Changes in functional status of recipients using long-term care services according to the type of long-term care service

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A Dissertation
Submitted to the Department of Public Health
and the Graduate School of Yonsei University
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Public Health

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June 2021

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June 2021

Acknowledgements

When I entered graduate school, I wanted to become a good researcher. While I was in graduate school, I have been busy trying to grow through academics, but I still feel a lot of shortcomings. It was difficult to have both graduate school and work life, but it was a precious time to grow in many ways.

I sincerely respect and appreciate Professor Eun-Cheol Park, who gave me the direction of the thesis, guided me with love and encouragement, and did not give up on me, who was lacking so much, so that I could go on a true learning attitude and academic path. I had a lot of time thinking that I couldn't fall short of the expectations of the professor who led me to grow as an independent researcher. However, I will do our best to become a good researcher without forgetting the lesson about the attitude of the professor who showed his passion for research. Thank you to the professor who taught me to grow up so that I can study, realize and study on my own.

In particular, I would like to express my sincere appreciation to Professor Gyu-ri Kim, who was highly dependent on her research direction despite busy schedule, and for providing a logical and systematic framework for thesis.

And I would like to express my deep gratitude to Professors, Professor Chung Mo

Nam, Professor Dong Chun Shin, Professor Woojin Chung, Professor Hyeon Chang Kim, Professor Sung-In Jang, Professor Suk-Yong Jang, Professor Jaeyong Shin and all the professors, who led the way to learning during the last graduate school life.

I would like to express my gratitude to Yeong Jun Ju, Jin Hyung Kim, Juhwan Noh, Seo-yoon Lee, Kyoung Hee Cho, Hyeon Ji Lee and the same period, seniors, juniors who have walked the academic path together in the department of health and helped me a lot. In my graduate school life that I couldn't have done if I was alone, seeing their enthusiasm for help and research helped me a lot. I sincerely thank Yu Jeong of the administration office for consistently guiding the graduate school Yonsei University department of public health news. I am deeply grateful to my co-workers for their consideration so that I can work and study at the same time.

Lastly, I am deeply grateful to my beloved father and mother who encouraged me during my graduate school study period, cheered me on, and my younger brother who cheered me by my side. I will continue to study and endeavor to grow further in the future.

June, 2021

Seung Hyun Kang

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Changes in functional status of recipients using long-term care services according to the type of long-term care service

Background: With the introduction of the government's long-term care insurance (LTCI) system, the number of users of long-term care (LTC) service increased. And the physical functional status of LTCI beneficiaries improved and the burden of caregivers decreased. However, depending on the type of LTC services used by the elderly, changes in physical function status and symptoms of recipients appear differently. Therefore, the purpose of this study is to analyze the characteristics of LTC service use for beneficiaries who use LTC services for the elderly and to identify changes in the functional status of users according to the types of LTC services.

Materials and Methods: The data were drawn from the 2009 to 2013 National Health Insurance Service (NHIS)-Senior cohort data. The analytic sample consisted of 3,415 beneficiaries in receipt of LTC services. The subject that followed up at least two times after receiving the first grading evaluation among LTCI service users who maintained grades 1 and 2 were included. The independent variable of interest was the type of LTCI

services, classified as home-based care, public institutional care service, or private facility institutional care service. The primary outcome was overall LTC score, with higher scores indicating more severe LTC needs. In this study, factors that may affect medical use were controlled, and the linear mixed effects model estimating (LMM) method was used as a statistical analysis method to examine the time-lagged relationship between type of LTCI services and functional status.

Results: In a multivariate analysis that controlled other factors, the average functional status score of public facility services was significantly highest (93.01), the average functional status score of home-based care was higher (91.29) and the average functional status score of private facility services was significantly lowest (89.49) at baseline ($p=0.0010$). Compared to home-based care, public facility services ($\beta= -1.03$, $p=0.2852$) was correlated with decreases in time-varying functional status score. Compared to home-based care, private facility services ($\beta= -2.65$, $p<0.0001$) was significantly correlated with decreases in time-varying functional status.

Conclusion: The condition of recipients who used public facility services improved more than those who used home services, and the condition of recipients who used private facility services improved the most than recipients who used other LTC services. Therefore, it is considered that public facility service and home-based service users need

more LTC care. The government needs to come up with measures to adjust the quality of services so that even if LTC users use different types of LTC services, there is no difference in the status changes of beneficiaries. In addition, a health care policy should be established so that the elderly can lead a healthy old age by providing various high-quality LTCI services for the elderly.

Key words: Long-term care insurance, long-term care service, functional status

I. Introduction

1. Study Background

In 2017, Korea has already entered an aging society with the elderly rate exceeding 14%, and geriatric diseases have also increased sharply. As medical technology develops and life expectancy is extended, the population is rapidly aging. Korea is expected to reach a super-aged society in 2025, and the elderly population will reach 16.1 million, reaching a peak at 38.1% of the total population by 2050 [1].

An aging population also leads to an increase in medical expenses for the elderly, which increases the burden of the people. The proportion of medical expenses for the elderly in the total medical expenses of health insurance in 2019 was 41.6%, 35,792 billion won, an increase of 1.6 times from 2015 [2]. At the end of 2019, Korea's health-covered population was 52,880 thousand, and the elderly over 65 years old was 7,463 thousand, accounting for 14.5% of the total population, and it has already entered the aged society in 2018 [2].

With the entry of an aging society, the number of elderly people with chronic diseases such as dementia and stroke that require long-term care (LTC) is rapidly increasing. 95.3% of the elderly over the age of 65 with chronic diseases, 71% of them have two or more complex chronic diseases, and they suffer from 4.1 chronic diseases on average [3].

As the number of senile diseases increases due to aging, it is a factor that causes family support and cost burden. With the emergence of health care problems for the elderly, such as a sharp increase in elderly care expenses and medical expenses [4][5], the demand for welfare services at the national level has increased to help the elderly with chronic diseases in their daily life activities [6][7].

As a result, families with elderly patient have burdens of support such as restrictions on social activities, negative changes in family relations with the elderly, psychological burdens, economic burdens and deterioration of physical health for care and nursing. Medical costs at the national level are also significant [8][9].

The government implemented Long-Term Care Insurance (LTCI) for the Elderly in July 2008 in order to improve the quality of life of the people by promoting health promotion and stability of life in the elderly, and alleviating the burden on their families. LTCI for the elderly is a social insurance system that provides LTC benefits such as physical activity or housework support to the elderly who are unable to carry out their daily life alone due to old age, and elderly diseases such as dementia, stroke [10].

The LTC services for the elderly include home-based benefits and facility benefits. Home-based benefits are provided with home-visit care, day and night care, home-visit bathing, home-visit nursing, short-term care, welfare equipment services. Facility benefits for the elderly provide Aged care facility, Geriatric care facility, Senior congregate housing. LTCI for the elderly can use benefit services only if they have obtained LTC

grade. In-home benefits can be received by persons with all grades from 1st to 3rd grade, but facility benefits are only eligible for 1st and 2nd grade [10]. The grade of LTCI for the elderly is basically determined based on the ability to perform daily living (Activities of daily living (ADL)) or the ability to perform instrumental daily living (Instrumental Activities of Daily Living (IADL)) [11].

The LTC accredited persons are graded from grade 1 to grade 3 according to the severity of daily life dysfunction. Grade 1 is LTC score of 95 points or higher, and in case of needing help with all daily activities due to in bed-ridden elderly or severe dementia. The grade 2 is a LTC score of 75 points or more and less than 95 points, and in case of partial assistance in daily life such as dressing and washing due to discomfort or dementia. And the grade 3 is a LTC score of 55 or more and less than 75, which is to need partial help in daily life, such as dressing, washing face, due to discomfort or dementia. LTC grades have an expiration date, and when the expiration period expires, the grade accredited person must undergo an accreditation investigation for grade renewal (re-recognition) [10][12].

As the government expected a rapid increase in fiscal expenditures for LTC due to the aging population, the government focused on expanding home welfare services such as daytime care and short-term care facilities expansion to reduce national finances. The expansion of home-based services allows the elderly to stay at home for as long as possible while receiving home care services, helping to maintain the quality of life and reduce costs for the elderly [13].

However, elderly people with LTC grade 1-2 may use in-home services instead of facility services [14]. About half of those eligible for grade 3 benefits also use facility benefits [15]. Although LTC service users actually prefer facility services, it seems that they are using in-home services due to the government's policy to expand support for in-home services and the LTCI services standard that allows the use of facility services for the elderly who have received grades 1 or 2 [10].

The LTC grade is basically adjusted according to the care needs of the person who intends to use LTCI. LTC grade for the elderly means the grade for each section of the LTC score, and the higher the final LTC score means that the people's health and function status are poor, and thus the need for medical care increases. It could be presumed that the increase of the grade was due to worsening of symptoms and deterioration of functional conditions such as the body, which resulted in an increase in the LTC score at the time of the secondary grading evaluation. However, the factors influencing the assessment evaluation are unknown, and only the condition of those eligible at the judgment time can be confirmed [16]. The use of LTC services for the elderly has a positive effect on the change of the people's condition and improves the score for each area of assessment evaluation [17].

As such, LTCI for the elderly played a positive role in relieving the burden of care and treatment, improving relations, and improving condition on the people and their families, but it was not possible to know how the type of LTC service affected the subject. Most of the previous studies related to the LTCI system are studies on the actual condition of LTC

service use, service selection factors and satisfaction levels according to the general characteristics of the people. The research on the status change of LTC recipients conducted in Korea was mainly conducted in consideration of individual characteristics.

No research has been conducted to derive the characteristics of LTC services including home-based services and facility services that affect the change of the condition of LTC service users for the elderly. There are insufficient studies affecting the change in the score for LTC and the change in the score for each area of assessment evaluation. The purpose of this study is to identify the characteristics of elderly people using LTC services continuously, who received LTC grade for the period 2008-2013, and to identify factors that influence changes in the LTC score and score of assessment evaluation areas.

2. Study objectives

The purpose of this study is to analyze the characteristics of LTC service use targeting recipients who use LTC services for the elderly, and to understand the change in functional status of recipients according to the type of LTC service.

Firstly, the purpose of this study is to analyze the change in the LTC score according to the types of LTC service of LTC service recipients.

Secondly, the purpose of this study is to analyze changes in score of ADL, cognitive function, and behavioral changes according to the type of LTC services.

Thirdly, the purpose of this study is to analyze the change in LTC score according to the type of LTC facility service of LTC service recipients.

II. Literature Review

1. Long-Term Care Insurance System for The Elderly

1) Purpose and Eligible Persons

The LTCI provides support for physical or housework activities to the elderly who are unable to carry out their daily life on their own due to old age or senile diseases, etc. It was introduced to improve the quality of life of the people. LTCI provides support for physical or housework activities to the elderly who are unable to carry out their daily life on their own due to old age or senile diseases, etc.

The LTC services can be used by the elderly over 65 years of age or those under the age of 65 with aging diseases who have difficulty in daily life alone.

2) Grading System

The LTCI is eligible to use benefit services only after obtaining LTC grade through the accreditation investigation for grade determination and the evaluation procedure of the grade evaluation committee based on the principle of application. The grading is basically determined based on Activities of daily living (ADL) or Instrumental Activities of Daily Living (IADL). In addition, the availability of family support, residential environment, and dysfunction due to dementia and mental illness are considered as necessary (Figure

1). The LTC needs Certification Committee evaluates grade 1~3, since 2014, according to the mental and physical function of LTCI applicant, the grade is judged in 6 grades based on the LTC score (Table 1). Due to the increased use of LTCI for patients with dementia, the existing "dementia special grade" was newly established, and the old LTC grade system was reorganized from the 1-3 grade system to the 1-5 grade system from July 2014 (Figure 2).

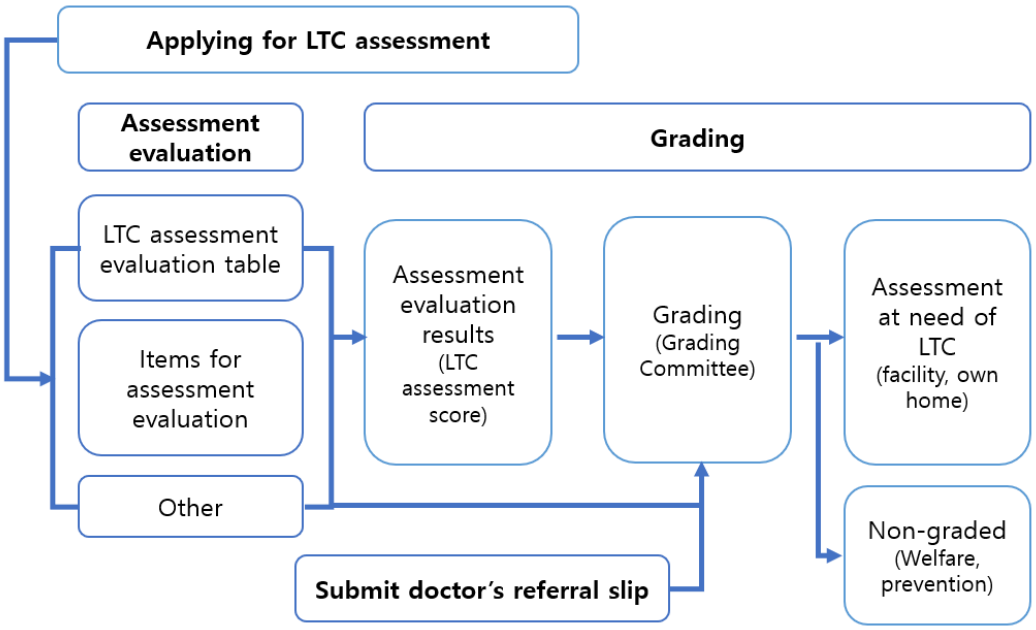

Figure 1. Process of assessing long-term care recipients

(Source: National Health Insurance Service. 2019 Long Term Care Insurance Statistical Yearbook)

Table 1. Representative states of recipients of long-term care benefits by grade

Grade	States of Mental and physical function	The long-term care assessment evaluation	
Grade1	A person with mental and physical disabilities completely dependent on the help of another person to take care of daily life	a score of over 95	
Grade2	A person with mental and physical disabilities in partial need of the help of another person to take care of daily life	a score of between 75 and 95	
Grade3	A person with mental and physical disabilities in partial need of the help of another person to take care of daily life	a score of between 60 and 75	
Grade4	A person with mental and physical disabilities in partial need of the help of another person to take care of daily life	a score of between 51 and 60	
Grade5	A person with dementia	A person with dementia whose score is between 45 and 51	2014.7.1. Reorganization
Grade Cognitive Assistant	A person with dementia	A person with dementia whose score is under 45	

(Source: National Health Insurance Service. 2019 Long Term Care Insurance Statistical Yearbook)

Existing rating system	**Grade1**	**Grade2**	**Grade3**	**Out of grade A**

New rating system (2014.7.1. Reorganization)	**Grade1**	**Grade2**	**Grade3**	**Grade4**	**Out of grade A**	**Out of grade B, C**
					Grade5 (Special grade for dementia)	Cognitive support grade
LTC Score	95	75	60	51	45	

Figure 2. Long-term care score according to the long-term care grade
(Source: Homepage of Long-Term Care Insurance. https://www.longtermcare.or.kr)

The Grading of the LTCI assesses the need for care based on the LTC score. LTC score is calculated by LTC employee of the National Health Insurance Service (NHIS) who has completed the prescribed training and visits the applicant directly and evaluate 52 items in five areas, including physical functions, cognitive functions, behavioral changes, nursing care, and rehabilitation, based on the ‘LTC approval checklist' (Table 2). The LTC score is calculated by applying the converted score (100 points) for each area to the Tree Regression Analysis[1], and the higher the LTC score, the higher the LTC needs.

The grading committee deliberates the applicant's functional status and the degree of LTC needs based on the result of weighting the evaluation score of each evaluation item, doctor's opinion, and special notes, according to the grade evaluation criteria, and decides whether or not the grade is recognized (Figure 1). In this grading process, in fact, the weight of ADL is relatively high in grading [11].

The LTC grades have an expiration date, and when the validity period expires, the grade accredited person must undergo an accreditation investigation for grade renewal (re-recognition). The validity period for LTC certification is at least one years. And from July 2020, the validity period has been changed to two years, if the renewal application results in the same grade as the previous grade, the validity period is extended. The LTC

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[1] It is a statistical method used to predict or classify results by data mining techniques. In long-term care insurance for the elderly, tree type analysis is used to predict the amount of service required according to the functional status of the applicant who needs the service.

grade 1 is extended for 4 years, LTC grade 2 to 4 is extended for 3 years, LTC grade 5, and cognitive support grade are extended by 2 years. In 2008-2013, the LTCI is valid for one year.

Table 2. Contents of long-term care recognition survey

Domain	Item	
Body function (12 items)	dressing; washing face; brushing teeth; bathing; eating; turning over in bed; sitting up in bed; moving in the room; going out of the room; using toilet; bowel control; bladder control	
Cognitive function (7 items)	short-term memory; remembering date, place, date of birth; understanding instructions; judgment; communication	
Behavior changes (14 items)	feeling persecuted, visual or auditory hallucination; depressed mood, reversal of day and night; resisting advice or care; restlessness; being lost; verbal or physical violence; trying to go out alone; destroying items; meaningless behavior; hiding money or items; dressing inappropriately; unsanitary behavior	
Nursing treatment (9 items)	tracheostomy care; suction; oxygen therapy; sore care; tube feeding; pain control; urine catheter care; colostomy care; dialysis care	
Rehabilitation (10 items)	Movement disorder (4 items)	Joint restriction (6 items)
	right arm; left arm; right leg; left leg	shoulder; elbow; wrist; hip; knee; ankle

(Source: Homepage of Long-Term Care Insurance. https://www.longtermcare.or.kr/)

3) Long-Term Care Benefits

The recipients who are graded 1 to 3 in the LTCI can receive facility benefits and home-based benefits.

There are six types of home-based benefits, including home-visit care, home-visit bathing, home-visit nursing, day and night care, short-term care, and other home benefits (welfare equipment services), and can be selected and used according to the condition and needs of the recipient (Table 3).

The facility benefits provide services for physical activity support, maintenance of mental and physical function, and education and training for improvement after long-term admission to the elderly care facility equipped with facilities and professional manpower necessary for medical treatment. The eligibility for admission to elderly nursing facilities are recipients of LTC grades 1 and 2 and LTC grades 3, 4, and 5 who have been recognized for facility benefits by the Grade Judging Committee for reasons.

Table 3. Type of long-term care In-home benefits

Type	Content
Home-Visit care	Long-term care benefit of supporting the physical activities and housework of recipients by visiting their home
Home-Visit bathing	Long-term care benefit of visiting recipients at home and helping them bath using bathing facilities
Home-Visit nursing	Long-term care benefit of nursing, assisting treatment, or providing consultation on care or dental hygiene services base on the referral slip of a Western or Korean medicine doctor, or dentist
Day and Night care	Long-term care benefit or providing recipients with care in a facility for a number of hours a day to support their physical activity and provide training and education in order to help them maintain and improve their mental and physical functions
Short-term Care	Long-term care benefit or providing recipients with care in a facility for a certain period within the scope decided by the Ministry of Health and Welfare to support their physical activity and provide training and education in order to help them maintain and improve their mental and physical functions
Other in-home benefits (welfare equipment)	Long-term care benefit or providing recipients with tools they need to support their physical activity or daily life or visiting them at home in order to support their rehabilitation as decided by presidential decree

(Source: National Health Insurance Service. 2019 Long Term Care Insurance Statistical Yearbook)

The Ministry of Health and Welfare, NHIS, LTC institutions, and local governments participate in the LTCI for the elderly projects. The Ministry of Health and Welfare oversees projects such as establishing a basic LTC plan. The NHIS performs the role of the applicant's accreditation survey and grade determination, Standard long-term care insurance plan support, service monitoring, insurance subscriber qualification management, insurance premium imposition and collection, etc. The LTC institutions provide LTC services such as In-home benefits and facility benefits by signing contracts with recipients who have been graded. The expenses for benefits provided by LTC institutions are billed to the NHIS. The local governments support the establishment and designation of LTC institutions (Figure 3).

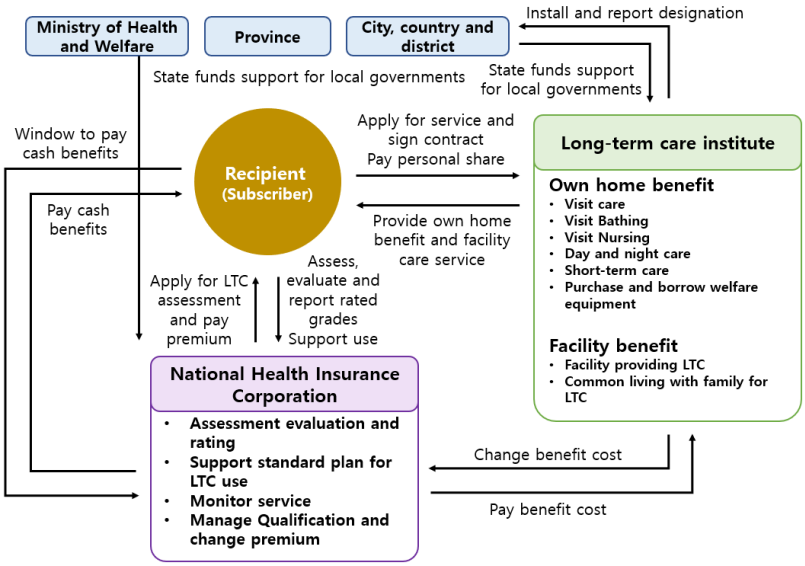

Figure 3. Long-term care insurance management system
(Source: National Health Insurance Service.
2019 Long Term Care Insurance Statistical Yearbook)

2. Long-Term Care Insurance Service and Functional Status Change

According to the 2014 LTCI Statistical Yearbook, 11.4% of the elderly, 736,879 people applied for LTC, and 79.44% of them, 585,386 people received grade recognition, which accounted about 9.1% of the elderly population [18]. Among them, 109,755 (18.8%) elderly people who belonged to the 1-2 grades who were eligible for admission to facility. There were 160,814 elderly people (27.5%) who were judged out of grade. Among them, 459,076 people actually use it, and 290,152 people for home and community benefits and 168,924 people for facility benefits. Therefore, the utilization rate of LTC benefits reached 78.4% in 2014. Looking at the rate of use of facility services and In-home services by grade, grade 1 was In-home benefits 48.6%, facility benefits 51.4%, grade 2 was In-home benefits 45.7%, facility benefits 54.3%, grade 3 was In-home benefits 67.0%, facility benefits 33.0%, and grade 4 was In-home benefits 79.4%, grade 5 was 93.6% (Table 4).

Table 4. The rate of using facility services and In-home services by grade

	Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**
In-home benefit service	48.60%	45.7%,	67.0%,	79.4%,	93.60%
Facility benefit service	51.40%	54.30%	33.00%	20.60%	6.40%

(Source: 2014 Long Term Care Insurance Statistical Yearbook)

The elderly people with LTC grade 1-2 who were eligible for facility benefits services do not use the facility. And not all of the 3-5 grades eligible for in-home benefit service use the in-home benefit service [14]. Almost half of the elderly use in-home services, even though the LTC grade is 1-2.

According to a study on the efficiency of the renewal procedure for LTCI, in general, LTC service users had a high grading maintenance rate, and there were many elderly people with deteriorated physical functioning status. This is because there are many persons whose mental and physical condition is difficult to improve after the initial grade recognition, and many of them are repeatedly re-recognized (renewed) when the grade recognition expiration date arrives [19].

As a result of a study on the status and problems of the LTCI grade determination, the change in the grade of LTC grade accredited person has shown that the functional state of the LTC grade accredited person is unlikely to improve significantly, and is likely to be maintained or worsened in most cases, and some functional conditions have improved [20].

In another study, the characteristics of LTC grade maintenance and change of LTCI users were identified. The users of LTCI benefit in 2008-2014 were classified by grade group (grades 1-3) and analyzed by demographic and sociological factors, disease factors, and service factors. As a result of the analysis, in terms of demographic and sociological factors, in the 1st and 3rd grades, those under the age of 64 were more likely to maintain

the grade than those over the age of 80. In terms of disease factor, people with dementia were high likelihood of maintaining the grade in grade 1. In grade 2, stroke holders and fracture holders were more likely to maintain grade. In terms of service factors, the higher the number of days of facility benefits use in the 1st grade, the higher the probability of maintaining the grade. And the higher the number of days of in-home benefits use in the 2nd grade, the higher the probability of maintaining the grade [19].

In a study on the determinants LTC services use for the elderly, the use of facility benefits or In-home benefits in the 1st to 2nd grade was higher compared to the 3rd grade, but there was no difference between the types of LTC service use according to the grade. The worse the daily life performance ability (ADL), instrumental daily life performance ability (IADL), cognitive function and behavior function, the higher the use of facility benefits, and it was found that facility benefits were used rather than In-home benefits [21].

1) Facility Services of Long-Term Care Insurance for The Elderly

Those who are eligible for the LTCI grade receive facility benefits and In-home benefits. Grades 1 and 2 can choose between facility benefits and In-home benefits, and grade 3 can only use In-home benefits [22]. In principle, about one-fifth of grades 3-5 accredited persons recommending the use of In-home benefits prefer facility benefits. As a result of the study, gender, age, medical insurance eligibility type, residential environment, subjective hearing level, daily living independence, dementia, stroke, LTC grade, and current residence were significant variables related to the preference for facility benefits of accredited grades 3-5 [15]. As a result of limited selection of person eligible for LTC, eventually, subjects are selected according to the severity of the disease, leading to expansion of facility benefits rather than In-home benefits.

Another study analyzed the factors influencing the conversion of in-home service users to facility admission. The 16.1% of total people had switched to facility admission after using in-home service. As a result of analyzing the factors that influence the conversion of in-home service users to facility admission, the elderly who used home-visit nursing and other in-home benefits rather than using only home-visit care, who had dementia or fracture disease, and who had primary caregiver except kindred, was a high probability of converting to a facility entrance [23].

In addition, cognitive impairments were found to have a positive relationship with

using of facility-benefits [24]. The use of facility-benefits decreased as the elderly felt that their perceived subjective health level was good [25]. As factors influencing the elderly caregiver's intention to use facility protection, the elderly's age, dementia, family support burden, subsidiary caregiver, and caregiver health status were significant. As for the variables related to the elderly, the higher the age, and the more cognitively impaired among the functional states of the elderly, the higher the intention to use facility protection [26]. In the previous studies on the use of facility protection services, if the elderly had cognitive impairment or dementia, facility protection services were increased [27].

In the study related with health status, social support of the elderly in LTC hospitals and nursing homes, ADL and subjective health status in nursing homes were worse than those in LTC hospitals, but it was not statistically significant [28]. In a study on cognitive function, ADL of the elderly with dementia in elderly care facilities, it was analyzed that the ADL and cognitive function of the elderly with dementia using elderly care facilities were lowered [29].

A study investigated the effects of social interactions of residents in LTC facilities on behavior symptoms of dementia. Less communication with family and relatives increased the severity of behavioral and psychological symptoms of dementia [30]. In the study of factors influencing behavior problem of dementia in elderly care facilities, there was a difference in the occurrence of behavior problem according to recipient's diagnosis period of dementia, marital status, LTC grade, coping behavior, and ADL. The longer the period

of diagnosis for dementia, the lower the LTC grade, the higher the aggressive behavior [31].

The study on the improvement rate of LTC grade analyzed the location of the institution, the establishment entity, the number of employees, the number of trainees for the grade improvement incentives, and the evaluation grade of the LTC institution. As a result, the establishment entity had an effect on the LTC grade improvement rate, enrollment rate and the LTC evaluation grade. In the case of elderly care facilities (revised law), the rate of improvement in grade was higher as the number of doctors increased. In the case of LTC facilities (old law), the grade improvement rate in urban nursing facilities was higher than in rural areas [32].

The grade improvement rate of elderly care facilities was highest in national and public facilities and lowest in private facilities. The more doctors, the grade improvement rate was higher in elderly care facilities (revised law) only. In foreign countries, the more workers in LTC institutions, the higher quality of service. The higher the number of personnel, the higher the quality of service, and the functional level, pressure sores, and weight loss of residents showed the closest relationship with the level of nursing personnel [33]. The higher the number of personnel, the higher the quality of service in four aspects: use of restraints, use of catheter, pain control, and bedsores [34]. Another study also found that the higher the number of nursing personnel, the lower the incidence of bedsores [35], and the more manpower, the higher the service quality [32].

In a study on the relationship between the evaluation grade of LTC facilities and improvement, the establishment entity, the location of the institution, and the LTC institution evaluation have an effect on the improvement of the LTC grade. In private facilities, grade improvement was the largest, because of the payment of LTC grade improvement incentives [36].

As a study on the factors influencing the physical environment for patients with dementia in LTC environment, environmental characteristics of the unit size, space arrangement, home-like personality, sensory stimulation, and social spaces affected the behavior and well-being of nursing facility residents [37].

Although LTCI facility services are preferred and facility benefits have been expanded, there is a study that the nutritional status of users living in the facility is poor. The nutritional status of elderly Koreans with dementia living in LTC facilities was evaluated. As a result, the malnutrition rate was 38.4%, and 54.7% of the participants were at risk of malnutrition. Malnutrition was followed by LTC hospitals (47.9%), nursing homes (34.1%), group, and housing (25.9%). The older and women had the more disabilities, such as cognitive impairment, neuropsychiatric symptoms, and higher functional dependence, which were associated with poor nutritional status [38].

2) In-home Service of Long-Term Care Insurance for The Elderly

Since the 1980s, due to the trend of deinstitutionalization, LTC services tend to prefer the form of home and community protection services rather than facility protection. Because, in terms of consumers of LTC services, receiving services in the home and community where the elderly live (aging in place) is more consistent with the welfare philosophy of integration, the increasing of home and community care services appears. The other is that it saves the public sector costs for LTC from the perspective of policy makers [39]. Looking at the number of prospective LTC recipients in Korea, it will continue to increase to 480 thousand (72.5%) in 2018, 603 thousand (74.2%) in 2021, 753 thousand (75.7%) in 2024, and 908 thousand (77.1%) in 2027 (Table 5) [13][40].

Table 5. Prospects for the number of long-term care insurance recipients

(Unit: thousand people (%))

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Total	662	712	764	812	876	939	995	1,056	1,106	1,178
Facility benefits	219	232	245	256	272	287	299	312	321	338
	(33.1)	(32.6)	(32%)	(31.5)	(31.1)	(30.6)	(30.1)	(29.6)	(29.1)	(28.7)
Home-based benefits	480	521	564	603	654	706	753	804	848	908
	(72.5)	(73.1)	(73.7)	(74.2)	(74.7)	(75.2)	(75.7)	(76.2)	(76.7)	(77.1)

(Source: National Assembly Budget Office. Financial Outlook for Long-Term Care Insurance for the Elderly in 2018-2027. 2018.)

In-home benefits of LTC services have been recognized as having the advantage of emotional stability through own home protection because they are relatively inexpensive compared to facility benefits, and their proportion has also increased rapidly [41].

In order to enable the efficient expenditure of LTCI for the elderly and at the same time ensure adequate financial savings and to improve the quality of life of the elderly in need of medical care, it is important to establish a nursing environment so that In-home benefits services can be easily received at home based on the local community rather than facility entrance [15].

The beneficiaries of in-home benefits can use home-visit care, home-visit bathing, home-visit nursing, day and night care, short-term care, welfare equipment services. Among LTC institutions that provide in-home services, home-visit care accounts for a large part. According to the LTC use plan preparation and operation plan, the most frequently used service combination is the case of using two services at the same time, home-visit care and home-visit bathing, it accounted for 30.4% of in-home service use. Looking at the current status of frequent use, it can be said that home-visit care benefits are a large part of the LTCI benefits for the elderly [42].

A study analyzed the effects of ADL and IADL disabilities of the elderly using LTC services on the use of in-home benefits services. The elderly people with disabilities of ADL and IADL used more in-home care services [43]. The studies on the effects of cognitive impairment in the elderly on in-home care services have shown that the use of

in-home care services decreases as cognitive impairment is severe [44]. While another study [45] found that cognitive impairments were not significant in choosing to use in-home care services, but amount of using in-home benefits increased after choosing of in-home care service [27].

As a result of a study on the factor related with the physical and mental functions of the elderly using LTC services, the IADL and MMSE-K of the elderly using In-home care service were significantly higher than those of the elderly using facility service, but there was no significant difference between ADL and CES-D [46].

In a study on the factors of fluctuations in the functional status and improvement measures of LTC applicants, the average LTC score for each area in grades 1 to 3 recipients was lowered by using LTCI services for the elderly. Therefore, the provision of LTC services has some effect on improving the functional condition. As a result of analyzing the factors of change in each grade, In-home services had a significant effect on improving functional status rather than facility services [17].

As a study to analyze changes in ADL, cognitive function, and risk of pressure sores before and after in-home service, the subjects who received in-home service showed improvement in ADL and cognitive function [47]. In a study on the effect of home-visiting service for the elderly of LTCI, the home-visiting service was related to the delay in the deterioration of ADL [48].

In a foreign study comparing the difference in daily living performance among the

elderly using home service and facility service, the ability of home service users to perform daily life improved compared to facility service users [49]. However, in other studies, there was no difference in ADL between in- home service users and facility service users after using the LTC service [50]. In a study that analyzed factors affecting ADL of in-home service and facility service users of all subjects recognized for LTC, it was reported that those who used facility services had worse ability to ADL than in-home service users [51].

On the other hand, the effect on ADL, behavior change, rehabilitation, IADL, cognitive function, and nursing treatment requirements of all subjects was analyzed [17]. In the study, rehabilitation and ADL were significantly improved in the case of facility service users.

In a study on the effects of in-home service, nursing home, and nursing hospital use on physical function, cognitive function problem behavior, nursing home use was associated with worse ADL and cognitive function than in-home service use in younger elderly. The use of nursing home was associated with worse ADL, better cognitive function, and problem behavior compared to nursing home use [52].

As a result of a study on the effect of stroke-affected elderly on the change of ADL, the ADLs of older adults with stroke who received HC improved, while those who received IC experienced deterioration [53]. In a study on changes of ADL and rehabilitation function according to the use of LTC services for the elderly with stroke, ADL of in-home

service users improved, but deteriorated in elderly nursing facility users [54].

Another study, compared in-home benefits and institutional services with regard to cognitive function, behavioral impairment, and physical function of LTCI beneficiaries with dementia. The research shows that those who receive in-home benefits were more likely to develop cognitive and physical function than those receiving institutional care services or combined care. But, they showed more behavioral symptoms two years after enrollment in LTCI [55].

There is a study comparing changes in cognitive function, behavioral symptoms, and physical function of beneficiaries with dementia in day care and home care settings. Day care showed less decline in cognitive and physical function compared to in-home care, but behavioral symptoms were less improved after 1 year of LTCI enrollment. Day care was associated with less cognitive decline, less disability progression, and decreases in behavioral symptoms when compared to home care [56].

But, in a study examining the effective characteristics of nursing homes and other residential LTC facilities, overall, the evidence on the effects of organizational characteristics, structures, and treatment processes on the health and psychosocial outcomes of patients with dementia was low or insufficient. In addition, the results did not differ between nursing homes for patients with dementia and residential nursing or assisted living facilities, except when treatment was necessary [57].

Table 6. Summary of previous literature

Study	Summary	Domain
[16] Jeon SM (2016)	The use of nursing facilities had an effect on the grade upgrade and the maintenance of grades in the number of days used for home-visiting care and day and night care.	LTCI services
[17] Hyun KR et al (2012)	The ADL, cognitive function, behavioral symptom improved. In-home service had a significant effect on improving functional status than facility service.	In-home care, Facility care
[28] Yun D (2016)	The ADL and subjective health status in nursing homes were worse than those in long-term hospitals, but it was not statistically significant.	Long term Care Hospital and Nursing Homes
[29] Kim JY (2009)	The ADL and cognitive function of the elderly with dementia were reduced.	Facilities
[31] Kim JI (2012)	The ADL, difference of problem behavior according to factors affected problem behavior.	Facilities

Study	Summary	Domain
[47] Oh JH (2012)	The subjects who received home service improved their ADL and cognitive function.	In-home service
[48] Lee SG et al (2016)	Using to visiting nursing services is associated with a delay in worsening ADL.	Visiting nursing services
[49] Mitchell JB (1978)	The patients placed in the home care program displayed the greatest mean improvement in functional health status.	Home care, Community-based nursing home care, Hospital-based nursing home care
[51] Lee TW et al (2015)	The ADLs of older adults who received home care showed significantly less deterioration than those of the older adults in nursing home care.	Nursing home and Home care settings
[52] Kim JY (2018)	The use of nursing hospital was associated with worse ADL, better cognitive function, and problem behavior compared to nursing home use.	In-home services, Nursing hospital, Nursing home

Study	Summary	Domain
[53] Jung WS et al (2016)	The ADLs of older adults with stroke who received HC improved, while those who received IC experienced deterioration.	In-home service, Facilities services
[54] Lee K (2012)	The ADL of home service users was improved, but deteriorated in elderly nursing facility users.	Nursing home and Home care
[55] Lee TW et al (2014)	In cognitive function, behavioral symptoms, and physical function between individuals receiving the three service types and overall improvements.	Home care, Institutional care, Combined care
[56] Lee TW et al (2019)	The cognitive function and disability declined less in the DC group, compared with the HC group. Behavioral symptoms showed a similar decrease between the two.	DC or HC

III. Material and Methods

1. Framework of the Study Design

This study was to analyze the change in the LTC score that can know the change in the grade of LTC service recipients according to the type of LTCI for the elderly. In addition, this study analyzed the changes in the activities of daily living, behavioral changes, and cognitive function of recipients using in-home service, public facility service, and private facility service.

The dependent variables were LTC score, ADL score, cognitive function score, and behavior symptoms score. Higher scores indicate worse functional status. The independent variables of interest were the type of LTCI services, classified as home-based care, public institutional care service, and private facility institutional care service. The covariates were age, gender, health Insurance type, region of residence, household income level as socio-demographic factors. Charlson's comorbidity Index (CCI) and disability were selected and analyzed as health factors, and primary caregiver, living arrangements as benefits use factors (Figure 4).

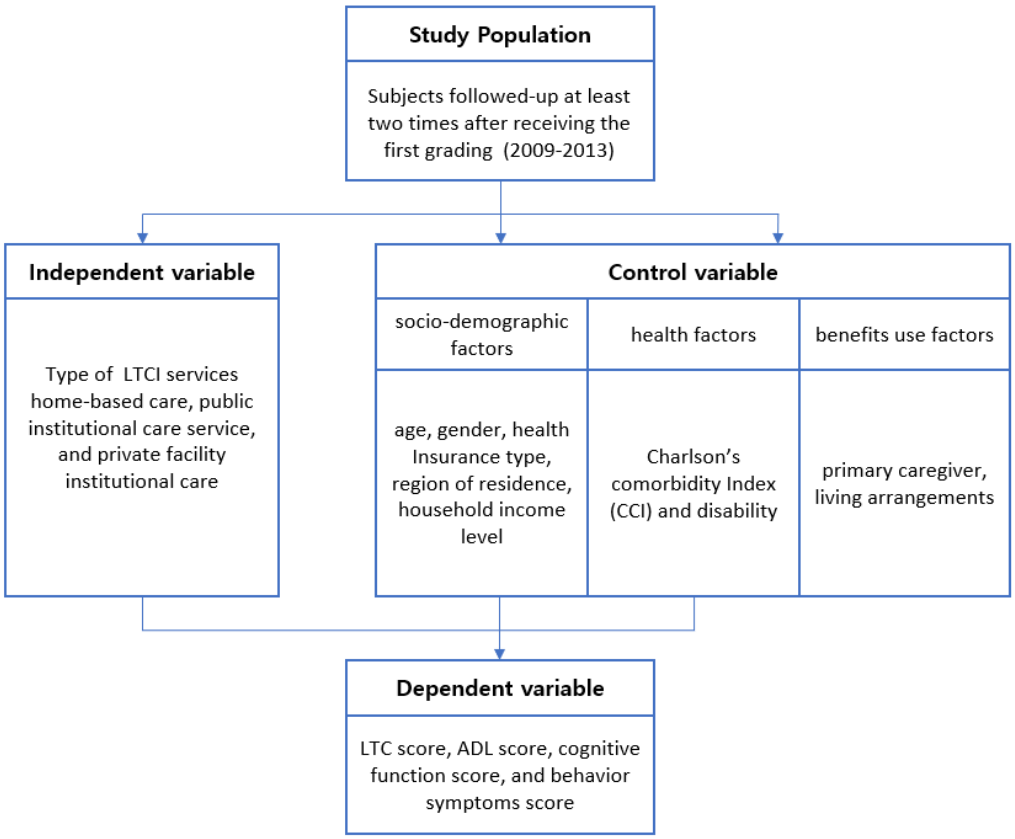

Figure 4. Framework of the study

2. Data and Study Population

1) Data

This study used data from the Senior Cohort DB of NHIS (2008-2013). The Senior Cohort data is data for non-individual identification of 558,147 people who simply randomly extracted 10% of about 5.5 million elderly people who maintain health insurance and medical benefit qualifications at the end of December 2002.

The qualifications and socio-economic information (including disability and death) for about 550,000 people from 2002 to 2013 (12 years), medical use (treatment and health checkup) at various medical institutions such as hospitals and clinics, information on the status of nursing institutions and the application and use of LTC services for the elderly from 2008 to 2013 (6 years), and the status of nursing facilities are established in a cohort format [58].

This data is for research purposes built to support research targeting the elderly, such as analysis of risk factors and prognosis of senile diseases [59]. This data has been prepared for the purpose of providing public health researchers and policy makers who need information on national health insurance use and health checkups.

The Senior Cohort DB includes all enrollees' health care insurance benefit eligibility assessment data and socio-demographic characteristics, general health status, LTCI

application and final decision, LTC, adjusted overall assessment score (LTC approval score), etc. It also includes LTC provider information and health insurance claim data.

2) Study Population

The subjects of this study used the LTCI DB for the Elderly of NHIS, and the total number of people who claimed LTC benefits from 2008 to 2013 was 558,147 as the total population. Among them, 15,852 people were eligible to maintain the 1st and 2nd LTCI grading from 2009 to 2013. From 15,852 people with LTCI grades 1-2 recognized, those who received grade 3 certification and extra-rating from 2009 to 2013 were excluded. Among them, 12,548 people were eligible for LTCI service. Among the LTCI service users who maintained grades 1 and 2 between 2009 and 2013, 3,415 subjects who followed up at least two times or more after receiving the grade for the first time were selected as the final study subjects. Because the LTCI system for the elderly was implemented in July 2008, the data of assessment evaluation persons in 2008 would have a bias due to the initial implementation of the system. Therefore, the 1st and 2nd grade accredited persons from 2009 to 2013 were selected as the scope of study subjects (Figure 5).

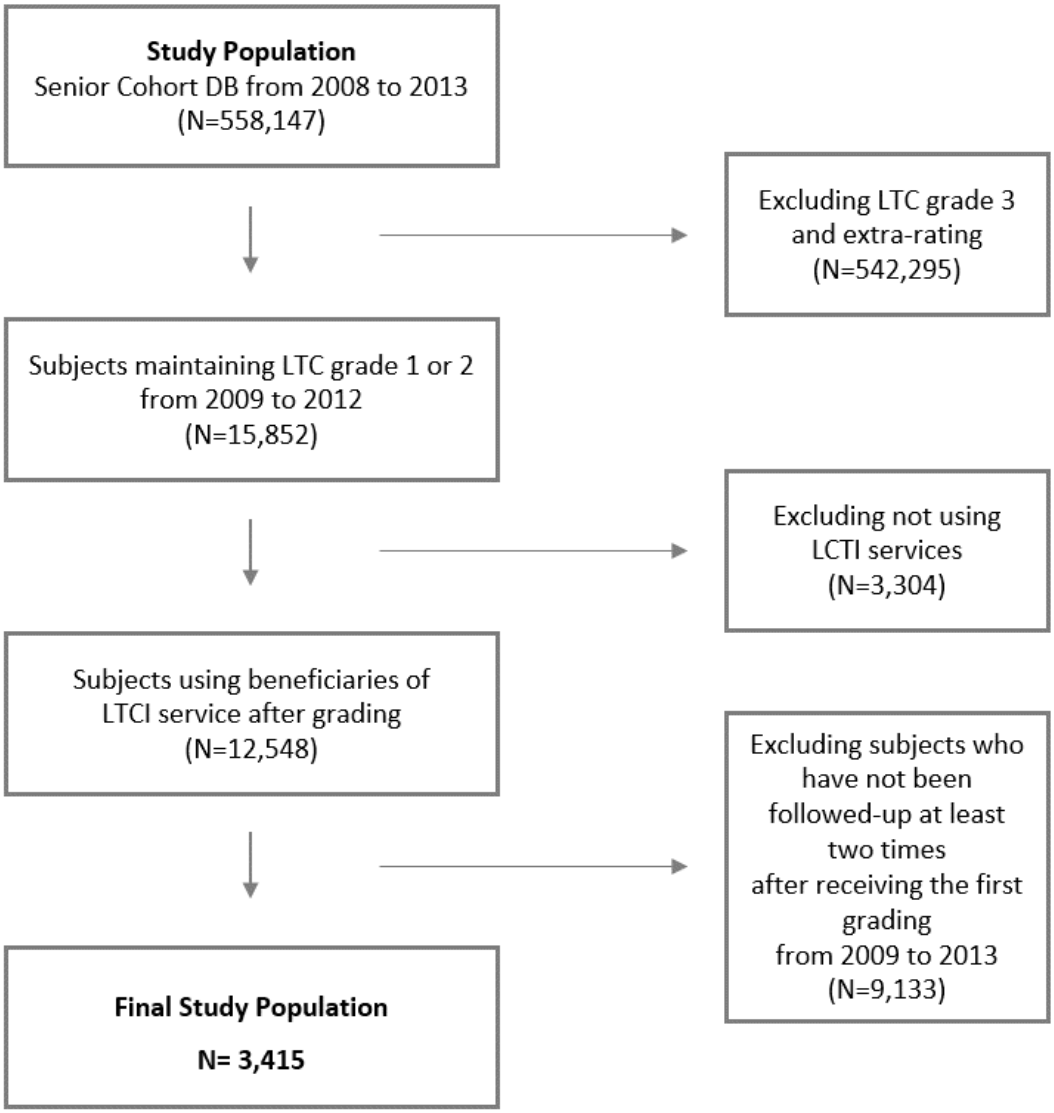

Figure 5. Flowchart of sampling of this study

3. Variables

1) Dependent Variables

In this study, the primary outcome was functional status (change in overall LTC score), with higher scores indicating more severe LTC needs.

The change in LTC score and the change of scores in the areas of ADL (physical function), cognitive function, and behavior change among the five areas of the LTC score were used as dependent variables (Table 8).

Among the results of the Senior Cohort DB assessment evaluation, 13 physical function areas (ADL), 16 behavioral changes, and 10 cognitive functions were added to the corresponding scores for each area as dependent variables (Table 7).

Table 7. Variables of ADL, behavioral changes, cognitive functions

	Description
Activities of daily living (13 items)	The level of physical function was assessed using 13 ADL items measuring dressing, washing face, brushing teeth, bathing, eating, turning over in bed, sitting up in bed, moving in the room, going out of the room, using toilet, bowel control, bladder control, washing hair. Each item is scored 1 (independent), 2 (partially dependent) and 3 (fully dependent) and possible score ranges are between 13 to 39, with higher scores indicating poorer physical function.
Cognitive function (10 items)	The cognitive function subscale consists of 10 items measuring short-term memory, orientation to date and place, long-term memory, understanding of instructions, circumstantial judgment, and communication problems. The possible range of cognitive ability is 0 to 10, with higher scores indicating poorer cognitive function.
Behavioral symptoms (16 items)	The behavioral symptoms subscale consists of 16 items focused on symptom changes over the previous 30 days, including delusional thinking, hallucinations, depression, sleep disturbance, agitation, rejection of care, verbal aggression toward others, threats to hurt others, wandering, destroying property, repetitious behavior, hiding money or things, inappropriate dressing, and fecal or urine smearing. Each behavioral symptom is assessed as yes or no. The range of the behavioral symptom subscale is 0 to 16, with higher scores indicating more behavioral symptoms.

2) Independent Variable of Main Interest

In this study, the independent variable of interest was the type of LTCI services, classified as home-based care, public institutional care service, or private facility institutional care service (Table 8).

The facilities established by the state and local governments were set to Institutional care (Publicly owned), and facilities established by corporations, individuals, and others were set to Institutional care (Privately owned).

3) Covariates

This study included age (<70, 70-79, 80≤), gender (Male, Female), Health Insurance type (Medical Aid, National health insurance), Region of residence (urban, rural), Household income level (high, middle, low), Charlson's comorbidity Index (CCI) (0, 1, 2, 3≤). The urban included Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan Metropolitan City, and Gyeonggi-do. The rural included Sejong, Gangwon, Chungcheong, Jeolla, Gyeongsang-do, Jeju. The CCI is the most widely used method among comorbid disease correction methods. This is a method of correcting the sum of the weights after assigning a constant weight from 1 to 6 points for 19 diseases by Charlson [60] and later modified by Romano [61]. The CCI converted from ICD-9 to ICD-10 have been systematically developed to improve predictive power [62].

The other independent variables were Disability (No, Yes), Primary caregiver (None, Spouse, Other family member, Paid caregiver, Other) and Living arrangements (Own home, Short-term Care, Senior welfare facilities, Nursing hospital, Other) were included (Table 8).

Table 8. Composition of variables

Variables	Definition
Dependent variables	
functional status	Change in LTC score
ADL score	Change in Activities of daily living score
Cognitive function score	Change in cognitive function score
Behavioral symptoms score	Change in behavioral symptoms score
Independent variable	
Type of LTC services	Home-based care Institutional care (Publicly owned) including the national and local governments Institutional care (Privately owned) including corporations, individuals, others
Covariates	
Age	1. <70 2. 70-79 3. ≥80
Gender	1. Male 2. Female
Health Insurance type	1. Medical Aid 2. National health insurance
Region of residence	1. Urban 2. Rural
Household income level	1. Low: 0-3rd quartile 2. Middle: 4-7th quartile 3. High: 8-10th quartile
Charlson comorbidity Index (CCI)	1. None 2. One 3. Two 4. Three or more
Disability	1. No 2. Yes
Primary caregiver	1. None 2. Spouse 3. Other family member 4. Paid caregiver 5. Other
Living arrangements	1. Own home 2. Short-term Care 3. Senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility) 4. Nursing hospital 5. Other

4. Statistical Methods

First, in order to understand the general characteristics and distribution of LTCI beneficiaries according to the type of LTC service, a descriptive statistics analysis was conducted on service use characteristics, service types, personal characteristics, health and function characteristics, and expressed in frequency and percentage.

Second, a t-test and one-way variance analysis (ANOVA) were conducted by conducting a single variable analysis on each variable of LTC service use characteristics, personal characteristics, health and function characteristics, and whether the LTC score.

Third, to understand the relationship between LTC score and changes in three areas (ADL, cognitive function, behavioral change) and LTC service use characteristics, demographic characteristics, health and function characteristics, multivariate analysis was performed using the Linear Mixed effect Models (LMM) method.

In this study, since the same subject must be repeatedly measured at several times over time, the subjects were independent of each other, but there were correlations in the data within the subject, so an analysis method taking this into account should be applied. Linear mixed effect models can be used when the dependent variable is continuous in repeated measured data [63].

The linear mixed-effects model considers both fixed and random effects, and

complements the limitations of the simple linear model. The basic equation of this model can be expressed as follows.

$$y = X\beta + Zb + \epsilon$$

X is the model matrix of β, which represents the regression coefficient of the fixed effect. And Z is the model matrix of b, which represents the regression coefficient of the random effect, and ϵ means the error [64]. AIC (Akaike Information Criterion) is used as the model selection criterion. The smaller the AIC value, the more appropriate model can be determined [65].

This study used linear mixed effect models for repeated measurements to examine the time-lagged relationship between type of LTCI services and functional status. The analysis accounts for non-independence between observations of the same individual at multiple time points, by specifying the within-individual error covariance matrix. In the time-lag model, the covariates measured at time T are related to the outcome variable assessed at the subsequent visit (T+1). Also, the previous functional status (assessed at the previous visit) was added to the model to model changes in functional status score rather than absolute functional scores. All modeling was performed using the PROC MIXED procedure in SAS. Estimates were computed using the restricted maximum likelihood method and autoregressive (AR (1)) covariance structure.

The analysis result was calculated Estimate (SE) and p-value.

SAS version 9.4 was used for statistical analysis of the data, and the case where the p value was less than 0.05 was judged to be statistically significant.

5. Ethics Statement

This study was approved by an institutional review board of Severance Hospital, Yonsei University Health System [IRB Number: 4-2021-0527].

IV. Results

1. General Characteristics of Study People

Using data from the Senior Cohort DB (2009-2013) of NHIS, it was targeted to the subject who followed up at least two times after receiving the first grading evaluation among long-term care insurance service users who maintained grades 1 and 2 were 3,415 people.

The general characteristics of long-term care insurance beneficiaries according to types of long-term care at study baseline are as follows (Table 9).

Home-based care was 50.42% (N=1,722), institutional care (publicly owned) was 4.45% (N=152), and institutional care (Privately owned) was 45.12% (N=1,541).

Looking at the related variables using home-based care, women were 70.73% (N=1,218), and the most common age was 70-79 years 47.91% (N=825). In terms of insurance type, the majority were National Health Insurance 89.14% (N=1,535) people, more than Medical Aid, and for Region of residence, 69.40% (N=1,195) in Urban, more than Rural. The high level of household income was 46.46% (N=800), and in the Charlson comorbidity index (CCI), CCI of 3 or higher 53.83% (N=927) were the highest. The number of subjects without disability was 95.64% (N=1,647). As for the primary caregiver, other family members were 45.24% (N=779), which was the most common

than other primary caregiver. In the living arrangements, owned home 80.20% (N=1,381) was the most common.

As for the related variable using institutional care (publicly owned), women were 84.87% (N=129), and 80 years old or older 53.29% (N=81) were the most common. The majority of insurance types were National Health Insurance 62.50% (N=95), which was more than Medical Aid, and in the Region of Residence, Urban was 51.32% (N=78), which was more than Rural. As for the household income level, the low level was 49.34% (N=75). In the CCI, CCI with a score of 3 or higher 50.00% (N=76) was the highest. There were 94.08% (N=143) without disability. As for the primary caregiver, Paid caregiver was 51.32% (N=78), which was the most frequent than other primary caregivers. For living arrangements, senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility) accounted for the highest number of 73.03% (N=111).

As for the related variable using institutional care (Privately owned), women were 87.35% (N=1,346), and 80 years old or older 55.42% (N=854) were the most common. In terms of insurance type, the majority were National Health Insurance 73.20% (N=1,128), more than Medical Aid, and for Region of residence, 55.74% (N=859) in Urban, more than Rural. As for the household income level, the low level was 43.61% (N=672). In the CCI, CCI with a score of 3 or higher 50.42% (N=777) was the highest. There were 96.24% (N=1,483) without disability. As for the primary caregiver, Paid caregiver was 50.36% (N=776), which was the most frequent than other main caregivers. For living

arrangements, Senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility) accounted for the highest number of 68.66% (N=1,058).

Table 9. General characteristics of long-term care insurance beneficiaries according to types of long-term care at study baseline

Characteristics	Total sample		Type of Long-term Care			p-value
			Home-based care	Institutional care (Publicly owned)	Institutional care (Privately owned)	
Number of subjects (%)	3,415	100.00	1,722 (50.42)	152 (4.45)	1,541 (45.12)	
Age at study entry, mean ±SD, y						<0.0001
<70	252	7.38	161 (9.35)	8 (5.26)	83 (5.39)	
70-79	1,492	43.69	825 (47.91)	63 (41.45)	604 (39.20)	
≥80	1,671	48.93	736 (42.74)	81 (53.29)	854 (55.42)	
Gender						<0.0001
Male	722	21.14	504 (29.27)	23 (15.13)	195 (12.65)	
Female	2,693	78.86	1,218 (70.73)	129 (84.87)	1,346 (87.35)	
Insurance type						<0.0001
Medical Aid	657	19.24	187 (10.86)	57 (37.50)	413 (26.80)	
National health insurance	2,758	80.76	1,535 (89.14)	95 (62.50)	1,128 (73.20)	

Characteristics	Total sample		Type of Long-term Care			p-value
			Home-based care	Institutional care (Publicly owned)	Institutional care (Privately owned)	
Region of residence						<0.0001
Urban	2,132	62.43	1,195 (69.40)	78 (51.32)	859 (55.74)	
Rural	1,283	37.57	527 (30.60)	74 (48.68)	682 (44.26)	
Household income level						<0.0001
Low	1,227	35.93	480 (27.87)	75 (49.34)	672 (43.61)	
Middle	769	22.52	442 (25.67)	32 (21.05)	295 (19.14)	
High	1,419	41.55	800 (46.46)	45 (29.61)	574 (37.25)	
Charlson comorbidity Index (CCI)						0.0266
0	461	13.50	236 (13.70)	18 (11.84)	207 (13.43)	
1	601	17.60	285 (16.55)	20 (13.16)	296 (19.21)	
2	573	16.78	274 (15.91)	38 (25.00)	261 (16.94)	
≥3	1,780	52.12	927 (53.83)	76 (50.00)	777 (50.42)	

Characteristics	Total sample		Type of Long-term Care			p-value
			Home-based care	Institutional care (Publicly owned)	Institutional care (Privately owned)	
Disability						0.3763
No	3,273	95.84	1,647 (95.64)	143 (94.08)	1,483 (96.24)	
Yes	142	4.16	75 (4.36)	9 (5.92)	58 (3.76)	
Primary caregiver						<0.0001
None	47	1.38	23 (1.34)	4 (2.63)	20 (1.30)	
Spouse	600	17.57	551 (32.00)	6 (3.95)	43 (2.79)	
Other family member	1,023	29.96	779 (45.24)	16 (10.53)	228 (14.80)	
Paid caregiver	1,124	32.91	270 (15.68)	78 (51.32)	776 (50.36)	
Other	621	18.18	99 (5.75)	48 (31.58)	474 (30.76)	
Living arrangements						<0.0001
Own home	1,645	48.17	1,381 (80.20)	20 (13.16)	244 (15.83)	
Short-term Care	55	1.61	50 (2.90)	1 (0.66)	4 (0.26)	

Characteristics	Total sample		Type of Long-term Care			p-value
			Home-based care	Institutional care (Publicly owned)	Institutional care (Privately owned)	
Senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility)	1,263	36.98	94 (5.46)	111 (73.03)	1,058 (68.66)	
Nursing hospital	316	9.25	114 (6.62)	16 (10.53)	186 (12.07)	
Other	136	3.98	83 (4.82)	4 (2.63)	49 (3.18)	

Abbreviation: SD= standard deviation; ADL= activities of daily living

2. The Average of Functional Status Score in Study Subject

The Mean and Standard Deviation (SD) of functional status scores at first follow-up (T1) according to Demographic and LTCI service types at baseline (T0) is as follows (Table 10).

According Type of LTCI service, the functional status (LTC score) of Home-based care was 91.29 (±16.24), Institutional care (public) was 93.01 (±15.11), and Institutional care (private) was 89.49 (±14.91) (p=0.0010).

The Cognitive function of Home-based care was 6.41 (±2.60), Institutional care (public) was 7.00 (±2.79), and Institutional care (private) was 6.93 (±2.39) (p<0.0001). The behavioral symptoms of Home-based care were 1.35 (±2.10), Institutional care (public) was 1.53 (±2.14), and Institutional care (private) was 1.71 (±2.29) (p<0.0001).

Among the participants' characteristics of the NHIS Senior Cohort, age 70 and younger showed a functional status (total LTC score) of 92.79 (±17.48) (p=0.0002), and ADL score of 70-79 years old was 32.71 (±4.23) (p=0.0001). Cognitive function and behavioral symptoms were 7.05 (±2.33) and 1.80 (±2.33) for those over 80 years old, and the higher the age, the higher the score (p<0.0001). In terms of gender, males had a Total LTC score of 91.69 (±16.07), which was higher than females and was statistically significant (p=0.0342). In terms of cognitive function and behavioral symptoms, females scored 6.84 (±2.44) (p<0.0001), and 1.59 (±2.24) (p=0.0010). For Region of residence,

ADL 32.54 (±4.24) (p=0.0112) of subjects living in Urban had higher than the score of subjects living in Rural. The behavioral symptoms 1.63 (±2.29) (p=0.0213) of subjects living in Rural was higher score than Urban. In the Household income level, the total LTC score 91.37 (±16.00) was highest in the subjects of the High Household income level (p=0.0071). In the CCI, subjects with a CCI score of 3 or higher had an ADL score of 32.64 (±4.19), which was higher than those with a CCI of less than 3 points (p=0.0003). In terms of cognitive function, subjects without CCI were 7.08 (±2.52) (p<0.0001) and in the behavioral symptoms, subjects with 1 CCI were 1.96 (±2.49) (p<0.0001), which were higher than those with other CCI scores. In the primary caregiver, the total LTC score 91.91 (±15.87) (p=0.0031), and the ADL 32.57 (±4.48) (p<0.0001), cognitive function 7.05 (±2.49) (p<0.0001) of the subjects whose Other types was the primary caregiver were higher than other primary caregivers. As for the behavioral symptoms, the subjects without primary caregiver scored 1.89 (±2.44) (p<0.0001), which was higher than other primary caregiver. For living arrangements, the ADL score of those living in Nursing hospital 32.96 (±3.69) (P=0.0002), cognitive function score of those living in senior welfare facilities 7.09 (±2.45) (p<0.0001), and behavioral symptoms of those living in short-term care facility 2.21 (±2.55) (p<0.0001) were higher than in the other type of living arrangements.

Table 10. Mean and Standard Deviation (SD) of functional status scores at first follow-up (T1) according to Demographic and LTCI service types at baseline (T0)

Characteristics	Overall functional status			ADL			Cognitive function			Behavioral symptoms		
	Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value
Type of LTCI service			0.0010			0.4012			<0.0001			<0.0001
Home-based care	91.29	16.24		32.36	4.25		6.41	2.60		1.35	2.10	
Institutional care (public)	93.01	15.11		32.86	4.19		7.00	2.79		1.53	2.14	
Institutional care (private)	89.49	14.91		32.26	4.38		6.93	2.39		1.71	2.29	
Age at study entry			0.0002			0.0001			<0.0001			<0.0001
<70	92.79	17.48		32.70	4.25		5.97	2.85		1.19	2.03	
70-79	91.46	16.36		32.71	4.23		6.35	2.63		1.25	2.02	
≥80	89.46	14.61		32.06	4.37		7.05	2.33		1.80	2.33	
Gender			0.0342			0.6862			<0.0001			0.0010
Male	91.69	16.07		32.44	4.19		6.04	2.75		1.27	1.99	
Female	90.26	15.51		32.47	4.34		6.84	2.44		1.59	2.24	

Characteristics	Overall functional status			ADL			Cognitive function			Behavioral symptoms		
	Mean	**SD**	**P-value**	**Mean**	**SD**	**P-value**	**Mean**	**SD**	**P-value**	**Mean**	**SD**	**P-value**
Insurance type			0.1042			0.9766			0.3528			0.1157
Medical Aid	91.49	15.83		32.39	4.63		6.76	2.59		1.65	2.19	
National health insurance	90.34	15.59		32.38	4.23		6.65	2.52		1.49	2.19	
Region of residence			0.7274			0.0112			0.6564			0.0213
Urban	90.64	15.85		32.54	4.24		6.69	2.50		1.45	2.13	
Rural	90.44	15.29		32.14	4.41		6.64	2.58		1.63	2.29	
Household income level			0.0071			0.1078			0.0870			0.1789
Low	90.54	15.57		32.23	4.51		6.80	2.47		1.61	2.23	
Middle	89.09	14.96		32.27	4.12		6.56	2.51		1.44	2.16	
High	91.37	16.00		32.57	4.23		6.62	2.59		1.48	2.19	
Charlson comorbidity Index (CCI)			0.1701			0.0003			<0.0001			<0.0001
0	91.55	15.84		32.48	4.17		7.08	2.52		1.59	2.24	
1	89.59	14.83		31.76	4.56		7.02	2.52		1.96	2.49	
2	91.21	15.04		32.18	4.46		6.68	2.52		1.74	2.36	
≥3	90.42	16.03		32.64	4.19		6.38	2.51		1.28	1.98	

Characteristics	Overall functional status			ADL			Cognitive function			Behavioral symptoms		
	Mean	**SD**	**P-value**	**Mean**	**SD**	**P-value**	**Mean**	**SD**	**P-value**	**Mean**	**SD**	**P-value**
Disability			0.4800			0.5808			0.5258			0.3520
No	90.60	15.68		32.39	4.32		6.68	2.53		1.53	2.21	
Yes	89.63	14.62		32.18	4.05		6.53	2.53		1.35	1.84	
Primary caregiver			0.0031			<0.0001			<0.0001			<0.0001
None	89.23	14.79		31.60	4.98		6.78	2.57		1.89	2.44	
Spouse	91.87	16.39		32.33	4.08		5.81	2.68		1.12	1.97	
Other family member	89.21	15.39		31.77	4.44		6.78	2.35		1.63	2.33	
Paid caregiver	90.42	15.26		32.91	4.11		6.82	2.53		1.45	2.04	
Other	91.91	15.87		32.57	4.48		7.05	2.49		1.81	2.37	
Living arrangements			0.0504			0.0002			<0.0001			<0.0001
Own home	90.54	16.03		32.05	4.29		6.42	2.56		1.42	2.19	
Short-term Care	87.65	12.44		31.59	4.38		6.73	2.65		2.21	2.55	

Characteristics	Overall functional status			ADL			Cognitive function			Behavioral symptoms		
	Mean	**SD**	**P-value**	**Mean**	**SD**	**P-value**	**Mean**	**SD**	**P-value**	**Mean**	**SD**	**P-value**
Senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility)	91.22	15.41		32.65	4.44		7.09	2.45		1.71	2.29	
Nursing hospital	88.45	14.73		32.96	3.69		6.39	2.46		1.17	1.73	
Other	90.89	15.82		32.87	4.35		6.45	2.56		1.46	2.16	

Abbreviation: SD= standard deviation; ADL= activities of daily living

3. The Association between Type of LTC and Functional Status

1) The Time-lagged Association between Type of LTCI and Functional Status

The results of the linear mixed effects model estimating the time-lagged association between type of LTCI service and functional status at subsequent time point is as follows (Table 11).

The change in LTC score of Intercept was β= 38.19 (±1.89) ($p<0.0001$), and Time (years) was β= 1.95 (±0.22) ($p<0.0001$). For Type of LTC, the change in LTC score of public facility services (β= -1.03 SE= 0.96) was lower compared to home-based care, which was not significant. And private facility services (β= -2.65 SE= 0.56, $p<0.001$) were significantly correlated with decreases in the change of LTC score. The change in LTC score of Functional status at time T was β= 0.60 (±0.01) ($p<0.0001$).

Table 11. Results of the linear mixed effects model estimating the time-lagged association between type of LTCI service and functional status at subsequent time point

	Functional status	
	Estimate (SE)	**p-value**
Intercept	38.19 (1.89)	<0.0001
Time (years)	1.95 (0.22)	<0.0001
Type of long-term care		
Home-based care	Reference	
Institutional care (Publicly owned)	-1.03 (0.96)	0.2852
Institutional care (Privately owned)	-2.65 (0.56)	<0.0001
Age		
<70	Reference	
70-79	-0.71 (0.71)	0.3154
≥80	-0.67 (0.72)	0.3594
Gender		
Male	Reference	
Female	0.66 (0.48)	0.1701
Insurance type		
Medical Aid	Reference	
National health insurance	-0.48 (0.59)	0.4247
Region of residence		
Urban	Reference	
Rural	0.26 (0.37)	0.4711
Household income level		
Low	Reference	
Middle	-0.20 (0.55)	0.7178
High	0.90 (0.49)	0.0727

	Functional status	
	Estimate (SE)	**p-value**
Charlson comorbidity Index (CCI)		
0	Reference	
1	-0.32 (0.64)	0.6175
2	0.91 (0.64)	0.1571
≥3	0.10 (0.55)	0.8557
Disability		
No	Reference	
Yes	-1.81 (0.84)	0.0639
Primary caregiver		
None	Reference	
Spouse	-1.10 (1.28)	0.3052
Other family member	-1.98 (1.21)	0.1263
Paid caregiver	-1.08 (1.16)	0.3651
Other	-0.20 (1.17)	0.8612
Living arrangements		
Own home	Reference	
Short-term Care	-2.12 (1.77)	0.2315
Senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility)	0.88 (0.70)	0.2069
Nursing hospital	-0.85 (0.88)	0.3318
Other	0.22 (1.11)	0.8411
Functional status at time T	0.60 (0.01)	<0.0001

Note: Higher scores are indicative of worse functional status

Type of LTCI services assessed at time T was related to functional status at time T+1, controlling for functional status at time T, baseline age, gender, socioeconomic status, region of residence, charlson comorbidity index, disability status, time-varying primary caregiver status and living arrangements.

2) The Time-lagged Association between Type of LTCI and ADL, Cognitive Function, Behavioral Change

The results of the linear mixed effects model estimating the time-lagged association between type of LTCI service and ADL, cognitive function area and behavioral change area at subsequent time point is as follows (Table 12).

The change in ADL score of Intercept was β= 12.67 (±0.48) (p<0.0001), and Time (years) was β= 0.42 (±0.05) (p<0.0001). For Type of LTC, the change in ADL score of those who use Institutional Care (Publicly owned) β= -0.27 (±0.23) and Institutional Care (Privately owned) β= -0.40 (±0.14) (p=0.0035) were lower than Home-based care. The change in ADL score of Functional status at time T was β= 0.63 (±0.01) (p<0.0001).

The change in cognitive function score of Intercept was β= 2.28 (±0.23) (p<0.0001), and Time (years) was β= 0.10 (±0.03) (p=0.0037). For Type of LTC, the change in cognitive function score of those who use Institutional Care (Publicly owned) β= -0.08 (±0.13) and Institutional Care (Privately owned) β= -0.06 (±0.08) were lower than Home-based care, which were not significant. By age, for over 80 years old, the change in cognitive function score was β= 0.22 (±0.10) (p=0.0276). The change in cognitive function score of Functional status at time T was β= 0.64 (±0.01) (p<0.0001).

The change in behavioral symptoms score of Intercept was β= 0.26 (±0.17), and Time (years) was β= β= -0.03 (±0.02). For Type of LTC, the change in behavioral symptoms

score of those who use Institutional Care (Publicly owned) β= 0.03 (±0.10) and Institutional Care (Privately owned) β= 0.08 (±0.06) were lower than Home-based care, which were not significant. According to the region of residence, LTC service users living in Rural had a higher change in behavioral symptoms score of β= 0.10 (±0.04) (p=0.0096) than Urban. In the living arrangements, the change in behavioral symptoms score of users living in short-term care facilities was β= 0.42 (±0.19) (p=0.0342). The change in behavioral symptoms score of Functional status at time T was β= 0.57 (±0.01) (p<0.0001).

Table 12. Results of the linear mixed effects model estimating the time-lagged association between type of LTCI service and ADL, cognitive function, behavioral change at subsequent time point

	ADL score		Cognitive function score		Behavioral symptoms score	
	Estimate (SE)	**p-value**	**Estimate (SE)**	**p-value**	**Estimate (SE)**	**p-value**
Intercept	12.67 (0.48)	<0.0001	2.28 (0.23)	<0.0001	0.26 (0.17)	0.1280
Time (years)	0.42 (0.05)	<0.0001	0.10 (0.03)	0.0037	-0.03 (0.02)	0.2323
Type of long-term care						
Home-based care	Reference		Reference		Reference	
Institutional care (Publicly owned)	-0.27 (0.23)	0.2457	-0.08 (0.13)	0.5278	0.03 (0.10)	0.8100
Institutional care (Privately owned)	-0.40 (0.14)	0.0035	-0.06 (0.08)	0.4916	0.08 (0.06)	0.1823
Age						
<70	Reference		Reference		Reference	
70-79	-0.07 (0.17)	0.6930	0.01 (0.10)	0.8864	-0.03 (0.02)	0.2323
≥80	-0.12 (0.17)	0.4905	0.22 (0.10)	0.0276	-0.03 (0.08)	0.7369

	ADL score		Cognitive function score		Behavioral symptoms score	
	Estimate (SE)	**p-value**	**Estimate (SE)**	**p-value**	**Estimate (SE)**	**p-value**
Gender						
Male	Reference		Reference		Reference	
Female	0.18 (0.12)	0.1142	0.25 (0.07)	0.0001	0.02 (0.05)	0.7623
Insurance type						
Medical Aid	Reference		Reference		Reference	
National health insurance	-0.06 (0.14)	0.6786	-0.03 (0.08)	0.6787	-0.02 (0.06)	0.7317
Region of residence						
Urban	Reference		Reference		Reference	
Rural	-0.05 (0.09)	0.5393	-0.05 (0.05)	0.3673	0.10 (0.04)	0.0096
Household income level						
Low	Reference		Reference		Reference	
Middle	-0.004 (0.13)	0.9753	-0.04 (0.08)	0.5742	0.001 (0.06)	0.9808
High	0.19 (0.12)	0.1100	0.07 (0.07)	0.3294	-0.02 (0.05)	0.6442

	ADL score		Cognitive function score		Behavioral symptoms score	
	Estimate (SE)	**p-value**	**Estimate (SE)**	**p-value**	**Estimate (SE)**	**p-value**
Charlson comorbidity Index (CCI)						
0	Reference		Reference		Reference	
1	-0.09 (0.15)	0.5346	0.01 (0.09)	0.9130	0.03 (0.07)	0.6598
2	0.25 (0.15)	0.1044	0.04 (0.09)	0.6247	-0.02 (0.07)	0.7358
≥3	0.02 (0.13)	0.8781	-0.07 (0.07)	0.3544	-0.03 (0.06)	0.6305
Disability						
No	Reference		Reference		Reference	
Yes	0.06 (0.20)	0.7622	-0.11 (0.11)	0.3436	-0.05 (0.09)	0.5885
Primary caregiver						
None	Reference		Reference		Reference	
Spouse	-0.31 (0.31)	0.3109	-0.09 (0.19)	0.6364	0.03 (0.14)	0.8168
Other family member	-0.37 (0.29)	0.2055	-0.06 (0.18)	0.7544	0.02 (0.13)	0.8632
Paid caregiver	-0.28 (0.28)	0.3197	-0.06 (0.17)	0.7115	-0.04 (0.13)	0.7369

	ADL score		Cognitive function score		Behavioral symptoms score	
	Estimate (SE)	**p-value**	**Estimate (SE)**	**p-value**	**Estimate (SE)**	**p-value**
Other	-0.14 (0.28)	0.6229	-0.03 (0.17)	0.8663	-0.03 (0.13)	0.7888
Living arrangements						
Own home	Reference		Reference		Reference	
Short-term Care	-0.47 (0.43)	0.2720	-0.11 (0.26)	0.6714	0.42 (0.19)	0.0342
Senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility)	0.31 (0.17)	0.0627	0.11 (0.10)	0.2946	0.05 (0.08)	0.4802
Nursing hospital	0.19 (0.21)	0.3638	-0.09 (0.13)	0.4962	0.07 (0.09)	0.4517
Other	0.37 (0.27)	0.1691	-0.05 (0.16)	0.1639	0.07 (0.12)	0.5891
Functional status at time T	0.63 (0.01)	<0.0001	0.64 (0.01)	<0.0001	0.57 (0.01)	<0.0001

Note: Higher scores are indicative of worse functional status

Type of LTCI services assessed at time T was related to functional status at time T+1, controlling for functional status at time T, baseline age, gender, socioeconomic status, region of residence, charlson comorbidity index, disability status, time-varying primary caregiver status and living arrangements.

3) The Association between Type of LTCI and Functional Status Score

The results of mixed effect model analyses for the association between type of LTCI service and overall functional status score, stratified by baseline characteristics is as follows (Table 13).

In the living arrangements of Institutional care (Publicly owned), the LTC score of users living in own home β= -4.28 (±2.09) (p=0.0425). The functional status score of men, 80 years old or older, CCI 1 and CCI 3 or more, spouse, own home and senior welfare facilities of the Institutional care (Publicly owned) were lower than Institutional care (Privately owned).

In the Institutional care (Privately owned), the LTC score of women was β= -2.73 (±0.63) (p<0.0001). By age, the LTC score of under 70 years old was β= -6.08 (±2.38) (p=0.0172), and 80 years old or older was β= -0.23 (±0.77) (p<0.0001). In the insurance type, the LTC score of those eligible using National health insurance was β= -2.75 (±0.61) (p<0.0001). Depending on the region of residence, the LTC score of users living in Urban were β= -2.52 (±0.74) (p=0.0008), and the LTC score of service users living in Rural were β= -2.75 (±0.87) (p=0.0021). In the household income level, the LTC score of low household income level was β= -2.25 (±0.95) (p=0.0199), and high household income level was β= -3.37 (±0.88) (p=0.0002). In the CCI, the LTC score of CCI 2 were β= -5.05 (±1.54) (p=0.0019), and CCI 3 or more were β= 2.57 (±0.74) (p=0.0007). In

terms of disability, the LTC score of users without disability was β= -0.38 (±0.14) (p=0.0067). In the primary caregiver, the LTC score of other family members β= -4.19 (±1.76) (p=0.0230), and Other type of primary caregiver β= -4.19 (±1.76) (p=0.0230). In the living arrangements, the LTC score of users living in own home β= -2.96 (±0.72) (p<0.0001), senior welfare facilities β= -3.37 (±1.35) (p=0.0157).

Table 13. Results of mixed effect model analyses for the association between type of LTCI service and overall functional status score, stratified by baseline characteristics

.	Type of LTCI service				
	Home-based care	Institutional care (Publicly owned)		Institutional care (Privately owned)	
	Estimate (SE)	Estimate (SE)	P-value	Estimate (SE)	P-value
Gender					
Men	Reference	-3.39 (2.50)	0.1795	-1.90 (1.32)	0.1564
Women	Reference	-0.71 (1.05)	0.4996	-2.73 (0.63)	<0.0001
Age at initial assessment					
<70	Reference	-2.83 (4.44)	0.5302	-6.08 (2.38)	0.0172
70-79	Reference	-0.73 (1.54)	0.6342	-1.36 (0.89)	0.1306
≥80	Reference	-1.24 (1.29)	0.3371	-0.23 (0.77)	<0.0001
Insurance type					
Medical Aid	Reference	1.13 (1.96)	0.5700	-1.44 (1.54)	0.3568

.	Type of LTCI service				
	Home-based care	**Institutional care (Publicly owned)**		**Institutional care (Privately owned)**	
	Estimate (SE)	**Estimate (SE)**	**P-value**	**Estimate (SE)**	**P-value**
National health insurance	Reference	-1.61 (1.15)	0.1617	-2.75 (0.61)	<0.0001
Region of residence					
Urban	Reference	-0.87 (1.32)	0.5108	-2.52 (0.74)	0.0008
Rural	Reference	-1.01 (1.41)	0.4748	-2.75 (0.87)	0.0021
Household income level					
Low	Reference	0.14 (1.46)	0.9214	-2.25 (0.95)	0.0199
Middle	Reference	-1.48 (2.21)	0.5044	-1.88 (1.19)	0.1192
High	Reference	-1.64 (1.63)	0.3156	-3.37 (0.88)	0.0002
Charlson comorbidity Index (CCI)					
0	Reference	-0.38 (2.62)	0.8854	-1.69 (1.69)	0.3256
1	Reference	2.20 (2.65)	0.4121	-1.76 (1.42)	0.2187

.	Type of LTCI service				
	Home-based care	**Institutional care (Publicly owned)**		**Institutional care (Privately owned)**	
	Estimate (SE)	**Estimate (SE)**	**P-value**	**Estimate (SE)**	**P-value**
2	Reference	-3.36 (2.34)	0.1574	-5.05 (1.54)	0.0019
≥3	Reference	-1.23 (1.33)	0.3553	2.57 (0.74)	0.0007
Disability					
No	Reference	-0.28 (0.24)	0.2423	-0.38 (0.14)	0.0067
Yes	Reference	-0.42 (0.95)	0.6610	-1.03 (0.62)	0.1160
Primary caregiver					
None	Reference	5.92 (8.41)	0.5540	-2.04 (4.03)	0.6629
Spouse	Reference	-8.25 (4.55)	0.0757	-2.86 (1.72)	0.1031
Other family member	Reference	-3.39 (2.31)	0.1510	-4.19 (1.76)	0.0230
Paid caregiver	Reference	0.82 (1.40)	0.5623	-1.39 (0.95)	0.1469
Other	Reference	-3.39 (2.31)	0.1510	-4.19 (1.76)	0.0230

.	Type of LTCI service				
	Home-based care	**Institutional care (Publicly owned)**		**Institutional care (Privately owned)**	
	Estimate (SE)	**Estimate (SE)**	**P-value**	**Estimate (SE)**	**P-value**
Living arrangements					
Own home	Reference	-4.28 (2.09)	0.0425	-2.96 (0.72)	<0.0001
Short-term Care	Reference	-2.16 (6.46)	0.7416	6.25 (3.53)	0.0946
Senior welfare facilities (Nursing home, Senior Congregate Housing, Geriatric care facility, Elderly care facility)	Reference	-1.62 (1.63)	0.3264	-3.37 (1.35)	0.0157
Nursing hospital	Reference	3.97 (2.46)	0.1131	-1.01 (1.24)	0.4202
Other	Reference	2.46 (4.88)	0.6186	-1.49 (2.23)	0.5099

Models were adjusted for covariates listed in table 9, except for the corresponding subgroup variable for analysis.

V. Discussion

1. Discussion of the Study Method

This study analyzed 3,415 people who followed up at least two times after receiving the first grading evaluation among long-term care insurance service users who maintained grades 1 and 2 in the Senior Cohort DB of NHIS. Unlike previous studies, this study is that it is a difference from previous studies that it has increased trust in terms of the size of the subject of analysis.

Another study analyzed the accredited persons in August-September 2008 because the accredited persons in July 2008 judged that there would be a bias due to the initial implementation of the elderly LTCI system [17]. In this study, it was judged that there would be a bias for the initial implementation of LTCI for the elderly in all of 2008. Thus, the accredited persons from January 2009 to December 2013 were analyzed. This study differs from other previous studies in that it was not an analysis of one-year service provision, but the change in status of accredited persons using LTC services during the period from 2009 to 2013.

The subjects of this study were recipients of LTCI applicants who used LTC care service among the first and second grade certified senior citizens across the country. There is a difference from preliminary study for residents only in nursing facilities

[36][66][67], a study on home-visit nursing services among in-home services [68], and prior studies targeting people with dementia [16][69][70][71].

Other study analyzed each grade based on the changes in the original score for each of the five areas, which are components of the accredited score, and the score in the IADL area [17]. Since the grades are classified for each score segment, there is a difference between the grades with a difference of 1 point, or even a difference of 10 points can be classified as the same grade. Therefore, in order to analyze detailed changes in the functional status, it is possible to reduce errors and the like by analyzing the scores based on the changes of each area rather than the changes between grades.

In this study, for a more detailed study, the changes in scores of LTC, ADL, cognitive function, and behavior change according to the type of LTC service when an accreditation investigation was received again for reasons such as grading re-evaluation and renewal were analyzed.

The methodological limitations of this study are as follows.

First, the data in this study used secondary data extracted from the customized LTCI DB for the elderly of NHIS. Therefore, it was not possible to reflect various variables such as family relations of targets using in-home services and facility services, the level of manpower of service providers, and service provision environment.

Second, the target of analysis at the group level was the LTC service for elderly care service. The types of LTC services included home-based benefits (visiting care, visiting

bathing, visiting nursing, day and night care, short-term care) and facility services. However, the analysis of the subdivided service types of in-home benefits and facility services was excluded.

Third, the change in functional status can be measured by whether or not the score for each area has changed, but the grade is an important criterion for applicants because the type of service and the monthly limit amount are determined according to the final grade. However, even if a person who received the same grade received the same service during the same period, it was impossible to confirm whether or not they received the same quality service. Thus, in order to analyze the status change of the 1st and 2nd grade accredited persons, this study analyzed the influencing factors on the change in the LTC score, and excluded the analysis on the grade change.

Fourth, since the items identified during the accreditation evaluation were set as independent variables, external factors of the subject were not considered. Depending on the subject's actual residence area, there might be other medical use in addition to LTCI for the elderly, and the influence of the surrounding environment or local support was not considered.

Despite these limitations, this study is meaningful in that LTC services are classified into in-home services, public facilities, and private facilities for those who were accredited in the 1st and 2nd grades of the Senior Cohort DB, and analyzed the factors influencing the change in the condition of recipients.

2. Discussion of the Result

The change of LTC score of Institutional care services was lower than Home-based care. And the change of LTC score of Institutional care (Publicly owned) was the lowest, and the change of LTC score of Institutional care (Privately owned) was lower than home-based care compared to Home-based care. It was seemed that the in-home service and facility service used by the elderly had a positive effect as exercise features and rehabilitation services to improve daily life performance were provided [72][73]. However, the functional condition of recipients using home-based care was not better than facility service.

In previous studies, as quota increases, the changes in scores of LTC, and ADL decreased, and the recipient's status improved [67]. In the study on the grade improvement rate of LTC facilities, the higher the number of personnel, the higher the quality of service, and the functional level, pressure sores, and weight loss of residents showed the closest relationship with the level of nursing personnel. The state of operation of national and public facilities was the best, and the private facilities were the lowest [33]. The results of this study are contrary to the results of previous studies that the LTC grade improvement rate of institutions with a large filling rate and capacity, and corporate facilities compare to private facilities were higher.

The results of this study are contrary to previous studies. The rehabilitation service is

not smooth due to the lack of manpower and expertise in the facility, and the condition of facility service users may deteriorate [74]. Because LTC facilities can only be deployed by nursing assistants, and the allocation of manpower is different depending on the size of the facility's capacity, the problem of lack of services, facility environment, and expertise is being raised [72]. On the other hand, in the case of in-home services, it is possible to provide customized services by nursing care workers, and the ratio that can be cared for by the family is high, so it has the advantage of providing appropriate services to patients rather than facility services [72]. In-home service provides intensive protection of the primary caregiver, not only taking care of the body of the elderly, but also playing an auxiliary role in daily life at home [75], and the improvement rate of daily life performance can be high.

In the case of in-home service, there may be problems such as deterioration of service quality due to lack of professionalism of service personnel, irrationality of service use time limit, and equal payment of home-visit care fee by grade. In addition, there are cases where the burden on users is excessive due to co-payments and non-pay items [48][76]. The subjects use in-home service because they wanted to stay with their family or in-home service was cheaper than the admission facility. As the period of using in-home service increased, the satisfaction level decreased. This is because of the perception that the benefits provided by LTCI are limited, and the services for each benefit are simple and do not contribute to the satisfaction of the recipient's needs and improvement of their functional status [77].

In the case of women using LTC services, it was found to have a negative effect on the functional status compared to men. This is predicted because women have a longer life expectancy than men, and the proportion of the elderly who need LTC is high. In previous studies [17], it is contrary to the worsening of the functional status of men compared to women according to gender.

In age, under the age of 70 had worse functional status compared to other age groups. It is predicted that the functional status of the elderly has already deteriorated, so that there is not much change in the functional status even with the use of LTCI services.

In terms of regional classification, the number of credits increased in the rural compared to urban. This is believed to have a negative effect of increasing LTC scores because users living in rural areas have difficulty receiving services from LTCI and medical institutions such as urban. This is presumed to be due to the less supply of services, less access to services, and traditional values of elderly care compared to urban areas.

The functional status of the subjects with the high household income level had deteriorated, but the functional status of the middle household income level got better. There are differences in accessibility to service use according to income level [27]. The out-of-pocket costs differ depending on the use of LTC services for the elderly, and additional costs are required for the services, so it is predicted that the use of services may differ by income level. Because the types of services that can be used are limited

according to the care grade, and there is the burden of additional costs due to the difference in co-payment depending on the use of LTC services for the elderly. Therefore, there may be differences in the monthly limit amount, the type and amount of services available for each grade. In addition, as LTC scores are high, it seems that the poorer the functioning state is, the more difficult it is to improve the function.

Regarding CCI, the subjects with a score of 1 improved their functional status. It can be seen that the elderly who are already in poor functional condition due to various diseases received differentiated services for chronic disease patients, and thus their physical function improved.

The LTC score of having the primary caregiver was decreased compared to None primary caregiver. In contrast to the results of this study, there is a previous study that when the primary caregiver is a spouse or children, it affects the deterioration of the functional state in some areas [17]. In another study, the condition worsened when other family members cared the elderly than the spouse cared the elderly [78], and the degree of deterioration was lower in the case of living alone than the spouse, which is contrary to the results of this study. This seems to be due to the burden of family members having to take care of the elderly or patients outside of the home service hours when receiving nursing care services. The recipients who do not have the primary caregiver must carry out their daily life on their own, so improvement in functional status may be difficult. In the case of the elderly who are cared for by their spouse or children, the rate of using home-based care was higher than institutional care.

As for living arrangements, the functional status of the subjects residing in short-term care and nursing hospital were better than those in the other living conditions. It seemed that short-term care and nursing hospital facility properly managed residents' diet and nutrition, physical and occupational therapy, and physical activities.

In ADL and cognitive function, the scores of subjects who used Institutional care (Publicly owned) and Institutional care (Privately owned) were lower than Home-based care. And in the behavioral symptoms, the scores of subjects who used Institutional care (Publicly owned) and Institutional care (Privately owned) were higher than Home-based care. The scores of most variables were low except for the gender, living arrangements in all areas, age of the cognitive function score, and the region of residence of the behavioral symptoms score. In the preceding study, the ADL score decreased and the functional status improved, but in cognitive function, the functional status was worse due to the increase in the cognitive function score in 2010 compared to 2008 [79]. In the other study [17], the degree of improvement in functional status was strong due to a decrease in the scores for all areas in 2009 compared to 2008.

As a result of analyzing the association between LTCI service of Institutional care (Publicly owned), Institutional care (Privately owned) and total LTC score change, Institutional care (Privately owned) score was lower than Institutional care (Publicly owned) in most variables of gender, age, Insurance type, Region of residence, Household income level, CCI, Disability, Primary caregiver, Living arrangements, etc. It was found that the condition of recipients using Institutional care (Privately owned) was better than

those who used institutional care (Publicly owned). The establishment entity, the location of the institution, and the LTC institution evaluation have an effect on the improvement of the LTC grade. In private facilities, grade improvement was the largest, because of the payment of LTC grade improvement incentives [36].

The research so far has mainly focused on the change of evaluation grade according to LTC services and the use of LTC facility services. The research on the change in the status of beneficiaries according to the types of services of LTCI for the elderly was insufficient. This study analyzed by considering both the individual characteristics of recipients and the characteristics of LTC services that provide in-home service, public facility services and private facility services. Therefore, it is meaningful that it will contribute to attracting attention to the change of the recipients' condition according to the type of LTC service.

3. Policy Implications

First, it was analyzed that the status of recipients using Institutional care (Privately owned) got better because the change in scores of LTC, ADL, and cognitive function in Institutional care (Privately owned) was lower than Home-based care and Institutional care (Publicly owned). In previous studies, as LTCI was introduced, the facility of LTC could be selected by the recipients, so non-profit corporate facilities were also forced to pursue profits [80] and might have low efficiency [81][82]. The results of these study are similar to the results in which the institutional care (publicly owned) of this study worsened the condition of recipient than other types of LTCI services. The institutional care (Publicly owned) has low publicity due to the marketization of LTC service supply, so LTC service outcomes are also considered to be lower than institutional care (Privately owned). Therefore, it is necessary to provide institutional support or mechanisms for non-profit corporate facilities to perform public functions rather than competition with for-profit facilities. In addition, the effective management policies should be prepared, such as reinforcing the expertise of manpower and preparing guidelines and regulations on the minimum service provision standards that can help with the ability to perform daily life in order to provide high-quality services for facility services [83]. As corporations and public institutions have higher program implementation rates than private institutions, there was a need to strengthen education and training and service quality management for the evaluation and monitoring of subject, and program implementation in the private

institutions [84]. However, as a result of this study, it seems necessary to strengthen the management of public facilities rather than private facilities. With the introduction of the LTCI, the quantitative expansion and accessibility of LTC services have improved, but in terms of service quality, there are differences depending on the size of the facility and the operating entity. Since large-scale facilities and non-profit corporations have a relatively high level of service quality, for continuous quality improvement, measures to improve the appropriateness of the facility scale and non-profitability are required [85]. In addition, since specific service standards for LTC institutions are not presented, it is necessary to establish service standards [86].

Second, the status of recipients using other types of services was more positive compared to in-home service recipients. There is a need to improve the professionalism of in-home service staff and to fill the workforce. In addition, it is necessary to establish a systematic caregiver management system and develop service standard guidelines. The government should develop and provide services for a variety of in-home benefits tailored to the needs and conditions of beneficiaries. Therefore, convenience-oriented nursing services and medical services necessary for daily life should be provided so that recipients can continue to live at home while maintaining their independence life in order to continuously provide high-quality home services [83]. The subject of LTC should be provided with a variety of services with high-quality program content over a long period of time. It is necessary to expand the amount of related services because the inmate must provide services outside of the service provision hours, and if the person lives alone, they

have to do other life on their own. In addition, since living with family members has a positive effect on grade improvement (deteriorating status) compared to living alone, it is necessary to consider not only the recipients, but also the person living with them, and furthermore the surrounding environment.

Third, due to the characteristics of the elderly, mental and physical function declines as age increases, and the more they reach the Oldest-Old, the wider the disparity [87], and LTC grade improvement decreases [36], and the possibility of maintaining the same grade decreases. It was analyzed that the condition of 70-79 years old and over 80 years old got better due to decrease in the LTC score of the under 70 years old group. Therefore, it is necessary to accurately judge the subjects of LTC, respond early, and prevent deterioration of the patient's condition. As their aging progresses, it is predicted that the number of people who require LTC services will increase in the future, so effective management policies are expected to be prepared.

Fourth, the patients with chronic diseases (stroke, diabetes, hypertension, arthritis) using LTCI service showed more improved condition than those without the disease. It can be said that the patients with mild disease get better relatively quickly than those without disease or with severe disease. Therefore, it is necessary to provide differentiated services to patients with diseases and to prepare measures to prevent chronic diseases with all recipients in mind. It is also worth considering the dissemination of chronic disease management programs that systematically provide complex services such as physical activity and mental support [67]. The physical training, such as occupational

therapy or rehabilitation training, should be accompanied along with medication guidance and cognitive training for chronic disease patients. In addition, it is necessary to manage the nutritional status of the subject.

Lastly, as a result of this study, the function status of recipients was different according to the type of LTC service used by the elderly. Therefore, the government needs to come up with a plan to adjust the quality of services so that even if users of LTC services for the elderly use different types of services, there is not much difference in change of condition. In addition, there is a need to prepare appropriate standards and an efficient interaction system so that these measures can be established systematically. The positive effect of LTCI implies the need for continuous implementation of the policy and expansion of qualifications for non-recipients who need LTC.

VI. Conclusion

This study analyzed the change in LTC score of 3,415 subjects who followed up at least two times after receiving the first grading evaluation among long-term care insurance service users who maintained grades 1 and 2 by LTCI DB of NHIS (2009-2013).

As a result of the study, there was a difference in the LTC score for users of LTC service according to the type of LTC. Institutional care (Privately owned) and Institutional care (Publicly owned) users were better than home-based service care users, and condition of the people using Institutional care (Privately owned) was the best.

In the areas of ADL function who used Institutional care (Privately owned) mostly decreased, and the condition of recipients using Institutional care (Privately owned) were better than other type of LTC services. In cognitive function and behavioral symptoms, the scores of peoples who used Institutional care (Privately owned) were higher than Institutional care (Publicly owned), and the condition of using Institutional care (Privately owned) were worsen than other type of LTC services.

The LTC score of Institutional care (Privately owned) in most variables was lower than The LTC score of Institutional care (Publicly owned), and the condition of recipients using Institutional care (Publicly owned) was worse.

In light of these research results, it is predicted that it is difficult to secure the quality of institutional care (Publicly owned) among elderly care facilities than Institutional care (Privately owned). Therefore, even if the recipients of LTC service use different types of services, it is necessary to prepare a plan to adjust the service quality so that there is not much difference in the change of the recipients' condition.

Although a lot of research has been conducted on LTCI at the time when it is necessary to prepare for Super-aged society, institutional supplementation is needed, such as improving service standards and strengthening quality management according to the type of LTCI services. And, the health care policies related with LTC should be established so that the elderly can live a healthy old age.

In addition, it is necessary to accurately judge those who are eligible for LTC grade early, to induce them who need to provide services to enter as recognized recipients of LTCI, and to provide a variety of high-quality LTCI services for the elderly according to the type of LTCI services. It is also necessary to consider providing differentiated services to chronic disease patients and the dissemination of chronic disease management programs that systematically operate physical activities or mental support.

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Korean Abstract

장기요양서비스 이용자들의 요양서비스 종류에 따른 기능상태 변화

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강승현

서론: 정부의 노인장기요양보험 제도의 도입으로 요양서비스 이용자들이 증가하였고, 노인장기요양보험 수급자들의 신체 기능상태가 호전되고 부양자의 부담이 감소되었다. 그러나, 노인들이 이용하는 요양서비스 종류에 따라서 수급자들의 신체 기능상태 및 증상의 변화가 상이하였다. 이에 노인장기요양서비스를 이용하는 수급자를 대상으로 장기요양서비스 이용 특성을 분석하여 요양서비스 종류에 따른 이용자의 기능상태 변화를 파악하고자 한다.

연구방법: 이 연구는 국민건강보험공단에서 제공하는 노인 코호트 자료(2009년~2013년) 를 활용하였다. 연구대상은 2009년~2013년 사이에 장기요양등급 1, 2등급을 유지하고 장기요양보험 서비스 이용한 사람 중에 최초로 등급 판정을 받은 이후에 최소 2번 이상 인정조사를 받은 3,415명이다. 이 연구의 주요 독립변수는 장기요양서비스의 유형으로 재가 서비스와 공립 시설서비스, 사립 시설서비스이다. 종속변수는 장기요양 인정 점수이며 점수가 높을수록 이용자의 상태가 악화되어 장기요양서비스의 요구가 더 필요한 것을 의미한다. 이 연구는 의료이용에 영향을 미칠 수 있는 요인들을 통제하였으며

통계분석방법으로는 혼합효과모형 (Linear mixed effects model estimating)을 이용하여 노인장기요양서비스 유형과 반복 측정된 기능상태 간의 시간에 따른 관계를 분석하였다.

연구결과: 다른 요인들을 통제한 다변량 분석에서는 기준 시점에서 장기요양 인정점수 평균은 공립 시설서비스가 93.01점으로 가장 높고, 재가서비스는 91.29점, 사립 시설서비스는 89.49점으로 가장 낮았고 통계적으로 유의하였다 (p=0.0010). 재가서비스와 비교하여, 공립 시설서비스 (β= −1.03, p=0.2852)는 시간에 따른 장기요양 인정점수 감소와 상관관계가 유의하지 않았다. 사립 시설서비스 (β= −2.65, p<0.0001)는 시간에 따른 장기요양 인정점수 감소와 유의한 상관관계가 있었다.

결론: 재가서비스를 이용한 수급자보다 공립 시설서비스를 이용한 수급자의 상태가 더 호전되었으며, 사립 시설서비스를 이용한 수급자들의 상태가 다른 장기요양 서비스를 이용한 수급자보다 상태가 가장 많이 호전되었다. 따라서 공립 시설서비스와 재가서비스를 이용한 수급자들은 더 많은 장기요양서비스 요구가 필요한 것으로 사료된다. 정부는 장기요양서비스 이용자들이 다른 종류의 요양서비스를 이용하더라도 수급자들의 상태 변화는 차이가 나지 않도록 서비스 질을 조정할 수 있는 방안을 마련할 필요가 있다. 그리고 다양한 양질의 노인장기요양보험 서비스 제공으로 고령자들이 건강한 노후를 지낼 수 있도록 하는 보건의료정책이 수립되어야 한다.