the average life expectancy and average healthy life expectancy in Koreans show a gap of about 10 years. There are also statistics that point out that two years out of every three years is spent being admitted in a hospital or receiving regular hospital treatment. If a longer life means constantly having to deal with medical issues, this also poses a burden to the children or spouse, not to mention the financial burden. The phrase "an aging population is also a form of a longer term illness" resonates with this researcher. To spend a successful time as a senior citizen after retirement and to have a 'good death', what must be done?

First, in terms of financial stability which is one of the requisites for 'successful aging', a social safety net must be put in place while prioritizing employment and housing issues. It was possible for the pre-baby boom generation to use the assets that they had saved during their younger years to spend relatively comfortable later years. But as baby boomers retired in mass, the situation has changed. A low interest rate, drop in asset value, economic downturn and various social crises make it difficult to spend a long period as an elderly just with basic assets. If we were to assume that one retires at the age of 55 and live until age 90, post-retirement life is just as long as employment life. That is why it is important to find a new job. Whether one can find employment and create income determines whether one can live a happy life after retirement.

What should social policies be on 'health' which is also a key factor for 'successful aging'? With increased interest in well-dying movements, treatments that focus on mitigating symptoms and alternative medicine have gained wide popularity. This researcher suggests developing a program that would complement or substitute existing physical therapy to be provided to the elderly at convalescence facilities. Various programs that are well developed will have a better price to quality value. Another task to be addressed is more cooperation in the field of research so that clinical experience and information on treatment methods can be shared as a whole and applied to actual patients⁹. Then what can individuals do for successful aging? The key is to gain wisdom of life as a whole in one's unique way as we head slowly towards death¹⁰. In this sense, programs to 'train and prepare for death' will help guide the elderly to reflect on how accepting death is also a form of successful living.

According to the 'Index for Preparation for Retirement by Samsung Life Insurance'11, the older the respondent, the more they preferred to spend their later years in the house that they used to live in, even if longer-term nursing and care-taking was required. It is ideal to die in one's own room, own home or a favorite place. Death at a hospital or a convalescent facility is neither warm nor give a sense of family. It is more human to greet the end of one's life surrounded by things familiar to oneself¹². But the complex lifestyles of contemporary people and the increase in single person households make this more of an ideal than reality. The reality is that most people will spend the last day of their life in a hospital or a medical welfare facility for the elderly. Then, welfare policies, too, must accept this reality and plan accordingly. A more active collaboration and information-sharing system among hospitals-convalescent hospitals-home and nursing homes, as well as increased quality of services for better quality of life and better quality of death are urgent than ever. As baby boomers become senior citizens, the demand for specialized convalescent home will only increase. The government must prepare for the need to supply high quality convalescent hospitals that are competitive. Moreover, policies need to be devised for the elderly who cannot be financially independent or who experience difficulty in daily life due to physical issues, as well as who suffer from loneliness in later life¹³.

This study sought to analyze the general characteristics, admission characteristics, characteristics of the treatment department, main diagnosis, and the average length of hospital stay and treatment cost and to identify the significance behind these categories. In doing so, the study seeks to provide a basic set of data for developing welfare policies for the elderly population. To complement the limits of this study, a qualitative study on the patients of convalescent hospitals would be needed before their death. The findings of these studies are expected to provide a more realistic and meaningful set of data.

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