Master's Thesis of Public Health

Analysis of medical service utilization and medical expense of near-poor National Health Insurance members in South Korea

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Department of Health Policy and Management
Graduate School of Public Health
Seoul National University
Sooyeol Park

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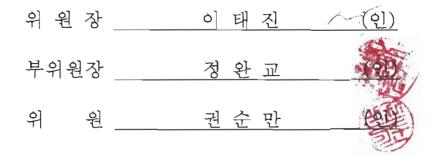
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박 수 열

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2020년 12월

위 원 장 _____ 이 태 진 _____ (인)

부위원장 _____ 정 완 교 _____ (인)

위 원 _____ 권 순 만 _____ (인)

Abstract

Background

The poor with NHI(near-poor), a low-income population that is excluded from the Republic of Korea's Medical Aid (MA) program, experiences insufficient use of medical services and high out-of-pocket (OOP) spending due to insufficient coverage by the country's National Health Insurance (NHI). This study aims to examine medical utilization, OOP spending, and occurrence of catastrophic health expenditures (CHE) among the poor with NHI compared to MA beneficiaries and other NHI members

Methods

A cross-sectional study was conducted drawing upon a nationally representative dataset based on the 2018 Korea Welfare Panel Study (KOWEPS). The study classified people into MA beneficiaries, the poor with NHI population below 50% of the median income threshold, and other NHI members above the 50% median income threshold. Using propensity score matching between MA beneficiaries and the poor with NHI and between the poor with NHI group and the group of those non-poor with NHI, this study examined medical utilization, OOP spending, and the occurrence of CHE among the study groups.

Results

The findings suggest that MA beneficiaries make greater use of outpatient services compared to the poor with NHI, but other uses of medical services were not significantly different among the study groups. However, OOP spending and occurrence of CHE were significantly higher in the poor with NHI group compared to the other two groups.

Conclusion

The study found that the poor with NHI group was the most vulnerable group in these terms among the Korean population. Health policy needs to take into account the vulnerability of the poor with NHI population.

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Introduction

1. Background

Universal health coverage aims to provide financial protection from catastrophic health expenditures (CHE) and subsequent impoverishment due to health care costs and also to allow access to essential health services [1]. The South Korean health care system includes the National Health Insurance (NHI) and Medical Aid (MA) programs, both aimed at providing protection from CHE and ensuring access to essential health services.

Although South Korea achieved a degree of UHC with the establishment of NHI in 1989, the program has been criticized for insufficient benefit coverage. For example, computed tomography (CT) was not covered until 1995, magnetic resonance imaging (MRI) was excluded from the benefits until 2005, and overall coverage reached only 62.7% in 2017, below the Organization for Economic Cooperation and Development (OECD) average of 73% [2, 3]. The original form of MA was initiated in 1997 as a part of the South Korean social welfare program known as the National Basic Livelihood Security System. It was re-envisioned as the MA program in 2001. MA is a public aid program that guarantees access to necessary health services to low-income populations incapable of maintaining their daily lives or who are having difficulty with living costs. It is comparable to the Medicaid program in the US [1]. MA beneficiaries are composed of Type I and Type II recipients

based on their level of inability or incapacitation [4]. Type I beneficiaries are exempted from out-of-pocket (OOP) payment for any medical utilization, while Type II beneficiaries are assigned minimum copayment rates of up to 15% [1]. Approximately 3% of the overall population qualified for MA in 2017 [4].

The poor with NHI is defined under the National Basic Living Security Act as those who are not eligible for public aid programs but who have equivalized disposable household incomes less than 50% of median ordinary income [5]. In this definition, the poor with NHI can be expressed as the poor with NHI. The OECD defines relative poverty using the same definition [6]. Because South Korea's entitlement criteria for MA is less than 40% of median ordinary income and several exceptions exist, South Korea's relative poverty rate based on a threshold of below 50% median ordinary income was 17.5% in 2017, but only 3% of the total population was eligible for MA in that year [7]. The remaining group is enlisted only in NHI, and because of its insufficient coverage, the majority of the low-income population remains in a blind spot within the health care system. With the low coverage provided by South Korea's health insurance, high OOP spending is blamed for the occurrence of unmet needs among the poor, with NHI caught in a blind spot in the health care system [8]. Excessive OOP spending among patients with low solvency can result in excessive medical expenses, leaving these populations vulnerable to CHE and impoverishment due to healthcare expenditures.

Because of this under-insuring taking place within NHI, it cannot function properly as a primary social safety net protecting citizens from financial crises caused by illness [9, 10]. The relatively poor health resulting from their sociodemographic condition means that the poor with NHI population tend to experience greater medical needs. Due to low coverage under NHI, however, the poor with NHI often cannot use the medical services that they require [11].

2. Literature Review

Extensive research has been performed on health care utilization and OOP spending among the low-income population in South Korea. Many studies have compared OOP spending and medical utilization among MA beneficiaries and NHI members [12, 13, 14]. The studies reviewed here show that MA beneficiaries tend to use more medical services but experience less OOP spending compared to NHI members. For instance, Kim (2015)[12] found that the number of outpatient visits was 1.431 times higher, and the hospitalized days per year was 1.604 times higher among MA beneficiaries compared to NHI members. However, studies examining health utilization and OOP spending among the poor with NHI are limited.

Lee (2016)[8] compared OOP spending and medical utilization among MA beneficiaries and NHI members by using propensity score matching, and because equivalized disposable household income was included in the matching variables, the study population extracted from NHI members had similar characteristics to those defining the poor with NHI group. Lee (2016)[8] found that a person enrolled in MA had less OOP spending for hospitalization and outpatient visits and their number of days of hospitalization was greater compared to NHI members. A study that compared MA benefits and Medicaid among low-income populations

found that the poor with NHI in South Korea had similar sociodemographic characteristics with MA beneficiaries [5].

Choi (2015)[15] found that poor people not enrolled in MA had significantly lower medical utilization compared to MA beneficiaries and greater healthcare costs as well.

However, these studies have only compared the poor with NHI with MA beneficiaries and do not include the population above the threshold of 50% of median income, or they did not divide the low-income groups according to specific criteria to separate the poor with NHI out of the low-income population. Because of the existence of supportive programs for CHE and aid for OOP spending among the poor with NHI population and because the poor with NHI have distinctive sociodemographic conditions compared to other NHI members above the 50% income threshold, there is a need to distinguish the poor with NHI population from other NHI members and compare them to examine the different sociodemographic and policy contexts they inhabit. In addition, studies using propensity score matching or defining the poor with NHI have relied only on income to distinguish the poor with NHI from other NHI members. The reasons for poor people being excluded from MA include not only the income threshold but other reasons as well [7]. For instance, those whose obligatory provider exceeds certain criteria are excluded from MA enrollment.

3. Purpose of Research

The purpose of this study is to analyze the medical service utilization and medical expense of the poor with NHI population. To attain the purpose, this study analyzed the medical utilization and OOP spending, occurrence of catastrophic expenditure among three separate groups. Because previous studies have only compared the poor with NHI with MA beneficiaries, formal studies did not account the effect of supportive programs for CHE and aid for OOP spending among the poor with NHI population. Also, because the poor with NHI have distinctive sociodemographic conditions compared to other NHI members above the 50% income threshold, this study included both MA beneficiaries and the non-poor with NHI as comparison to demonstrate the sociodemographic and policy aspects of the poor with NHI group.

The study examines general characteristics by dividing total respondents by equivalized disposable household income of 50%, and then separates the poor with NHI population from the low-income population according to specific criteria which will be discussed later. In addition, the study analyzed medical utilization, OOP spending, occurrence of catastrophic health expenditure among three separate groups. For medical utilization, this study analyzed two types of medical utilization, outpatient, and inpatient service. Inpatient service is analyzed in three variables, hospital visit,

hospitalized days, hospitalized days per visit. For the occurrence of catastrophic health expenditure, 20% and 40% threshold were used.

4. Hypothesis

1. Comparing Medical aid beneficiaries and the poor with NHI, enrollment of Medical aid will increase the number of medical utilization in both outpatient and inpatient services.

2. Comparing Medical aid beneficiaries and the poor with NHI, enrollment of Medical aid will decrease the amount of out-of-pocket spending on medical expenses and the chance of experiencing catastrophic health expenditure.

3. Comparing non-poor with NHI and the poor with NHI, the poor with NHI will use less medical service in both outpatient and inpatient services

4. Comparing non-poor with NHI and the poor with NHI, the poor with NHI will have a higher chance of experiencing catastrophic health expenditure.

Materials and Methods

1. Data source

The study collected individual data from the 14th Korea Welfare Panel Study (2019) database, which is conducted by Seoul National University and the KIHASA. The Korea Welfare Panel Study was designed to provide a probability sample of South Korea's population. The study subjects were selected to compare low-income and general families by collecting half of the samples from low-income households [16]. Data collected from February 18 through May 21, 2019 were used for this study. The period of the survey was January 1 through December 31, 2018 for flow data and December 31, 2018 for stock data.

Among the total of 14,418 individuals and 6,331 households initially selected for this study, 3,183 individuals were excluded due to being a minor under the age of 18, missing health care program type information, being beneficiaries of free medical treatment for reasons of national merit, and as individuals non-poor with NHI but still beneficiaries of MA. Eventually, 11,235 individuals were selected as subjects of this study.

2. Variable Definition

Defining the Study Group

The study population was categorized into three groups: MA beneficiaries, the poor with NHI(poor with NHI), and non-poor with NHI. The poverty line was defined as 50% of median income by the number of household members in 2018. Poor with NHI was defined as the population who are below the poverty line and enrolled in NHI, or who were subject to national basic living security aid in 2018 but not enlisted in MA because the obligatory provider's income or property exceeded criteria or for a failure to pay the NHI contribution for more than six months and thus being excluded from NHI benefits. NHI members not grouped as poor with NHI were placed in the non-poor with NHI. The entire population enlisted as MA beneficiaries were grouped as MA beneficiaries.

Selection and definition of explanatory variables

The study examined two types of medical utilization for 2018: outpatient services and inpatient services. (Table 1) Inpatient services were examined in terms of three variables: hospital visits, hospitalized days, and hospitalized days per visit. For OOP spending, the Korea Welfare Panel Study includes all OOP spending, including hospital costs, dental costs, Korean traditional medicine costs, and drug costs. CHEs are defined as annual OOP spending exceeding a specified fraction of annual income, which is distinct from high health costs defined simply as those exceeding a

determined amount [17, 18]. The specified fraction threshold varies between 10% to 40%; for this study, 20% and 40% were used as a threshold.

TABLE 1 dependent variable and definitions used in the study

Variables		Definition
Outpatient visits		(count variable)
Inpatient service	Hospital visit	(count variable)
	Hospitalized days	(count variable)
	Hospitalized days per visit	Hospitalized days / Hospital visit
Out-of-pocket spending		(continuous variable)
Catastrophic health expenditure		20% threshold
		40% threshold

Sex, age, marital status, education, employment, income, self-reported health status, chronic disease states, private insurance coverage status, depression, and other disorders were set as predisposing factors affecting medical utilization and OOP spending. (Table 2) Educational achievement was grouped into no completion, below high school diploma, high school diploma, and above high school diploma. Employment was grouped into temporary employee; employer, self-employed, pr unpaid family worker; unemployed or economically inactive; and permanent employee. Income was defined as equivalized disposable personal income by adding gross income and non-consumption expenditures to calculate household disposable income and dividing household disposable income by the square root of the number of household members. Annual income variables were log-transformed in the analysis process, except for reporting demographic characteristics

within each group (Table 3) and during the propensity matching sequence. (Table 4) Self-reported health status was measured with "very healthy," "healthy," "moderate" deemed healthy and "not very healthy," and "unhealthy" as bad health. Private insurance coverage status was measured by whether the respondent has at least one type of private insurance. Depression status was measured on the CESD-11 scale. Depression status was defined as the sum of CESD-11 questionaries (0 - 33 points) multiplied by 20/11 being greater than or equal to 16 [19]. Respondents were grouped as having another disorder if any type of mental, kidney, heart, respiratory, liver, physical, speech, facial nerve, brain lesion, visual disturbance, hearing impairment, mental retardation, or intestinal disorder was present.

TABLE 2 Independent variable and definitions used in the study

	Variables	Definition
Socio-economic variables	Age	(continuous variable)
	Sex	0 Male
		1 Female
	Marital Status	0 Not married
		1 Married
	Education	0 No diploma
		1 Below high school diploma
		2 High school diploma
		3 Above high school diploma
	Occupation	0 Permanent employee
		1 Temporary employee
		2 Employer, Self-employed, Unpaid family worker
		3 Unemployed, Economically inactive
	Annual income (ten thousand won)	Total household income divided by square root of household members
Health	Self-reported health	0 Healthy

related	status	1 Unhealthy
variables	Chronic disease status	0 Not having chronic disease
		1 Having chronic disease
	Disable status	0 Not being disabled
		1 Disabled
	Depression status	0 Not having depression
		1 Depression
Private insurance subscription		0 Have not subscribed to any private insurance
		1 Subscribed to at least one private insurance

3. Statistical Analyses

Study examined the effect of MA and poverty on health utilization and OOP spending. Because the decision to use medical services and incur OOP spending is not random given that an individual's health status, occupational status, and various other factors influence it, the study applied the model by Rubin (1974)[20]. Following his notation, the study observed $Y = \alpha + \beta \cdot X + \delta \cdot T + \epsilon$, where T is a 0 to 1 indicator of whether an individual is assigned to the treatment (MA beneficiary or below poverty line) or control group, X is the observable factors, Y is the outcome (medical utilization, OOP spending, or occurrence of CHEs), and ϵ is unobservable but influences Y. If simply compare the realized outcomes, for instance, based on the average treatment effect on the treated (ATT), that is $E(Y_1|T = 1) - E(Y_1|T = 0)$, selection bias will occur due to the non-randomness of factors that influence the decision [21]. However, if the assignment of treatment is random for individuals with similar values of observable covariates, the ATT can be identified.

The study used propensity score matching to estimate treatment's effects in an unbiased manner by accounting for possible covariates that predict receiving treatment [22]. To conduct matching between the MA and poor with NHI groups, a propensity score was derived by applying a probit model, setting

policy variables as to whether the individual is an MA beneficiary, and other covariates were adjusted between the control and case group. Sex, age, marital status, education, employment, income, self-reported health status, chronic disease states, private insurance coverage status, depression, and other disorders were set as covariates.

Propensity score for respondent i is the conditional probability of assignment to the treatment condition, as follows.

$$Pr(T_i = medical\ aid, poverty\ line) = \frac{e^{X\beta}}{1 + e^{X\beta}},$$

$$where\ \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \cdots \beta_k X_k$$

Estimated propensity scores were used to match MA beneficiaries and the poor with NHI group. Given that an increasing number of controls matched to each case resulted in improved efficiency, but efficiency is minor when one-to-M matching exceeds M=5, the study applied one-to-four nearest neighbor matching with replacement and 0.01 caliper width [23]. After matching was completed, a t-test was applied to verify whether the covariates' distribution was the same between the groups.

To conduct matching between the poor with NHI and non-poor with NHI groups, the poor with NHI was matched with the non-poor with NHI group, setting policy variables as to whether or not the individual is below the poverty line. The same procedure was conducted to derive the propensity score and matching between the poor with NHI and non-poor with NHI groups.

After matching was completed, regression was applied to check each policy variable's effect on medical utilization and OOP spending. The study assumed that the outpatient and inpatient medical usage in this analysis follows a Poisson basic model [24]. For medical utilization, there are three fundamental statistical properties: 1) To be non-negative; 2) to have no non-trivial fraction of zero outcomes; 3) to follow a positively skewed distribution of non-zero realization [25]. To accommodate these unique count data structures, a zero-inflated Poisson (ZIP) model was used to model hospital visits, hospitalized days, and hospitalized days per visit. For outpatient use, the study applied a negative binomial model.

Let x_i be the vector for the covariates with μ_i the expected number of occurrences where x_i is the vector independent variable and β the vector of parameters to be estimated.

$$\mu_i = \exp(\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki}) = \exp(x'_i \beta) > 0$$

The ZIP model first models the probability of observing zeroes using logistic regression, and then uses a Poisson regression to model the non−zero count data while accounting for the excess zeroes. The ZIP model can be presented as y_i, which represents the count of the hospital visits, hospitalized days, and hospitalized days per visit for the ith person and π as the probability of a case in which the count is zero and $1 - \pi$ is the probability of a case in which the count is not zero. Therefore, the probability distribution of y_i can is written as follows.

$$\Pr(y_i = j) = \begin{cases} \pi_i + (1 - \pi_i) \exp(-\mu_i) & if \ j = 0 \\ (1 - \pi_i) \dfrac{\mu_i^{y_i} \exp(-\mu_i)}{y_i!} & if \ j > 0 \end{cases}$$

The negative binomial model can be written as below, where y_i presents the count of the dependent variable outpatient use for the ith person and $\alpha = \frac{1}{v}$, where v is the scale parameter of the gamma noise variable, and the negative binomial regression model can be shown as follows:

$$\Pr(Y = y_i | \mu_i, \alpha) = \frac{\Gamma(y_i + \alpha^{-1})}{\Gamma(\alpha^{-1})\Gamma(y_i + 1)} \left(\frac{1}{1 + \alpha\mu_i}\right)^{\alpha^{-1}} \left(\frac{\alpha\mu_i}{1 + \alpha\mu_i}\right)^{y_i}$$

Because the OOP spending data is skewed to the right and was not normally distributed, log-link Generalized Linear Model(GLM) was applied to model OOP spending [26]. The gamma distribution is undefined for values of '0', an offset of 0.00001 was added to each OOP spending value in consideration of the users who had no OOP spending, and results were interpreted with exponentiated coefficients [27]. The occurrence of CHEs was modeled by applying binomial logistic regression to estimate the coefficient.

In analyzing medical utilization and OOP spending, the occurrence of CHE among the poor with NHI group and the non-poor with NHI group, additional analysis was conducted by including the annual income variable from covariates and excluding the annual income variable from covariates. This is because the poor with NHI variable (whether the respondents are included in the poor with NHI group) and annual income variable is closely correlated as the criteria for the poor with NHI includes whether the annual income of respondent is above or below the 50% of national median income, the study first analyzed the dependent variable (medical utilization, OOP spending, the occurrence of CHE) without the annual income

variable as covariates to compare the effect of being in the poor with NHI group compared to non-poor with NHI group. Then, another analysis was applied by including the annual income variable in covariates in order to figure out the effect of annual income within and between the groups.

All statistical analyses were performed using Stata ver. 16 (StataCorp, College Station, Texas, USA). This study protocol was approved by the Institutional Review Board of Seoul National University (IRB No. E2010/001-004).

Results

1. Demographic Characteristics

Various demographic and socioeconomic characteristics, health status, and occupation status among the three study groups are compared (Table 3). MA beneficiaries and the poor with NHI group were found to show similar Health and demographic status. The average age for MA beneficiaries was 66.21, and the poor with NHI for 72.27. Both had similar health status, as 85.55% of MA beneficiaries, and 84.53% of the poor with NHI group reported that they had a chronic disease.

However, For annual income, the mean value of annual income was larger among MA beneficiaries. Also, the poor with NHI group tends to be more economically active than the MA beneficiaries. The poor with NHI had a larger share of permanent employee and temporary employees compared to MA beneficiaries.

The non-poor with NHI group was found to have better health and socioeconomic status and was more economically active. Respondents who reported that they had bad health were 14.49%, which is smaller compared to the poor with NHI group where 47.61% reported that they had bad health. Also, the poor with NHI

had a larger share of respondents with chronic disease, disabled, and depression.

For socioeconomic status, the Non-poor with NHI group had better education level, and were more economically active, and had a larger share of permanent employee. The annual income of non-poor with NHI group was about four times larger compared to the poor with NHI group.

TABLE 3 Demographic characteristics of the study population

	Medical Aid beneficiaries		Poor with NHI group		Non-poor with NHI group		Total	
	Frequency	Relative frequency (%)	Frequency	Relative frequency (%)	Frequency	Relative frequency (%)	Frequency	Relative frequency (%)
N	616	5.48	2,153	19.16	8,466	75.35	11,235	
Categorical variables								
Female	384	62.34	1,394	64.75	4,588	54.19	6,366	56.66
Married	164	26.62	1,150	53.41	5,554	65.60	6,868	61.13
Education								
∈ no diploma	110	17.86	493	22.90	245	2.89	848	7.55
∈ below high school diploma	328	53.25	1,221	56.71	2,021	23.87	3,570	31.78
∈ high school diploma	129	20.94	303	14.07	2,665	31.48	3,097	27.57
∈ above high school diploma	49	7.95	136	6.32	3,535	41.76	3,720	33.11
Occupation								
∈ permanent employee	2	0.32	15	0.70	2,319	27.39	2,336	20.79
∈ temporary employee	52	8.44	309	14.35	1,891	22.34	2,252	20.04
∈ employer, self-employed, unpaid family worker	11	1.79	302	14.03	1,161	13.71	1,474	13.12
∈ unemployed, economically inactive	551	89.54	1,527	70.92	3,095	36.56	5,173	46.04
Reporting bad Health	358	58.12	1,025	47.61	1,227	14.49	2,610	23.23
Chronic disease patient	527	85.55	1,820	84.53	3,971	46.91	6,318	56.23
Disabled	115	18.67	170	7.90	265	3.13	550	4.90

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Private insurance subscription	123	19.97	468	21.74	6,499	76.77	7,090	63.11
Depression	276	44.81	649	30.14	782	9.24	1,707	15.19
Continuous variables								
Age	66.21 (mean)	16.60 (SD)	72.27 (mean)	13.02 (SD)	50.27 (mean)	17.65 (SD)	55.30 (mean)	19.02 (SD)
OOP spending (ten thousand won)	6.90	139.09	22.57	768.59	27.52	1100.05	25.44	1007.464
Annual income (ten thousand won)	1,105.13 (mean)	377.402 (SD)	979.25 (mean)	638.31 (SD)	3,759.28 (mean)	2,530.93 (SD)	3,081.01 (mean)	2,513.95 (SD)

2. Matching Quality

In the selection of matching covariates, the potential variables with a possible effect on outpatient and inpatient service use and OOP spending, and the occurrence of CHE were included. The selected covariates for the matching can be categorized into sociodemographic variables, health-related variables, and private insurance variable. For sociodemographic variables, sex, marital status, education, occupation, age, annual equivalized disposable household income was included. For health-related variables, self-perceived health status, chronic disease, depression, disable was included. For private insurance-related variable, a private insurance subscription was included. However, in matching with the poor with NHI and the non-poor with NHI, annual equivalized disposable household income was excluded from the matching covariates in order to secure the sufficient sample size, and to analyze the effect of being poor with NHI, as the majority of samples categorized into the poor with NHI were related to annual income, as being ones below the 50% national median annual income.

Overall descriptive statistics for all covariates were compared among the three study groups. (Table 4) Before matching, almost all covariates are statistically different between the groups at the 5% significance level. After matching, there are no significant differences in all covariates among the groups. A matched sample of

507 MA beneficiaries and 915 individuals from the poor with NHI group was generated and used in the subsequent analysis.

For the poor with NHI and non-poor with NHI, before matching, all covariates are statistically different between the groups at 5% significance level. After matching, there are no significant differences in covariates except below high school diploma and temporary employee, unemployed or economically inactive, depression variable. A matched sample of 1,949 poor with NHI and 2,405 individuals from the non-poor with NHI group was generated and used in the subsequent analysis.

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TABLE 4 Descriptive statistics according to treatment and matching status

Matching variable	Before matching			After matching		
	Medical Aid group	Poor with NHI group	$p > [t]$	Medical Aid group	Poor with NHI group	$p > [t]$
Poor with NHI and Medical aid						
N	516	1949		507	915	
Categorical variables						
Female	62.34	64.75	0.272	63.31	60.04	0.285
Married	26.62	53.41	0.000	26.62	24.50	0.440
Education						
∈ below high school diploma	53.35	56.71	0.127	52.46	51.49	0.758
∈ high school diploma	20.94	14.07	0.000	21.69	22.12	0.869
∈ above high school diploma	7.96	6.31	0.151	8.67	9.82	0.528
Occupation						
∈ temporary employee	4.44	14.35	0.000	9.07	9.08	0.993
∈ employer, self-employed, unpaid family worker	1.79	14.03	0.000	1.77	202	0.774
∈ unemployed, economically inactive	89.44	70.92	0.000	88.75	88.19	0.781
Reporting bad health	58.11	47.60	0.000	55.81	54.61	0.701
Chronic disease patient	88.55	84.53	0.535	85.6	84.13	0.516
Disabled	22.28	8.71	0.000	21.30	19.44	0.463
Private insurance subscription	19.96	21.73	0.345	20.51	21.84	0.604
Depression	44.8	30.14	0.000	44.37	45.48	0.725
Continuous variables						
Annual income (ten thousand won)	1105.1	979.26	0.000	1078.4	1063.8	0.563

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Age	65.22	72.28	0.000	65.43	65.02	0.718
	Poor with NHI group	Non-poor with NHI group	p> [t]	Poor with NHI group	Non-poor with NHI group	p> [t]
Poor with NHI and non-poor with NHI groups						
N	1949	8151		1949	2405	
Categorical variables						
Female	64.75	54.19	0.000	64.64	65.7	0.491
Married	53.41	65.60	0.000	53.30	52.54	0.630
Education						
∈ below high school diploma	56.71	23.87	0.000	56.18	59.63	0.029
∈ high school diploma	14.07	31.47	0.000	14.72	14.45	0.812
∈ above high school diploma	6.31	41.75	0.000	6.72	6.67	0.949
Occupation						
∈ temporary employee	14.35	22.33	0.000	14.57	11.96	0.017
∈ employer, self-employed, unpaid family worker	14.03	13.71	0.000	14.00	13.46	0.625
∈ unemployed, economically inactive	70.92	36.55	0.000	70.75	73.57	0.049
Reporting bad health	47.60	14.49	0.000	46.84	47.15	0.847
Chronic disease patient	84.53	46.90	0.000	83.73	84.01	0.811
Disabled	8.71	3.25	0.000	8.67	7.28	0.111
Private insurance subscription	21.73	76.76	0.000	22.31	20.78	0.243
Depression	30.14	9.23	0.000	29.81	26.23	0.013
Continuous variables						
Age	70.36	50.27	0.000	72.06	72.10	0.925

Nearest neighbor matching with replacement, 1:4 ratio, caliper: 0.01, Annual income variable was excluded in matching with poor with NHI and non-poor with NHI group to secure sufficient sample size and to estimate the effect of being poor with NHI

3. Difference in Health Utilization and OOP spending among Medical Aid beneficiaries and the poor with NHI group

Difference in health utilization among MA beneficiaries and the poor with NHI group were shown in Table 5(outpatient) and Table 6(inpatient).

The MA beneficiaries group was found to use 35% more outpatient services than the poor with NHI group ($p < 0.01$; $\exp(0.30)=1.35$). The two groups showed no significant difference in hospital visit frequency and hospitalized days per visit. The MA group showed a significantly lower number of expected hospitalized days than the poor with NHI group. The expected number of hospitalized days for the MA group was estimated to be 31% smaller than the poor with NHI group ($p < 0.1$; $\exp(-0.36)=0.69$).

The other three occupation groups were found to use significantly fewer outpatient services and hospital visits than permanent employees. Private insurance subscriptions had a negative effect on hospital days and hospital days per visit based on Poisson estimation ($p < 0.05$). Respondents who reported bad health, chronic disease showed higher use of medical service in both outpatient and inpatient services to respondents who responded that their perceived health status is healthy, and ones with no chronic disease among MA beneficiaries and the poor with NHI in at least 10% significance level.

For the annual income variable, it had no significant effect in medical service utilization in both inpatient and outpatient service among MA beneficiaries and the poor with NHI group.

TABLE 5 Effect on medical utilization among Medical Aid and poor with NHI groups (outpatient)

	Outpatient visits	
	Negative binominal	
	β	SE
Medical Aid	0.30***	0.07
Female	0.40***	0.08
Age	0.10**	0.00
Married	-0.06	0.08
Education		
∈ below high school diploma	0.21**	0.08
∈ high school diploma	0.28**	0.12
∈ above high school diploma	0.09	0.22
Occupation		
∈ temporary employee	-0.37*	0.22
∈ employer, self-employed, unpaid family worker	-0.48*	0.29
∈ unemployed, economically inactive	-0.43**	0.21
Annual income (log-transformed)	0.12	0.09
Reporting bad health	0.34***	0.08
Chronic disease patient	1.55***	0.13
Disabled	0.08	0.10
Private insurance subscription	-0.00	0.10
Depression	0.16**	0.07

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$

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TABLE 6 Effect on medical utilization among Medical Aid and poor with NHI groups (inpatient)

| | Hospital visits | | | | Hospitalized days | | | | Hospitalized days per visit | | | |
| | Poisson | | Logit | | Poisson | | Logit | | Poisson | | Logit | |
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Medical Aid	0.20	0.25	0.37	0.299	-0.36*	0.19	0.14	0.163	-0.20	0.218	0.14	0.163
Female	-0.21	0.30	-0.13	0.34	-0.69**	0.25	0.02	0.202	-0.85***	0.216	0.02	0.203
Age	-0.05***	0.01	-0.05***	0.12	-0.02**	0.011	-0.01**	0.007	-0.00	0.010	-0.01**	0.007
Married	-0.37	0.34	-0.37	0.393	-0.22	0.255	-0.02	0.187	-0.30	0.262	-0.27	0.187
Education												
∈ below high school diploma	0.53	0.36	0.28	0.485	-0.13	0.193	-0.15	0.214	-0.33	0.231	-0.15	0.214
∈ high school diploma	-0.16	0.30	-0.72	0.578	-0.07	0.321	-0.42	0.311	-0.15	0.318	-0.42	0.311
∈ above high school diploma	-0.89*	0.49	-1.78*	1.006	0.20	0.481	-0.78*	0.467	0.56	0.460	-0.78*	0.466
Occupation												
∈ temporary employee	-3.84***	1.10	-1.72	2.295	-1.22*	0.708	1.84*	1.088	-0.75	0.668	1.90*	1.090
∈ employer, self-employed, unpaid family worker	-1.52**	0.68	-0.87	1.527	0.05	0.496	0.52	1.153	0.01**	0.528	0.55	1.158
∈ unemployed, economically inactive	-1.91**	0.75	-1.38	1.529	0.45	0.473	0.42	1.016	0.55	0.476	0.45	1.021
Annual income (log-transformed)	-0.28	0.22	-0.17	0.452	0.29	0.155	-0.05	0.216	0.04	0.241	-0.05	0.216
Reporting bad health	1.35***	0.37	0.01	0.581	0.71**	0.325	-1.06***	0.197	-0.67**	0.278	-1.06***	0.197
Chronic disease patient	1.75**	0.55	1.78	1.380	1.54**	0.594	0.04	0.316	1.06*	0.595	0.02	0.315
Disabled	-0.08	0.31	0.15	0.384	0.05	0.226	0.18	0.218	-0.02	0.292	0.18	0.218
Private insurance subscription	-0.11	0.68	-0.62	0.611	-0.87**	0.324	-0.34	0.224	-0.58**	0.287	-0.33	0.224
Depression	0.52*	0.30	0.13	0.377	0.28	0.189	-0.15	0.166	0.08	0.217	-0.16	0.165

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

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OOP spending and CHE occurrence were compared among the poor with NHI and MA beneficiaries. MA beneficiaries showed 73.6% lower OOP spending and less chance of CHE experience for both the 20% and 40% thresholds compared to the poor with NHI group ($p < 0.01$) (Table 7).

Permanent job status was found to show a lower chance of occurrence of CHE than the other occupational statuses, with the exception of unemployed or economically inactive (at least 10% significance level). People with private insurance responded as spending 41.9% more on OOP spending ($p < 0.05$) but had no significant effect on the occurrence of CHE. Respondents who considered themselves bad health had 82% higher OOP spending ($\exp(0.60) = 1.82$) and a higher chance of experiencing CHE in both 20% and 40% threshold compared to respondents who responded that their perceived health status is healthy among MA beneficiaries and poor with NHI group at 1% significance level.

TABLE 7 Effect on out-of-pocket (OOP) spending and occurrence of catastrophic health expenditures (CHE) among the Medical Aid and poor with NHI groups

	OOP spending Log-link GLM		CHE (40%) Logit		CHE (20%) Logit	
	β	SE	β	SE	β	SE
Medical Aid	-1.33***	0.092	-2.27***	0.289	-1.78***	0.169
Female	-0.04	0.107	0.10	0.301	0.02	0.186
Age	-0.01	0.005	0.00	0.012	0.01	0.007
Married	0.52***	0.100	0.41*	0.232	0.84***	0.169
Education						
∈ below high school diploma	0.02	0.140	-0.07	0.251	0.05	0.200
∈ high school diploma	0.04	0.203	-0.48	0.418	-0.23	0.295
∈ above high school diploma	-0.10	0.241	-0.30	0.630	0.42	0.421
Occupation						
∈ temporary employee	-0.57	0.403	-2.60**	1.228	-2.22*	1.148
∈ employer, self-employed, unpaid family worker	-1.11**	0.439	-2.24*	1.319	-2.51**	1.190
∈ unemployed, economically inactive	-0.34	0.401	-1.54	1.202	-1.40	1.124
Annual income (log-transformed)	0.36**	0.144	-0.35*	0.196	-0.72	0.161
Reporting bad health	0.60***	0.103	0.97***	0.246	0.94***	0.173
Chronic disease patient	0.25	0.160	0.61	0.469	0.35	0.307
Disabled	-0.15	0.131	0.18	0.280	0.00	0.213
Private insurance subscription	0.35**	0.137	0.35	0.312	0.06	0.228
Depression	0.18*	0.094	0.37*	0.216	0.20	0.163

*** p < 0.01
** p < 0.05
* p <0.1

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4. Difference in Health Utilization and OOP spending among the poor with NHI and non-poor with NHI groups

Differences in outpatient service use among the poor with NHI and the non-poor with NHI groups were shown in Table 8(annual income not adjusted) and Table9(annual income adjusted). The difference in inpatient service use was shown in Table 10(annual income not adjusted) and Table 11(annual income adjusted)

Before adjusting the annual income variable, there was no significant difference in medical utilization except hospitalized days and hospitalized days per visit between the poor with NHI and non-poor with NHI groups. For hospitalized days, the higher use of hospitalized days was conditional on being a hospital user, as Poisson and logit estimates were both positive ($p < 0.1$). The poor with NHI group had a 18% greater chance of no hospital visits compared to the non-poor NHI group ($p < 0.1$; $\exp(0.17)=1.18$). However, the significance disappeared after the annual income was adjusted in both Poisson and logit estimates for the hospitalized days, and logit estimates for the hospitalized days per visit.

Occupation status was not a significant factor influencing medical utilization in both outpatient and inpatient service, and the trend was not changed after the annual income variable was

adjusted.

Private insurance subscription was found to be negatively associated with the chance of no hospital visits, as it had negative logit estimates in a hospital visit, hospitalized days, and hospitalized days per visit in at least 10% significance level. This trend remained after the annual income variable was adjusted.

Respondents who reported bad health, the chronic disease showed higher use of medical service in both outpatient and inpatient services compared to respondents who responded that their perceived health status is healthy, and ones with no chronic disease among the poor with NHI and non-poor with NHI groups in at least 10% significance level. This trend remained the same after adjusting the annual income variable.

TABLE 8 Effect on medical utilization among the non-poor with NHI and poor with NHI groups (outpatient, annual income not adjusted)

	Outpatient visits	
	Negative binominal	
	β	SE
Poor with NHI	0.04	0.040
Female	0.35***	0.048
Age	0.01***	0.002
Married	-0.02	0.044
Education		
∈ below high school diploma	0.01	0.061
∈ high school diploma	-0.05	0.078
∈ above high school diploma	-0.10	0.106
Occupation		
∈ temporary employee	-0.08	0.188
∈ employer, self-employed, unpaid family worker	-0.05	0,.189
∈ unemployed, economically inactive	-0.20	0.187
Reporting bad health	0.31***	0.044
Chronic disease patient	0.99***	0.090
Disabled	0.04	0.715
Private insurance subscription	0.10*	0.054
Depression	0.05	0.052

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$

TABLE 9 Effect on medical utilization among the non-poor with NHI and poor with NHI groups (outpatient, annual income adjusted)

	Outpatient visits	
	Negative binominal	
	β	SE
Poor with NHI	-0.01	0.069
Female	0.35***	0.480
Age	0.01***	0.002
Married	-0.01	0.044
Education		
∈ below high school diploma	0.01	0.061
∈ high school diploma	-0.05	0.078
∈ above high school diploma	-0.08	0.108
Occupation		
∈ temporary employee	-0.09	0.187
∈ employer, self-employed, unpaid family worker	-0.07	0.189
∈ unemployed, economically inactive	-0.21	0.186
Annual income (log-transformed)	-0.06	0.059
Reporting bad health	0.31***	0.044
Chronic disease patient	0.99***	0.090
Disabled	0.04	0.071
Private insurance subscription	0.11**	0.053
Depression	0.04	0.053

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$

TABLE 10 Effect on medical utilization among the non-poor with NHI and poor with NHI groups (inpatient, annual income not adjusted)

| | Hospital visits | | | | Hospitalized days | | | | Hospitalized days per visit | | | |
| | Poisson | | Logit | | Poisson | | Logit | | Poisson | | Logit | |
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Poor with NHI	-0.01	0.167	0.24	0.317	0.16*	0.103	0.17*	0.095	0.10	0.115	0.17*	0.095
Female	-0.33	0.279	-0.36	0.473	-0.45	0.152	0.83	0.112	-0.05	0.159	0.08	0.112
Age	-0.02**	0.009	-0.05***	0.014	-0.01	0.007	-0.01**	0.005	0.01	0.008	-0.12**	0.005
Married	-0.25	0.209	0.13	0.321	-0.21	0.124	0.26**	0.107	-0.14	0.132	0.26**	0.107
Education ∈ below high school diploma	0.28	0.247	0.15	0.506	-0.01*	0.136	-0.16	0.139	-0.14	0.150	-0.16	.139
∈ high school diploma	0.32	0.365	0.25	0.742	0.24	0.206	-0.08	0.184	0.02	0.227	-0.08	0.184
∈ above high school diploma	-0.27	0.452	-0.88	0.975	-0.16	0.321	-0.18	0.231	-0.05	0.365	-0.18	0.231
Occupation ∈ temporary employee	-0.28	0.449	0.53	0.913	-0.86*	0.503	0.86*	0.448	-0.90*	0.539	0.86*	0.448
∈ employer, self-employed, unpaid family worker	-0.34	0.363	-0.49	0.816	-0.57	0.491	0.32	0.443	-0.73	0.526	0.32	0.443
∈ unemployed, economically inactive	0.00	0.433	-0.17	0.941	-0.40	0.482	0.20	0.433	-0.58	0.521	0.20	0.433
Reporting bad health	0.69***	0.182	-0.39	0.339	0.51***	0.114	-0.87***	0.108	0.41***	0.118	-0.87***	0.108
Chronic disease patient	0.75**	0.272	0.65	0.567	0.44**	0.168	-0.31*	0.166	0.31**	0.148	-0.31*	0.166
Disabled	0.03	0.215	-0.28	0.367	0.29*	0.176	-0.20	0.163	0.25	0.217	-0.20	0.163
Private insurance subscription	-0.63**	0.313	-1.67*	0.882	-0.14	0.170	-0.27**	0.115	0.07	0.161	-0.27**	0.115
Depression	0.50**	0.210	0.27	0.417	0.39***	0.119	-0.30***	0.109	0.21	0.135	-0.30***	0.109

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*** p < 0.01
** p < 0.05
* p < 0.1

TABLE 11 Effect on medical utilization among the non-poor with NHI and poor with NHI groups (inpatient, annual income adjusted)

| | Hospital visits | | | | Hospitalized days | | | | Hospitalized days per visit | | | |
| | Poisson | | Logit | | Poisson | | Logit | | Poisson | | Logit | |
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Poor with NHI	-0.17	0.194	0.05	0.357	0.13	0.150	0.19	0.144	0.08	0.154	0.19	0.144
Female	-0.28	0.267	-0.27	0.463	-0.03	0.154	0.08	0.112	-0.04	0.160	0.08	0.112
Age	-0.25**	0.009	-0.05***	0.014	-0.00	0.007	-0.01**	0.005	0.01	0.009	-0.01**	0.005
Married	-0.18	0.198	0.24	0.317	-0.20	0.129	0.27**	0.107	-0.14	0.140	0.27**	0.107
Education												
∈ below high school diploma	0.29	0.235	0.16	0.481	-0.00	0.136	-0.16	0.139	-0.14	0.150	-0.16	0.139
∈ high school diploma	0.32	0.353	0.24	0.729	0.24	0.205	-0.09	0.184	0.02	0.226	-0.09	0.184
∈ above high school diploma	-0.18	0.441	-0.71	0.957	-0.14	0.320	-0.17	0.232	-0.03	0.361	-0.16	0.232
Occupation												
∈ temporary employee	-0.39	0.469	0.37	1.010	-0.87*	0.506	0.88*	0.451	-0.91*	0.546	0.88*	0.451
∈ employer, self-employed, unpaid family worker	-0.43	0.381	-0.63	0.902	-0.58	0.494	0.34	0.446	-0.74	0.532	0.34	0.446
∈ unemployed, economically inactive	-0.11	0.443	-0.35	1.031	-0.41	0.487	0.23	0.437	-0.59	0.531	0.23	0.437
Annual income (log-transformed)	-0.17	0.140	-0.23	0.273	-0.03	0.126	0.02	0.117	-0.02	0.130	0.02	0.117
Reporting bad health	0.68***	0.180	-.41	0.338	0.50***	0.113	-0.88***	0.108	0.41***	0.118	-0.88***	0.108
Chronic disease patient	0.75***	0.277	0.71	0.618	0.44*	0.169	-0.29*	0.166	0.31**	0.149	-0.29*	0.166
Disabled	0.07	0.200	-0.23	0.345	0.29	0.180	-0.21	0.163	0.25	0.224	-0.21	0.163
Private insurance subscription	-0.66***	0.318	-1.79*	0.986	-0.14***	0.170	-0.26**	0.116	0.07	0.162	-0.26**	0.116
Depression	0.51**	0.200	0.30	0.400	0.39***	0.119	-0.30***	0.109	0.21	0.136	-0.30***	0.109

*** p < 0.01

** p < 0.05

* p <0.1

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Difference in OOP spending and occurrence of CHE among the poor with NHI and the non-poor with NHI groups were shown in Table 12(annual income not adjusted) and Table13(annual income adjusted).

The poor with NHI group were more likely to experience CHE but less OOP spending compared to the non-poor with NHI group before adjusting annual income. The poor with NHI spend 38% less OOP spending (exp(-0.56)=0.61; $p < 0.01$) but had 163% higher chance of experiencing CHE in 40% threshold, (exp(0.97)=2.63; $p < 0.01$) and 169% higher chance of experiencing CHE in 20% threshold. (exp(0.99)=2.69; $p < 0.01$) However, for CHE in 40% threshold, the significance disappeared after adjusting the annual income variable.

Respondents who reported bad health faced 25% higher OOP spending (exp(0.23)=1.25) and a higher chance of CHE in both 20% and 40% threshold compared to respondents who responded that their perceived health status is healthy among the poor with NHI and non-poor with NHI groups in at least 10% significance level. Also, respondents who reported depression had higher OOP spending, and higher chance of experiencing CHE in both 20% and 40% threshold. This trend remained the same after adjusting the annual income.

For the annual income variable, it was positively related to

OOP spending, but had negatively affected the chance of experiencing CHE in both 40% and 20% threshold at a 1% significance level.

TABLE 12 Effect on out-of-pocket (OOP) spending and occurrence of catastrophic health expenditure (CHE) among the non-poor with NHI and poor with NHI groups (annual income not adjusted)

| | OOP spending | | CHE (40%) | | CHE (20%) | |
| | Log-link GLM | | Logit | | Logit | |
	β	SE	β	SE	β	SE
Poor with NHI	-0.49***	0.041	0.97***	0.120	0.99***	0.084
Female	-0.00	0.052	0.00	0.125	-0.01	0.096
Age	0.00	0.002	0.01*	0.005	0.15***	0.004
Married	0.43***	0.046	0.22*	0.117	0.42***	0.091
Education						
∈ below high school diploma	-0.00	0.059	0.06	0.145	0.12	0.117
∈ high school diploma	0.10	0.085	-0.13	0.208	0.10	0.161
∈ above high school diploma	0.14	0.097	0.03	0.284	0.06	0.206
Occupation						
∈ temporary employee	-0.26	0.164	-1.12*	0.612	-0.15	0.508
∈ employer, self-employed, unpaid family worker	-0.02	0.168	-0.91	0.611	0.09	0.508
∈ unemployed, economically inactive	0.02	0.162	-0.41	0.595	0.37	0.500
Reporting bad health	0.23***	0.048	0.71***	0.116	0.73***	0.087
Chronic disease patient	0.31***	0.086	0.40*	0.204	0.40**	0.133
Disabled	0.15	0.107	0.21	0.170	0.10	0.150
Private insurance subscription	0.08	0.049	-0.14	0.138	-0.03***	0.104
Depression	0.28***	0.053	0.32***	0.121	0.39***	0.098

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$

TABLE 13 Effect on out-of-pocket (OOP) spending and occurrence of catastrophic health expenditure (CHE) among the non-poor with NHI and poor with NHI groups (annual income adjusted)

	OOP spending Log-link GLM		CHE (40%) Logit		CHE (20%) Logit	
	β	SE	β	SE	β	SE
Poor with NHI	-0.17***	0.060	0.18	0.210	0.35**	0.151
Female	-0.01	0.050	0.04	0.127	0.02	0.098
Age	0.00	0.002	0.01**	0.006	0.01***	0.004
Married	0.40***	0.046	0.35***	0.122	0.53***	0.093
Education						
∈ below high school diploma	0.00	0.059	0.07	0.146	0.12	0.118
∈ high school diploma	0.10	0.085	-0.11	0.212	0.14	0.164
∈ above high school diploma	0.05	0.096	0.16	0.293	0.19	0.213
Occupation						
∈ temporary employee	-0.18	0.178	-1.45**	0.623	-0.39	0.151
∈ employer, self-employed, unpaid family worker	0.04	0.183	-1.20*	0.621	-0.08	0.512
∈ unemployed, economically inactive	0.11	0.177	-0.81	0.607	0.11	0.506
Annual income (log-transformed)	0.34***	0.053	-0.91***	0.199	-0.74***	0.147
Reporting bad health	0.28***	0.046	0.68***	0.117	0.69***	0.087
Chronic disease patient	0.30	0.083	0.45*	0.214	0.44**	0.138
Disabled	0.10	0.092	0.27	0.172	0.16	0.153
Private insurance subscription	0.06	0.050	-0.07	0.143	0.04	0.106
Depression	0.29***	0.052	0.30**	0.121	0.37***	0.099

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$

Discussion

The study found that the poor with NHI group was the most vulnerable group among the Korean population. There were no significant differences in medical utilization between the poor with NHI and non-poor with NHI group except hospital days after controlling for potential bias and between the poor with NHI group and MA beneficiaries except outpatient use. In addition, the poor with NHI group was found to make more OOP spending by 73.55% than did MA beneficiaries and to have a significantly higher chance of experiencing CHE at both the 40% and 20% thresholds compared to the two other groups after equivalized disposable personal income was adjusted. These results demonstrate that the poor with NHI group could be the most vulnerable population based on medical service utilization and OOP spending. This assumption is in agreement with the results reported by several other studies. MA beneficiaries were found to use more inpatient and outpatient services, incurred less OOP spending, and had a lower chance of experiencing CHEs compared to NHI members [8, 28]. A study which defined the poor with NHI as people not enrolled in MA with income less than 120% of the minimum cost of living found that MA beneficiaries experienced significantly higher health care utilization in terms of both outpatient visits and inpatient visits, and lower health care costs and proportion of OOP spending to income compared to the poor not enrolled in MA [15]. However, contrary to previous findings, this study shows that the difference in medical

utilization only applies to outpatient visits among MA beneficiaries and the poor with NHI. Furthermore, the expected number of hospitalized days for the MA group was estimated to be 31% smaller than the poor with NHI group. There can be two possible explanations. First, this might demonstrate the effect of recent policy changes. CHE support for the population below 50% of the median income, which matches the defined poor with NHI population in this study, was implemented for severe diseases in 2013 and expanded to all diseases in inpatient service in 2018 [29]. Additionally, the current administration implemented an NHI coverage expansion in 2017 by alleviating uncovered services and restricting the OOP spending threshold to 10% of annual income for the bottom 50% income group [30]. Because previous research was based on data from before 2016, the findings do not reflect these recently implemented policies affecting the medical utilization of the poor with NHI. Further study is needed to examine the effects of this recent policy change on medical utilization among the poor with NHI. Second compared to outpatient services, inpatient services rely more on the decision of health experts than the patient's discretion [31, 32]. Hospitalization and length of stay are affected more by health experts, commonly physicians, so factors of individual patients may not affect inpatient service to a great degree.

In comparison with the poor with NHI and the non-poor with NHI group, the finding suggests that the poor with NHI had less OOP spending, but had a higher chance of CHE occurrence in both

20% and 40% threshold compared to the non-poor with NHI group. This is because the absolute income of the poor with NHI group is smaller compared to the non-poor with NHI, as the mean value of income in the poor with NHI is about 26.04% of the man value of income in the non-poor with NHI, although the OOP spending of the poor with NHI is about 64.06% of the non-poor with NHI. The relatively high OOP spending as considering the small annual income in the poor with NHI group can be an explanation for the higher chance of CHE in the poor with NHI group compared to the non-poor with NHI group. This explanation can be supported by the study's result that the annual income has positive effect on the amount of OOP spending, but has a negative effect on the occurrence of CHE in both 40% and 20% threshold.

The presence of chronic disease was significantly associated with greater numbers of outpatient and inpatient visits among the three study groups but was not related to OOP spending and CHEs beyond the case of the CHE threshold of 20% among NHI members. Chronic disease has been confirmed in several studies as a significant factor in determining outpatient service use, such as the number of outpatient visits [33]. Because the average age of this study population is high, the presence of chronic disease likely influences higher inpatient use due to a lack of proper self-management [34, 35]. Additional focus is required on chronic disease prevention by empowering the population through strengthening education. Self-management programs must be

supported in order to mitigate hospitalization due to chronic disease. Also, the perceived negative health status was associated with a higher volume of outpatient and inpatient use. Perceived negative health status can lead to poor physical health and greater social isolation [36]. Thus, self-evaluated health status must be considered in the development of health promotion programs among both MA beneficiaries NHI members.

In the comparison of hospitalized days and private health insurance subscription among the poor with NHI and non-poor with NHI groups, the conflict result of Poisson and logit estimators may reflect the different characteristics of subgroups among the poor with NHI and subscribers to private health insurance [24]. For hospitalized days, it may indicate a subgroup among the poor with NHI, which may have both a higher number of hospitalized days overall and a greater probability of no hospital visits. This might indicate the possibility of preventable hospitalization due to a lack of hospital visits. Because of the socioeconomic status of the poor with NHI, it can be presumed that they felt a significant financial burden from hospital visits [37]. Insufficient hospital visits could result in deterioration of health and eventually hospitalization and longer length of stays. For private health insurance subscription, it might indicate that the subgroup of subscribers may have a lower number of hospital visits overall but less probability of no hospital visits.

South Korea has constantly implemented expansions of NHI

coverage and pursued the reduction of copayments and support programs for CHEs among the poor with NHI population to ensure proper health care use and to prevent impoverishment by health care costs. Despite these efforts, several studies, including this study, have demonstrated that the poor with NHI population still remains unprotected from the occurrence of CHEs. Moreover, previous studies have found that the poor with NHI population is reported to experience higher unmet needs compared to MA beneficiaries [13. 38]. An expansion of MA could be considered an alternative for alleviating this burden and ensuring essential health services among the poor with NHI. Lee (2020)[14] found that people who shifted from NHI to MA increased their number of outpatient visits without increasing OOP spending. A more focused policy regarding populations in a blind spot within the health care system, including perceived health status and chronic disease, is required to ensure essential health services for the poor with NHI group.

This study has certain limitations and strengths. These findings may not be generalizable to other countries with different medical utilization and OOP spending programs. This study conducted a cross-sectional analysis including 516 MA beneficiaries, 915 among the poor with NHI, and 1,492 in the non-poor with NHI group after matching, which could be an insufficient sample size for analysis using several independent variables. Second, the study could not resolve the issue of supply-induced

demand among MA beneficiaries. Third, although using propensity score matching to adjust the potential bias, the study could not examine several factors that may influence medical utilization and OOP spendings due to a lack of data. Finally, given the limits of the data, the study could not identify the use of uncovered medical services because medical services were not categorized as covered or uncovered services. Because several high-quality medical services offered in South Korea are uncovered by either MA or NHI, the study cannot verify the quality of medical service that respondents used. Future research should examine various factors that may influence medical utilization and OOP spendings, including variables such as unmet need, health service quality, and service accessibility-related factors.

The strengths of this study include its analysis of socioeconomic and health-related factors and the use of several statistical methods to accommodate the unique characteristics of outcome variables and minimize potential bias. In addition, the study examined the medical utilization and OOP spendings of non-poor with NHI group not included in previous studies [39].

Conclusion

This study found that the poor with NHI population showed no significant difference in medical utilization compared to the MA and non-poor with NHI groups, but that they incurred greater OOP spending and were exposed to a higher chance of experiencing CHE. This result indicates that the poor with NHI group is the most vulnerable within South Korea's population. Health policy needs to take into account this vulnerability of the poor with NHI population and several factors, such as chronic disease and perceived health status, that significantly influences medical use and cost in order to ensure essential services and provide protection from impoverishment by health care costs.

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국문 초록

차상위계층의 본인부담의료비 지출과
과부담의료비 발생 및 의료이용 행태 분석

박수열

보건학과 보건정책관리학 전공

서울대학교 보건대학원

한국의 차상위계층은 의료급여제도에서 제외된 저소득층으로 정의되며, 한국의 국민건강보험의 부족한 보장성으로 인해 높은 본인부담금과 충분하지 못한 의료이용을 경험하고 있다. 따라서 이 연구는 한국의 차상위계층에 있어 의료이용, 본인 부담 비용, 그리고 재난적 의료비 발생 행태를 확인하고자 한다.

2018년 한국 복지패널에 기반해 횡단면 연구가 수행되었다. 대상을 의료급여 수급자, 차상위계층, 비차상위계층 건강보험가입자로 분류하였다. 의료급여수급자는 중위소득 50% 이하의 의료급여 수급자, 차상위계층은 중위소득 50% 이하 중 건강보험 가입자, 비차상위계층 건강보험 가입자는 중위소득 50% 초과 중 건강보험 가입자로 정의되었다. 의료급여 수급자와 차상위계층, 그리고 차상위계층과 비차상위계층 건강보험 가입자간 성향점수 매칭을 수행하여, 외래이용에 대한 음이항회귀분석, 내원 이용에 대한 영과잉 포아송회귀분석, 본인 부담 의료비 지출에 대한 로그 연결 일반화 선형모형, 그리고 재난적 의료비 발생에 대한 이항형 로지스틱 회귀분석을 수행하였다.

분석 결과, 의료이용에 있어 의료급여 수급자가 차상위계층과 비

교해 외래 이용을 더 많이 하는 것을 제외하면 의료이용에 있어 집단 간 차이는 유의미하지 않았다. 하지만, 차상위계층이 의료급여 수급자와 비차상위 계층 건강보험 가입자와 비교해 유의하게 본인 부담 의료비 지출이 높았고, 재난적 의료비 발생 가능성이 높았다.

본 연구에서는 이러한 결과를 바탕으로 차상위계층이 한국의 의료보장체계에서 가장 취약한 계층임을 확인하였다. 이후 보건 의료 정책은 차상위계층의 취약성을 고려하여 이들의 취약성을 감안한 정책 구성을 구성해야 할 필요가 있다.