

Disability, poverty, and role of the basic livelihood security system on health services utilization among the elderly in South Korea

著者	Jeon Boyoung, Noguchi Haruko, Kwon Soonman, Ito Tomoko, Tamiya Nanako
journal or publication title	Social science & medicine
volume	178
page range	175-183
year	2017-04
権利	(C) 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
URL	http://hdl.handle.net/2241/00146037

doi: 10.1016/j.socscimed.2017.02.013



Disability, poverty, and role of the basic livelihood security system on health services utilization among the elderly in South Korea



Boyoung Jeon ^a, Haruko Noguchi ^b, Soonman Kwon ^{c,d}, Tomoko Ito ^a, Nanako Tamiya ^{a,*}

^a Department of Health Services Research, Faculty of Medicine, University of Tsukuba, Japan

^b School of Political Science and Economics, Waseda University, Japan

^c Asian Development Bank, Philippines

^d Graduate School of Public Health, Seoul National University, South Korea

ARTICLE INFO

Article history:

Received 13 June 2016

Received in revised form

14 October 2016

Accepted 9 February 2017

Available online 14 February 2017

Keywords:

Social security

Disability

Poverty

Aged

Health services

South Korea

ABSTRACT

With rapid aging, many of the elderly suffer from poverty and high healthcare needs. In Korea, there is a means-tested and non-contributory public assistance, the National Basic Livelihood Security System (NBLSS). The purpose of this study is to show older population's condition of disability and poverty, to evaluate the impact of NBLSS on health services utilization, and to examine the differential effect of the NBLSS by disability status among the elderly. This study used the Korea Welfare Panel Study data 2005–2014 with the final sample of 40,365, who were 65 years and older. The participants were divided into people with mild disability, severe disability, and without disability according to the Korean disability registration system. The income-level was defined to the low-income with NBLSS, the low-income without NBLSS, and the middle and high income, using the relative poverty line as a proxy of the low-income. The dependent variables were the number of outpatient visits and inpatient days, experience of home care services, total healthcare expenditure, and financial burden of healthcare expenditure. We performed Generalized Estimating Equations population-averaged model using the ten years of panel data. The result showed that within the same disability status, the low-income without NBLSS group used the least amount of inpatient care, but their financial burden of health expenditure was the highest among the three income groups. The regression model showed that if the elderly with severe disability were in the low-income without NBLSS, they reduced the outpatient and inpatient days; but their financial burden of healthcare became intensified. This study shows that the low-income elderly with disability but without adequate social protection are the most disadvantaged group. Policy is called for to mitigate the difficulties of this vulnerable population.

© 2017 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

With global aging, the proportion of people who are 65 years and older is expected more than 40% in 2050 in South Korea, and the speed of population aging is faster than other developed countries (OECD, 2015a). At the same time, the proportion of aged 65 and over among people with disabilities has quickly increased, from 30.3% in 2000 to 43.3% in 2014, which is over three times

higher compared to the growth rate of overall population aging (from 7.2% in 2000 to 12.7% in 2014) (MOHW, 2015a). On the other hand, Korea is not well prepared for the upcoming aged society, especially in terms of serious low-income issues. It shows the highest elderly poverty rate among OECD countries, with the highest elderly poverty rate among OECD countries, with the relative poverty rate (percentage with incomes less than 50% of median household disposable income) 49.6% for the elderly, followed by Australia (35.5%), Mexico (31.2%), United States (21.5%), Japan (19.4%), and OECD average (12.6%) (OECD, 2015b).

The elderly with disabilities are the most vulnerable group in both poverty and ill health. For example, among the elderly with disabilities, 67.3% was under the minimum living cost (Roh and Paik, 2012). At the same time, when they become older, their needs for healthcare increased (40.3% in 65–79 years old, 45.7% in 80 years or older), rather than the needs for income security (37.8% in 65–79

* Corresponding author. Department of Health Services Research, Faculty of Medicine, University of Tsukuba, 1-1-1 Tenno-dai, Tsukuba, Ibaraki, 305-8575, Japan.

E-mail addresses: jeon.boyoun26@gmail.com (B. Jeon), h.noguchi@waseda.jp, noguchi.haruko@gmail.com (H. Noguchi), skwon@adb.org, kwons@snu.ac.kr (S. Kwon), ittmxo@gmail.com (T. Ito), ntamiya@md.tsukuba.ac.jp (N. Tamiya).

years old, 33.1% in 80 years or older) (Hwang, 2015). However, the elderly with disabilities are not well protected by both of income and health systems, for the policies of the disabled and those for the elderly are not mutually linked in many social security areas. Because the current public policies for persons with disability is targeting 18–64 years old, when a person with disability become 65 years old, the eligibility for diverse social benefits changes to the regime of the elderly policy. For example, cash benefits of disability pension, which is an income support for people with severe disability in low-income, is ended and they become a target population of basic old-age pension; in-kind benefits of Personal Assistance Service is ended and they have to pass a separate eligibility test to receive long-term care insurance services (MOHW, 2016a, 2016b). The problem is the policies in elderly regime are rigid in population coverage but less inclusive in depth of service coverage. Therefore, the elderly with disabilities in the low-income level depend on general public assistance programs, especially when they do not have a chance to receive contributory pensions.

To mitigate poverty and improve the quality of life for the low-income families, there are several public assistance programs in Korea. The most representative program is the National Basic Livelihood Security System (NBLSS), which is non-contributory transfers for the targeted population by supporting cash and in-kind benefits. The NBLSS derived from the Livelihood Protection Law enacted in 1961, which provided limited benefits to the low-income families who lacked working capacity. The economic crisis in 1997 increased the demand for social safety nets, and the National Basic Livelihood Security Act was implemented in 2000. This Act started to emphasize the “right” to receive the support from government (Lee and Kim, 2012). However, NBLSS is a strict means-tested program for households who are under the designated minimum income line, and only about 3% of the whole population can receive this benefits (MOHW & Statistics Korea, 2016). The NBLSS is composed of 7 types of benefits: livelihood income assistance, Medical Aid, housing assistance, educational assistance, childbirth assistance, funeral assistance, and self-support assistance. The amount and types of benefit depends on family's welfare needs and ability to work. The maximum livelihood income assistance benefits is about \$1020 (KRW 1,273,516) per month for a family of four in 2016 (MOHW, 2016c).

As Korea has universal health coverage system by mandatory National Health Insurance, Medical Aid is separately financed by the central and local government's general revenue although it is administered by the health insurance system (Kwon, 2009). The copayment rate for inpatient care is from zero to 10% (whereas the copayment rate for National Health Insurance is 20%), and from \$0.8 to \$1.6 for outpatient care (whereas the copayment rate for National Health Insurance is 30–60%) (NHIS, 2016). Therefore, if a person become a beneficiary of NBLSS, the person can receive not only the income subsidy, but also the discounted copayment in health services. At the same time, for people who are 65 years and older, there is special discount system for outpatient care services; the copayment is fixed to \$1.2 (KRW 1500) for every service until \$12 (KRW 150,000); and if the total cost is more than \$12, they pay for 30% as coinsurance. This copayment is favorable to people who need consistent management of chronic conditions; but less advantageous to people who need highly intensive care.

We need to consider the role of NBLSS, which has both in-kind benefits and public income transfer, as older people have complex needs related to poverty and healthcare. Among the beneficiaries of NBLSS, a considerable proportion is the elderly (29.1%) and families with disability member (21.9%) in 2014 (MOHW & Statistics Korea, 2016). This large portion means many of the older and disability populations depend on public assistance. Especially, the role of

public income transfer became more important recently with the reduced role of private transfer (Yeo, 2013), and some of the NBLSS beneficiaries desire to remain under this program rather than getting out of poverty (Jo, 2007). Meanwhile, there are sizable number of the elderly and people with disabilities who are not protected by adequate safety nets.

The purpose of this study is to examine the impact of disability and poverty on health services utilization and health expenditure among the elderly; and to estimate the role of social security system for the low-income families, focusing on the NBLSS. More specifically, this paper shows the prevalence of disability and relative poverty rate, and size of NBLSS beneficiaries from 2005 to 2014; and compares the health services utilization and financial burden of health expenditure among the elderly by the disability status and income-level. Lastly, this study estimates the impact of NBLSS on health services use and financial burden of health expenditure, and evaluates the differential impact of NBLSS by disability status among the older population.

2. Data and methods

2.1. Data source and study measures

Our research used the Korea Welfare Panel Study (KoWePS) from the 1st (2005) to 10th (2014) yearly data. This survey consists of detailed information about general characteristics, economic and employment status, social security, welfare needs, and disability. It was performed by the Korea Institute for Health and Social Affairs and Seoul National University (KIHASA & SNU, 2016). The KoWePS is unidentified dataset which is publicly available on the official website (KoWePS, 2016). Because this study used only the anonymized unlinked secondary data, ethical review was deemed not to be required (MOHRW, 2015; MOHW, 2016d). This survey has over-sampled the low-income household (who are less than 60% of median income) by allocating the 50% of the sample to the low-income. Therefore, this data is suitable for studies targeted to develop poverty and/or low-income policies in the national level. By applying a designated weight, the data can represent the actual population size of South Korea.

Across a ten-year period, the panel retention rate was 67.3% from the 1st to 10th survey. In the 7th survey, there was an additional sampling for survey sustainability, and the follow-up rate was 85.2% from 7th survey to 10th survey (KIHASA & SNU, 2016). The pooled KoWePS dataset included a total of 169,927 observations. Among them, our study included people with three types of disabilities (physical, visual, and auditory), and with no disability as a reference group. Physical, visual, and auditory disabilities are the most prevalent (82.3%) among the 15 disability types in the Korean National Disability Registry (Statistics Korea, 2015). Physical disabilities include impairment in limb (resulting from amputation, joint disability, limb deformities, motor disturbance, or spinal cord injuries) or brain (caused by stroke, brain damage, or brain palsy); visual disabilities include sight loss and visual field defect; and auditory disabilities include impairments in hearing and sense of equilibrium. We excluded people with other types of disabilities ($n = 3435$), such as disabilities in kidneys, heart, intellectual, developmental, and mental because the healthcare needs of those with mental or internal conditions are too heterogeneous (Jeon et al., 2011). We excluded people in their 64 years old and less ($n = 125,871$) because this study is focusing on the elderly. Observations with missing data for the dependent and independent variables in our analytic model were also excluded ($n = 256$). Our final sample was unbalanced panel, which consisted of 40,365 observations. Among the final participants, the number of people without disabilities was 34,650, with mild disabilities 4,703, and

with severe disabilities 1012.

3. Definition of variables

3.1. Dependent variables

The dependent variables were the number of outpatient physician visits, the number of inpatient days, experience of home care services under long-term care insurance, total household healthcare expenditure, and financial burden due to healthcare expenditure within the previous 12 months from the survey date. The number of outpatient visits was measured by the sum of annual outpatient uses, excluding visits for health screening. The number of inpatient days was measured by the sum of annual length of stay at all kinds of hospitals. Experience of home care services was defined whether a family member have received the long-term care insurance home care benefits at least one time per year. Because long-term care insurance (LTCI) was implemented in 2008, 4th–10th data were used for this variable. Total healthcare expenditure was used in a form of logarithm of (out-of-pocket payments+1), to reduce the missing variable by zero spending. The financial burden of healthcare expenditure on household was defined as “[out-of-pocket payments/(total household consumption net of food consumption)] \times 100” (Wagstaff and van Doorslaer, 2003). The total healthcare expenditure for each household included out-of-pocket payments for outpatient care, inpatient care, pharmaceutical, long-term care, assistive devices, and other related expenses. The total household consumption included expenses for food, housing, education, transportation and communication, taxes, and other consumables. Since the KoWePS did not survey healthcare costs in the second survey year, when the dependent variable included healthcare expenditure, 1st, and 3rd–10th data were used.

3.2. Independent variables

The main independent variables were three disability status and three income-levels. The disability status was defined by the severity index of Korean disability registration system; the index one means the severest disability level, and index six means less severe level. In this study, people without disability means a respondent does not have any disability; people with mild disability means a respondent's disability severity index was within three to six; and people with severe disability means a respondent's disability severity index was one or two. Mild disability included people who perform some daily tasks by themselves even though they partly need personal assistance or assistive devices. Severe disability included individuals who highly depend on personal assistance or assistive devices (MOHW, 2015b). The reason for separating people with disability into severe and mild was that not only they had different health needs but also several welfare benefits had been determined by that severity definition.

The income level in this study was categorized into three groups to reflect the role of NBLSS: “The low-income with NBLSS,” “the low-income without NBLSS,” and “the middle and high income.” The low-income with NBLSS includes people who are below the relative poverty line, and receive the benefits of NBLSS; the low-income without NBLSS includes people who are below the relative poverty line, but do not receive the benefits of NBLSS; the middle and high income includes people whose household income is greater than the relative poverty line. The relative poverty line was defined 60% of median household income based on the equalised household income (market income/ $\sqrt{\text{household size}}$) each year. If a household is NBLSS beneficiaries, it means the household was below the designated minimum income level, which has an alternative meaning of absolute poverty line

(MOHW, 2016c).

As covariates, socio-demographic characteristics, benefits of pension, health status, and year dummy were included. Socio-demographic factors included sex, age (continuous), family type, place of residence, education, and current economic activity. In addition, we added two variables of public pension for the elderly, whether a participant has received benefits from basic old-age pension or not; and whether a participant has received benefits from public pension or not; to adjust the effect of other public income on household. To adjust additional health problems rather than disability, chronic diseases was included; and to capture the last year's health status, patterns of health services utilization, and preference or capacity to expense for health services, lagged dependent variable (the t-1 year's health service utilization or health expenditure) was included as a covariate in each panel regression model (Ke et al., 2011). We also included year dummy variables to capture the annual effect, such as other policy changes or fluctuations in economic condition. The definition and handling method of the variables are summarized in Appendix A.

4. Statistical analysis

The overall increasing or decreasing trends in the selected variables, such as disability, relative poverty, and the NBLSS, were evaluated by Cochran-Armitage trend test with Proc Freq. Two-sided p-values were considered to see the statistical significance (Ishii et al., 2015; Liu, 2007). Chi-Square test and ANOVA test were used to compare the frequencies or means of general characteristics by disability status and annual healthcare utilization by income level; or overall change in mean of age during ten years. In ANOVA test, p values by Type III sums of squares was used, which is preferred in testing the effects of unbalanced cases, or Welch's test was used when homogeneity of variance was weak in GLM procedure (Brownie et al., 1990; Northern Arizona University, 2016).

Because the KoWePS is a ten years panel data, we needed to consider heteroscedasticity and autocorrelation problems to present consistent estimators (Gujarati, 2001). We performed panel Generalized Estimating Equations (GEE) population-averaged model to reduce the problems of heterogeneity and autocorrelation in the longitudinal dataset. In the panel GEE, one unit increase in independent variable means an estimated population-averaged increase in dependent variable. We assumed the exchangeable correlation of error terms after pooling the panel observations (Min and Choi, 2012). For model selection, we also tested between fixed-effect model and random-effect model using the Hausman test, and fixed-effect was proven to be better to apply (Gujarati, 2001). However, we did not choose the fixed-effect model as it examines within-subject changes over time, but does not estimate time-invariant variables (Gardiner et al., 2009; Min and Choi, 2012). Moreover, there were many sample exclusions when the sum of the dependent variables were “0”; these exclusions might come from systematic missing values. Persons who could not access to inpatient care or home care at least one time due to financial problems, physical accessibility problems, or lack of information, they might be excluded. Therefore, we judged that GEE population-averaged method was appropriate for this study.

When the dependent variables were count data, such as the number of outpatient visits or inpatient days, we performed GEE population-averaged negative binomial regression model. When the dependent variable was binary variable, such as whether the respondents had experience of home care services, we adopted GEE population-averaged logistic regression model. And when the dependent variable was continuous, like logarithm of healthcare expenditure or financial burden of healthcare expenditure, GEE population-averaged model with assumption of normal

distribution was used.

We applied interaction terms for each regression model to test the differential impact of NBLSS by disability status. For main effect, we hypothesized that people with mild disability would use more outpatient care services; and people with severe disability would use more inpatient care services (Jeon et al., 2015); and people with any status of disability would spend higher expenditure (Wu et al., 2013). At the same time, we suppose that people who are protected by NBLSS would use more health services with lower burden of health expenditure; on the opposite, people who are under low-income without NBLSS would use less health services but experience higher burden of health expenditure (Choi et al., 2015; S. J. Kim and Huh, 2011; Roh, 2012). In addition to the main effect, we hypothesize that the NBLSS changes the effect of disability on healthcare utilization; especially the people with severe disability, although they have higher needs for healthcare services, when they are interacted with the situation of low-income without NBLSS, they would experience lower accessibility to healthcare while suffer from higher burden of health expenditure.

5. Results

5.1. Trends in rates of disability and poverty

The trends for mean of age, percentage of mild and severe disability, relative poverty, and the beneficiaries of NBLSS among the elderly from 2005 to 2014 are displayed in Table 1. Our dataset was unbalanced panel data, included all the people who were 65 years and older in every year. Because persons who newly became 65 years old was included in every year, the average age of population was not changed dramatically in every year, from 72.5 (2005) to 74.8 (2014). The increasing trend of mild disability rate was statistically significant, but the severe disability rate was maintained at less than 3%. The relative poverty rate declined; the proportion of NBLSS beneficiaries slightly declined in the study sample, but the downward trend was not significant for the weighted sample. Although Table is not shown, we tried to confirm the aging effect, by tracking the participants who were more than 65 years old in 2005, and participated fully for the KoWePS survey during the 10 years. Within the 10 years cohort (about 54.3% of initial member), the average age were changed from 70.4 (2005) to 79.4 (2014); the disability rate increased from 8.2% (2005) to 15.0% (2014); the relative poverty rate gradually declined from 73.4%

(2005) to 70.0% (2014); and the proportion of NBLSS beneficiaries were 11.0% (2005) to 10.4% (2014). Therefore, we might say that the increasing trends of disability might be partially affected by aging of study participation; the decreasing trends of relative poverty may be attenuated by the aging of participants.

5.2. General characteristics of study population according to disability status

Table 2 shows the general characteristics of study population in 2014. Among 4787 older persons, people without disability was 83.7%, mild disability 14.1%, and severe disability 2.2%. According to the three disability status, people with severe disability was relatively higher percentage in men and older, and highly depended on the NBLSS benefits. More detail, within people with severe disability, when they under low-income with NBLSS group, the percentage of public transfer comprised more than 70% of household income, and their equivalised household income was higher than the low-income without NBLSS group. People with mild or severe disability was more likely to receive basic old-age pension, which is granted to every older people except the highest 30% income level; but less likely to receive public pension, which is usually more favorable to person who worked for formal sector. The prevalence of chronic disease was higher among people with mild or severe disability than people without disability.

5.3. Health services utilization and health expenditure according to disability and income-level

According to disability status, the utilization of inpatient care and LTCI home care services, amount of health expenditure and financial burden of health expenditure were highest among people with severe disability, except the number of outpatient visits. Within same disability status, the low-income without NBLSS group showed significantly higher burden of healthcare expenditure, although this group used the least amount of health services. It is a noteworthy that the absolute amount of healthcare expenditure and the relative burden of healthcare expenditure showed a different pattern by income-level. In detail, the amount of expenditure was the highest in the middle and high income group, however, the financial burden of health expenditure was the highest among the low-income without NBLSS Table 3.

Table 1
Trends in rates of disability and poverty in persons 65 years and older in the Korea Welfare Panel Study participants, 2005–2014.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	P values (trend test)
Sample size (N = 40,365)	3397	3429	3517	3606	3574	3492	4865	4898	4800	4787	
Age (mean)	72.5	72.8	72.9	73.1	73.4	73.8	73.8	74.1	74.5	74.8	<0.001
Age (mean, weighted)	72.3	72.7	72.7	72.9	73.1	73.3	73.4	73.5	73.7	73.8	<0.001
People with disability (%)	9.2	11.0	11.9	13.1	14.2	14.7	15.3	16.3	16.5	16.3	<0.001
People with disability (weighted %) ^a	9.2	11.0	11.7	12.8	13.8	14.1	14.5	16.1	16.8	16.6	<0.001
Mild disability (%)	6.7	8.4	9.4	10.6	11.5	12.1	12.7	13.8	14.0	14.1	<0.001
Mild disability (weighted %) ^a	6.6	8.3	9.2	10.4	11.3	11.6	12.1	13.4	13.8	13.9	<0.001
Severe disability (%)	2.6	2.6	2.5	2.5	2.7	2.7	2.6	2.5	2.4	2.2	0.288
Severe disability (weighted %) ^a	2.7	2.7	2.5	2.4	2.5	2.5	2.5	2.7	3.0	2.8	0.533
Relative poverty (%) ^b	73.5	67.3	68.9	66.7	64.1	65.9	63.0	64.0	65.1	64.0	<0.001
Relative poverty (weighted %) ^{a,b}	56.3	55.0	57.1	55.2	54.0	54.5	53.2	53.1	53.9	52.4	<0.001
National Basic Livelihood Security System beneficiaries (%)	11.5	12.6	12.9	12.5	12.0	11.3	11.1	10.7	10.7	10.3	<0.001
National Basic Livelihood Security System beneficiaries (weighted %) ^a	8.7	10.1	10.5	10.0	9.9	9.5	9.6	9.1	9.0	8.7	0.241

Note: In the 7th survey, there were additional household sampling for survey sustainability. The follow-up rate was 85.2% from 7th survey to 10th survey, and 67.3% from 1st to 10th survey.

^a Weighted estimation of parameter for each year.

^b The relative poverty line defined 60% of median household income based on the equivalised household income in each year in KoWePS.

Table 2
General characteristics of the study population according to disability status (in 2014).

Characteristics		Total (n = 4787) %	People without disability (n = 4,005, 83.7%) %	People with mild disability (n = 677, 14.1%) %	People with severe disability (n = 105, 2.2%) %	p values		
Sex	Men	37.7	36.6	42.0	55.2	<0.001		
	Women	62.3	63.5	58.1	44.8			
Age (continuous)	mean ± SD	74.8 ± 6.3	74.9 ± 6.3	74.4 ± 5.7	75.2 ± 6.5	<0.001		
Family type	Living alone	30.0	30.3	30.0	20.0	0.012		
	Living with spouse	46.0	45.1	49.9	52.4			
	Living with children, other families	24.0	24.6	20.1	27.6			
Place of residence	Rural, sub-urban	64.4	64.1	65.9	63.8	0.679		
	Metropolis	35.6	35.9	34.1	36.2			
Education	High school and higher	18.5	19.1	14.8	21.0	0.022		
	Middle school and lower	81.5	80.9	85.2	79.1			
Current economic activity	Yes	26.1	27.1	22.2	13.3	<0.001		
Income level	Yes	10.3	9.5	13.7	19.1	<0.001		
	Low-income with NBLSS (n = 493)	Annual household income ^a (mean ± SD)	829.2 ± 270.5	818.4 ± 278.3	829.9 ± 221.3		1029.7 ± 262.5	0.003
	Percentage of public transfer among household income (mean ± SD)	70.3 ± 20.1	69.5 ± 20.6	73.0 ± 19.3	72.3 ± 13.7	0.294		
Income level	Yes	53.7	53.6	54.4	53.3	0.930		
	Low-income without NBLSS (n = 2570)	Annual household income ^a (mean ± SD)	895.6 ± 284.5	892.9 ± 286.2	898.2 ± 277.0		982.9 ± 253.6	0.064
	Percentage of public transfer among household income (mean ± SD)	30.5 ± 18.1	30.0 ± 17.8	32.8 ± 19.3	33.5 ± 20.6		0.013	
Income level	Yes	36.0	36.9	31.9	27.6	0.008		
	Middle and high income (n=1724)	Annual household income ^a (mean ± SD)	2561.8 ± 1607.6	2566.3 ± 1543.1	2513.2 ± 2042.5		2697.8 ± 1123.6	0.812
	Percentage of public transfer among household income (mean ± SD)	24.2 ± 27.4	24.2 ± 27.4	23.9 ± 26.9	23.9 ± 30.7		0.987	
Basic old-age pension	Received	76.6	75.8	80.1	85.7	0.005		
Public pension	Received	31.9	32.7	28.5	23.8	0.018		
Chronic disease	Have	87.8	86.5	94.5	94.3	<0.001		
Disability types ^b	Physical disability	12.2	0.0	76.2	62.9	<0.001		
	Visual disability	1.9	0.0	10.6	20.0			
	Auditory disability	2.2	0.0	13.2	17.1			

Note: NBLSS means National Basic Livelihood Security System.

^a Equivalised household income (unit: 10,000 KRW, \$1 = KRW 1088.50, based on the rate of December 31, 2014.).

^b Among persons with disability, chi-square test p = 0.007.

5.4. Effect of NBLSS on health services utilization and the differential effect by disability status

In Table 4, accordance with our hypothesis, people with mild or

severe disability were more likely to use health services and spent more on healthcare than people without disability, except the outpatient care, where people with mild disability visited more frequently but people with severe disability visited less. In terms of

Table 3
Health services utilization and health expenditure according to disability and income-level.

	Number of outpatient visits ^a (n = 40,365)		Number of inpatient days ^{a,b} (n = 40,365)		LTCI Home care ^c (n = 30,022)		Healthcare expenditure ^d (n = 4787)		Financial burden of healthcare expenditure ^e (n = 36,936)			
	Mean (Median)	p	%	p	Mean (Median)	p	%	p	Mean ± SD	p		
People without disability												
Low-income with NBLSS	38.1 (22)	***	19.0	***	30.1 (15)	***	3.1	NS	60.2 ± 125.3	***	9.0 ± 12.7	***
Low-income without NBLSS	31.5 (18)		16.4		23.7 (14)		2.5		168.2 ± 277.5		18.7 ± 16.3	
Middle and high income	25.8 (15)		17.7		28.4 (15)		2.5		326.7 ± 406.5		14.1 ± 15.9	
Total	30.3 (17)		17.2		26.2 (15)		2.5		216.5 ± 334.4		16.1 ± 16.1	
People with mild disability												
Low-income with NBLSS	38.3 (24)	**	29.3	***	35.8 (20)	NS	7.7	**	63.0 ± 129.1	***	10.6 ± 13.9	***
Low-income without NBLSS	39.6 (24)		22.4		34.0 (15)		4.6		184.0 ± 221.5		20.6 ± 16.2	
Middle and high income	34.7 (20)		26.4		34.8 (16)		6.4		364.5 ± 448.2		17.4 ± 17.8	
Total	37.9 (23)		24.6		34.6 (16)		5.6		225.0 ± 321.8		18.2 ± 16.7	
People with severe disability												
Low-income with NBLSS	38.0 (20)	*	38.6	**	57.2 (20)	†	18.5	*	142.2 ± 231.9	**	14.9 ± 17.3	***
Low-income without NBLSS	28.3 (12)		26.1		39.5 (21)		23.9		213.0 ± 205.1		23.1 ± 18.5	
Middle and high income	29.8 (12)		33.1		59.1 (21)		30.9		459.3 ± 554.2		16.0 ± 16.1	
Total	30.5 (13)		30.3		49.7 (21)		25.0		267.5 ± 360.1		19.6 ± 18.0	

Note: p=p values by income-level within same disability status, ***p < 0.001, **p < 0.01, *p < 0.05, †p < 0.1, NS = not significant.

NBLSS means National Basic Livelihood Security System, LTCI means Long-term care insurance, SD means standard deviation.

^a 1st–10th data were used.

^b %: The percentage of any inpatient care utilization. Mean (Median): Among those who admitted hospital at least one time for inpatient care.

^c 4th–10th data were used because the long-term care insurance system has been started since 2008.

^d Only 10th data was shown in this Table, because of the variations in money value for ten years. Unit: 10,000 KRW, \$1 = KRW 1088.50, based on the rate of December 31, 2014.

^e 1th, 3rd–10th data were used because the 2nd survey did not surveyed the information of healthcare expenditure. Definition: [out-of-pocket payments/(total household consumption net of food consumption)]×100.

Table 4
Effect of National Basic Livelihood Security System on health services utilization and the differential effect by disability status among the older population^a.

	Number of outpatient visits		Number of inpatient days		LTCI Home care ^b		Healthcare expenditure ^c		Financial burden of healthcare expenditure ^{c,d}	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)
Disability status (ref. = People without disability)										
Mild disability	0.144*** (0.022)	0.172*** (0.036)	0.377*** (0.00)	0.256*** (0.035)	0.688*** (0.119)	0.800*** (0.193)	0.078** (0.026)	0.083‡ (0.043)	0.614* (0.303)	1.183* (0.512)
Severe disability	-0.081‡ (0.046)	-0.007 (0.078)	0.654*** (0.041)	0.871*** (0.071)	1.841*** (0.158)	1.729*** (0.269)	0.244*** (0.056)	0.208* (0.096)	2.564*** (0.645)	0.735 (1.137)
Income-level (ref. = Middle and high income group)										
Low-income with NBLSS	0.107*** (0.026)	0.129*** (0.028)	-0.238*** (0.025)	-0.266*** (0.027)	0.018 (0.158)	0.034 (0.190)	-1.557*** (0.032)	-1.566*** (0.035)	-6.617*** (0.368)	-6.513*** (0.401)
Low-income without NBLSS	0.006 (0.015)	0.011 (0.016)	-0.525*** (0.016)	-0.536*** (0.017)	-0.240* (0.111)	-0.216‡ (0.128)	-0.445*** (0.019)	-0.445*** (0.020)	-0.162 (0.231)	-0.134 (0.247)
Interaction term										
Mild disability•Low-income with NBLSS		-0.164* (0.067)		0.183** (0.063)		0.083 (0.345)		-0.051 (0.081)		-1.481 (0.956)
Severe disability•Low-income with NBLSS				0.012 (0.131)		-0.302 (0.484)		0.430** (0.161)		3.448‡ (1.901)
Mild disability•Low-income without NBLSS				-0.012 (0.042)		0.168*** (0.043)		-0.250 (0.247)		0.005 (0.051)
Severe disability•Low-income without NBLSS				-0.158‡ (0.092)		-0.442*** (0.089)		0.315 (0.115)		-0.072 (0.115)
Wald chi2	5993.95*	6014.55*	11861.60*	11923.55*	1750.90*	1745.64*	9799.10*	9815.92*	4065.31*	4074.08*
Number of observations	33,329	33,329	33,329	33,329	23,691	23,691	27,001	27,001	27,001	27,001

Note: Coef. = coefficients, SE = standard error, ***p < 0.001, **p < 0.01, *p < 0.05, †p < 0.1. NBLSS means National Basic Livelihood Security System, LTCI means Long-term care insurance.

^a Sex, age, family type, place of residence, education, economic activity, basic old-age pension, public pension, chronic diseases, lagged dependent variables (the t-1 year's health services utilization or health expenditure), and year dummy variables were adjusted.

^b 4th–10th data were used because the long-term care insurance system has been started since 2008.

^c 2nd data was not included because the 2nd survey did not surveyed the information of healthcare expenditure.

^d Definition: [out-of-pocket payments]/(total household consumption net of food consumption)] × 100.

income-level, the low-income with NBLSS used more outpatient services, but different from our expectation, their length of stay was shorter than the middle and high income group. Among the low-income without NBLSS, they used less amount of health services, including inpatient care and LTCI home care. The financial burden of health expenditure was reduced only for the low-income with NBLSS.

In addition to the main effect, the interaction of disability and income-level showed that older adults' utilization of health services in response to disability status varied by income-level, especially by the NBLSS. For example, for people with mild disability, the low-income with NBLSS results in decrease of outpatient visits but increases the inpatient days in hospital; the low-income without NBLSS also results in increase the length of stay in hospital. Meanwhile, for people with severe disability, the low-income with NBLSS results in increase the health expenditure and increase the financial burden of health expenditure; the low-income without NBLSS results in reduction of outpatient visits and inpatient days but higher financial burden of health expenditure.

6. Discussion

The purpose of this study was to show older population's condition of disability and poverty, and to examine the role of safety nets, the NBLSS, on health services utilization. Our study showed that the prevalence of disability among the elderly has significantly increased while the relative poverty rate has decreased from 2005 to 2014. The elderly with disability were more likely to be in the low-income groups. If the elderly with severe disability were in the low-income group but lived without social protection by the NBLSS, their use of healthcare services was lower and they suffered from higher financial burden of health expenditure.

This study showed that the prevalence of disability has increased among the elderly during the last ten years, from 9.2% in 2005 to 16.3% in 2014, and the mild disability accounted for the majority of the increasing trend. This result implies that the new onset of disability caused by aging mostly happened in the mild level, and this aging-related disability is closely related with high healthcare utilization and expenditure. On the other hand, the rate of severe disability has maintained less than 3%, which might be affected by the policy of Ministry of Health and Welfare, for the severest two levels are eligible to generous welfare benefits. There was a declining trend in weighted relative poverty rate during the ten years, but there was no significant change in the percentage of NBLSS beneficiaries, about 10% of the elderly population. The reduction in the relative poverty rate might be affected by the introduction of basic old-age pension system in 2008 and other public or private transfers rather than the increase in market income (Jeong et al., 2009). On the contrary, the strict standards of NBLSS might affect the consistent rate of NBLSS beneficiaries among the elderly.

People with severe disability heavily depend on the NBLSS benefits, compared with those with mild disability and without disability. It is known that probability of income poverty is positively associated with physical function difficulties, but consumption poverty is not, because there are public transfer or informal support for the severely disabled elderly (World Bank, 2016). In our study, when a severely disabled person was in the low-income group with NBLSS benefits, about 72.3% of income consisted of public transfer; and their household income was higher than that of persons without NBLSS. The higher income among the low-income with NBLSS may be comes from the targeting errors of NBLSS beneficiaries. Because the NBLSS impose strict obligation of support by family members, the income of older adult's children is counted,

even their children who do not have enough capacity or willingness to support their parents. This might under qualify the need of some older adult, who could not receive the NBLSS benefits even though they were suffer from low income (Yeo et al., 2009). On the other hand, there are possibility of some older adults who were inordinately benefited from the NBLSS, even they saved enough wealth from informal sector.

As we hypothesized, having mild disability affected on higher number of outpatient care visits; having any status of disability affected on longer inpatient days and higher probability of experience the LTCI home care services, and higher healthcare expenditure. The effect of disability on health services is consistent with previous studies that moderate-to-severe limitations in mobility and instrumental activities of daily living (IADL) increased the utilization of outpatient, emergency and inpatient services, and medical expenditure among older people (Wu et al., 2013). IADL limitation is known to be a positive factor for home care services among the beneficiaries of long-term care insurance (S. Kim, Park and Nam, 2011), and persons with severe disability are known to stay longer in hospitals but not necessarily visit primary care because of access barriers (Jeon et al., 2015).

In terms of income-level, both of the low-income with NBLSS group and without NBLSS group stayed shorter in hospital, compared to the middle and high income group, even after controlling for the disability status and other health conditions. The lower utilization of inpatient care services might derived from less intensive or less high-technology care of the low-income groups. For example, the Medical Aid beneficiaries (one of the NBLSS benefits) showed lower access to tertiary hospitals, which provide more specialized care (Seo and Lee, 2015; Youn, 2014). At the same time, the low-income without NBLSS group showed lower health services utilization, including LTCI home care, and higher burden of health expenditure (Roh, 2012), by supporting our hypothesis.

Once interaction terms were included in the regression models, we confirmed our hypothesis that for people with severe disability, the low-income without NBLSS intensified the financial burden of health expenditure, while they reduced the number of outpatient visits and inpatient days. These results reflect that persons with severe disability and low-income without NBLSS are suffering from cumulated disadvantages: poor health status, deficient income support by public transfer, and burdensome health expenditure compared to their ability to pay. The complex difficulties may force them to reduce health services utilization but still experience financial burden of healthcare even though their health needs are not satisfied.

On the contrary to our expectation, for people with severe disability, the low-income with NBLSS also intensified the financial burden of health expenditure. But the mechanism was different, because they also increased health expenditure. When we consider the significant main effect of the low-income with NBLSS, severe disability might attenuate the tendency of lower expenditure and lower financial burden of health expenditure, because of they have high healthcare needs.

When people with mild disability receive NBLSS benefits, the higher tendency of physician visits was lessened but the longer hospitalization was intensified. These mean some of the elderly with mild disability who can receive discounted copayment and additional income support by NBLSS might stay longer in hospitals while reduce physician visits. Previous studies pointed out the overutilization of health services by Medical Aid beneficiaries (J. H. Kim et al., 2016), especially in the case of percutaneous transluminal coronary angioplasty patients and hypertension patients (Seo and Lee, 2015; Suh et al., 2014). However, our study showed that people with mild disability and in the low-income without NBLSS group also increased their hospitalization days. This means

there are other factors contributing to the hospitalization of the people with mild disability who is under the relative poverty line. For example, mild disability rate significantly increased for ten years, and the new occurrence of disability might have been more frequent in the low-income group; and the onset of disability could contribute to the greater use of inpatient services (Dryden et al., 2004). Therefore, we need to be careful when we interpret the potential overuse of public assistance beneficiaries.

6.1. Policy implications

Our study provides empirical evidence that the disability population is increasing among the elderly and poverty is still a meaningful concern although the poverty rate has decreased slightly. Even though public pension service and basic old-age pension system have been implemented, the role of NBLSS is crucial to relieve poverty, increase the access to health services, and mitigate the burden of health expenditure among the low-income elderly. Especially, since people with severe disability usually have permanent functional difficulties, they have lower probability to engage in contribution-based pension or stable income. Therefore, if a low-income older person with severe disability could not get support from public transfer, he or she may be more likely to experience difficulties in access to necessary health services and suffer from higher burden of health expenditure.

NBLSS is cash and in-kind benefits for the low-income family, rather than the targeted program for the elderly or people with disability. Therefore, it has a limitation to increase the number of beneficiaries because the budget and delivery system is strictly controlled by government. As a result, there were many low-income families who were not protected by social security system although there has been a reform to extend the population coverage since July 2015 (MOHW, 2016c).

We also need to consider the meaning of out-of-pocket payments among the low-income elderly. Our study showed that the health expenditure was two or three times higher among the middle and high income families, compared with those in the low-income families even with similar disability status. The out-of-pocket payments have different meanings across income groups; for example, it can be caused by the use of uncovered (i.e., not in the benefit coverage of national health insurance) expensive services in the middle and high income groups; but it can be related to the use of essential covered services in the low-income families. Without any subsidy for copayment, the burden of out-of-pocket payments can result in the under-utilization of necessary services by the low-income disabled elderly. Therefore, government needs to develop the policies for this underprivileged group, such as reducing the cap on out-of-pocket payments; or stream-lining the segmented or overlapped funding or programs to older people, people with disabilities, and the worse off.

6.2. Limitations of study

First of all, there is a possibility of bias on the estimated effect of NBLSS by disability status, due to potential endogeneity problems. The direction of the bias is not clear: If those who have disability are expected to use more healthcare because they are unhealthy, this could overestimate the impact of NBLSS. On the other hand, if people with severe disability have lower access to healthcare due to mobility difficulties or social environment factors, this could underestimate the effect of NBLSS. To reduce the impact of endogeneity and to draw unbiased causal inference, several adjustment methods can be applied, such as instrumental variables. Although this study did not choose the alternative method, further studies need to put efforts for reducing the possible endogeneity problems.

Secondly, this study used 'equivalised household income' when we measure the older population's socioeconomic status. However, previous studies argued that 'wealth' is a better indicator for the elderly (Hoffmann, 2011; Shaw et al., 2014). In spite of the potential weakness, the elderly in lower income and ill health groups heavily depend on current income (Um and Lee, 2015), and the NBLSS is targeting to increase the basic income level of poor families.

Thirdly, this study could not control the specific comorbid conditions, which is an important covariate to estimate the healthcare use and expenditure. Previous studies showed that after they control the comorbidity index, the overuse tendency by Medical Aid was lessened (Seo and Lee, 2015; Suh et al., 2014; Youn, 2014). To reduce the possible omitted variable, we adjusted chronic conditions and lagged dependent variable, which reflect the last year's healthcare needs and preference for health services.

Fourthly, this study could not include the expenditure of each items due to the limitation of survey data. The detailed analysis on separate healthcare expenditures of each item may offer a more nuanced understanding of the relationship between disability, NBLSS and health expenditure for each types of services.

In addition, there were several policy changes during the ten years. To reduce the possible biases due to other policies or economic change, this study adopted panel data modeling and included basic old-age pension, public pension, and year dummy variables which absorbs any exogenous macro-shocks in regression models. Nevertheless several social and health policy changes might have influenced the behavior of the elderly and healthcare providers.

Definition of variables.

Variable	Definition	
Dependent variables		
Number of outpatient visits (2005–2014)	Sum of outpatient visits number during 1 year, excluding visits for health screening	
Number of inpatient days (2005–2014)	Sum of length of stay for inpatient care at all kinds of hospitals during 1 year	
Experience of long-term care insurance (LTCI) home care services (2008–2014)	Whether an older adult received the LTCI home care benefits (one of the in-home services: home-visit care, home-visit nursing, short-term respite care, home-visit bathing, day and night care, welfare equipment) at least one time during 1 year	
Total healthcare expenditure (2005, 2007–2014)	ln (Total household out-of-pocket payments+1), during 1 year	
The financial burden of healthcare (2005, 2007–2014)	[Total household out-of-pocket payments/(total household consumption net of food consumption)]×100 during 1 year	
Key independent variables		
Disability status	People with mild disability	A respondent's registered disability severity index was within three to six, they perform some daily tasks by themselves even though they partly need personal assistance or assistive devices
	People with severe disability	A respondent's registered disability severity index was one or two, they highly depend on personal assistance or assistive devices for their daily activities
	People without disability (reference group)	A respondent does not have any disability
Income-level	The low-income with NBLSS	People who are below the relative poverty line, and receive the benefits of NBLSS
	The low-income without NBLSS	People who are below the relative poverty line, but do not receive the benefits of NBLSS
	The middle and high income (reference group)	People whose household income is greater than the relative poverty line
Control variables		
Sex	Women, men	
Age (continuous)	Survey year – birth year	
Family type	Living alone, living with spouse (the number of family is two, husband and wife), and living with children or other families (the number of family is two and more)	
Place of residence	Urban (Seoul or metropolis), rural or sub-urban	
Education	Middle school and lower, high school and higher	
Economic activity	Yes (if a respondent is working for full-time paid job, part-time paid job, senior employment program, self-support program, self-employed, or employer), no (if a respondent is unemployed, economically inactive, or unpaid family worker)	
Beneficiary of basic old-age pension	Yes (if a respondent has received the basic old-age pension, which is granted to all older people except the highest 30% income group), no	
Beneficiary of public pension	Yes (if a respondent has received public pension, which is usually granted to formal sector worker who already paid for insurance fee for the public pension, such as national pension, government employees pension, military pension etc.), no	

7. Conclusion

This study presented disability and poverty situations among the elderly and examined the role of the NBLSS on health services utilization and financial burden of healthcare expenditure according to person's disability status in South Korea. The result implies that the low-income disabled elderly without adequate social security are the most disadvantaged because they suffer not only from unstable income or ill health but also from high out-of-pocket payments for healthcare. Policy attention is called for to mitigate the poverty and low access to health services along with high burden of health expenditure in this venerable population.

Acknowledgements

This study was supported by "Issues and Implications of Ageing Asian Population, The Global Frontier Fund" from Japanese Sasakawa Peace Foundation. The Sasakawa Peace Foundation had not involved in study design, data analysis, interpretation of results, and decision for submission. The authors do not have any conflict of interest. An earlier version of this study was presented at 11th Annual Conference of Japan Health Economics Association, September 2016.

Appendix A.

(continued)

Variable	Definition
Chronic diseases	Yes (when a respondent takes and/or needs ongoing prescribed medication due to chronic conditions more than 3 months), no
Lagged dependent variable (the t-1 year's health service utilization or health expenditure) of each regression model	Number of outpatient visits in t-1 year Number of inpatient days in t-1 year Experience of LTCI home care services in t-1 year Total healthcare expenditure in t-1 year The financial burden of healthcare in t-1
Year dummy	2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014

References

- Brownie, C., Boos, D.D., Hughes-Oliver, J., 1990. Modifying the t and ANOVA F tests when treatment is expected to increase variability relative to controls. *Biometrics* 46 (1), 259–266. <http://dx.doi.org/10.2307/2531650>.
- Choi, J.W., Park, E.-C., Chun, S.-Y., Han, K.-T., Han, E., Kim, T.H., 2015. Health care utilization and costs among medical-aid enrollees, the poor not enrolled in medical-aid, and the near poor in South Korea. *Int. J. Equity Health* 14 (1), 1–7. <http://dx.doi.org/10.1186/s12939-015-0257-9>.
- Dryden, D.M., Saunders, L.D., Rowe, B.H., May, L.A., Yiannakoulis, N., Svenson, L.W., Voaklander, D.C., 2004. Utilization of health services following spinal cord injury: a 6-year follow-up study. *Spinal Cord* 42 (9), 513–525. <http://dx.doi.org/10.1038/sj.sc.3101629>.
- Gardiner, J.C., Luo, Z., Roman, L.A., 2009. Fixed effects, random effects and GEE: what are the differences? *Statistics Med.* 28 (2), 221–239.
- Gujarati, D.N., 2001. *Basic Econometrics*, fourth ed. McGraw-Hill Higher Education, New York.
- Hoffmann, R., 2011. Socioeconomic inequalities in old-age mortality: a comparison of Denmark and the USA. *Soc. Sci. Med.* 72 (12), 1986–1992. <http://dx.doi.org/10.1016/j.socscimed.2011.04.019>.
- Hwang, J., 2015. Aging in Population with Disability: Current Conditions and Implications Health and Welfare: Issue and Focus, vol 278, pp. 1–8.
- Ishii, S., Ogawa, S., Akishita, M., 2015. The state of health in older adults in Japan: trends in disability, chronic medical conditions and mortality. *PLoS One* 10 (10), e0139639. <http://dx.doi.org/10.1371/journal.pone.0139639>.
- Jeon, B., Kwon, S., Kim, H., 2015. Health care utilization by people with disabilities: a longitudinal analysis of the Korea Welfare Panel Study (KoWePS). *Disabil. Health J.* 8 (3), 353–362. <http://dx.doi.org/10.1016/j.dhjo.2015.01.001>.
- Jeon, B., Kwon, S., Lee, H., Kim, H., 2011. Factors associated with health service utilization of the disabled elderly in Korea. *J. Korea Gerontological Soc.* 31 (1), 171–188.
- Jeong, K., Lee, Y., Choi, H., Kim, T., Lee, H., Lee, S., Yoon, J., 2009. A Study on Socio-economic Impact Assessment for Basic Old-age Pension System [Korean]. Ministry of Health and Welfare and Korea Institute for Health and Social Affairs.
- Jo, J.Y., 2007. The National Basic Livelihood Security System in Korea: Effects on Poverty and Social Development (Ph.D. Dissertation). University of California, Berkeley California.
- Ke, X., Saksena, P., Holly, A., 2011. The Determinants of Health Expenditure: a Country-level Panel Data Analysis: Results for Development Institute (R4D). World Health Organization.
- KIHASA, SNU, 2016. Korean Welfare Panel Study User's Guild. Korea Institute for Health and Social Affairs (KIHASA) and Social Welfare Research Center of Seoul National University (SNU), Seoul.
- Kim, J.H., Kim, N.R., Park, E.C., Han, K.T., Choi, Y., Lee, S.G., 2016. Impact of continuous Medical aid utilisation on healthcare utilisation: unique insight using the 2008–2012 Korean Welfare Panel Study (KOWEPS). *BMJ open* 6 (4), e008583. <http://dx.doi.org/10.1136/bmjopen-2015-008583>.
- Kim, S., Park, C., Nam, C., 2011. Related factors of in-home service utilization in Korean long-term care insurance among certificated elderly living alone. *Health Soc. Sci.* 29, 237–258.
- Kim, S.J., Huh, S.I., 2011. Financial burden of health care expenditures and unmet needs by socioeconomic status. *Korean J. Health Econ. Policy* 17 (1), 47–70.
- KoWePS, 2016. Korea Welfare Panel Survey Homepage. Retrieved from: <https://www.koweps.re.kr:442/main.do>.
- Kwon, S., 2009. Thirty years of national health insurance in South Korea: lessons for achieving universal health care coverage. *Health Policy Plan.* 24 <http://dx.doi.org/10.1093/heapol/czn037>.
- Lee, J.-Y., Kim, J.-S., 2012. *Social Security: Principles and Practices*. Hakjisa, Seoul.
- Liu, H., 2007. Cochran-armitage Trend Test Using SAS: Merck Research Labs. Merck & Co., Inc, Rahway, NJ.
- Min, I., Choi, P., 2012. STATA Advanced Panel Data Analysis the Korean Association of STATA. Jiphil Media, Seoul, South Korea.
- MOHRW, 2015. Ethical Guidelines for Medical and Health Research Involving Human Subjects: Provisional Translation (As of March 2015). Retrieved from: <http://www.mhlw.go.jp/file/06-Seisakujouhou-10600000-Daijinkanboukousei-kagakuka/0000080278.pdf>.
- MOHW, 2015a. Release of 2014 National Survey on People with Disability [Press release].
- MOHW, 2015b. The Judgment Criteria for Rating Disability [Korean]. Division of Policy for Persons with Disabilities, Ministry of Health and Welfare, South Korea.
- MOHW, 2016a. Disability Pension [Korean]. Retrieved from: <http://www.bokjiro.go.kr/pension/p03.jsp>.
- MOHW, 2016b. Personal Assistance Service [Korean]. Retrieved from: http://www.socialservice.or.kr/user/htmlEditor/view2.do?p_sn=6.
- MOHW, 2016c. Introduction for National Basic Living Security System [Korean]. South Korea. Ministry of Health and Welfare. Retrieved from: <http://oneclick.law.go.kr/CSP/CsmMain.laf?csmSeq=672>.
- MOHW, 2016d. Ethical Review or Exemption Guidelines for Research Involving Human Subjects [Korean]. Retrieved from: <http://irb.or.kr/Home/html/menu05/FreeTarget.aspx>.
- MOHW, Statistics Korea, 2016. The Number of Beneficiaries of National Basic Livelihood Security System in Korea [Korean]. Retrieved from: http://www.index.go.kr/potal/main/EachDtlPageDetail.do?idx_cd=2760.
- NHIS, 2016. Copayment Rates for Healthcare Utilization According to Institution Types [Korean]. National Health Insurance Service. Retrieved from: http://hi.nhic.or.kr/wbj/guide_new/popup17.html.
- Northern Arizona University, 2016. Understanding the One-way ANOVA. Retrieved from: <http://oak.ucc.nau.edu/rh232/courses/EPS525/Handouts/Understanding%20the%20One-way%20ANOVA.pdf>.
- OECD, 2015a. Long-term Care Beds in Institutions and Hospitals, in Health at a Glance 2015. Organization for Economic Cooperation and Development.
- OECD, 2015b. Pensions at a Glance 2015: OECD and G20 Indicators. Organization for Economic Cooperation and Development.
- Roh, S.-H., 2012. The longitudinal study on the factors of catastrophic health expenditure among disabled elderly households. *Korean J. Soc. Welf.* 64 (3), 51–77.
- Roh, S.-H., Paik, E.-R., 2012. The longitudinal study on the poverty decision factors of disabled aged households. *Korea Employ. Agency Disabl.* 22 (4), 267–293.
- Seo, E.-W., Lee, K.-S., 2015. Difference in healthcare utilization for percutaneous transluminal coronary angioplasty inpatients by insurance types: propensity score matching analysis. *Health Policy Manag.* 25 (1), 3–10.
- Shaw, B.A., McGeever, K., Vasquez, E., Agahi, N., Fors, S., 2014. Socioeconomic inequalities in health after age 50: are health risk behaviors to blame? *Soc. Sci. Med.* 101, 52–60. <http://dx.doi.org/10.1016/j.socscimed.2013.10.040>.
- Statistics Korea, 2015, 07 May. Number of People with Disabilities in South Korea [Korean]. Retrieved from: http://kosis.kr/statHtml/statHtml.do?orgId=117%26;tblId=DT_11761_N004.
- Suh, H.S., Kang, H.-Y., Kim, J., Shin, E., 2014. Effect of health insurance type on health care utilization in patients with hypertension: a national health insurance database study in Korea. *BMC Health Serv. Res.* 14 (1), 1–12. <http://dx.doi.org/10.1186/s12913-014-0570-9>.
- Um, S.-Y., Lee, Y.-J., 2015. Analysis for division of state, market and family in income sources of the elderly. *J. Korea Contents Assoc.* 15 (5), 191–199.
- Wagstaff, A., van Doorslaer, E., 2003. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993–1998. *Health Econ.* 12 (11), 921–934. <http://dx.doi.org/10.1002/hec.776>.
- World Bank, 2016. Live Long and Prosper: Aging in East Asia and Pacific. World Bank, Washington, DC.
- Wu, C.Y., Hu, H.Y., Li, C.P., Fang, Y.T., Huang, N., Chou, Y.J., 2013. The association between functional disability and acute care utilization among the elderly in Taiwan. *Arch. Gerontol. Geriatr.* 57 (2), 177–183. <http://dx.doi.org/10.1016/j.archger.2013.04.011>.
- Yeo, E.-G., 2013. Old-age poverty by household type and policy efforts to reduce it. *J. Crit. Soc. Policy* 40, 185–219.
- Yeo, E.-G., Kim, M.G., Kim, S.K., Koo, I.H., Oh, J.H., Song, C.H., 2009. Study on Improvement of Support Obligor Criteria in the National Basic Livelihood Security System. Ministry of Health and Welfare, Korea Institute for Health and Social Affairs.
- Youn, K., 2014. Comparisons of health care utilization patterns and outcome for national health insurance and medical aid program cancer patients. *J. Health Inf. Statistics (JHIS)* 39 (1), 42–59.