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**Does long-term care insurance reduce burden of medical costs? A  
retrospective elderly cohort study**

Jae Woo Choi

**Department of Public Health  
The Graduate School  
Yonsei University**

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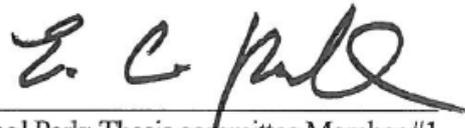
The Dissertation submitted to  
the Department of Public Health, Yonsei University  
in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy

**Jae Woo Choi**  
**December, 2016**

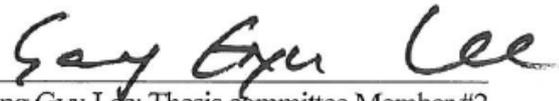
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**January, 2017**

**Jae Woo Choi**

## TABLE OF CONTENTS

ABSTRACT .....	i
I. Introduction.....	1
1. Background.....	1
2. Objectives .....	4
II. Literature Review .....	6
1. Conceptualizations of Medical Utilization .....	6
2. Long-term Care Insurance .....	17
3. Consequences of Introducing Long-Term Care Insurance .....	28
4. Previous Studies on the Burden of Medical Costs.....	39
III. Material and Methods.....	49
1. Framework of This Study .....	49
2. Study Population and Design.....	50
3. Variables.....	53
4. Statistical Analysis.....	56
5. Ethics Statement .....	57

IV. Results.....	58
1. General Characteristics of Long-Term Care Insurance Beneficiaries .....	58
2. Trends of Semi-Annually Average Values in Study Subject .....	60
3. Regression Model Estimates.....	72
V. Discussion .....	77
1. Discussion of Study Methods .....	77
2. Discussion of Study Results .....	81
VI. Conclusion.....	85
References .....	86
Appendix .....	98
1. Trends of Medical Utilizations according to Income Group .....	98
2. Regression model estimates according to Income Group.....	110
Korean Abstract .....	116

## LIST OF TABLES

Table 1. Eligible persons of long-term care insurance .....	18
Table 2. Representative states of recipients of long-term care benefits by grade .....	20
Table 3. The number of application and approval in LTCI .....	27
Table 4. The number of recipients by grades .....	28
Table 5. Data structure of the elderly cohort database .....	50
Table 6. Monthly mean earned income according to decile distribution ratio by year .....	54
Table 7. Composition of variables .....	56
Table 8. General characteristics of long-term care insurance (LTCI) beneficiaries (2008).....	59
Table 9. Regression model estimates for medical utilization by long-term care insurance (LTCI) .....	72
Table 10. Regression model estimates for number of hospitalization by long-term care insurance (LTCI) according to hospital type .....	73
Table 11. Regression model estimates for length-of-stay by long-term care insurance (LTCI) according to hospital type .....	74
Table 12. Regression model estimates for burden of medical costs by long-term care insurance (LTCI) .....	75
Table 13. Regression model estimates for burden of support costs by long-term care	

insurance (LTCI) ..... 76

## LIST OF FIGURES

Figure 1. Causal diagram of substitution model .....	10
Figure 2. Andersen's final model .....	14
Figure 3. Suchman's stage model of illness and medical care .....	15
Figure 4. Health Belief Model .....	16
Figure 5. Process of assessing long-term care recipients .....	18
Figure 6. Long-term care insurance management system .....	26
Figure 7. Framework of this study .....	49
Figure 8. Flowchart of sampling of this study .....	52
Figure 9. The trends of average number of hospitalization in study subject .....	60
Figure 10. The trends of average number of hospitalization according to hospital type .....	61
Figure 11. The trends of average number of hospitalization according to hospital type (Beneficiaries) .....	62
Figure 12. The trends of average number of hospitalization according to hospital type (Non-beneficiaries) .....	63
Figure 13. The trends of average length-of-stay in study subject .....	64
Figure 14. The trends of average length-of-stay according to hospital type .....	65
Figure 15. The trends of average length-of-stay according to hospital type (Beneficiaries) .....	66

Figure 16. The trends of average length-of-stay according to hospital type (Non-beneficiaries) .....	67
Figure 17. The trends of average number of outpatient visit in study subject .....	68
Figure 18. The trends of average number of drug prescription in study subject .....	69
Figure 19. The trends of average ratio of burden of medical costs in study subject .....	70
Figure 20. The trends of average ratio of burden of support costs in study subject .....	71

## ABSTRACT

### **Does long-term care insurance reduce burden of medical costs? A retrospective elderly cohort study**

**Background:** The government has implemented the long-term care insurance (LTCI) to support the healthcare needs of the elderly. The purpose of this service is to reduce unnecessary inpatient medical utilization and reduce the burden of excessive medical costs through a substitution effect. Thus, this study aims to examine whether LTCI reduces medical utilization and the burden of medical costs of beneficiaries who have received the service for at least three consecutive years.

**Materials and Methods:** We utilized the elderly cohort database (DB) of the National Health Insurance Service during 2005-2013. The subjects are 3,029 beneficiaries who received consecutive LTCI services. In addition, we performed a 1:3 case-control match on the propensity score to select a comparison group and the final subjects were 12,116 people, including 9,087 who formed the control group. The dependent variables were semiannually measured medical utilizations (inpatient, outpatient, and drug prescription) and the burden of medical costs at the individual level, and the independent variable is an interaction term (benefit\*period) through

difference-in-difference analysis. This study adjusted factors that affect medical utilization and then applied the method of generalized estimating equations (GEE) to the data.

**Results:** After applying multivariable models, this study indicates that the number of hospitalizations of beneficiaries significantly decreased compared to non-beneficiaries (adjusted ratio: 0.95; 95% confidence interval [CI], 0.95 to 0.96). Similarly, length-of-stay (LOS) of beneficiaries also shows significant reduction compared to non-beneficiaries (adjusted ratio: 0.76; 95% C.I., 0.73 to 0.79). The number of hospitalizations (adjusted ratio: 0.87; 95% C.I., 0.74 to 0.98) and LOS (adjusted ratio: 0.36; 95% C.I., 0.14 to 0.87) of beneficiaries decreased substantially compared to non-beneficiaries' stay in long-term care hospitals, among hospital types. The number of outpatient visits and receipt of drug prescriptions of beneficiaries and non-beneficiaries increased marginally. The burden of medical costs of beneficiaries reduced considerably compared to non-beneficiaries (adjusted ratio: 0.80; 95% C.I., 0.77 to 0.83). However, the burden of support costs (medical cost + long-term care cost) in beneficiaries increased significantly compared to non-beneficiaries (adjusted ratio: 1.18; 95% C.I., 1.15 to 1.21).

**Conclusions:** Long-term care insurance has led to a significant decline in the utilization rates of inpatient service. The government needs to arrange appropriate criteria, an efficient link system, and a trained specialist who can coordinate inpatient

care for patients in an LTCI hospital or facility. The study results also show that the burden of medical costs for LTCI beneficiaries reduced significantly compared to non-beneficiaries, despite the rise in medical costs in the elderly. The positive effect of LTCI supports continuous implementation and expansion of the LTCI service for non-beneficiaries who need care assistance.

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Key words: Long-term care insurance, Medical utilization, Burden of medical costs

## I . Introduction

### 1. Background

Environment of Korean health care consistently has changed and one of emerging issues recently is increase of aging population. The percentage of aging population (above 65 years old) is 13.1% (6.6 million people) of entire population in Korea. Aged society which the percentage of aged population is 14% of total population will start at 2018 and super aged society that the percentage of aging people is 20% of entire population will begin in 2026<sup>1</sup>. More than 65 years old population will increase to 12.7 million people (24.3% of entire population) in 2030 and they will account for 37% of total population in 2050<sup>2</sup>. Especially, more than 85 years old population will be predicted to increase thirty seven thousand people in 2010 to 4.5 million people, which increase more than 10 times<sup>3</sup>. This rapidly growth of elderly population leads to increase medical costs<sup>4</sup>. A medical costs for health insurance of aging population is 21.4 trillion Korean won and it is 36.8% of 58 trillion Korean won which is total health insurance expenditure. In addition, elderly health insurance expenditure per capita is 3.3 million Korean won in 2015 and the expense size is 2.9 times compared to total health insurance expenditure per capita, which are 1.2 million Korean won<sup>5</sup>.

The reason that medical costs of the elderly are higher than other age group is

increase of individual medical costs in the aged as well as increase in the number of aging population. In fact, health expenditure per capita in 2000 is two hundred seventy thousand Korean won and the elderly health expenses per capita is six hundred sixty thousand Korean won, which is higher than 2.4 times in 2000. However, health expenditure per capita in 2010 is 1.2 million Korean won and the elderly health expenses per capita is 3.3 million Korean won, which is higher than 2.9 times in 2010<sup>5</sup>. This phenomenon results from difference between elderly population and other age group. Reduction in physiological function by senescence, chronic complex diseases and take of multiple drugs, weaken of daily living function causes medical demands of the elderly<sup>6-10</sup>. Especially, high prevalence rate of chronic diseases is major cause of increase of medical costs in aging population. While the prevalence rate of chronic diseases in general adults is 29.9% in Korea, 88.5% of elderly people have chronic diseases and the old people with chronic complex diseases more than three is 44.3%<sup>11</sup>. In other words, the elderly have less acute diseases which can be treated or recover quickly, whereas they have more chronic diseases that take longer to cure. This means that medical services focusing to treat acute diseases in aging population lead to increase medical costs.

In addition, social hospitalization which be hospitalized in an acute hospital or long-term care hospital for a long time despite of simple care for slight diseases result in increase medical expenses. Although the elderly with minor severity for diseases

do not need to enter the hospital, they tend to choose hospitalization rather than care facilities due to shortage of senior citizen welfare facilities or enter a hospital for living or recuperation rather than their treatment. Recently, there was a study result that about 40% of the aged entering a hospital is relevant to receive a nursing facilities or nursing home service<sup>12, 13</sup>.

Government has implemented long-term care insurance at July 2008 to support long-term care for the aged that government and society responsible for them<sup>14-16</sup>. Government has aimed to reduce burden of families supporting senior citizen by solving problem for hospitalization during long period though the old men do not need additional treatment<sup>17</sup>.

There are conflict perspectives for the effect of long-term care insurance on medical utilization and costs of senior citizen. One side implies that long-term care service may decrease medical costs by substituting medical demand. The other side said that long-term care insurance would increase health care expenditure by improvement of medical accessibility in beneficiaries<sup>18</sup>. Forder (2009) suggested that long-term care service induce proper discharge from hospital and reduce medical utilization by reducing length-of-stay (LOS)<sup>19</sup>. A few previous studies showed that long-term care insurance could substitute medical utilization and costs<sup>20, 21</sup>. Whereas, Noh (2011) argued that long-term care insurance could not satisfy demand of the beneficiaries who have medical wants and increase their social hospitalization in spite

of little medical needs<sup>22</sup>.

However, most previous studies for utilization or costs of medical service in the elderly examined using cross-sectional data. Although a few studies used longitudinal data, the examination period is relatively short period, which is about 2 or 3 years. Given cross-sectional or short longitudinal data limit to examine, there is need to observe using longitudinal data for medical utilization and costs of the elderly.

This study also aim to examine how burden of medical costs change by long-term care insurance in Korea. Previous research examined burden of medical expenses utilizing subjective cognition<sup>23</sup>, but there is no study that examine burden of health care expenditure objectively. Although medical costs of senior citizen reduced by long-term care insurance (LTCI), burden of medical expenses would not decrease or increase if their capacity to pay decreased. Examining evidences for change in burden of medical costs by LTCI is crucial goal in LTCI and can be utilized in improving LTCI.

## 2. Objectives

This study aims to examine whether long-term care insurance reduces medical utilization and burden of medical costs in beneficiaries who at least have received long-term care service for 3 years. Detailed purpose of this research is below:

First, this study examines semi-annual changes of medical utilization of

beneficiaries by introduction of long-term care insurance.

Second, this research observes whether LTCI affect change of medical utilization of beneficiaries in any hospital (acute hospital, long-term care hospital).

Third, this study examines changes in burden of medical costs in beneficiaries by LTCI.

Finally, this research observes how support burden that includes long-term care expenses varies by LTCI.

## II. Literature Review

### 1. Conceptualizations of Medical Utilization

The representative theory for medical utilization is the substitution model, behavior model of health service utilization, stage theory, health belief model, the models for the demand for medical care, Sick role theory, general model of help seeking<sup>24-30</sup>. These models have pros and cons for explanation of a certain health-related behavior.

The substitution model of Greene explained that formal support for senior citizen can be substituted to informal support. Greene implied that formal support is provided to supplement deficiency of formal support, whereas the formal support could substitute informal support by giving a rest to informal support providers. Study results indicated that a substantial tendency for formally provided care to be substituted for informal care<sup>28</sup>. After discussion for this substitution effect of support in aging population, diverse studies for substitution effect of medical services has been examined. Services of rapidly increasing aging population have increased and research for substitution relationship between medical services and long-term care service has been started recently.

Behavior model of Andersen that is widely used model in explaining behaviors of medical utilization is behavior model of health service utilization<sup>31</sup>. This model

considers utilization of medical services as “behavior” and the model aim to examine factors affecting medical utilization behaviors. The reason that Andersen model often is used in examining medical utilization is integrated model predicting external factors as well as internal elements (individual characteristics) in utilization of medical services<sup>32-35</sup>.

Stage theory of Suchman details a linear relationship between five different points in the individual's decision process to utilize health care. According to Suchman, the five stages of the decision process are (1) the symptom experience stage, (2) the assumption of the sick role stage, (3) the medical care contact stage, (4) the dependent-patient role stage, and (5) the recovery or rehabilitation stage<sup>26</sup>.

Economics demand function model of Feldstein explain concept of utility maximization by using medical demands model. This model considers decision factors of medical demands as medical needs factor such as price of medical service, income level, prices of substitution material, health status, demographic factor, socio-economic factor, medical supply factor, preference of medical services<sup>24,36</sup>.

According to parsons's theory, when an individual is sick, they adopt a role of being ill. This sick role has four main components: 1) the individual is not responsible for their state of illness and is not expected to be able to heal without assistance; 2) the individual is excused from performing normal roles and tasks; 3) there is general recognition that being sick is an undesirable state; and 4) to facilitate recovery, the

individual is expected to seek medical assistance and to comply with medical treatment. Parsons' theory attempted to identify typically seen behavior in individuals who are ill. However, while groundbreaking, the sick role failed to account for variability in illness behavior. As a result, scholars have proposed multifaceted models and theories which identify factors influencing health care seeking<sup>30</sup>.

The health belief model of Becker is a psychological health behavior change model developed to explain and predict health-related behaviors, particularly in regard to the uptake of health services. The health belief model was developed in the 1950s by social psychologists at the U.S. Public Health Service and remains one of the best known and most widely used theories in health behavior research. The health belief model suggests that people's beliefs about health problems, perceived benefits of action and barriers to action, and self-efficacy explain engagement (or lack of engagement) in health-promoting behavior. A stimulus, or cue to action, must also be present in order to trigger the health-promoting behavior<sup>29</sup>.

Mechanic's general theory of help seeking takes a psychological approach to health care utilization. The theory incorporates ten decision points which determine illness behavior: 1) the salience of deviant signs and symptoms; 2) the individual's perception of symptom severity; 3) the disruption of the individual's daily life as caused by the illness; 4) the frequency of symptoms and their persistence; 5) the individual's tolerance of symptoms; 6) the individual's knowledge and cultural

assumptions of the illness; 7) denial of illness as a result of basic needs; 8) whether or not response to the illness disrupts needs; 9) alternative interpretations of symptom expression; and 10) treatment availability via location, economic cost, psychological cost (stigma, humility, etc.), and treatment resources. Beyond these ten points, Mechanic's theory allowed for illness response to be influenced by either the individual or a person who makes decisions for the individual. Thus, as expressed in the illness behavior theory, autonomy and heteronomy influence health care utilization<sup>27</sup>.

#### 1) Greene's Substitution Model

The substitution model of Greene explained that formal support for senior citizen can be substituted to informal support. Greene implied that formal support is provided to supplement deficiency of formal support, whereas the formal support could substitute informal support by giving a rest to informal support providers. Study results indicated that a substantial tendency for formally provided care to be substituted for informal care and the theoretical model is below (Figure 1).

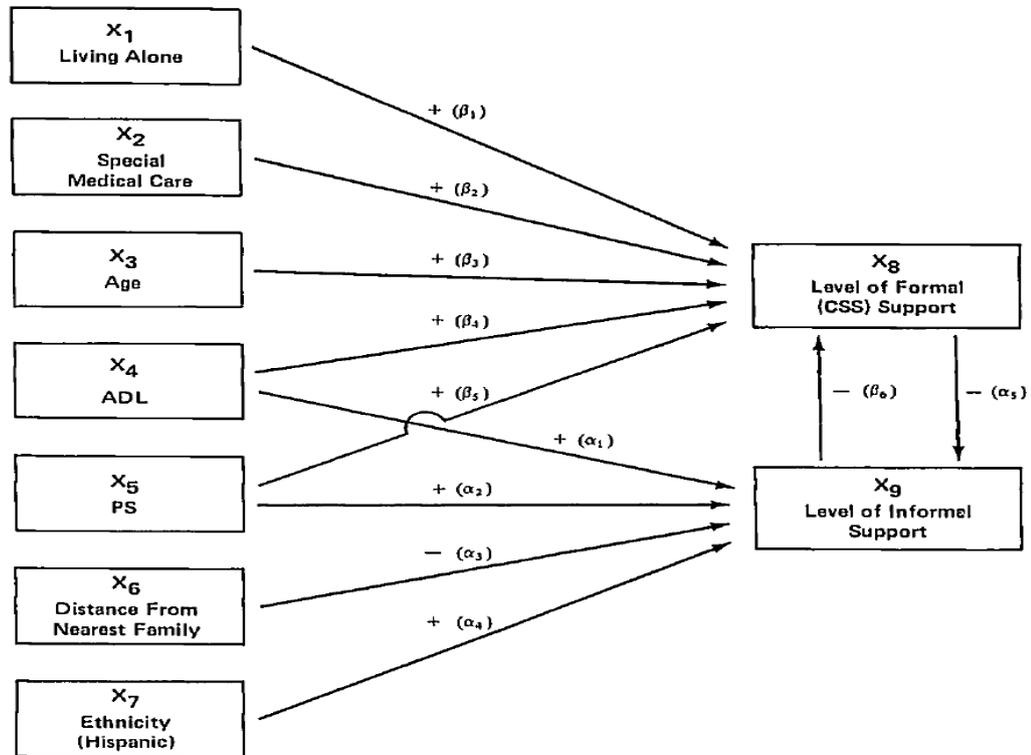


Figure 1. Causal diagram of substitution model<sup>28</sup>

After discussion for this substitution effect of support in aging population, diverse studies for substitution effect of medical services has been examined. Roos (1989) identified those DRG categories that appear to have the most potential for inpatient-outpatient substitution. The research demonstrated that large numbers of surgical DRG's lend themselves to inpatient-outpatient substitution. Moreover, shifts across settings vary by DRG, depending on the financial incentives<sup>37</sup>. Fortney (2005) examined that primary care services result in decreases (substitution) or increases (complementation) in the use and cost of other types of health services. The instrumental variables analysis results indicated that primary care was a substitute for

specialty medical encounters and that increases in primary care utilization have no significant impact on physical health admissions<sup>38</sup>. Jian (2015) examined the substitution effect of outpatient services on inpatient services and provide suggestions on designing outpatient policies. The study concluded that there is a substitution effect of outpatient services on inpatient services<sup>39</sup>.

## 2) Andersen's Behavior Model of Health Service Utilization

Andersen's model is a conceptual model aimed at demonstrating the factors that lead to the use of health services. According to the model, usage of health services (including inpatient care, physician visits, dental care etc.) is determined by three dynamics: predisposing factors, enabling factors, and need. Predisposing factors can be characteristics such as race, age, and health beliefs. For instance, an individual who believes health services are an effective treatment for an ailment is more likely to seek care. Examples of enabling factors could be family support, access to health insurance, one's community etc. Need represents both perceived and actual need for health care services. The original model was expanded through numerous iterations and its most recent form models past the use of services to end at health outcomes and includes feedback loops.

A major motivation for the development of the model was to offer measures of access. Andersen discusses four concepts within access that can be viewed through the conceptual framework. Potential access is the presence of enabling resources, allowing the individual to seek care if needed. Realized access is the actual use of

care, shown as the outcome of interest in the earlier models. The Andersen framework also makes a distinction between equitable and inequitable access. Equitable access is driven by demographic characteristics and need whereas inequitable access is a result of social structure, health beliefs, and enabling resources.

Andersen also introduces the concept of mutability of his factors. The idea here being that if a concept has a high degree of mutability (can be easily changed) perhaps policy would be justified in using its resources to do rather than a factor with low mutability. Characteristics that fall under demographics are quite difficult to change, however, enabling resources is assigned a high degree of mutability as the individual, community, or national policy can take steps to alter the level of enabling resources for an individual. For example, if the government decides to expand the Medicaid program an individual may experience an increase in enabling resources, which in turn may beget an increase in health services usage. The RAND Health Insurance Experiment (HIE) changed a highly mutable factor, out-of-pocket costs, which greatly changed individual rates of health services usage.

The initial behavior model was an attempt to study of why a family uses health services. However, due to the heterogeneity of family members the model focused on the individual rather than the family as the unit of analysis. Andersen also states that the model functions both to predict and explain use of health services<sup>40</sup>.

A second model was developed in the 1970s in conjunction with Aday and

colleagues at the University of Chicago. This iteration includes systematic concepts of health care such as current policy, resources, and organization. The second generation model also extends the outcome of interest beyond utilization to consumer satisfaction<sup>41</sup>.

A third model builds upon this idea by including health status (both perceived and evaluated) as outcomes alongside consumer satisfaction. Furthermore, this model include personal health practices as an antecedent to outcomes, acknowledging that it not solely use of health services that drives health and satisfaction. This model emphasizes a more public health approach of prevention, as advocated by Evans and Stoddart wherein personal health practices (i.e. smoking, diet, exercise) are included as a driving force towards health outcomes.

The latest iteration of Andersen's conceptual framework focuses on the individual as the unit of analysis and goes beyond health care utilization, adopting health outcomes as the endpoint of interest (Figure 2). This model is further differentiated from its predecessors by using a feedback loop to illustrate that health outcomes may affect aspects such as health beliefs, and need. By using the framework's relationships we can determine the directionality of the effect following a change in an individual's characteristics or environment. For example, if one experiences an increase in need as a result of an infection, the Andersen model predicts this will lead to an increased use of services (all else equal). One potential

change for a future iteration of this model is to add genetic information under predisposing characteristics. As genetic information becomes more readily available it seems likely this could impact health services usage, as well as health outcomes, beyond what is already accounted for in the current model<sup>42</sup>.

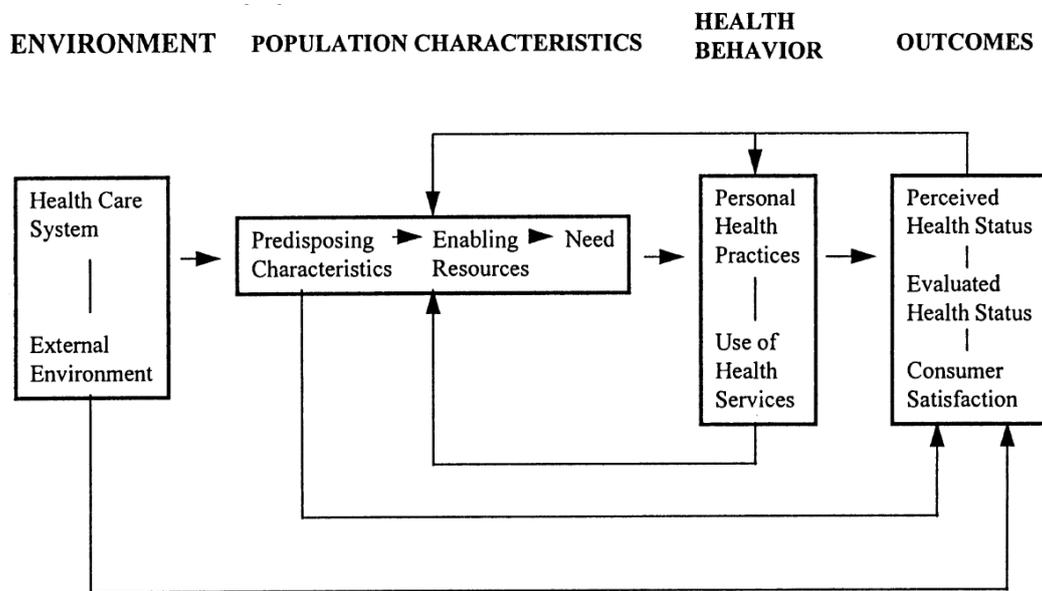


Figure 2. Andersen's final model<sup>25</sup>

### 3) Suchman's Stage Theory

Suchman's stages of illness and medical care indicates five stages of the individual's decision process in determining whether or not to utilize health care: 1) the individual's symptom experience, including pain, emotion, and recognition of experience as symptomatic of illness; 2) the individual's assumption of a sick role.

During this second stage, the individual also explores his or her lay referral system for validation of the sick role and for exploration of treatment options; 3) medical care contact. During this stage the individual seeks a professional health care system. However, the pace at which a person enters this stage is determined by their membership within parochial and cosmopolitan<sup>3</sup> social networks. If a person's social network is parochial, they will tend to delay medical care contact by continuing the first two stages for longer than a person who is a member of a cosmopolitan network; 4) the assumption of a dependent-patient role via acceptance of professional health care treatment. It is possible for this stage to be disrupted if the individual and the professional health care provider have differing opinions of the illness; 5) the individual's recovery from illness. The individual recovers upon relinquishing their role as patient. However, if an illness is not curable, a person may assume a chronically ill role (Figure 3).

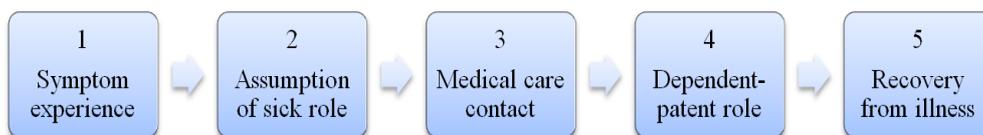


Figure 3. Suchman's stage model of illness and medical care<sup>26</sup>

#### 4) Becker's Health Belief Model

The health belief model discusses the individual's actions to treat and prevent disease via consideration of four central variables: 1) the individual's perceived susceptibility to disease. An individual will seek preventive health services if he or she believes they are susceptible to disease; 2) the individual's perception of illness severity. If a person does not perceive the illness as serious, they will not seek treatment or prevention; 3) the individual's rational perception of benefits versus costs. An individual will not take action unless the treatment or prevention is perceived as having greater benefits than costs; 4) the individual's cues to action. Media, friends, family, or well known citizens can provide an impetus for prevention. The absence of cues to action will reduce the likelihood of prevention. Thus, the individual's choice to utilize health services is contextually dependent (Figure 4).

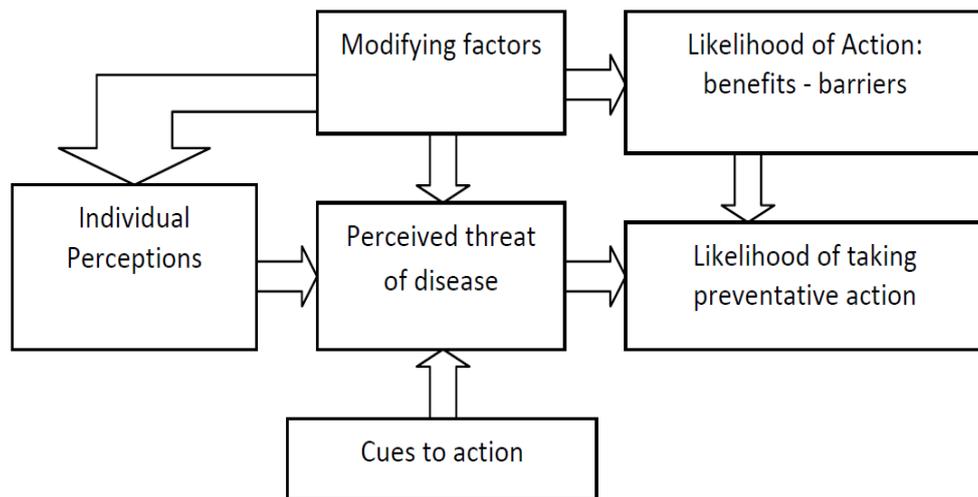


Figure 4. Health Belief Model<sup>29</sup>

## 2. Long-Term Care Insurance

### 1) Purpose

The long-term care insurance regulates items on long-term care benefit, which supports the physical activity or housework for the elderly who have difficulty taking care of themselves due to old age or geriatrics diseases. It aims at promoting senior citizens health and life stabilization as well as improving the quality of people's lives by mitigating the burden of care on family member.

### 2) Management and Operation System

#### (1) Eligible Persons

Those eligible for the long-term care insurance is all Korean citizens [The insured of Long Term care Insurance and dependents (the same as the health insurance) + recipients of medical benefits]. Among the insured of the National Health Insurance, the contribution of the employee insured and the self-employed insured is to be calculated under the contributions system of the National Health Insurance. Those applying for long-term care assessment are those eligible for the Long-Term Care Insurance elderly over 65 or those under 65 with geriatric diseases. Beneficiaries of long-term care benefit (recipients) are of those who have applied for the Long-Term Care Insurance and with difficulty taking care of daily life alone for more than six months assessed as needing long-term care by the Long-Term Care

Grading Committee (Table 1).

Table 1. Eligible persons of long-term care insurance

Category	Scope of application
Those eligible for the long-term care insurance	All Korean citizen (The insured long-term care insurance and dependents (the same as the health insurance)+recipients of medical benefit)
Those paying the contributions	Among the insured of the National Health Insurance, the contributions of the employee insured and the self-employed insured is to be calculated under the contributions system of the National Health Insurance
Those applying for long-term care assessment	Those eligible for the long-term care insurance elderly over 65 or those under 65 with geriatric diseases
Beneficiaries of long-term care benefit (recipients)	Of those who have applied for the long-term care insurance and with difficulty taking care of daily life alone for more than six months assessed as needing long-term care by the long-term care grading committee

Source: National Health Insurance Service, 2015

## (2) Evaluation

A trained employee of the National Health Insurance Corporation visits the applicant for grading evaluation. The employee is to comprehensively evaluate the physical and intellectual functions, behavioral changes, nursing measures taken, areas in need of rehabilitation, environmental state, desire for service, etc. of applicants

based on an evaluation table (long-term care assessment evaluation table) researched by experts of long-term care.

### (3) Grading and Reporting of Results

The Long-Term Care Needs Certification Committee (composed of people with knowledge and experience in public health, welfare, and medical services) installed in cities (si), counties (gun) and districts (gu) decide the degree an applicant needs long-term care and the state of his or her mental and physical health after which it considers the applicant as a recipient of long-term care benefits according to the grading when it deems the applicant has difficulty taking care of daily life alone for over six months based on assessment evaluation results, application, doctor's referral slip and other documents necessary for deliberation (Figure 5).

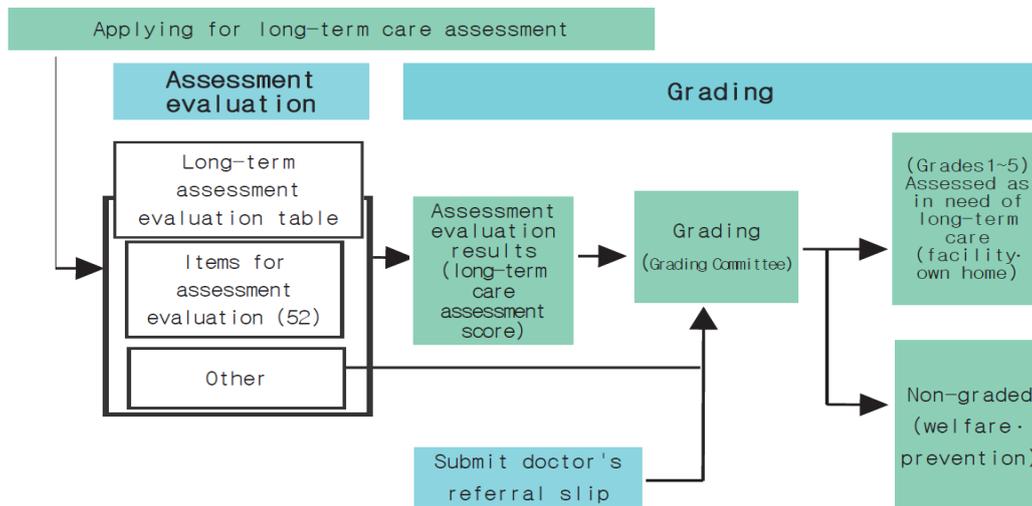


Figure 5. Process of assessing long-term care recipients

The Long-Term Care Needs Certification Committee is to individually send the “Standard Plan Long-Term Care Benefits” where the long-term care grade, expiration date and type of long-term care benefits are written to recipients evaluated as being of grades 1 to 5 of long-term care insurance (Table 2).

Table 2. Representative states of recipients of long-term care benefits by grade

Grade	Standard
Grade 1	A person with mental and physical disabilities completely dependent on the help of another person to take care of daily life and with a score of over 95 in the long-term care assessment evaluation
Grade 2	A person with mental and physical disabilities in partial need of the help of another person to take care of daily life with a score of between 75 and 95 in the long-term care assessment evaluation
Grade 3	A person with mental and physical disabilities in partial need of the help of another person to take care of daily life with a score of between 60 and 75 in the long-term care assessment evaluation
Grade 4	A person with mental and physical disabilities in partial need of the help of another person to take care of daily life with a score of between 51 and 60 in the long-term care assessment evaluation
Grade 5	A person with dementia whose score of between 45 and 51 in the long-term care assessment evaluation

Source: National Health Insurance Service, 2015

#### (4) Types of Long-Term Care Benefits

A kind of long-term care benefits is in-home benefits, facilities benefits, special cash benefit.

##### A. In-Home Benefits

In-Home benefits consist of visit care, visit bathing, visit nursing, day and night care, short-term care, other in home benefits. Home-visit care is long-term care benefit of supporting the physical activities and housework of recipients by visiting their home. Home-visit bathing is long-term care benefit of visiting recipients at home and helping them bath using bathing facilities. Home-visit nursing is long-term care benefit of nursing, assisting treatment, or providing consultation on care or dental hygiene services based on the referral slip of a western or Korean medicine doctor or dentist. Day and night care is long-term care benefit of 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 is long-term care benefit of 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 is long-term care benefit of providing recipients with tools they need to support their physical activity or daily life or visiting them at

home in order to support their rehabilitations as decided by presidential decree.

#### B. Facility Benefits

Long-term care benefit of providing recipients with training and education to help maintain and improve their physical and mental health for a long period in a welfare medical facility for the elderly managed by long-term care providing institutes according to Article 34 of “Act on Welfare for Senior Citizens”.

#### C. Special Cash Benefit

As benefit paid in cash to recipients receiving much long-term care benefit of visit care from their family, 150,000 Koran won is paid a month regardless of their long-term care grade.

#### (5) Cost of Long-Term Care Benefits

Partial share of recipients (individual copayment) of in-home benefits are 15 percent of the cost of long-term care. Partial share of recipients of facility benefits are 20 percent of the cost of long-term care.

Long-term care expenses no included in the scope or eligibility of benefit according to regulations of the “Act on Long-Term Care Insurance for Senior Citizens” (food ingredients, additional expenses for using a bedroom of higher grade, beauty care, etc.) are not covered by government. In addition, recipients fully have to pay the difference when a different long-term care benefit was received by selecting a type

and content of long-term care benefit different to that written on the long-term care assessment certificate. Long-term care surpassing the monthly limit of its benefit according to article 28 of the “Act on Long-term Care Insurance for Senior Citizens” is not supported by long-term care insurance.

Recipients as defined by Items 2 to 9, Clause 1, Article 3 of the “Act on Medical Benefit” or Those with income and assets under a certain amount set and notified by the Minister of Health and Welfare or when it has become difficult to sustain livelihood for reasons set by a decree of the Ministry of Health and Welfare such as natural disasters is possible to pay 50% of total out-of-pocket payment.

### 3) The Financial Resources of Long-Term Care Insurance

#### (1) Long-Term Care Insurance Contributions

Long-term care insurance rate is amount applicable to 6.55 percent of the health insurance contributions. In the case of the self-employed insured, they are responsible for 100% of the contributions. In the case of the employee insured, both the employers and employees are equally paying their contributions. The employee insured such as civil servants and public school teachers as well as state, local government and private schools are to co-pay 50 percent each (in the case of private schools, the school pays 30 percent and the state 20 percent).

#### (2) State and Local Government Share

Within the scope of its annual budget, the state is to provide 20 percent of the expected annual revenue from long-term care insurance premium to the corporation. The state and local governments are responsible for the payment of all management cost and the corporation is to pay its share of the cost (including the share of the cost the corporation is to pay from exemption and reduction according to proviso of Clause 1 of Article 40 and Item 1, Clause 3) of issuing visit nursing order, doctor referral slips and long-term care benefit for recipients of medical benefit according to regulations set by presidential decree.

#### (3) Individual Copayment (beneficiaries' partial share)

Partial share of recipients (individual copayment) of in-home benefits are 15 percent of the cost of long-term care. Partial share of recipients of facility benefits are 20 percent of the cost of long-term care. Recipients of benefit according to the Act on Guaranteeing People's Basic Life are exempted and 50 percent reduction is provided for other medical benefit recipients.

#### 4) Long-term Care Insurance management System

Ministry of Health and Welfare is director of long-term care insurance and draw up and adjust basic plan for long-term care.

National Health Insurance Corporation (NHIC) manages qualifications of subscribers of long-term care insurance and their dependents as well as recipients of

medical benefits. NHIC charge and collect long-term care insurance premium as well as manage the funds. NHIC investigate applicant and manage the Grading Committees and decide long-term care grades. NHIC write the assessment certificate of long-term care and provide standard plan for long-term care use. NHIC manage and evaluate long-term care benefits and provide information, guidance and consultation to recipients and support the use of long-term care benefits. NHIC evaluate own home and facility benefit cost and pay special cash benefits and check information provided on long-term care benefits. NHIC investigate research and publicize the long-term care project. NHIC runs project to prevent geriatric diseases and charge and collect unfair benefits according to law. NHIC develop standards for the provision of long-term care benefits and install and manage long-term care providing institutes in order to review the appropriateness of long-term care benefit cost.

Long-term care institution established and designated according to the Act on Welfare for senior citizens” and the “Act on Long-Term Care Insurance for senior citizens”. Long-term care institution sign contract with recipients of long-term care benefits and provide long-term care benefits. Long-term care institution charge the corporation for the cost of providing long-term care benefits provided to recipients.

Local government draws up and execute detailed plan for the execution of the basic plan for long-term care and run project to prevent geriatric diseases. They also install and designate long-term care providing institutes (Figure 6).

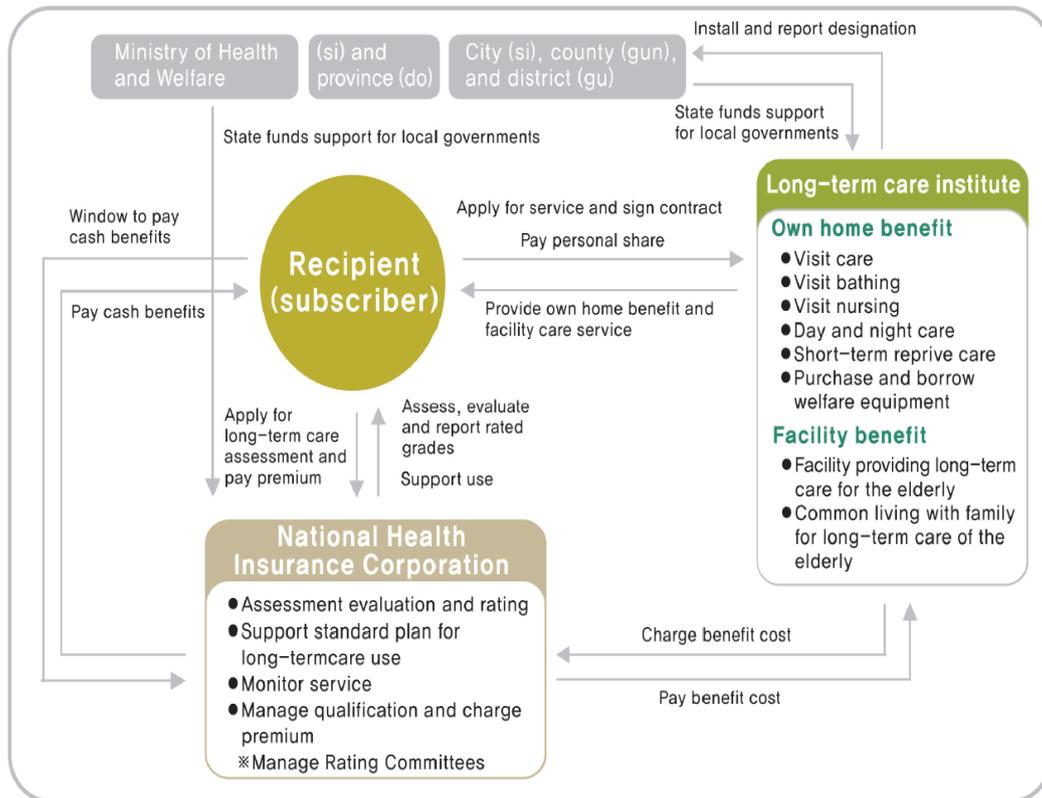


Figure 6. Long-term care insurance management system

## 5) Present Condition of Beneficiaries and Institutions

### (1) Beneficiaries

Korean medical security population is about 52 million in 2015 and the elderly (more than 65 years old) people is 12.9% of total population (Table 3). The number of people with national health insurance is about 50.5 million (the employee insured:

36.2 million people, the self-employed insured: 14.3 million people). The number of person with medical-aid is one hundred twenty thousand and the number of person with recipients of basic livelihood security is 1.4 million.

The number of applicants for long-term care insurance is about seven hundred ninety thousand. The number of recipients of them is about four hundred sixty eight thousand and this figure present about 7.0% of the aging population (Approval rate: 74.2%).

Table 3. The number of application and approval in LTCI Unit: Thousand

	2011	2012	2013	2014	2015
Aging population (above 65 years old)	5,645	5,922	6,193	6,463	6,719
Applicant	617	643	686	737	789
Approver (Approver / Applicant)	324(52.5%)	342(53.2%)	379(55.2%)	425(57.7%)	468(59.3%)
Approver / aging population	5.7%	5.8%	6.1%	6.8%	7.0%

Source: National Health Insurance Service, 2015

The number of approvers per grade is 37,921(1<sup>st</sup> grade), 71,260(2<sup>nd</sup> grade), 176,336(3<sup>th</sup> grade), 162,763(4<sup>th</sup> grade), 19,472(5<sup>th</sup> grade). The percentage of approvers per grade is 8.1%(1<sup>st</sup> grade), 15.2%(2<sup>nd</sup> grade), 37.7%(3<sup>th</sup> grade), 34.8%(4<sup>th</sup> grade), 4.2%(5<sup>th</sup> grade)(Table 4).

Table 4. The number of recipients by grades Unit: Thousand

Category	2015						2012	2013	2014
	Total	1 <sup>st</sup> grade	2 <sup>nd</sup> grade	3 <sup>th</sup> grade	4 <sup>th</sup> grade	5 <sup>th</sup> grade			
Total	467,752	37,921	71,260	176,336	162,763	19,472	341,788	378,493	424,572
General	303,355	25,023	46,293	114,805	103,260	13,974	249,963	250,117	278,938
Reduction recipient	84,446	6,516	13,594	32,694	28,624	3,018	30,113	62,690	74,207
Medical-Aid	5,675	422	803	2,139	2,074	237	4,302	4,592	5,190
Recipient of basic livelihood security	74,276	5,960	10,570	26,698	28,805	2,243	57,410	61,094	66,237

Source: National Health Insurance Service, 2015

## (2) Long-Term Care Institutions

The total number of long-term facilities is 18,002 in 2015. The number of long-term home care facilities is 12,917 and the number of long-term care facilities is 5,085.

## 3. Consequences of Introducing Long-Term Care Insurance

### 1) Medical Utilization

Fundamental principal of long-term care service has to provide proper level by considering state of mind and body, living environment, want, and their choice. In addition, the service has to be prioritized to provide long-term home care which can live a daily life in residential area and provide to sustain or improve their health status

by connecting medical services. Since they have chronic diseases as well as complex functional disabilities, comprehensive medical and welfare service consistently has to be provided to the elderly.

According to 2008 elderly survey, 11.4% and 27.0% of the elderly more than 65 years old have disabilities of Activities of Daily Living (ADL) and Instrumental activity of Daily Living (IADL), respectively. In addition, prevalence rate of chronic complex diseases is 64.2% of them and the higher age is, the more decline of physical and cognition function is. The elderly generally have medical demand by acute or chronic diseases and long-term care demand by mind or physical function decline. If proper connection between medical services and long-term care services is incomplete, ineffectiveness of health insurance is occurred and expenses of social security would be increased<sup>43</sup>. Although long-term care insurance mainly provide care-centered service, appropriate medical service such as treatment, rehabilitation, nursing care need to be given to the beneficiaries to sustain or improve their health status. To intensify connection between medical service and long-term care service, beneficiaries in long-term care facilities have received needed medical services according to visit of doctor in convention hospital of the facilities or non-regular doctor. Home-visit nursing in in-home benefits contributes to improve health of the elderly.

There is little study for relationship between long-term care and medical

utilization because not many countries that have implemented health insurance and long-term care insurance together. Although a few countries have operated the two programs, they have a difficult to connect the independent two programs each other. However, medical utilization of the elderly gradually is concerned due to ageing and rapid increase of medical costs of the elderly and research for relationship between long-term care and medical utilization has been started recently<sup>44</sup>.

Appropriate long-term care service could decrease unnecessary inpatient utilization and reduce burden of excessive medical costs<sup>45</sup>. In Germany, long-term care insurance has been introduced to curb medical expenses in health insurance and Geraedts (2000) showed financial stability and reduction effect of medical costs by long-term care insurance<sup>46</sup>. Grabowski (2007) found that inflation-adjusted spending on nursing home hospitalizations increased 29 percent from 1999 through 2004. By 2004, aggregate spending totaled roughly \$972 million, of which 23 percent was attributable to ambulatory care-sensitive conditions. These data highlight the potential for cost savings associated with programs designed to reduce these potentially avoidable hospitalizations from the nursing home setting<sup>47</sup>. In addition, appropriate provision of long-term care service after hospital discharge associated to decrease hospitalization, delayed discharge, re-visit of emergency room<sup>48-50</sup>.

A few studies reported substitution relationship between long-term care and medical utilization. Forder (2009) explored utilization of long-term care service could

substitute medical utilization. The results indicate that for each additional £1 spent on care homes, hospital expenditure falls by £0.35. Also, £1 additional hospital spend corresponds to just over £0.35 reduction on care home spend<sup>19</sup>. Lichtenberg (2011) examined that home health care serves as a substitute for inpatient hospital care using longitudinal data. The research did not find a significant relationship between growth in utilization of home health care and growth in utilization of nursing and residential care facilities. However, the study found that larger increases in the fraction of patients discharged to home health care tended to have larger declines in mean length of stay (LOS). Between 1998 and 2008, mean LOS declined by 4.1%, from 4.78 days to 4.59. The estimates indicate that this was entirely due to the increase in the fraction of hospital patients discharged to home health care, from 6.4% in 1998 to 9.9% in 2008. The estimated reduction in 2008 hospital costs resulting from the rise in the fraction of hospital patients discharged to home health care is 36% larger than the increase in the payroll of the home health care industry<sup>50</sup>.

Examining the substitution relationship between long-term care and medical utilization is important because appropriate resource allocation or transfer would reduce unnecessary resource waste and increase efficiency of resource utilization and decrease costs. If long-term care facilities provide medical service which can substitute the services in specialized hospitals, the effect would be large<sup>51</sup>. These reasons brought about institutional concern for connection and transfer of proper

service, appropriate coordination between long-term care and medical utilization in U.K.<sup>52</sup>.

However, there are a few previous studies for complementary relationship between long-term care and medical utilization in contrast to substitution effect. Patients with mild severity diseases could take care of or treatment in long-term care facilities (or home-visit nursing), whereas patients having severe diseases have to visit an acute hospital or long-term care hospital continuously. Hicks (2014) implies that long-term care service substitute or complement utilization of medical services<sup>53</sup>.

Studies for connection between long-term care and medical utilization recently have been started after introduction of long-term care insurance in Korea. Jeon (2010) analyzed the changes in medical fee and utilization of services before and after the introduction of the long-term health insurance for the elderly and identified the factors influencing the changes<sup>54</sup>.

This study analyzed the annual medical fee and inpatient days per person for the 51,771 elderly patients (25.7% of the total eligible patients) who are qualified for the long-term health insurance. Paired t-test was used for comparing medical fee and inpatient days before and after the introduction of the long-term health insurance and GEE regression and multiple-regression were used to identify the factors influencing the changes. Results showed that after introduction of the Long-Term Care Insurance, the average annual treatment fees on qualified patients of long-term care were

lowered 10.3%, from 6.4 to 5.74 million won, and the number of days of care lowered 9.6% from 106.0 to 95.8 days and is significantly low statistically. Alzheimer's disease treatment fee was lowered by 6.8% from 4,350,000 to 4,050,000 won, and treatment days was reduced by 3.4% from 62.7 days to 64.9 days but showed lower reduction rate than entire disease treatment fee. Over the same period, general health insurance payment of patient age over 65 increased by 6.8% from 3.03 to 3.23 million won and Alzheimer's disease treatment fee raised respectively by 2.0% from 6,210,000 to 6,340,000 won.

Kim (2013) analyzed the effect of long-term care utilization on health care utilization of the elderly<sup>44</sup>. The sample in this study includes 23,269 people older than 65 who are extracted from 2009-2010 long-term care insurance and health insurance claim data. The study group was divided into two groups, namely acute care hospitals and long-term care hospitals. Two part model were used for statistical analysis and instrumental variables analysis were used for controlling endogeneity in the group of long-term care hospitals. This study evaluated the impact of long-term care costs on the probability of health care utilization experience and costs of health care utilization. The results showed that an increase in long-term care costs was associated with an increase in utilization of acute care hospitals, but it was associated with a decrease in utilization of long-term care hospitals. When 1% increases in long-term care costs was associated with 0.5% decrease in costs of long-term care hospitals.

Kim (2013) examined how the supplies of acute hospitals and nursing homes had influences on the inpatient expenditures of long-term care hospitals of the elderly<sup>55</sup>. Inpatient expenditures were divided into three dependent variables: number of inpatients per bed, length of stay per inpatients, and cost per day. The supplies of acute hospitals and nursing homes were measured as location quotient (LQ), denoting the share of acute hospitals and nursing homes in a 16 province to the share of acute hospitals and nursing homes at the national level. Multiple-regression was employed as an analytic tool using National Health Insurance data, hospitals reporting data, and annual report of Long Term Insurance in 2010. Nursing homes and acute hospitals were substitution as long-term care hospitals. Furthermore, there were competition between nursing homes and long-term care hospitals. In the regression model of number of inpatients per bed, interaction term between acute hospitals and nursing homes accelerated the main effect.

Han (2013) analyzed the medical expense change and influencing factors after introducing long-term care insurance<sup>56</sup>. The study period was 2 years before and after introduction of the insurance. This study analyzed data collected from two divided group lived in Incheon. Four hundred and eighty-five elderly who received long-term care wage for one year were selected for experimental group. For control group, 1,940 elderly were selected by gender and age stratified random sampling. Difference-In-difference analyses were used for evaluating policy effectiveness. Also

multiple regression analyses were conducted to identify the factors associated with total medical expenditures. The control variables were demographic variables, economic status, diseases, and medical examination variables. Difference-in-difference analyses showed that total average medical expenses among long-term patients have decreased by 61.85%. Of these, the hospitalization expenses have decreased by 91.63% and the drug expenses have increased by 31.85%. Multiple regression analyses results showed that total average medical expenses among long-term patients have significantly decreased by 46.5% after introducing the long-term care insurance. The hospitalization expenses have significantly decreased by 148.5%, whereas the drug expenses have increased by 53.6%. And outpatient expenses have increased by 10.4%, but the differences were not statistically significant.

Kang (2014) examined the relationship between home-visit nursing services and health care utilization under the public long-term care insurance program in Korea<sup>57</sup>. We analyzed the long-term care need assessment database and the long-term care and the health insurance claim databases of National Health Insurance Service between July 2011 and June 2012. The sample includes a total of 20,065 home-visit nursing recommended-older beneficiaries who use home-visit nursing and/or home-visit care, based on a standard benefit model developed by the Health Insurance Policy Institute of National Health Insurance Service. The beneficiaries were categorized into home-visit nursing use and non-use groups, and the home-visit nursing use group was again

divided into high-use and low-use groups home-visit nursing, based on their total annual home-visit nursing expenditure. Two-part models and negative-binomial regression models were used for the statistical analysis. The home-visit nursing use was negatively associated with the number of outpatient visit and cost, while adjusting for all covariates. The home-visit nursing use was also negatively associated with the inpatient cost among the high home-visit nursing use group.

Lee (2015) examined the effect of long-term care utilization on health care utilization of the elderly. This study used health insurance (medical care) data (qualifications and benefits) and the long-term care insurance data (assessment and benefits) in 2007 and 2012. Total analysis subject are 33,448 people, beneficiaries and non-beneficiaries in long-term care insurance are 16,724 people, respectively. This research showed that the total medical expenses and hospitalization medical expenses have decreased after the introduction of long-term care insurance. However, the medical expenses for outpatient service and prescription drug have increased after the introduction of long-term care insurance<sup>17</sup>.

This research has a few differences compared to previous studies. First, previous studies mainly analyzed using cross-sectional data. Utilizing cross-sectional design has some advantage such as getting much information for diverse factors with relatively small time and cost, examining association between factors, whereas the data is difficult to infer causality. Though a little study also analyzed using

longitudinal data, the research is hard to comprehend longitudinal process and trend because they only used data during 2 or 3 years. This study examined trend of medical utilization and burden of medical costs in beneficiaries for 8 years from 2005 to 2013. Second, this study selected comparison group which is similar to factors affecting medical utilization of beneficiaries in long-term care insurance. Although beneficiaries' medical utilization increase or decrease, unobservable factors may affect the change of medical utilization. Therefore, this study examined pure policy effect by comparing beneficiaries with non-beneficiaries who is similar to factors affecting medical utilization of beneficiaries through difference-in-difference (DID) analysis method<sup>58</sup>. Finally, this study examined burden of medical costs apart from utilization of medical services in beneficiaries. Since ultimate purpose of long-term care insurance is to mitigate support families' burden, examining changes in burden of medical costs in beneficiaries by LTCI might be utilized as evidence to evaluate policy.

## 2) Support Burden

Support burden of the elderly mainly is consisted of diverse aspects such as social, physical, emotional, economical factors and a few previous studies for economic aspect of them was examined.

Han (2012) investigated the factors affecting family caregiver financial burden

of out-of pocket expenses for the nursing home service under Long-term Care Insurance. This study conducted a national cross-sectional descriptive survey from July to September 2010 to collect data based on the long-term care benefits cost specification. Total 1,016 family caregivers completed questionnaires. 185 of total were excluded from the data analysis due to being answered by user (18 cases), or caregivers not to pay for services expenditures (122 cases), having a missing data on family caregivers characteristics (45 cases). Finally, 831 were included in the study. The average financial burden was  $3.18(\pm 0.71)$ . We divided subject into two groups by level of burden, high-burden group and low-burden group. In the result of the multiple logistic regression analysis, family caregiver financial burden was significantly higher in family caregivers with ages 40 to 49 compared to less than 40, lower educational level, un-satisfaction for long-term care service, high percentage (more than 50%) of cost-sharing and high total out-of pocket expenses (more than 300,000 won) for long-term care services. Also, Family caregivers who are spouse felt higher financial burden compared to son<sup>59</sup>.

Lee (2012) evaluated of family burden of caring for elders who receive long term care services and examined of differences in burden before and after the introduction of long term care service in Korea. Data were collected by questionnaires from 416 caregivers of elders who were registered with the Long Term Care Insurance Corporation in six cities. Data were collected in September, 2010 and

analyzed using descriptive statistics, paired t-test, and ANOVA with the Scheffe test, and stepwise multiple regression. Family burden decreased significantly after long-term care service was initiated. Subjective burden decreased from 2.93 to 2.69 ( $t=11.78$ ,  $p<.001$ ), and objective burden, from 3.40 to 3.10 ( $t=12.73$ ,  $p<.001$ ). Stepwise multiple regression analysis revealed that factors affecting subjective burden were family relations ( $F=13.60$ ,  $p=.003$ ), age ( $F=5.47$ ,  $p=.019$ ), job ( $F=6.98$ ,  $p=.008$ ), and education ( $F=4.59$ ,  $p=.032$ ), and that factors affecting objective burden were living together ( $F=17.66$ ,  $p<.001$ ), job ( $F=13.34$ ,  $p=.003$ ), monthly income ( $F=6.61$ ,  $p=.010$ ), and type of service ( $F=6.62$ ,  $p=.010$ )<sup>60</sup>. However, previous studies for economic aspect of support burden have measured subjective level according to survey and there is no research to examine by measuring objective level.

#### 4. Previous Studies on the Burden of Medical Costs

Burden of medical costs is major financial barrier of access to health service and is determinant hindering equity. Rich people afford to bear higher burden of medical costs, whereas poor persons may give up treatment which have to pay expensive price due to low capacity to pay. Therefore, government continuously has to monitor trend in burden of medical costs and try to mitigate the burden level<sup>61, 62</sup>. Since there is no study for the effect long-term care insurance on burden of medical costs, this study arranged previous research for effect of insurance (National Health Insurance

(employee or self-employed) or Private Insurance) on burden of medical costs.

Ekman (2007) quantitatively analyze the role of health insurance in the determinants of catastrophic health payments in a low-income country setting. The study uses the most recent publicly available household level data from Zambia collected in 1998 containing detailed information on health care utilization and spending and on other key individual, household, and community factors. An econometric model is estimated by means of multivariable regression. The main results are counterintuitive in that health insurance is not found to provide financial protection against the risk of catastrophic payments; indeed, insurance is found to increase this risk<sup>63</sup>.

Xu (2007) implied that many countries rely heavily on patients' out-of-pocket payments to providers to finance their health care systems. This prevents some people from seeking care and results in financial catastrophe and impoverishment for others who do obtain care. Surveys in eighty nine countries covering 89 percent of the world's population suggest that 150 million people globally suffer financial catastrophe annually because they pay for health services. Prepayment mechanisms protect people from financial catastrophe, but there is no strong evidence that social health insurance systems offer better or worse protection than tax-based systems do<sup>64</sup>.

Galarraga (2010) examine whether Seguro Popular (SP, or "Popular Health Insurance") in Mexico was to improve the financial protection of the uninsured

population against excessive health expenditures. This paper estimates the impact of SP on catastrophic health expenditures (CHE), as well as out-of-pocket (OOP) health expenditures, from two different sources. First, we use the SP Impact Evaluation Survey (2005–2006), and compare the instrumental variables (IV) results with the experimental benchmark. Then, we use the same IV methods with the National Health and Nutrition Survey. This study estimate naïve models, assuming exogeneity, and contrast them with IV models that take advantage of the specific SP implementation mechanisms for identification. The IV models estimated included two-stage least squares (2SLS), bivariate probit, and two-stage residual inclusion (2SRI) models. Instrumental variables estimates resulted in comparable estimates against the “gold standard.” Instrumental variables estimates indicate a reduction of 54% in catastrophic expenditures at the national level. SP beneficiaries also had lower expenditures on outpatient and medicine expenditures. The selection-corrected protective effect is found not only in the limited experimental dataset, but also at the national level.<sup>65</sup>

Li (2012) assess the degree to which the Chinese people are protected from catastrophic household expenditure and impoverishment from medical expenses and to explore the health system and structural factors influencing the first of these outcomes. Data were derived from the Fourth National Health Service Survey. An analysis of catastrophic health expenditure and impoverishment from medical

expenses was undertaken with a sample of 55,556 households of different characteristics and located in rural and urban settings in different parts of the country. Logistic regression was used to identify the determinants of catastrophic health expenditure. The rate of catastrophic health expenditure was 13.0%; that of impoverishment was 7.5%. Rates of catastrophic health expenditure were higher among households having members who were hospitalized, elderly, or chronically ill, as well as in households in rural or poorer regions. A combination of adverse factors increased the risk of catastrophic health expenditure. Families enrolled in the urban employee or resident insurance schemes had lower rates of catastrophic health expenditure than those enrolled in the new rural corporative scheme. The need for and use of health care, demographics, type of benefit package and type of provider payment method were the determinants of catastrophic health expenditure<sup>66</sup>.

In domestic studies, Kim (2008) addresses a number of issues related to health expenditures of the low income households according to the medical assistance and residential districts. For the purpose of the study, "the community panel data (the second wave)" was used. The result of the study indicated that those households supported by the public assistance showed the highest share of medical expenditures out of their income. Especially, their high elasticity of ability to pay compared to the case of the higher income class clearly showed the higher volatility in medical expenditures according to change in their income level<sup>67</sup>.

Kim (2011) investigated catastrophic health care expenditures and unmet needs for health care at household level, taking account of socioeconomic status (SES). Data from the 2006 National Household Living Environment Survey using nationally representative sample was analyzed. To identify factors associated with catastrophic health expenditures and unmet needs multivariable logistic regression analyses were employed. Overall, about 2 percent of households experienced catastrophic burden on health expenditures and households covered by the NHI with income under the poverty line and those near poverty line were more disadvantaged than other SES groups. About 12 percent of households experienced unmet needs and households covered by the Medical Aid with income under the poverty line and those near poverty line were associated with unmet needs<sup>68</sup>.

Kang (2012) examines the effect of PHI on households with cancer patient applying the definition of catastrophic health expenditure. Cancer is not only a disease that is a major subject of the PHI, but also a disease that reduced deductibles can be applied since the introduction of the Special Cancer Patient Protection Policy in 2005. The study analysed the Korean Health Panel Data 2008(beta 1.1.1) and first half year part of the Korean Health Panel Data 2009 (beta 1.1.1). Major part of the analysis was based on 2009 data focusing on households with cancer patient, and in order to compare any alteration to prior time the full year data of 2008 were utilized. Out of 6,798 households which participated the survey in the first half year of 2009,

420 households were selected as samples since those households have family members diagnosed with cancer. The study is composed with three parts. The first part explores the question of if there any effect of moral hazard due to the PHI. In order to solve the problems regarding the endogeneity of PHI, the study redefined the meaning of joining the health insurance (only the study considers those who enrolled PHI before diagnosis with cancer) in order to reduce the effect of moral hazard. The second part concerns the catastrophic health expenditure caused by the number of PHI products. For the last part, the study has modified the concept of medical cost to a net-medical cost, which is the “sum of medical expenditure and PHI fee subtracted by refund” in order to predict the effect of PHI more accurately, The results from the first part of the study depict the fact that households with PHI are 1.71 times more likely to be exposed to the catastrophic health expenditure than those without PHI, implying that there exist effects of the moral hazard that induced medical utilization. The findings from the second part of the research indicate that patients with more than three PHI are 0.44 times less likely to be exposed to the catastrophic health expenditure than those with only one PHI. Since high income households are more likely to have PHI than low income households based on the descriptive results, this means PHI tends operate in favor of the high income household. Lastly, considering the net-medical cost, catastrophic health expenditure occurred 3.04 times more when having PHI but being exempted for the refund from PHI compare to those without

PHI. However, with refund, the odds of catastrophic health expenditure were reduced by 0.46, and this depicts the importance of PHI on income and the fact that PHI protects household from economic crisis caused by excessive medical expenditure<sup>69</sup>.

Yoon (2012) examine the horizontal equity on the healthcare utilization and incidence of the household catastrophic health expenditure from 2001 to 2010 using the second to fifth Korea National Health and Nutrition Examination Survey (KNHANES II-V). The horizontal equity and household catastrophic health expenditure have been improved in overall since the implementation of the policies focusing on serious illness and poor group, and the prominent change has been identified in inpatient visit. The horizon equity was improved significantly at the initial stage of policy implementation, but the incidence of household catastrophic health expenditure was increased during the same period. The decrease of household catastrophic health expenditure was identified after cost-wise new policy was introduced concurrently. This result implies that the various approach is required for policy implementation in light with both of main goals of health insurance coverage expansion policy, which are patients' access to health care utilization and protection from household catastrophic health expenditure. In addition, the poor group showed higher incidence of the catastrophic health expenditure than the rich group in overall. The high unmet need was identified that the catastrophic expenditure was showed continuously in non-serious illness group in poor group in contrast to significantly

low rate in richer group<sup>70</sup>.

Kim (2012) analyze the scale of occurrence and factors influencing the household Catastrophic Health Expenditure(CHE) and unmet needs based on the types of health care system, such as employee insured and self-employed insured in National Health Insurance(NHI), and Class 1 and 2 recipients in Medical Aid Program. For the empirical analysis, logistic regression analysis was employed using the data of 5th wave in Korea Welfare Panel (KOWEP). The occurrence of the CHE in the entire households appeared to be 21.1%, 22.1%, 24.9%, and 12.5% with the threshold at 10%, 20%, 30%, and 40%, respectively. The main factors that determined the CHE were the number of household members, the gender and health conditions of householder, the existence of either old aged or chronic disease patients, low-income households, and types of health care system, etc. It also showed that employee insured in NHI rated higher probability to have the CHE than those with self-employed insured or the recipients in Medical Aid Programs. Only about 1.4% of households experienced unmet health needs. The factors influencing those unmet needs were the educational level and health condition of households, the existence of either old aged or chronic disease patients, low income households, and types of health care system. It was also revealed that the probability of unmet needs for self-employed insurer was higher than that for employee insurer in NHI<sup>71</sup>.

Choi (2015) highlight the characteristics of Medical-Aid enrollees, the poor not

enrolled in Medical-Aid, and the near poor and their utilization and costs for health care. We examined the financial burden of health care services by estimation of the proportion of medical expenses to disposable income. The findings of the study suggest that significantly lower health care utilization was observed for the poor not enrolled in Medical-Aid compared to those enrolled in Medical-Aid. On the other hand, two groups (the poor not enrolled in Medical-Aid, the near poor) had higher health care costs, percentage of medical expenses to income compared to Medical-Aid<sup>72</sup>.

Lee (2015) explored the determinants of catastrophic health expenditure using two undiscovered variables so far: unmet medical need and payment for uncovered services. Korea Health Panel was used to estimate the incidence and determinants of catastrophic health expenditure. The results showed that the incidence of catastrophic health expenditure has been increased during last five years. Contrary to hypothesis, unmet medical need was associated with increased probability of catastrophic health expenditure, and payment for uncovered services showed higher impact on catastrophic health expenditure in medical aid group than national health insurance group<sup>73</sup>.

Choi (2016) compare the financial burden of healthcare services between two groups of poor persons with disabilities: those not enrolled in Medical-Aid and Medical-Aid enrollees. The dependent variable was CHE, as defined by the World

Health Organization (WHO). According to the WHO, CHE occurs when out-of-pocket (OOP) spending exceeds 40 % of a household's capacity to pay. This study found that about 4.2 % of the poor not enrolled in the Medical-Aid experienced CHE and the poor not enrolled in Medical-Aid were 2.1 times more likely to experience CHE than Medical-Aid enrollees after applying multivariable models adjusted for several covariates<sup>74</sup>.

In summary, national health insurance or private health insurance affect reduction of burden of medical costs. The decrease in burden of medical costs may be caused by coverage expansion or financial assistance for medical service.

### III. Material and Methods

#### 1. Framework of This Study

This study selected substitution model of Greene as research model. Through this model, we examine whether long-term care insurance affects medical utilization and burden of medical costs in beneficiaries who at least have received long-term care service for 3 years. The framework of this study is below (Figure 7).

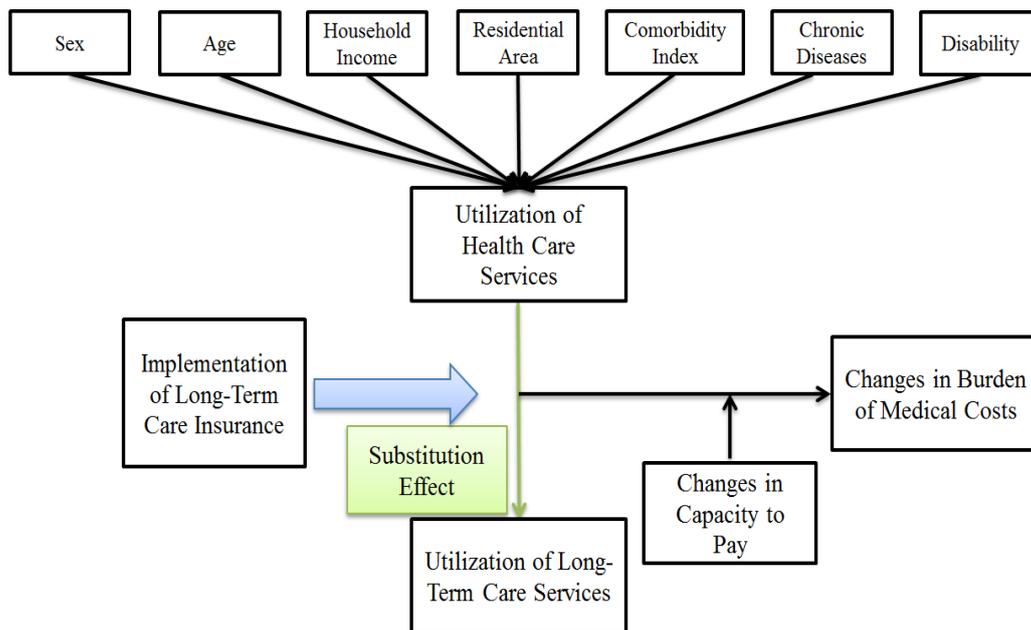


Figure 7. Framework of this study

## 2. Study Population and Design

This study utilized the elderly cohort database (DB) in National Health Insurance Service. The elderly cohort DB has been established to support research for risk factors of geriatric diseases and prediction analysis in the aging population. The elderly cohort DB include information for qualification, socio-economic characteristics, medical utilization in hospitals (treatment), hospital characteristics of the elderly (more than 65 years old) for about 550,000 people (10% of total senior citizen in South Korea) from 2002 to 2013. The elderly cohort DB also includes application and utilization information for long-term care services from 2008 to 2013(Table 5).

Table 5. Data structure of the elderly cohort database Unit: Thousand

DB	2005	2006	2007	2008	2009	2010	2011	2012	2013
Qualification	522	504	487	470	453	436	422	406	388
Treatment	7,006	8,208	11,225	13,660	13,804	13,563	13,394	13,531	12,927
Hospital	72	75	76	77	78	79	80	81	82
Long-term care	-	-	-	78	258	336	372	383	385

The qualification DB includes information for health security of beneficiaries joining national health insurance and medical-aid. Specific items of the DB consist of demographic information (sex, age, and residential area), mortality-related information (death time, death causes), type of health insurance (national health insurance, medical-aid), socio-economic status (income level, disability information).

Treatment DB includes information for utilization and expenses in medical

services in hospitals. Specific items of the DB consist of hospital utilization information, health care expenditures, treatment department and disease information, benefit information for examination or treatment or surgery, materials for medical treatment, drug prescription information in pharmacy.

Hospital DB includes information for size and establishment type, the number of bed, doctor in hospitals treating study subject.

Long-term care DB includes application and utilization information for long-term care services from 2008 when introduced the long-term care insurance. Specific items of the DB consists of information for application and judgment for long-term care insurance, recognition desire survey, doctor's opinion, claiming specification, general characteristics of long-term care facilities. This study used by merging four DB (qualification, treatment, hospital, and long-term care DB).

This study selected 11,856 people applied for the long-term care insurance from 2008 to 2010 except the elderly who not applied for the LTCI (N=458,149). Of them, we excluded the elderly who had not been approved in LTCI benefit (N=2,606) and beneficiaries who had not received consecutive LTCI services (N=1,836). In addition, we eliminated the elderly who joined local health insurance or medical-aid and missing data (N=4,355) and subject of this study is 3,029 beneficiaries who received consecutive LTCI services.

This study performed a 1:3 case-control match on the propensity score and

considered covariates (sex, age, income level, residential area, charson’s comorbidity index, chronic diseases and disability) in the matching. Therefore, final subject of this study is 12,116 people including 9,087 people who are control group (Figure 8).

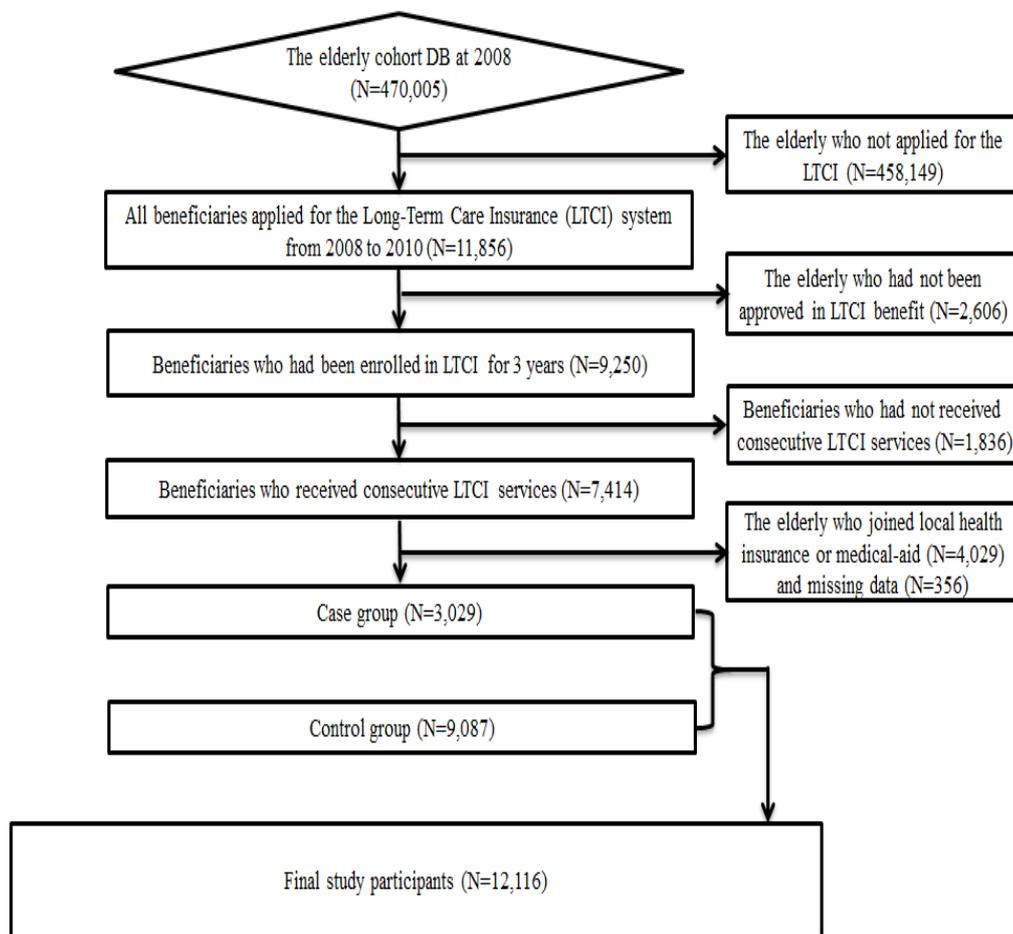


Figure 8. Flowchart of sampling of this study

### 3. Variables

#### 1) Dependent variables

The dependent variables of this study semi-annually measured medical utilizations (inpatient, outpatient, and drug prescription) and burden of medical costs at individual-level. First of all, medical utilization is inpatient services (number, length-of-stay), outpatient services (number), and drug prescription service (number) of the elderly. Information for medical services is measured through medical claiming specifications and data for inpatient service is bundled up semi-annually.

Another dependent variable used in this study is burden of medical costs. Medical expenses utilized as numerator are total benefit out-of-pocket payment per capita semi-annually combining inpatient, outpatient, and drug prescription expenditures. The denominator utilized as capacity to pay is premium fractile which is proxy variable of income level. We used monthly mean earned income according to decile distribution ratio by year in statistics survey because premium is charged from any percentage of earned income (Table 6).

Table 6. Monthly mean earned income according to decile distribution ratio by year

Unit: Korean Won

	2005	2006	2007	2008	2009	2010	2011	2012	2013
1 (Lowest)	788,517	830,123	826,361	885,252	908,231	921,228	1,016,768	1,066,637	1,098,037
2	1,297,067	1,399,334	1,399,254	1,495,165	1,472,622	1,608,179	1,705,154	1,821,492	1,952,380
3	1,687,651	1,739,651	1,789,633	1,930,867	1,984,517	2,139,450	2,232,679	2,417,286	2,489,877
4	2,021,262	2,130,610	2,201,055	2,272,260	2,359,581	2,570,942	2,668,580	2,774,613	2,916,290
5	2,333,270	2,478,440	2,631,562	2,787,735	2,793,660	2,944,929	3,085,462	3,181,384	3,401,796
6	2,658,450	2,903,968	3,043,189	3,196,017	3,239,831	3,300,101	3,547,906	3,704,203	3,809,164
7	3,105,811	3,359,807	3,542,995	3,726,531	3,694,662	3,756,514	3,965,371	4,304,356	4,394,174
8	3,519,959	3,811,888	3,977,271	4,298,308	4,313,430	4,396,018	4,628,654	4,831,433	5,080,148
9	4,170,124	4,449,489	4,852,479	5,029,777	4,955,874	5,194,330	5,440,976	5,845,327	5,964,016
10 (Highest)	5,880,082	6,156,549	6,707,342	7,240,515	7,069,807	7,502,030	7,814,866	8,424,948	8,455,913

Source: Korean Statistics, 2016

This study defined burden of medical costs as continuous variable because certain threshold values completely have been reached an agreement in South Korea and concerned with pre- and post- changes of burden of medical costs by measuring equivalent persons repeatedly.

## 2) Independent variable of main interest

This study has defined interaction term (benefit\*period) as independent variable. Benefit variable is decided by whether they are beneficiary or non-beneficiaries. Period variable explains pre- and post- introduction of long-term care insurance.

## 3) Covariates

This study included sex (men, women), age (65-69, 70-74, 75-79, 80-84, 85≤), income level (high, mid-high, mid-low, low), residential area (urban, rural), charson's comorbidity index (0, 1,2, 3≤), and disability to control factors affecting utilization of medical services. The charson's comorbidity index is the summation of weighted scores assigned to many major health conditions according to a validated method originally developed by Charlson et al.<sup>75</sup> and later modified by Romano et al.<sup>76</sup> Many researchers have reliably converted the CCI from ICD-9 to ICD-10 codes<sup>77</sup>. This study defined hypertension, diabetes, mental and behavioral disorder, cardiovascular disease, cerebrovascular disease, and cancer as chronic disease according to disease

subject for claiming chronic disease management under Health Insurance Medical Expense (Table 7).

Table 7. Composition of variables

<b>Variables</b>	<b>Definition</b>
<b>Dependent variables</b>	
Medical utilization	Inpatient service, outpatient service, prescription drug
Burden of medical costs	Medical costs ÷ monthly mean earn income
<b>Independent variable</b>	
Period	Pre-LTCI (2005. 1 ~ 2008. 6), Post-LTCI (2008. 7 ~ 2013. 12)
benefit	Case: Those who has been approved in long-term care insurance Control: Those who did not applied long-term care insurance
Interaction term	benefit*period
<b>Covariates</b>	
Sex	Men, Women
Age	65-69, 70-74, 75-79, 80-84, 85≤
Household income level	High, Mid-high, Mid-low, Low
Residential area	Urban, Rural
Charson's comorbidity index	0, 1, 2, 3≤
Chronic diseases	Hypertension, Diabetes, Mental and behavioral disorder, Cardiovascular disease, Cerebrovascular disease, Cancer
Disability	Yes, No

#### 4. Statistical Analysis

Chi-square tests of association were used to evaluate differences in proportion according to implementation in LTCI for each categorical factor.

We developed a series of multivariable models to assess the independent effect of implementation in LTCI on medical utilization and burden of medical costs. We

adjusted factors that affect medical utilization and then applied generalized estimating equations (GEE) to the data (SAS version 9.4; SAS Institute, Austin, TX). We also used log-link poisson-distribution GEE to assess count data such as inpatient number and identity-link normal-distribution GEE to evaluate assess log-transformed burden of medical costs.

## 5. Ethics Statement

This study was approved by an institutional review board of Graduate School of Public Health, Yonsei University [IRB Number: 2-1040939-AB-N-01-2016-415-01].

## IV. Results

### 1. General Characteristics of Long-Term Care Insurance Beneficiaries

Table 8 shows the general characteristics of the subject in 2008. The percentage of the elderly who received consecutive LTCI services from 2008 to 2010 of total subject is 25.0% (N=3,029) and non-beneficiaries are 75.0% (N=9,087). The average age of beneficiaries is 78.5 and 75.2% is Women. The average age of non-beneficiaries is 78.8 and 74.1% is women. Those who with high household income level are 29.4% in beneficiaries and people with high income level are 30.1% in non-beneficiaries. 46.7% of beneficiaries have lived at urban and 47.6% of non-beneficiaries have lived 46.3%. About half of beneficiaries and non-beneficiaries do not have comorbidity diseases. In chronic diseases, those who with hypertension, diabetes, mental and behavioral disorder, cardiovascular disease, cerebrovascular diseases, and cancer are 37.5, 13.5, 25.1, 6.6, 22.1, and 0.9% in beneficiaries and people with high income level are 38.6, 13.6, 24.0, 6.4, 21.4, and 0.7% in non-beneficiaries, respectively. Disability rate of beneficiaries is 4.5% and of non-beneficiaries is 3.4% and there is no statistical difference in all variables used in this study except disability.

**Table 8. General characteristics of long-term care insurance (LTCI) beneficiaries (2008)**

Variables	The elderly who received consecutive LTCI services		The elderly who not received LTCI services		P-value
	N	%	N	%	
Sex					0.254
Men	752	24.8	2,351	25.9	
Women	2,277	75.2	6,736	74.1	
Age, mean $\pm$ SD	78.5 $\pm$ 7.0		78.8 $\pm$ 7.1		0.013
Age					0.356
65-69	351	11.6	976	10.7	
70-74	590	19.5	1,716	18.9	
75-79	750	24.8	2,235	24.6	
80-84	689	22.7	2,071	22.8	
$\geq$ 85	649	21.4	2,089	23.0	
Household income level					0.742
High	890	29.4	2,738	30.1	
Mid-high	668	22.1	2,040	22.4	
Mid-low	627	20.7	1,849	20.3	
Low	844	27.9	2,460	27.1	
Residential area					0.401
Urban	1,414	46.7	4,322	47.6	
Rural	1,615	53.3	4,765	52.4	
Charson's comorbidity index					0.075
0	1,550	51.2	4,880	53.7	
1	772	25.5	2,251	24.8	
2	417	13.8	1,131	12.4	
$\geq$ 3	290	9.6	825	9.1	
Chronic diseases					
Hypertension	1,137	37.5	3,505	38.6	0.311
Diabetes	409	13.5	1,237	13.6	0.878
Mental and behavioral disorder	760	25.1	2,185	24.0	0.245
Cardiovascular disease	201	6.6	585	6.4	0.702
Cerebrovascular disease	668	22.1	1,948	21.4	0.475
Cancer	26	0.9	60	0.7	0.261
Disability					0.007
Yes	135	4.5	308	3.4	
No	2,894	95.5	8,779	96.6	
<b>Total</b>	<b>3,029</b>	<b>100.0</b>	<b>9,087</b>	<b>100.0</b>	

## 2. Trends of Semi-Annually Average Values in Study Subject

### 1) Medical Utilizations

Figure 9 shows that the trends of average number of hospitalization in study subjects. The average number of hospitalization in beneficiaries has decreased from 0.44 (six months before LTCI) to 0.36 (six months after LTCI) and 0.23 (one year after LTCI), whereas that in non-beneficiaries steadily has increased from 0.19 (six months before LTCI) to 0.18 (six months after LTCI) and 0.20 (one year after LTCI).

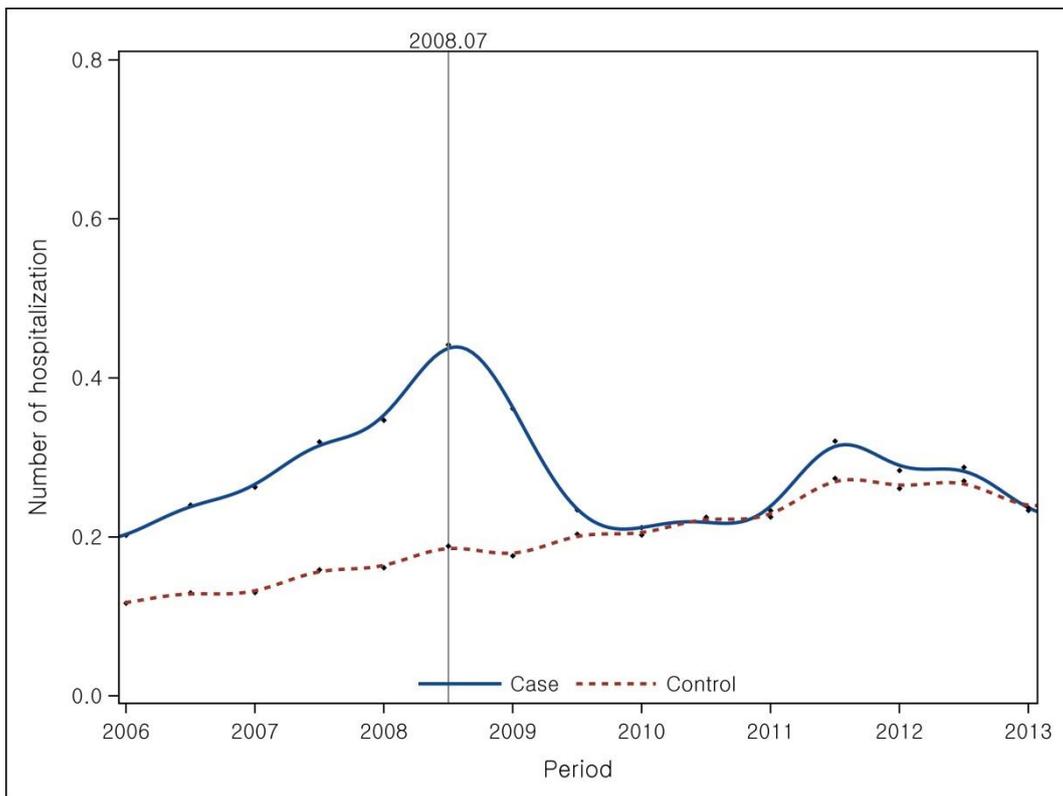


Figure 9. The trends of average number of hospitalization in study subject

Figure 10 shows that the trends of average number of hospitalization according to hospital type. Hospital type consists of general hospital (bed $\geq$ 100), hospital (bed $\geq$ 30), long-term hospital (bed $\geq$ 30), and clinic (bed $\leq$ 29). Average number of hospitalization of beneficiaries has decreased after introduction of LTCI, whereas that in non-beneficiaries steadily has increased without great changes.

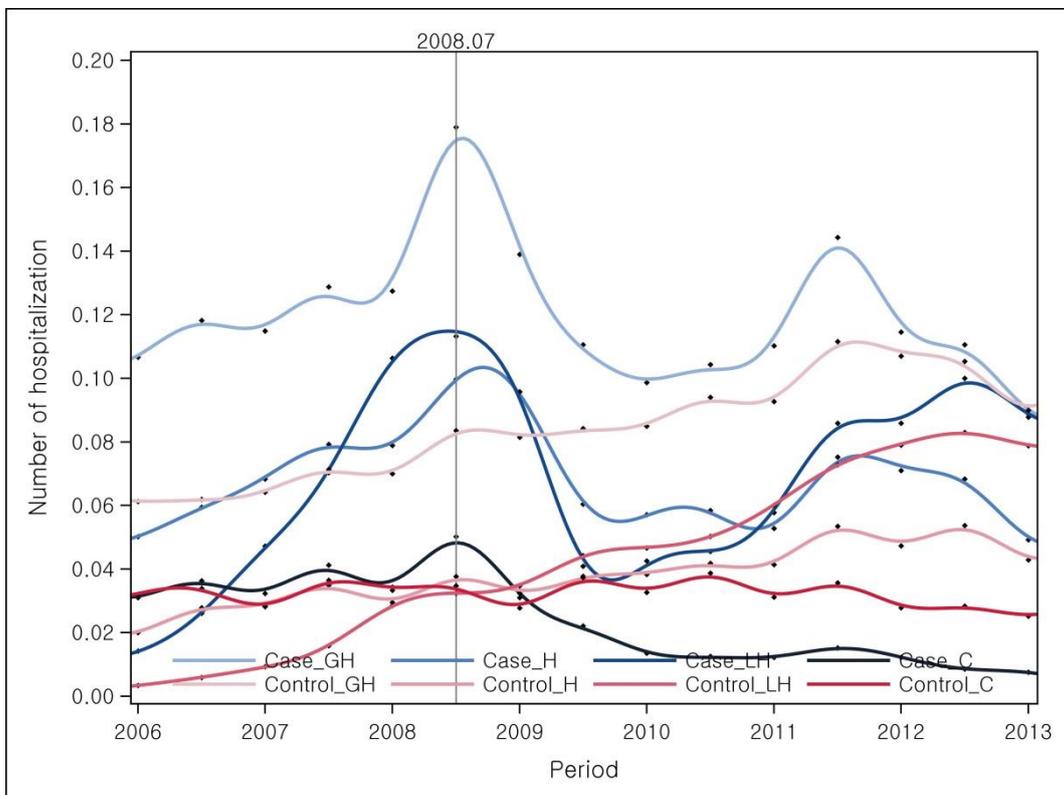


Figure 10. The trends of average number of hospitalization according to hospital type

Figure 11 shows that the trends of average number of hospitalization according to hospital type in beneficiaries. Average number of hospitalization in general hospital has decreased from 0.18 (six months before LTCI) to 0.14 (six months after LTCI) and 0.11 (one year after LTCI). In hospital, Average number of hospitalization has decreased from 0.10 (six months after LTCI) to 0.10 (six months after LTCI) and 0.06 (one year after LTCI). Average number of hospitalization in long-term hospital has decreased from 0.11 (six months before LTCI) to 0.10 (six months after LTCI) and 0.04 (one year after LTCI). Average number of hospitalization in clinic has decreased from 0.05 (six months before LTCI) to 0.03 (six months after LTCI) and 0.02 (one year after LTCI).

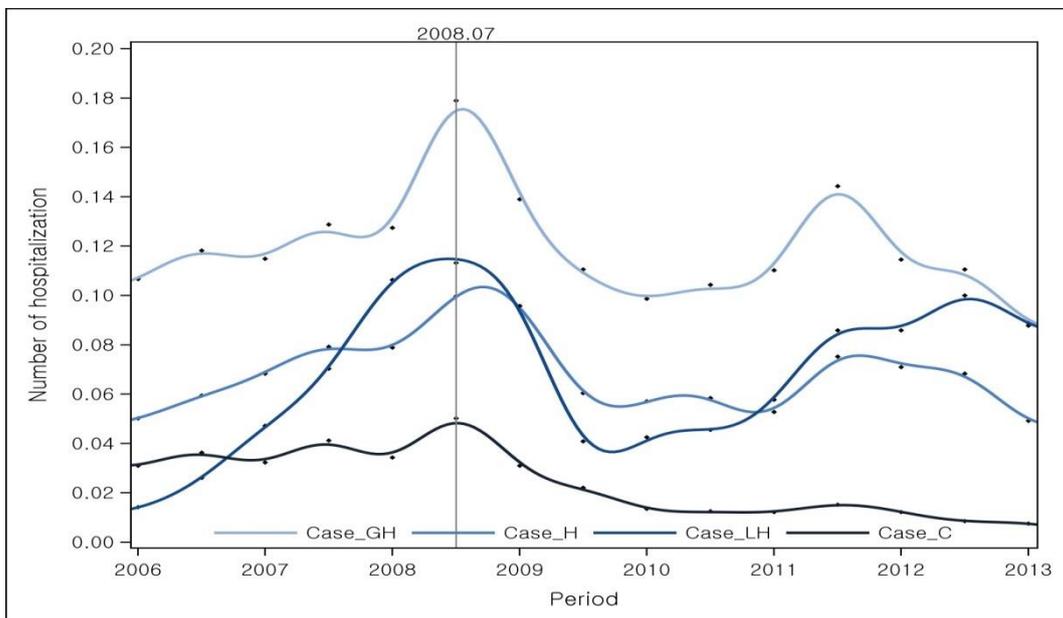


Figure 11. The trends of average number of hospitalization according to hospital type (beneficiaries)

Figure 12 shows that the trends of average number of hospitalization according to hospital type in non-beneficiaries. Average number of hospitalization in general hospital remains unchanged from 0.08 (six months before LTCI) to 0.08 (six months after LTCI) and 0.08 (one year after LTCI). In hospital, Average number of hospitalization remains unchanged from 0.04 (six months after LTCI) to 0.03 (six months after LTCI) and 0.04 (one year after LTCI). Average number of hospitalization in long-term hospital has increased from 0.03 (six months before LTCI) to 0.04 (six months after LTCI) and 0.04 (one year after LTCI). Average number of hospitalization in clinic remains unchanged from 0.04 (six months before LTCI) to 0.03 (six months after LTCI) and 0.04 (one year after LTCI).

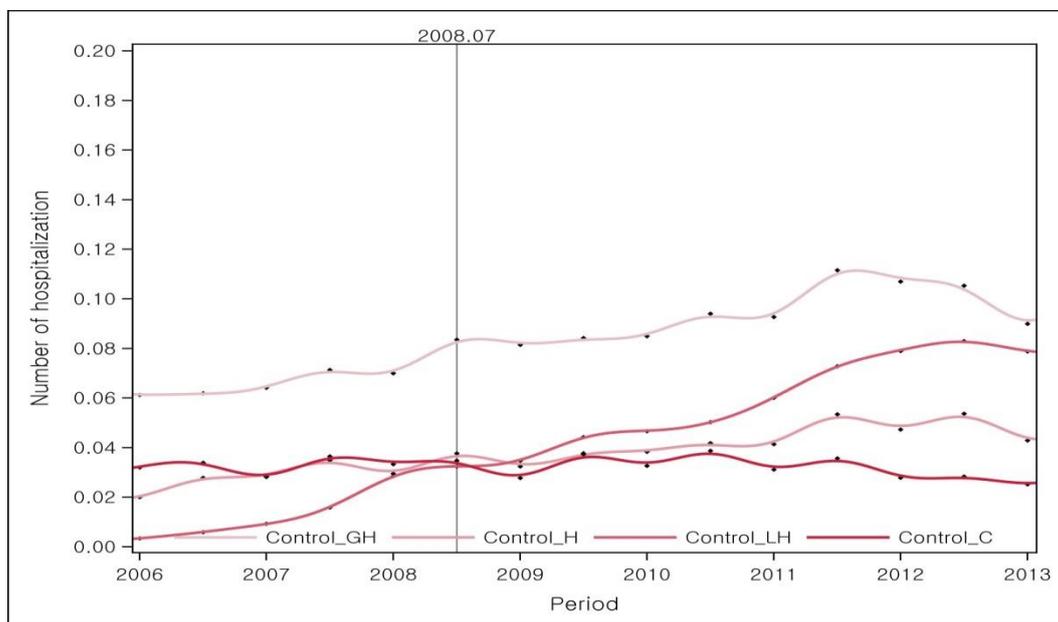


Figure 12. The trends of average number of hospitalization according to hospital type (non-beneficiaries)

Figure 13 shows that the trends of average length-of-stay in study subjects. The average length-of-stay in beneficiaries has decreased from 18.5 (six months before LTCI) to 9.7 (six months after LTCI) and 5.3 (one year after LTCI), whereas that in non-beneficiaries steadily has increased from 5.8 (six months before LTCI) to 7.0 (six months after LTCI) and 7.9 (one year after LTCI).

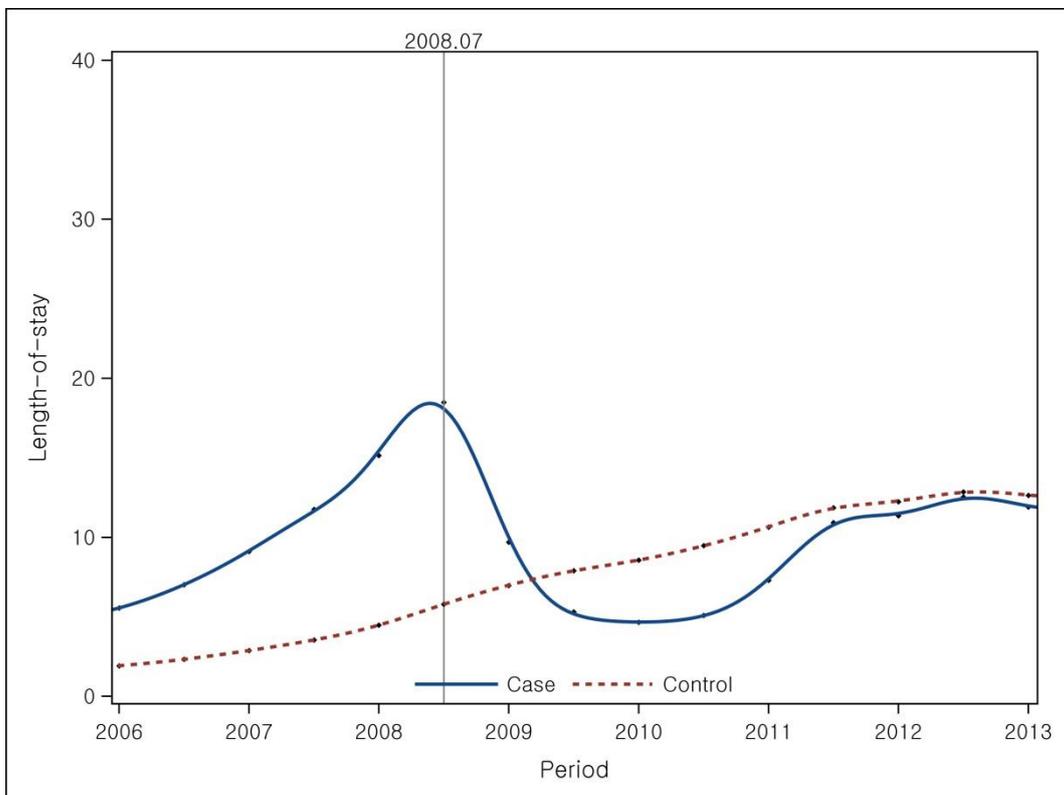


Figure 13. The trends of average length-of-stay in study subject

Figure 14 shows that the trends of average length-of-stay according to hospital type. Hospital type consists of general hospital (bed $\geq$ 100), hospital (bed $\geq$ 30), long-term hospital (bed $\geq$ 30), and clinic (bed $\leq$ 29). Average length-of-stay of beneficiaries has decreased after introduction of LTCI, whereas that in non-beneficiaries steadily has increased without great changes.

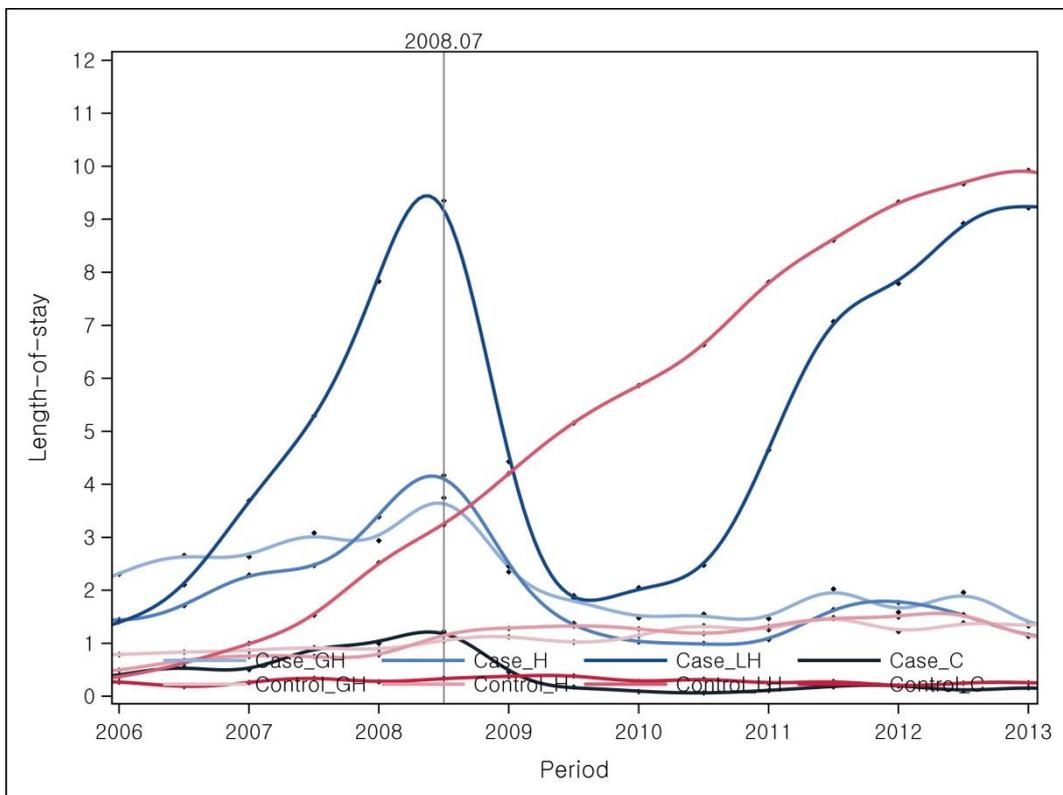


Figure 14. The trends of average length-of-stay according to hospital type

Figure 15 shows that the trends of average length-of-stay according to hospital type in beneficiaries. Average length-of-stay in general hospital has decreased from 3.8 (six months before LTCI) to 2.4 (six months after LTCI) and 1.9 (one year after LTCI). In hospital, Average length-of-stay has decreased from 4.2 (six months after LTCI) to 2.5 (six months after LTCI) and 1.4 (one year after LTCI). Average length-of-stay in long-term hospital has decreased from 9.4 (six months before LTCI) to 4.4 (six months after LTCI) and 1.9 (one year after LTCI). Average length-of-stay in clinic has decreased from 1.2 (six months before LTCI) to 0.5 (six months after LTCI) and 0.2 (one year after LTCI).

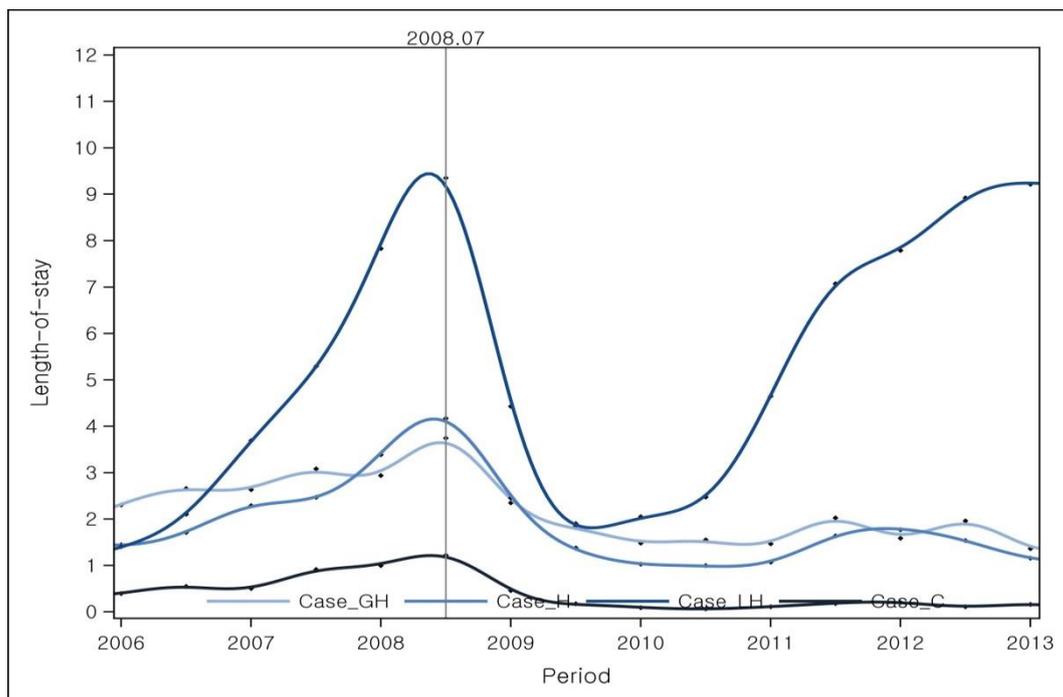


Figure 15. The trends of average length-of-stay according to hospital type (beneficiaries)

Figure 16 shows that the trends of average number of hospitalization according to hospital type in non-beneficiaries. Average number of hospitalization in general hospital has decreased from 1.1 (six months before LTCI) to 1.1 (six months after LTCI) and 1.0 (one year after LTCI). In hospital, Average number of hospitalization has increased from 1.2 (six months after LTCI) to 1.3 (six months after LTCI) and 1.3 (one year after LTCI). Average number of hospitalization in long-term hospital has increased from 3.2 (six months before LTCI) to 4.2 (six months after LTCI) and 5.2 (one year after LTCI). Average number of hospitalization in clinic has increased from 0.3 (six months before LTCI) to 0.4 (six months after LTCI) and 0.4 (one year after LTCI).

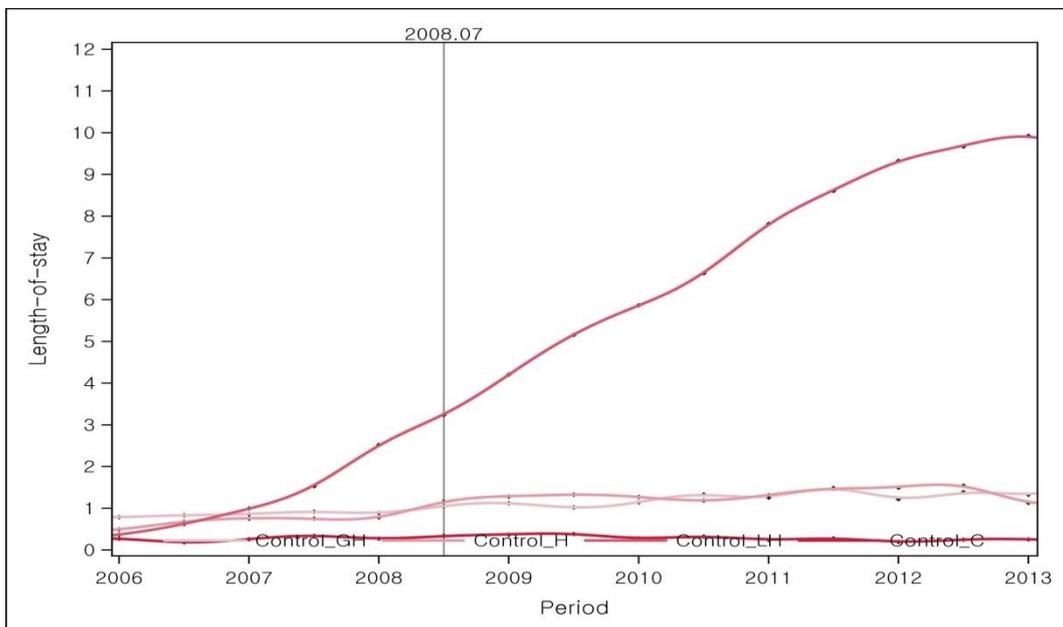


Figure 16. The trends of average length-of-stay according to hospital type (non-beneficiaries)

Figure 17 shows that the trends of average number of outpatient visit in study subjects. The average number of outpatient visit in two groups has increased after 2007. The average number of outpatient visit in beneficiaries at the first half is 8.2 and that at the last half is 11.5. The average number of outpatient visit in non-beneficiaries at the first half is 9.4 and that at the last half is 14.0. In other words, the average number change of outpatient visit in non-beneficiaries is 4.6, whereas that in beneficiaries is 3.3.

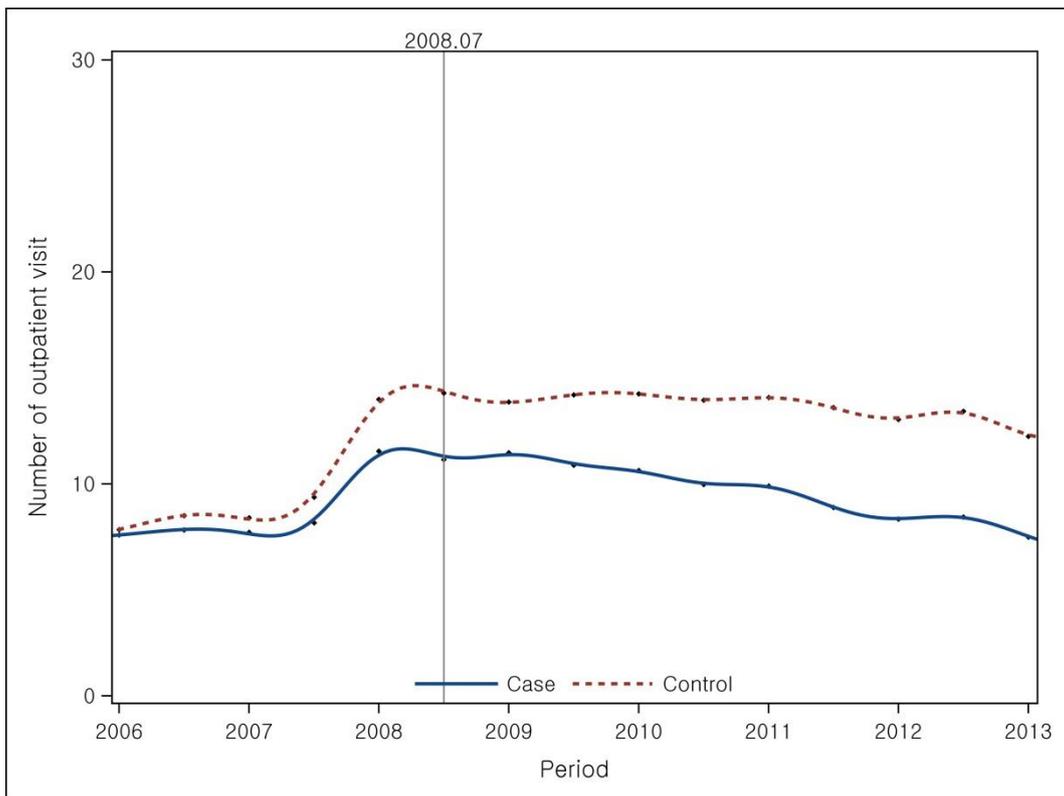


Figure 17. The trends of average number of outpatient visit in study subject

Figure 18 shows that the trends of average number of drug prescription in study subjects. The average number of drug prescription in two groups has increased after 2007. The average number of drug prescription in beneficiaries at the first half is 5.7 and that at the last half is 7.1. The average number of drug prescription in non-beneficiaries at the first half is 7.1 and that at the last half is 9.6. In other words, the average number change of drug prescription in non-beneficiaries is 2.5, whereas that in beneficiaries is 1.4.

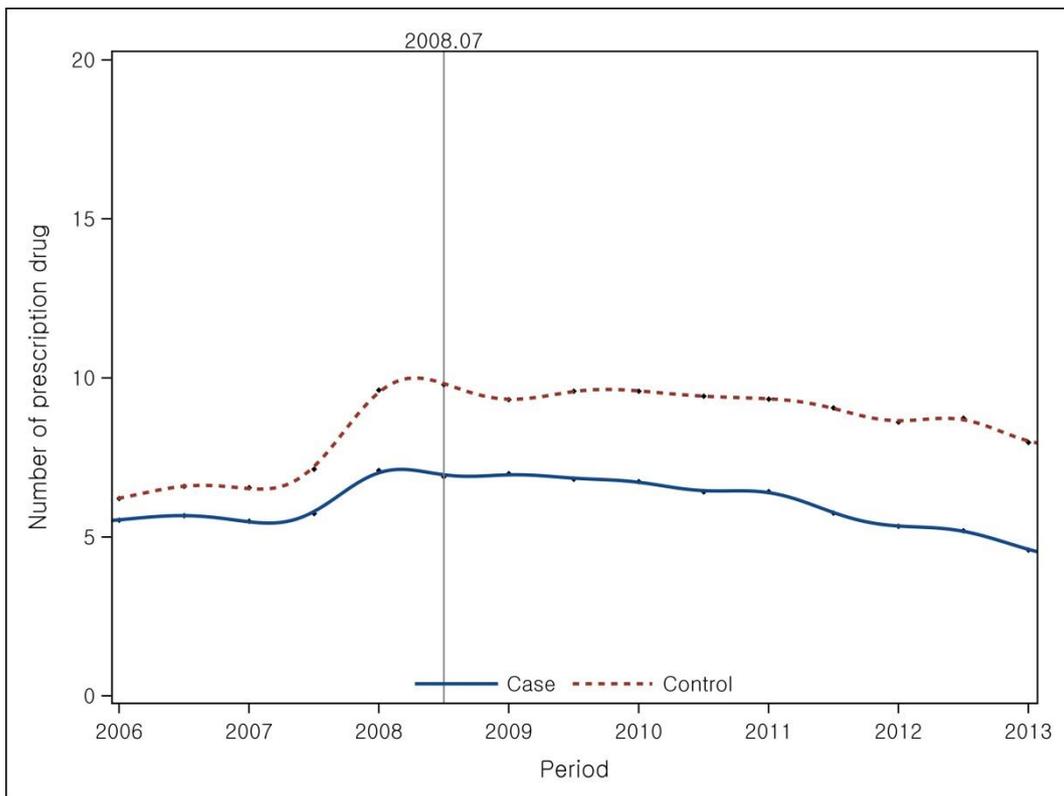


Figure 18. The trends of average number of drug prescription in study subject

2) Burden of medical costs

Figure 19 shows that the trends of burden of medical costs in study subjects. The average ratio of burden of medical costs has decreased from 4.3 (six months before LTCI) to 3.8 (six months after LTCI) and 3.3 (one year after LTCI), whereas that in non-beneficiaries has increased from 2.4 (six months before LTCI) to 2.6 (six months after LTCI) and 2.7 (one year after LTCI).

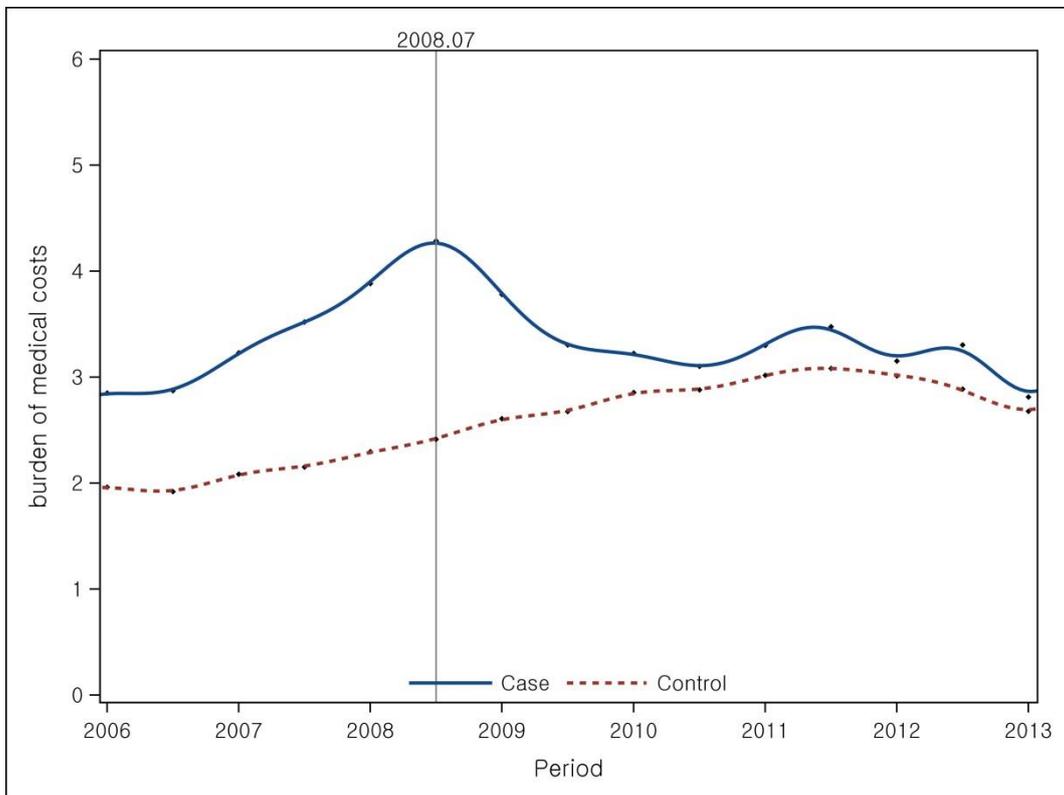


Figure 19. The trends of average ratio of burden of medical costs in study subject

### 3) Burden of Support Costs

Figure 20 shows that the trends of burden of support costs (medical cost+long-term care cost) in study subjects. The average ratio of burden of support costs has increased from 4.3 (six months before LTCI) to 4.5 (six months after LTCI) and 4.2 (one year after LTCI). That in non-beneficiaries has increased from 2.4 (six months before LTCI) to 2.6 (six months after LTCI) and 2.9 (one year after LTCI).

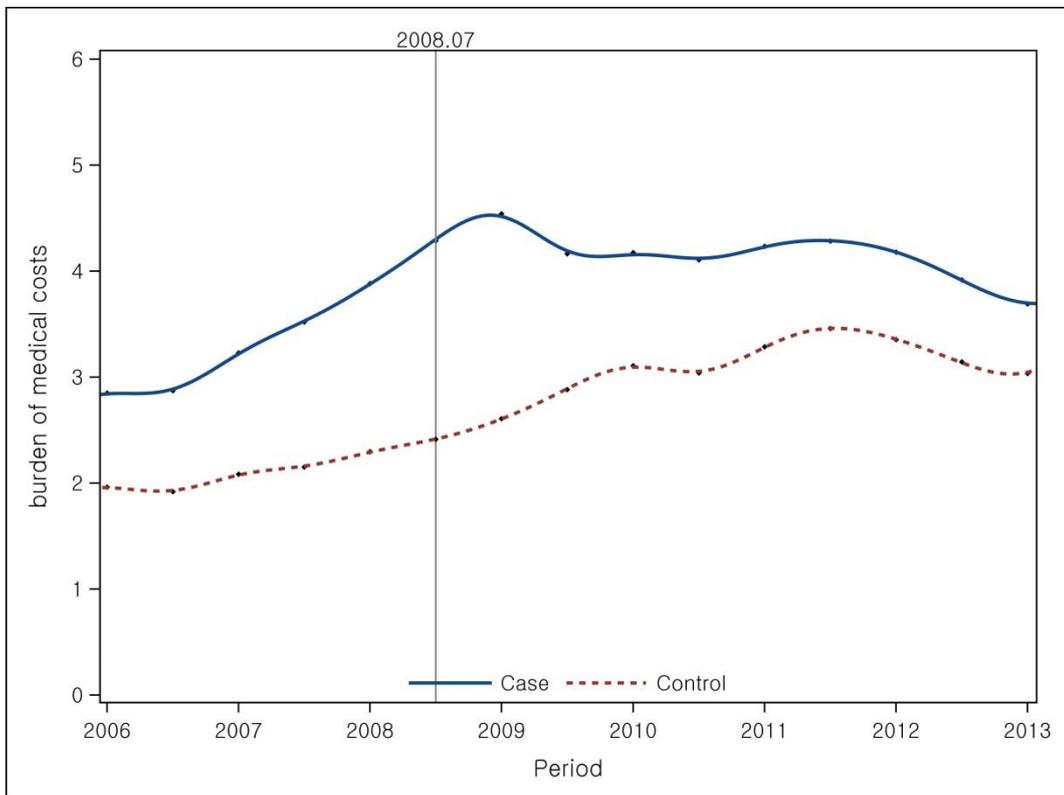


Figure 20. The trends of average ratio of burden of support costs in study subject

### 3. Regression Model Estimates

#### 1) Medical Utilization

After applying multivariable models adjusted for characteristics, we present in table 9 that the number of hospitalization of beneficiaries significantly decreased compared to non-beneficiaries (adjusted ratio: 0.95; 95% confidence interval [CI], 0.95 to 0.96). Length-of-stay of beneficiaries also significantly decreased compared to non-beneficiaries (adjusted ratio: 0.76; 95% C.I., 0.73 to 0.79). However, table 9 reveals that the number of outpatient visit and receipt of drug prescription of beneficiaries and non-beneficiaries significantly increased slightly.

Table 9. Regression model estimates for medical utilization by long-term care insurance (LTCI)

Variables	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in- difference (DID) Effect</i>	
	<i>Mean</i>	<i>Mean</i>		<i>Ratio</i>	<i>95% CI</i>
Number of hospitalization					
Beneficiaries	0.29	0.26	<.001	0.95	0.95-0.96
Non-beneficiaries	0.14	0.23	<.001		
Length-of-stay (day)					
Beneficiaries	10.28	9.23	<.001	0.76	0.73-0.79
Non-beneficiaries	3.23	10.72	<.001		
Number of outpatient visit					
Beneficiaries	8.77	8.96	0.045	1.05	1.00-1.10
Non-beneficiaries	10.01	13.30	<.001		
Receipt of drug prescription					
Beneficiaries	5.98	5.65	<.001	1.04	1.02-1.06
Non-beneficiaries	7.43	8.81	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, income level, residential area, charson's comorbidity index, chronic diseases, disability)

We measured regression model estimates for number of hospitalization by long-term care insurance (LTCI) system according to hospital type (Table 10). The number of hospitalization of beneficiaries significantly greatly decreased compared to non-beneficiaries in long-term hospital among hospital type (adjusted ratio: 0.87; 95% confidence interval [CI], 0.74 to 0.98).

Table 10. Regression model estimates for number of hospitalization by long-term care insurance (LTCI) according to hospital type

Hospital type	Unadjusted number (pre-LTCI)	Unadjusted number (post- LTCI)	<i>p</i> -value for pre-/post difference	Adjusted difference- in-difference (DID) Effect	
	Mean	Mean		Ratio	95% CI
General hospitals					
Beneficiaries	0.13	0.11	<.001	0.98	0.98-0.99
Non-beneficiaries	0.07	0.10	<.001		
Hospital					
Beneficiaries	0.07	0.06	0.006	0.99	0.99-1.00
Non-beneficiaries	0.03	0.04	<.001		
Long-term care hospital					
Beneficiaries	0.06	0.07	<.001	0.87	0.74-0.98
Non-beneficiaries	0.01	0.06	<.001		
Clinics					
Beneficiaries	0.04	0.01	<.001	0.99	0.99-0.99
Non-beneficiaries	0.03	0.03	0.022		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, income level, residential area, charson's comorbidity index, chronic diseases, disability)

We measured regression model estimates for length-of-stay by long-term care insurance (LTCI) system according to hospital type (Table 11). The LOS of beneficiaries significantly decreased compared to non-beneficiaries. LOS of beneficiaries who admitted to long-term hospital greatly has decreased compared to non-beneficiaries among hospital type (adjusted ratio: 0.36; 95% confidence interval [CI], 0.14 to 0.87).

Table 11. Regression model estimates for length-of-stay by long-term care insurance (LTCI) according to hospital type

Hospital type	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	<i>Mean</i>	<i>Mean</i>		<i>Ratio</i>	<i>95% CI</i>
General hospitals					
Beneficiaries	2.75	1.69	<.001	0.93	0.92-0.95
Non-beneficiaries	0.88	1.28	<.001		
Hospital					
Beneficiaries	2.44	1.37	<.001	0.96	0.94-0.98
Non-beneficiaries	0.73	1.29	<.001		
Long-term care hospital					
Beneficiaries	4.38	6.02	<.001	0.36	0.14-0.87
Non-beneficiaries	1.36	7.89	<.001		
Clinics					
Beneficiaries	0.71	0.16	<.001	0.96	0.95-0.97
Non-beneficiaries	0.27	0.27	0.899		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, income level, residential area, charson's comorbidity index, chronic diseases, disability)

## 2) Burden of Medical Costs

After applying multivariable models adjusted for characteristics, the burden of medical costs in beneficiaries significantly decreased compared to non-beneficiaries (adjusted ratio: 0.89; 95% C.I., 0.87 to 0.90)(Table 12).

Table 12. Regression model estimates for burden of medical costs by long-term care insurance (LTCI)

Variable	<i>Unadjusted rates (pre-LTCI)</i>	<i>Unadjusted rates (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		<i>Ratio</i>	<i>95% CI</i>
Burden of medical costs					
Beneficiaries	3.32	3.27	0.292	0.89	0.87-0.90
Non-beneficiaries	2.09	2.86	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, income level, residential area, charson's comorbidity index, chronic diseases, disability)

### 3) Burden of Support Costs

After applying multivariable models adjusted for characteristics, the burden of support costs (medical cost + long-term care cost) in beneficiaries significantly increased compared to non-beneficiaries (adjusted ratio: 1.18; 95% C.I., 1.15 to 1.21)(Table 13).

Table 13. Regression model estimates for burden of support costs by long-term care insurance (LTCI)

Variable	<i>Unadjusted rates (pre-LTCI)</i>	<i>Unadjusted rates (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		<i>Ratio</i>	<i>95% CI</i>
Burden of support costs					
Beneficiaries	3.32	4.12	<.001	1.18	1.16-1.21
Non-beneficiaries	3.09	3.16	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, income level, residential area, charson's comorbidity index, chronic diseases, disability)

## V. Discussions

### 1. Discussion of Study Methods

#### 1) Difference-In-Difference Matching (DDM) Model

This study used a combined matching and a difference in difference (DID) regression approach rather than a matching estimator alone to estimate the intervention effect. An advantage of the DDM approach is that it relies on relatively weaker assumptions compared to the matching estimators alone. In the case of matching estimators, the estimated intervention effect relies on the independence assumption between the exposure to the intervention and potential health outcome upon controlling the relevant covariates<sup>78</sup>. One way to violate this assumption would be through unobservable factors affecting the selection to the intervention that in turn affects health outcome. The DDM approach removes any remaining, even after matching, time-invariant systematic differences between the intervention and control units.

Propensity score matching (PSM) was used to organize the population in both surveys into randomized groups to reduce selection bias in sampled population. Since the population of this study included two different groups of people, those “who has been approved in long-term care insurance” and those “who did not applied long-term care insurance”, this study allowed Berkson’s bias which may result from differences

in characteristics between the two groups<sup>79</sup>. PSM typically involves the formation of pairs of treated and untreated subject with similar propensity score (PS) values. Hence, a logistic regression model was used to calculate and save the predicted probability of the dependent variable and the PS for each observation in the data set. This single score (between 0 and 1) represented the relationship between multiple characteristics and the dependent variable as a single characteristic.

This study applies the difference-in-difference (DID) method to estimate the effects of the LTCI on the medical utilizations and burden of medical costs for those aged 65 years and over before and after the introduction of the LTCI<sup>80, 81</sup>. Many studies have used the DID approach to measure the effects of policy changes or an introduction of a new policy<sup>82-84</sup>. The DID method is a standard policy evaluation tool that examines the effects of a policy intervention on a treatment group in comparison to a control group once a particular policy is initiated. The treatment group in this study consists of people aged 65 years or older who use the services offered by the LTCI program in Korea, while the control group consists of those aged 65 years or older who do not use the services provided by the LTCI program.

When conducting a policy analysis by using cohort data, the DID method assumes that unobserved effects are the same for both the treatment group and the control group. Thus, the change in health care use in the treatment group before and after the introduction of the LTCI program, minus the corresponding change in the

control group, provides an estimate of the impact of the LTCI program on health care use<sup>85</sup>.

## 2) Episode of Inpatient Data

Hospitals monthly submit claiming specification to National Health Insurance Service (NHIS) for receipt of benefits. Since the claim data of NHIS consists of monthly claimed data regardless of length-of-stay of patients, data for patients who have hospitalized for a long time indicates numerous rows. Thus, analyses for medical utilization without episode may be measured excessively.

Type of episode of claim data consists of hospital episode, inpatient episode, and treatment episode. First, hospital episode ties successive hospitalization services of patient in equivalent hospital. Second, inpatient episode ties successive hospitalization services of patient in whole hospital in South Korea. Third, treatment episode ties total services including outpatient services as well as hospitalizations. Of diverse methods to tie episode, we selected inpatient episode semi-annually. Generally, episode for quarter or annual period often has utilized in previous analyses. However, we chose 6 months unit for episode of inpatient data because LTCI has started at July 2008 and length-of-stay of the elderly relatively is longer than other age group.

### 3) Limitations of This Study

We acknowledge the limitations of this study. First, we did not consider un-insured costs of the out-of-pocket payment, although un-insured rate is quite high in South Korea. Second, we defined ability to pay as premium fractile which is proxy variable of income level. Although the absolute amount of premiums in study subject has some differences, they could be included in same income level. However, we are concerned with changes for burden of medical costs by LTCI in same person rather than differences between one person and another person. Third, this study defined study subject (LTCI beneficiary) as beneficiaries who at least have received long-term care service for 3 years after LTCI because the number of beneficiary who has got the benefit more than 4 years is very small. Fourth, since we analyzed data for employee insured only, we cannot easily generalize our findings. Fifth, nature between case (beneficiary) and control group (non-beneficiary) may be heterogeneous. To minimize the limitation, we utilized PSM for selection of control group which have similar characteristics with case group. Finally, our analyses may have overlooked relevant complications in the study subject because our research was limited to data that could be captured at the administrative level. However, we used CCI scores for assessing the clinical status of patients to partially address this limitation.

## 2. Discussion of Study Results

This study examines semi-annual changes of medical utilization and burden of medical costs of beneficiaries by introduction of long-term care insurance. This research results found that the number of hospitalization and length-of-stay in beneficiaries significantly decreased compared to non-beneficiaries after introduction of LTCI. However, the number of outpatient visit and receipt of drug prescription of beneficiaries and non-beneficiaries slightly increased. In inpatient services, the number of hospitalization and LOS of beneficiaries significantly greatly decreased compared to non-beneficiaries in long-term hospital among hospital type. In addition, the burden of medical costs in beneficiaries significantly decreased compared to non-beneficiaries. However, the burden of support costs (medical cost + long-term care cost) in beneficiaries significantly increased compared to non-beneficiaries.

This research results is similar to previous studies which showed reduction of medical utilizations. Han (2013) analyzed the medical expense change and influencing factors after introducing long-term care insurance<sup>56</sup>. Multiple regression analyses results showed that total average medical expenses among long-term patients have significantly decreased by 46.5% after introducing the long-term care insurance. The hospitalization expenses have significantly decreased by 148.5%, whereas the drug expenses have increased by 53.6%. And outpatient expenses have increased by 10.4%, but the differences were not statistically significant. Lee (2015) examined the

effect of long-term care utilization on health care utilization of the elderly<sup>17</sup>. This research showed that the total medical expenses and hospitalization medical expenses have decreased after the introduction of long-term care insurance. However, the medical expenses for outpatient service and prescription drug have increased after the introduction of long-term care insurance.

This substitution effect of utilization of inpatient services by LTCI may result in cheaper price for hospitalization in long-term care facilities than hospital. According to The elderly Cohort Data in 2013, annually average out-of-pocket payment per one case in medical services which include inpatient, outpatient, and drug prescription service is five hundred eighty thousand Korean won, but that in long-term care services that include facility and home service is one hundred ten thousand Korean won. In addition, annual average out-of-pocket payment per one case in inpatient services is 1.4 million Korean won, but that of in long-term facility is 1.2 million Korean won.

In results of inpatient service utilization according to hospital type, this study found great reduction of inpatient service in long-term care hospitals. These results show duplication of services between long-term care and medical utilization. Noh (2011) implies that physical function of the users are mixed normality and severe disability and transfer between facilities and hospitals appropriately has not been realized. This would bring about inefficiency and more expenses occurrence.

Therefore, government needs to arrange appropriate criteria, efficient link system, and train specialist who can coordinate inpatient patients in long-term care hospital or facility. Japan has charged full payment for treatment if patients hospitalize more than 90 days and we can refer to this case.

Government needs to consider eligibility extension in long-term care insurance. Although benefit is extended from 3rd level to 5th level in LTCI, approval rate of care level is not less than 60% in 2015. The LTCI approver ratio compared to the total aging population 5.8% in 2012, whereas Japan and Germany that has started LTCI prior to South Korea is 18.3%, 14.1%, respectively. In limited resources, government needs to consider method such as differential charge for OOP according to income level. Continuous extension for eligibility with appropriate connections between long-term care facilities and hospitals would contribute efficiency of health care spending.

Medical assistance for the LTCI beneficiaries needs to be extended. This study results indicate that the number of outpatient utilization or drug prescription has increased after LTCI. Although the beneficiaries mainly receive rehabilitation treatment in long-term care hospital, they would need medical service. Therefore, government needs to consider irregular doctor service in long-term care facilities and resource link with hospitals in equivalent community in addition to nursing home services.

This study result also shows that the burden of medical costs in beneficiaries significantly decreased compared to non-beneficiaries despite of rapid growth of medical costs in the elderly. This positive effect of LTCI was predominant in the low-income group. We imply that LTCI positively have contributed to improve quality of people's live by mitigating the burden of medical costs on family member. The trends for burden of medical costs in beneficiaries need to be monitored consistently.

The burden of support costs in beneficiaries significantly increased compared to non-beneficiaries. This result is similar to previous study results that financial burden by LTCI changed most negatively among physical, social, emotional, financial burden. This phenomenon may be caused by complex utilizations of long-term care services and medical services. The institutional solicitude for them needs to be considered.

## VI. Conclusion

The long-term care insurance has led to significant reductions in utilizations of inpatients service. Government needs to arrange appropriate criteria, efficient link system, and train specialist who can coordinate inpatient patients in long-term care hospital or facility. This study result also shows that the burden of medical costs in beneficiaries significantly decreased compared to non-beneficiaries despite of rapid growth of medical costs in the elderly. The positive effect of LTCI supports continuous implementation and expansion of the LTCI for non-beneficiaries who need care assistance.

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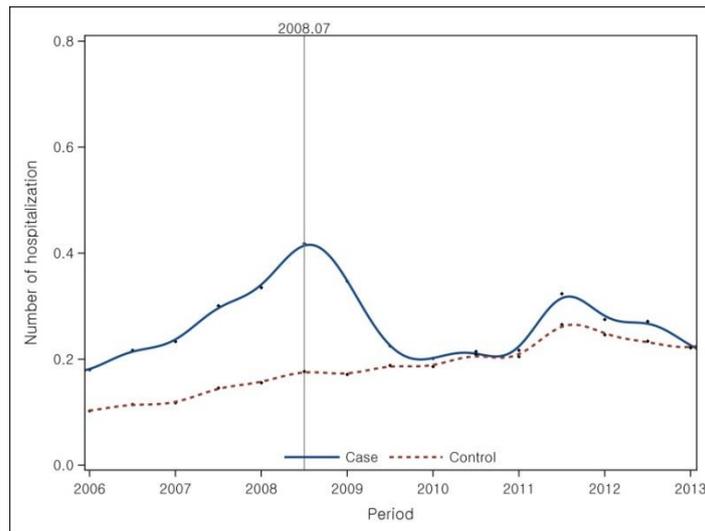
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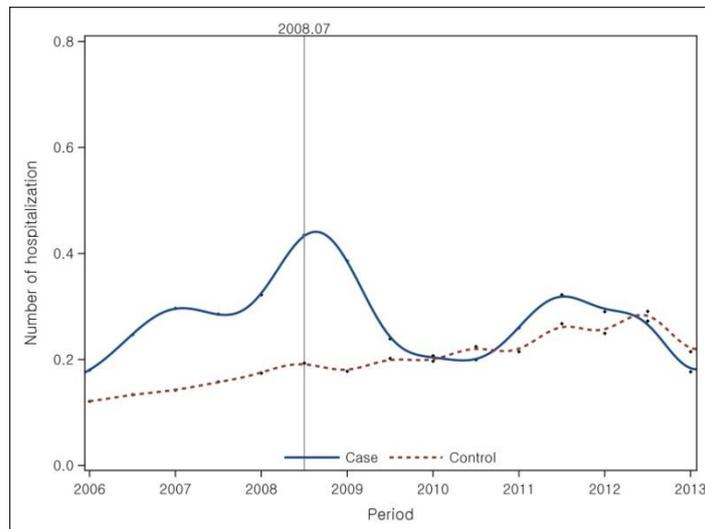
## Appendix

### Appendix A. Trends of Medical Utilizations according to Income Group

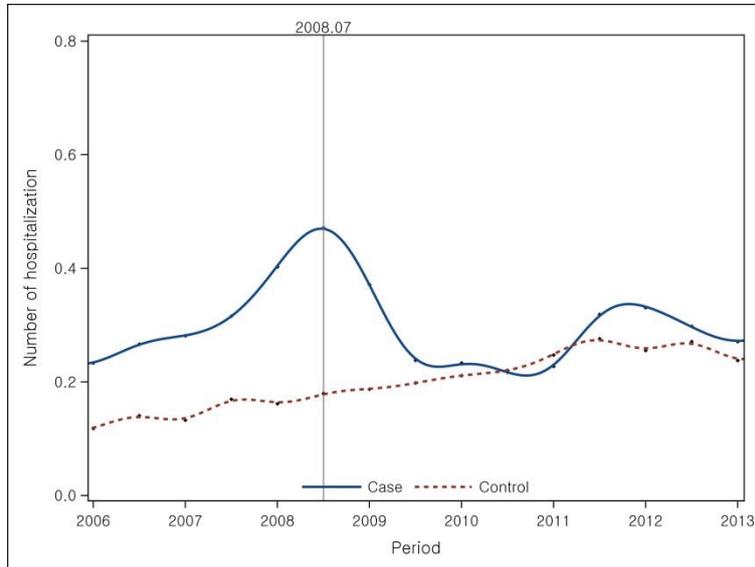
#### A-1. Trends of Average Number of Hospitalization in Low Income Group



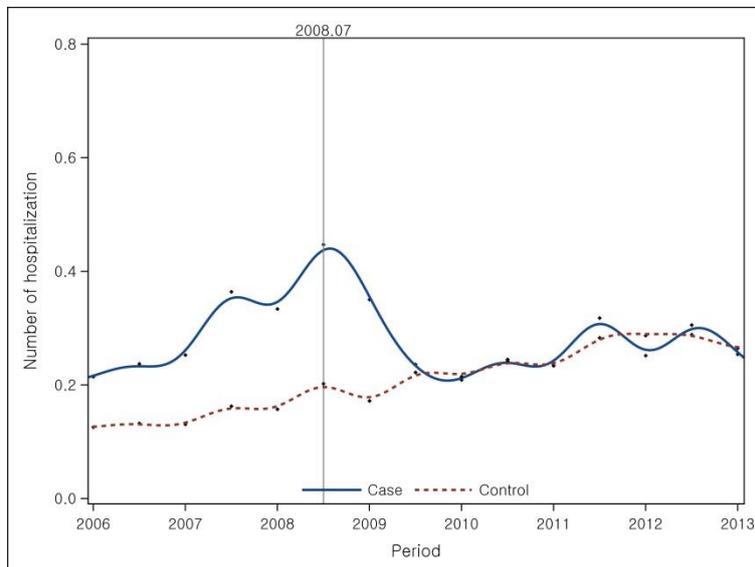
#### A-2. Trends of Average Number of Hospitalization in Mid-Low Income Group



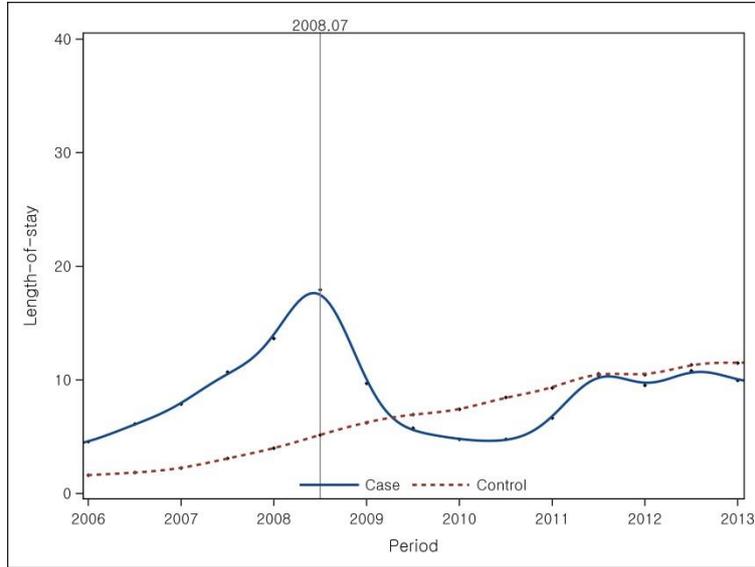
**A-3. Trends of Average Number of Hospitalization in Mid-High Income Group**



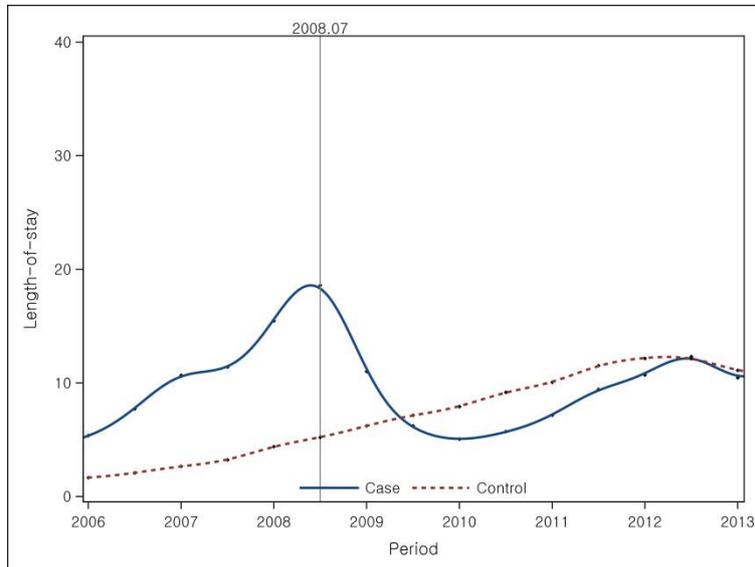
**A-4. Trends of Average Number of Hospitalization in High Income Group**



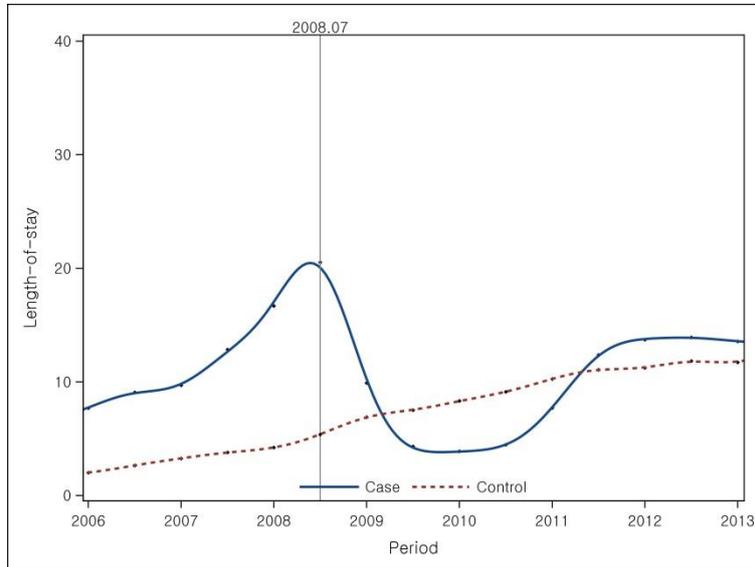
**A-5. Trends of Average Length-of-Stay in Low Income Group**



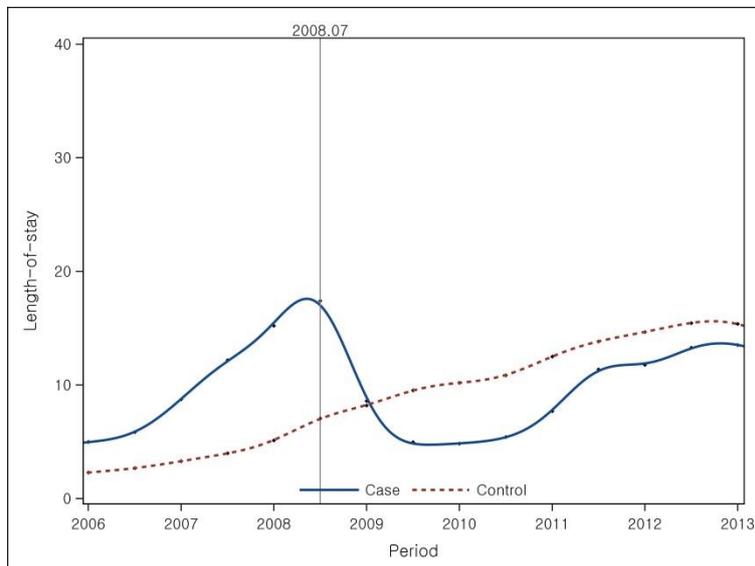
**A-6. Trends of Average Length-of-Stay in Mid-Low Income Group**



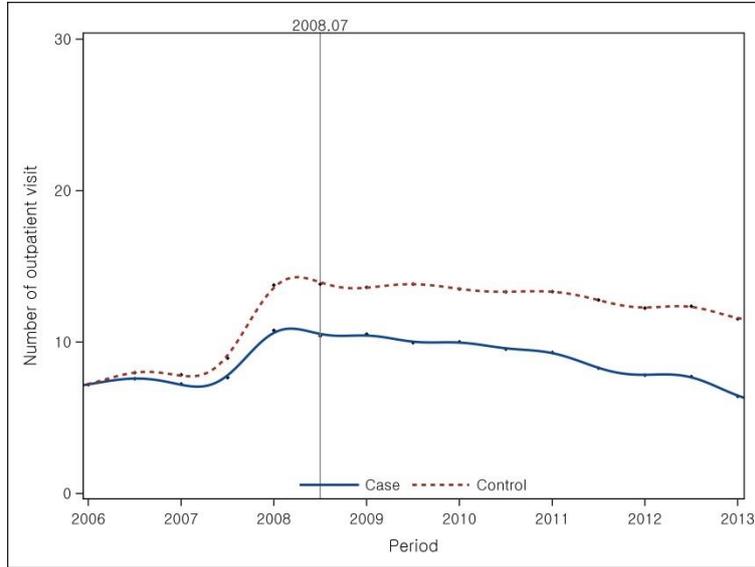
**A-7. Trends of Average Length-of-Stay in Mid-High Income Group**



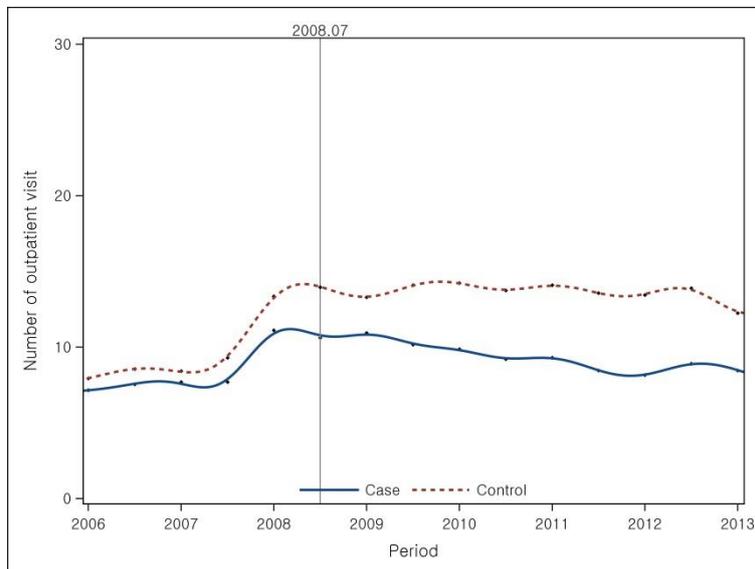
**A-8. Trends of Average Length-of-Stay in High Income Group**



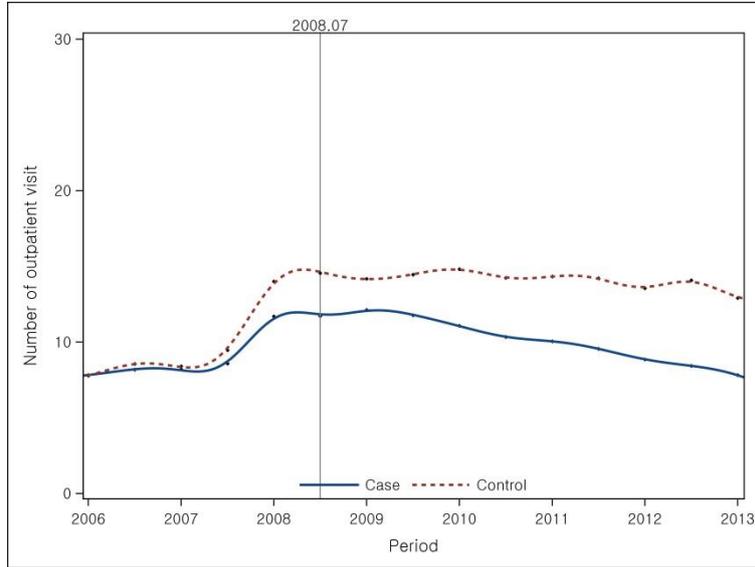
**A-9. Trends of Average Number of Outpatient Visit in Low Income Group**



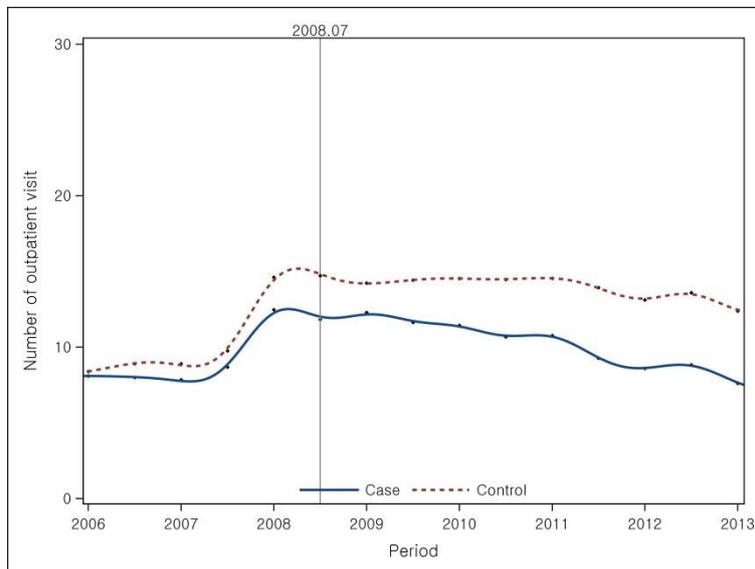
**A-10. Trends of Average Number of Outpatient Visit in Mid-Low Income Group**



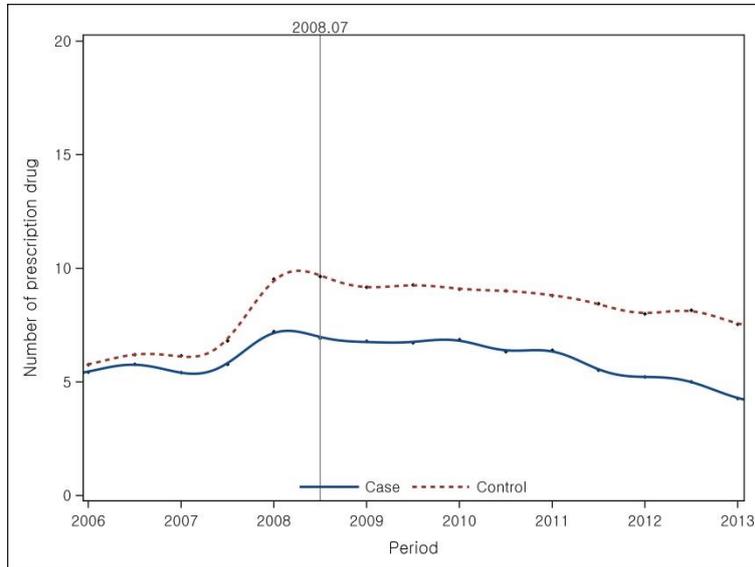
**A-11. Trends of Average Number of Outpatient Visit in Mid-High Income Group**



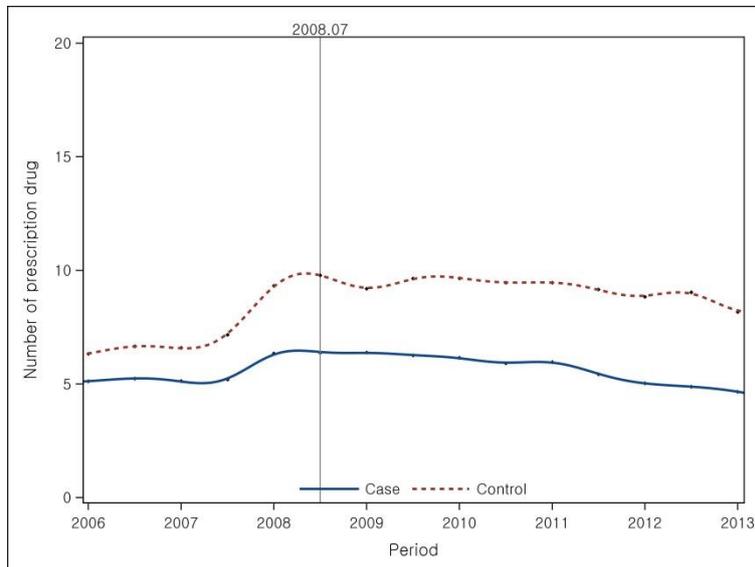
**A-12. Trends of Average Number of Outpatient Visit in High Income Group**



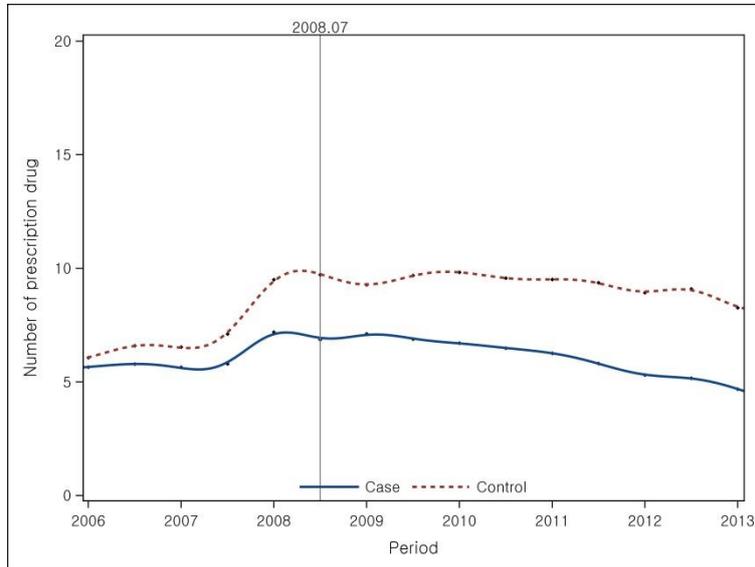
**A-13. Trends of Average Number of Drug Prescription in Low Income Group**



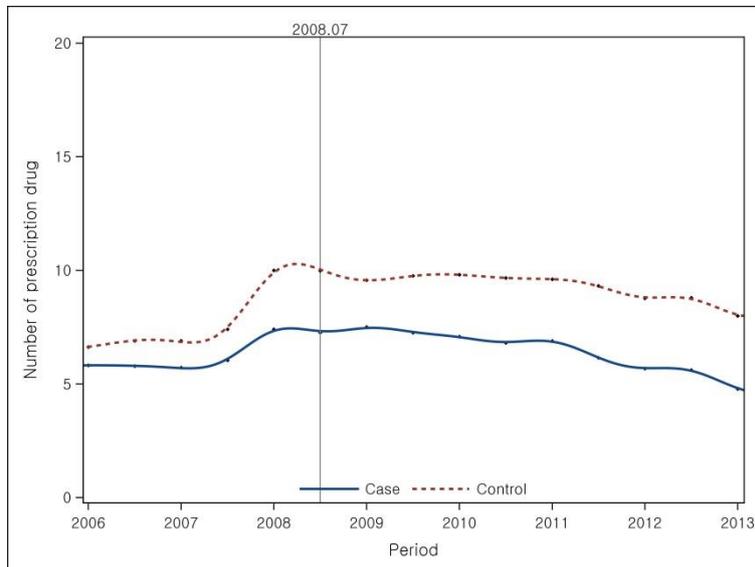
**A-14. Trends of Average Number of Drug Prescription in Mid-Low Income Group**



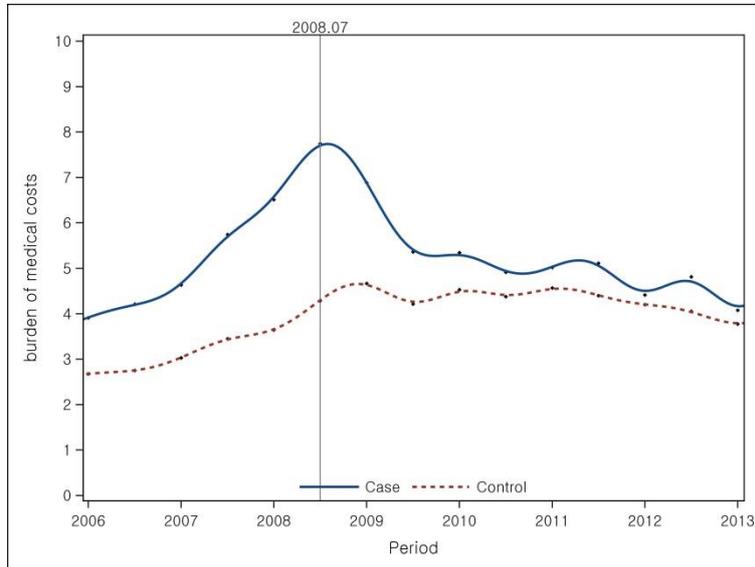
**A-15. Trends of Average Number of Drug Prescription in Mid-High Income Group**



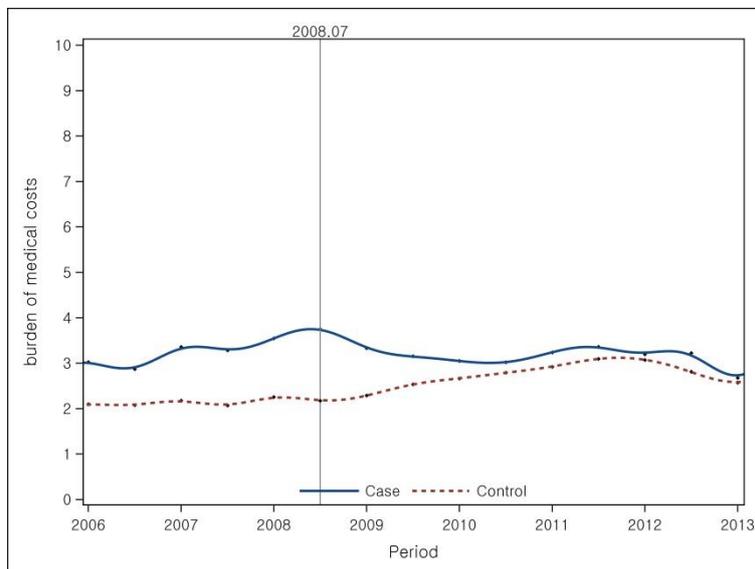
**A-16. Trends of Average Number of Drug Prescription in High Income Group**



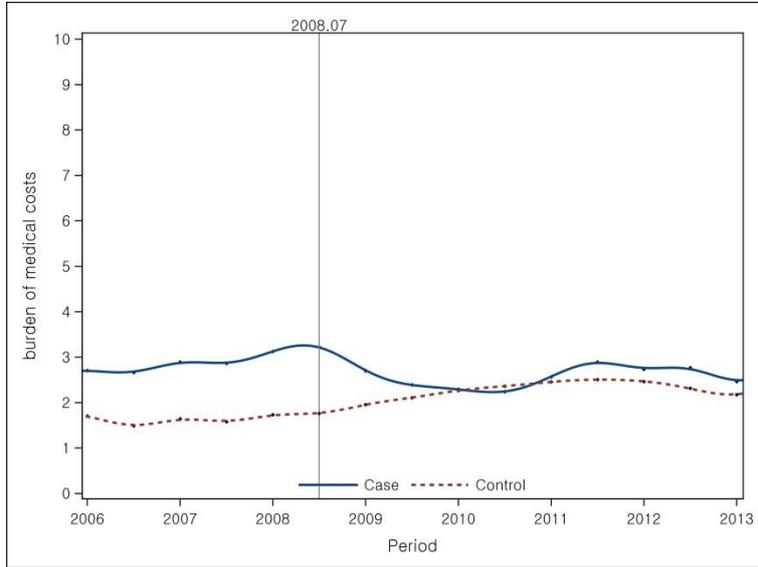
**A-17. Trends of Burden of Medical Costs in Low Income Group**



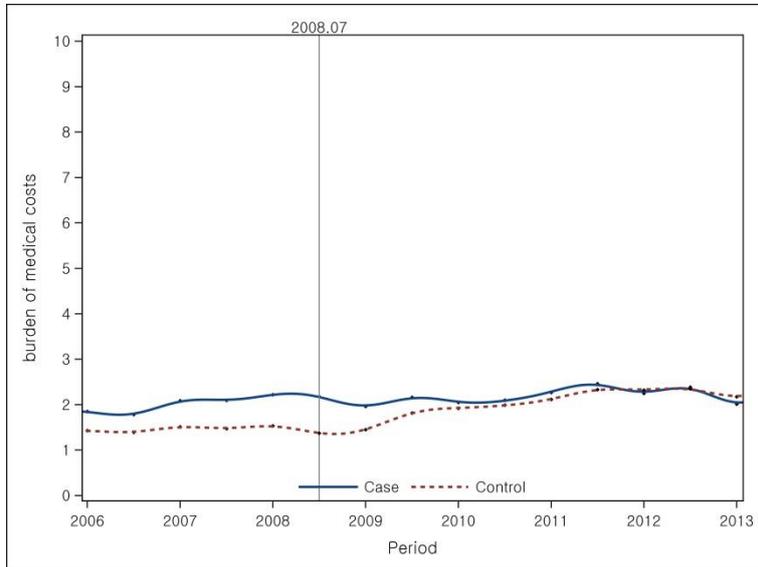
**A-18. Trends of Burden of Medical Costs in Mid-Low Income Group**



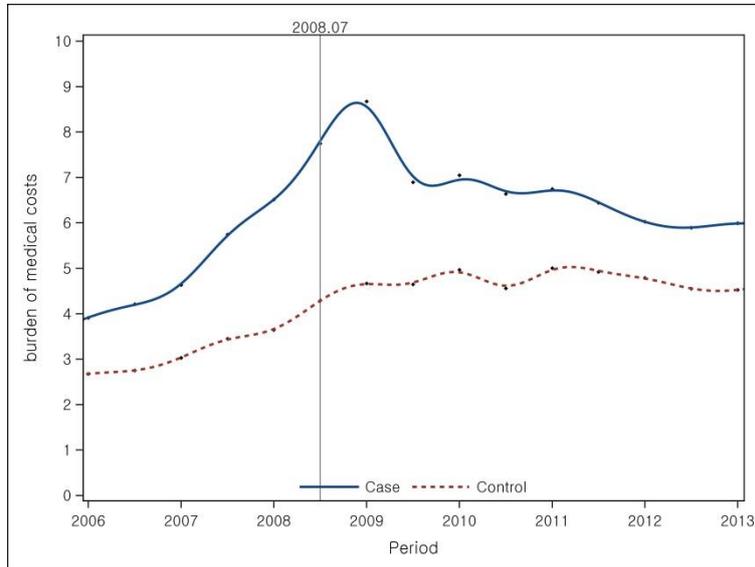
**A-19. Trends of Burden of Medical Costs in Mid-High Income Group**



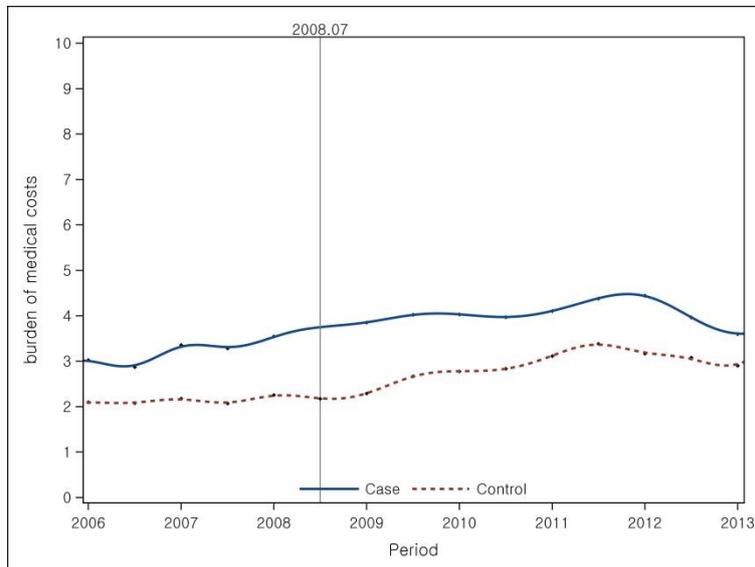
**A-20. Trends of Burden of Medical Costs in High Income Group**



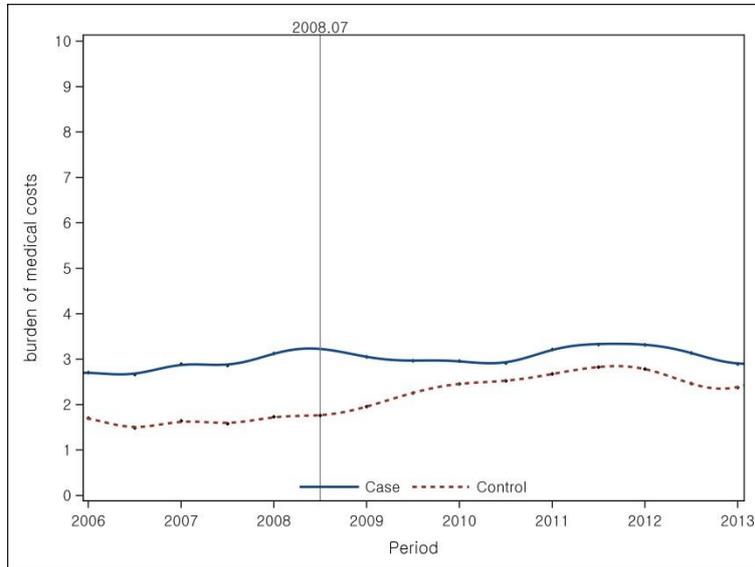
**A-21. Trends of Burden of Support Costs in Low Income Group**



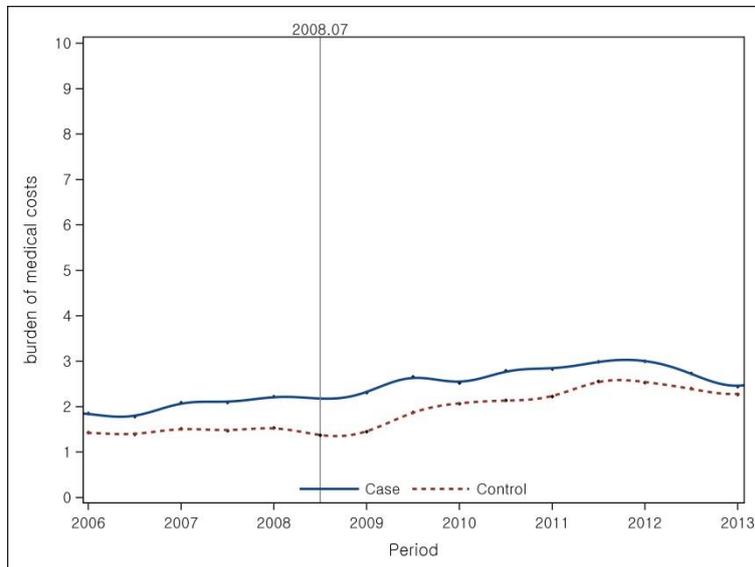
**A-22. Trends of Burden of Support Costs in Mid-Low Income Group**



**A-23. Trends of Burden of Support Costs in Mid-High Income Group**



**A-24. Trends of Burden of Support Costs in High Income Group**



## Appendix B. Regression model estimates according to Income Group

### B-1. Regression model estimates for medical utilization in Low Income Group

Variables	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	<i>Mean</i>	<i>Mean</i>		<i>Ratio</i>	<i>95% CI</i>
Number of hospitalization					
Beneficiaries	0.27	0.27	0.839		
Non-beneficiaries	0.13	0.23	<.001	0.96	0.94-0.97
Length-of-stay (day)					
Beneficiaries	9.60	9.27	0.526		
Non-beneficiaries	2.66	10.12	<.001	0.78	0.73-0.84
Number of outpatient visit					
Beneficiaries	8.21	9.26	<.001		
Non-beneficiaries	9.18	13.17	<.001	1.02	0.98-1.07
Receipt of drug prescription					
Beneficiaries	5.91	6.01	0.329		
Non-beneficiaries	7.09	8.87	<.001	1.02	0.98-1.07

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-2. Regression model estimates for medical utilization in Mid-Low Income Group

Variables	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	<i>Mean</i>	<i>Mean</i>		<i>Ratio</i>	<i>95% CI</i>
Number of hospitalization					
Beneficiaries	0.29	0.28	0.813		
Non-beneficiaries	0.14	0.24	<.001	0.96	0.94-0.98
Length-of-stay (day)					
Beneficiaries	10.18	10.01	0.793		
Non-beneficiaries	3.16	11.60	<.001	0.17	0.03-1.06
Number of outpatient visit					
Beneficiaries	8.59	9.72	<.001		
Non-beneficiaries	9.79	13.40	<.001	1.44	0.92-2.25
Receipt of drug prescription					
Beneficiaries	5.72	6.08	0.003		
Non-beneficiaries	7.36	8.93	<.001	1.12	0.68-1.85

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-3. Regression model estimates for medical utilization in Mid-High Income Group

Variables	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	<i>Mean</i>	<i>Mean</i>		<i>Ratio</i>	<i>95% CI</i>
Number of hospitalization					
Beneficiaries	0.31	0.29	0.081		
Non-beneficiaries	0.14	0.24	<.001	0.94	0.92-0.96
Length-of-stay (day)					
Beneficiaries	12.02	10.05	0.004		
Non-beneficiaries	3.17	10.55	<.001	0.92	0.68-1.23
Number of outpatient visit					
Beneficiaries	9.17	10.03	<.001		
Non-beneficiaries	10.23	14.43	<.001	1.02	0.97-1.07
Receipt of drug prescription					
Beneficiaries	5.95	6.20	0.051		
Non-beneficiaries	7.45	9.44	<.001	0.89	0.93-1.46

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-4. Regression model estimates for medical utilization in High Income Group

Variables	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	<i>Mean</i>	<i>Mean</i>		<i>Ratio</i>	<i>95% CI</i>
Number of hospitalization					
Beneficiaries	0.30	0.28	0.244		
Non-beneficiaries	0.15	0.25	<.001	0.95	0.93-0.96
Length-of-stay (day)					
Beneficiaries	9.77	11.14	0.013		
Non-beneficiaries	3.89	12.06	<.001	0.44	0.13-1.54
Number of outpatient visit					
Beneficiaries	9.31	10.42	<.001		
Non-beneficiaries	10.62	14.17	<.001	0.72	0.46-1.14
Receipt of drug prescription					
Beneficiaries	6.37	6.50	0.210		
Non-beneficiaries	7.84	9.33	<.001	1.03	0.99-1.08

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-5. Regression model estimates for burden of medical costs in Low Income Group

Variable	Unadjusted number (pre-LTCI)	Unadjusted number (post-LTCI)	p-value for pre-/post difference	Adjusted difference-in-difference (DID) Effect	
	%	%		Ratio	95% CI
Burden of medical costs					
Beneficiaries	5.70	5.88	0.184	0.89	0.86-0.93
Non-beneficiaries	3.57	5.19	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-6. Regression model estimates for burden of medical costs in Mid-Low Income Group

Variable	Unadjusted number (pre-LTCI)	Unadjusted number (post-LTCI)	p-value for pre-/post difference	Adjusted difference-in-difference (DID) Effect	
	%	%		Ratio	95% CI
Burden of medical costs					
Beneficiaries	2.92	2.88	0.562	0.89	0.86-0.92
Non-beneficiaries	1.84	2.57	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-7. Regression model estimates for burden of medical costs in Mid-High Income Group

Variable	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		<i>Ratio</i>	<i>95% CI</i>
Burden of medical costs					
Beneficiaries	2.52	2.34	0.001	0.87	0.84-0.90
Non-beneficiaries	1.49	2.13	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-8. Regression model estimates for burden of medical costs in High Income Group

Variable	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		<i>Ratio</i>	<i>95% CI</i>
Burden of medical costs					
Beneficiaries	1.77	1.74	0.3156	0.91	0.88-0.93
Non-beneficiaries	1.24	1.58	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-9. Regression model estimates for burden of Support costs in Low Income Group

Variable	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		Ratio	95% CI
Burden of medical costs					
Beneficiaries	5.70	7.55	<.001	1.24	1.14-1.35
Non-beneficiaries	3.57	5.77	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-10. Regression model estimates for burden of Support costs in Mid-Low Income Group

Variable	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		Ratio	95% CI
Burden of medical costs					
Beneficiaries	2.92	3.68	<.001	0.89	0.86-0.93
Non-beneficiaries	1.84	2.73	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-11. Regression model estimates for burden of Support costs in Mid-High Income Group

Variable	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		<i>Ratio</i>	<i>95% CI</i>
Burden of medical costs					
Beneficiaries	2.52	2.90	<.001	1.19	1.15-1.23
Non-beneficiaries	1.49	2.33	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

### B-12. Regression model estimates for burden of Support costs in Mid-High Income Group

Variable	<i>Unadjusted number (pre-LTCI)</i>	<i>Unadjusted number (post-LTCI)</i>	<i>p-value for pre-/post difference</i>	<i>Adjusted difference-in-difference (DID) Effect</i>	
	%	%		<i>Ratio</i>	<i>95% CI</i>
Burden of medical costs					
Beneficiaries	1.77	2.13	<.001	1.1	1.07-1.14
Non-beneficiaries	1.24	1.70	<.001		

Values are presented adjusted ratios (95% confidence interval).

Adjusted ratios obtained from multiple regression analysis with all of the variables (sex, age, residential area, charson's comorbidity index, chronic diseases, disability)

## Korean Abstract

### 장기요양보험이 의료비 부담을 감소시켰는가? 후향적 노인 코호트 연구

최재우

**서론:** 정부는 노인의 장기요양을 지원하기 위해 장기요양보험제도를 시행하였다. 이러한 장기요양보험제도의 도입은 대체효과를 통해 수급자들의 불필요한 입원이용을 감소시키고 과도한 의료비 부담을 낮출 수 있을 것이다. 따라서 이 연구는 장기요양보험제도가 최소 3년 이상 장기요양서비스를 받았던 수급자들의 의료이용과 의료비 부담을 감소시켰는지를 관찰하고자 한다.

**자료 및 방법:** 이 연구는 국민건강보험공단에서 제공하는 노인 코호트 자료 중 2005-2013년 자료를 활용하였다. 연구대상은 최소 3년 이상 연속적으로 장기요양서비스를 받은 수급자 3,029명이다. 또한 이 연구에서는 비교군을 선정하기 위해 성향점수를 통한 1:3 매칭방법을 사용하여 대조군 9,087명을 추출하였으며 따라서 이 연구의 최종 연구대상은 총

12,116명이었다. 이 연구의 종속변수는 개인단위의 반기별 의료이용(입원, 외래, 약제처방)과 의료비 부담수준이었으며 독립변수는 이중차이분석 방법을 통한 교호작용 항(Interaction term)이었다. 이 연구는 의료이용에 영향을 미칠 수 있는 요인들을 통제하였으며 통계분석방법으로는 일반화추정방정식 (GEE) 방법을 이용하였다.

**결과:** 다른 요인들을 통제한 다변량 분석에서 장기요양보험 수급자의 입원횟수와 재원일수가 각각 통계적으로 유의하게 감소하였다. 병원유형 중 요양병원에 입원한 환자의 입원횟수와 재원일수가 크게 감소하였다. 외래방문횟수와 처방약 수령횟수는 수급자와 비수급자 모두에서 약간 증가하였다. 수급자의 의료비 부담은 비수급자에 비해 통계적으로 유의하게 감소하였으나 부양 부담은 통계적으로 유의하게 증가하였다.

**결론:** 장기요양보험제도는 수급자들의 입원 서비스 이용과 의료비 부담을 통계적으로 유의하게 감소시켰다. 따라서 정부는 요양병원 또는 요양시설에 입원한 환자들을 조정할 수 있는 전문가를 양성하고 적절한 기준과 효율적인 연계 시스템을 마련할 필요가 있다. 또한 노인의 의료비의 급격한 증가에도 불구하고 이 연구결과는 장기요양보험제도로 인해 수급자의 의료비 부담이 비수급자들에 비해 감소하였다는 것을 보여준다. 이러한 장기요양보험의 긍정적인 효과는 제도의 지속적인 실행과 장기요양을 필요로 하는 비수급자에 대한 자격확대의 필요성을 시사한다.