

Effect of Private Health Insurance on Medical Expenditure and Unmet Medical Needs: Evidence from South Korea

Hyounghim Choi¹, Young-il Jung²

¹Assistant Professor, Department of Nursing, Hansei University, Gyeonggi-do, Republic of Korea;

²Assistant Professor, Department of Environmental Health, Korea National Open University, Seoul, Republic of Korea

ABSTRACT

South Korea is experiencing increases in private health insurance (PHI). The purpose of this study is to examine the role of PHI on medical expenditure and unmet medical needs. This longitudinal study used data from the nationally representative 2011–2014 Korea Health Panel Survey (KHPS). Propensity score matching was performed to control the endogeneity from enrolling in PHI for the sake of healthcare utilization. Fixed-effects panel data analyses were performed to control for time-invariant factors. The final matched sample of 2,390 participants was retained throughout the study period. In this study, about 83.4% of the participants were covered by PHI in 2011 (fixed benefit 70.2%, indemnity 29.8%). Results from the fixed effects analysis with matched panel data showed that the impact of PHI on personal medical expenditure and unmet medical needs was not statistically significant. However, it was found that PHI had a positive and statistically significant influence on out-of-pocket (OOP) expenditure at point of use, including that for non-covered services. Particularly, indemnity type insurance plans had a large effect on OOP expenditure. The results show that PHI increased OOP expenditure but failed to decrease unmet medical needs. Additional analyses of the contribution of PHI and exploration of policy alternatives are required.

Keywords: Private health insurance, Healthcare expenditure, Out-of-pocket expenditure, Unmet medical needs, Republic of Korea.

Introduction

South Korea has a national health insurance (NHI) system in the form of universal public health insurance¹. NHI was established as a public security system only recently; it involves a low healthcare expenditure level compared to GDP and has excellent health outcomes². However, when NHI coverage is calculated as the ratio of public resources to individual medical expenditure, the resulting rate of 55.1% is far lower than the Organisation for Economic Cooperation and Development's (OECD) average of 73.0%³. Private Health Insurance (PHI) is

used as supplementary health insurance to compensate for the limited coverage.

Recently, South Korea has been experiencing increases in PHI coverage due to insufficient public coverage rates¹. The expansion of the PHI market creates the possibility of the over-consumption of medical services, that is, the possibility of moral hazard for medical consumers who have joined both public health insurance and PHI⁴. Also, the recent rapid increase in medical expenses among OECD countries has contributed to the possibility of moral hazard caused by PHI⁵. The question is whether healthcare consumers who join PHI increase their demand for real medical expenses after contracting with PHI⁴. The effect of PHI has been debated. Many studies have reported that PHI has a positive impact on outpatient expenditure, but the effect on inpatient expenditure was not consistent^{6,7}. In recent years, there have been studies analyzing the effect of indemnity PHI on the utilization of medical services due to the rapid increase in the subscription

Corresponding Author:

Young-il Jung
Assistant Professor,
Department of Environmental Health,
Korea National Open University,
Seoul, Republic of Korea.
Email: extra012@knou.ac.kr

rate of indemnity PHI; the results differed depending on the sources and research methods^{1,8,9}. Although several studies have quantitatively demonstrated the relation between PHI and medical utilization, to quantify the causality between them, it is necessary to address the issue of the endogeneity of insurance variables⁹.

So far, there are few studies concerning the impact of PHI on healthcare equity¹⁰. PHI is expected to reduce unmet medical needs, as a supplementary role in coverage and depth, but the Korean NHI has a high incidence of unmet medical needs¹¹. Unmet medical needs is an important issue to identify and improve in terms of policy, because diseases can worsen and complications can arise if a problem is not treated in a timely manner; thus, it is also important to understand the relationship between PHI and unmet medical needs¹⁰. Some studies used propensity score matching to counter the endogeneity issues, while others applied panel data analysis to examine the longitudinal effect of PHI on healthcare utilization and expenditure^{6,7}. One small study applied both methods to analyze the effect of PHI on medical expenditure, but no study has yet investigated the impact of unmet medical needs on PHI. The purpose of the current study was to examine the role of supplementary PHI on medical expenditure and explore the impact on unmet medical needs.

Materials and Method

Materials: The data for this study are based on the 2011–2014 data from the Korea Health Panel Survey (KHPS). The KHPS has been conducted since 2008 to provide the Korean government with data about medical expenditure and appropriate healthcare utilization rates. The representative sample of households was selected using a two-step probabilistic stratified cluster method and each household member was surveyed. Items concerning demographic characteristics, health status, and healthcare utilization were covered. Respondents' medical expense histories were retrieved from actual receipts, allowing us to identify specific costs and out-of-pocket payments. Also, survey items specifically addressed enrollment in PHI plans. The analysis excluded participants under 20 years of age, as younger citizens may have limited decision-making experience regarding healthcare utilization, and those over 65, as they have restricted private insurance enrollment.

Method

Measurements: The independent variables were enrollment in PHI (non-enrollment, enrollment) and type of insurance (non-enrollment, fixed-benefit, indemnity). We classified those enrolled in both types of insurance as having indemnity-type insurance plans, under the assumption that health service utilization will be influenced more heavily by them. Dependent variables were: (1) total medical expenditure, (2) out-of-pocket expenditure, and (3) experience of unmet medical needs. Variables (1) and (2) are annualized personal medical expenditures for outpatient services, inpatient services, and emergency services; (1) includes covered NHI expenses and out-of-pocket expenditures, and (2) refers to only out-of-pocket expenditures at point of use. This measure of medical expenditure relied on information from receipts and household accounts to mitigate problems caused by recall bias (which occurred in general surveys) or by inaccurate measurement of the overall payment (which occurred in administrative data due to non-covered expenditures). Because of the skewed nature of the distribution of medical expenditure, log transformation was applied for normalization. In (3), an unmet medical need was defined as an individual feeling that they had been unable to access treatment for medical needs experienced over the past year.

Covariates included demographic variables such as sex, age, marital status, education level (middle school graduate, high school graduate, college, and above), income (quintiles), and participation in the labor force, as well as health variables such as the diagnosis of chronic disease, physical activity, and self-rated health.

Statistics Analysis: The characteristics of the sample will be different depending on enrollment in PHI. Because enrollment in PHI is based on individual choice, the tendency for those who are more likely to utilize health services to enroll may lead to the problem of endogeneity. To overcome this problem, we utilized propensity score matching (caliper matching) techniques. Propensity score matching was carried out based on individual data from the 2011 dataset, including information on demographics (age, sex, marital status, education level, income level, labor force participation) and health status (chronic disease, smoking, physical activity, and self-rated health). Matching was done with greedy matching without a replacement option, with nearest neighbor

matching within the caliper (0.01). We 1:1 matched 7,470 individuals (6,227 with PHI and 1,243 without PHI) and extracted 2,390 individuals as our matched sample (1,195 with PHI, 1,195 without PHI).

To use an analytic model that controlled for confounding factors influencing medical expenses and the experience of unmet medical needs, we conducted both fixed-effect panel data analysis and ordinary least squares (OLS) regression with pooled longitudinal data. The panel data analysis was carried out to control for time-invariant factors. The Hausman test was applied to the fixed-effects and random-effects models for error analysis. The null hypothesis was rejected at the 1% significance level, and the fixed-effects panel model was adopted. We validated the heteroscedasticity robust Hausman-Robust test for panel data serial correlation introduced in Born & Breitung¹².

We tested for correlation between the variables and multicollinearity. Correlation among variables was not significant and the variance inflation factor was below 2, confirming that multicollinearity was not a concern. Statistical analyses were conducted using Stata (ver. 15) software.

Results and Discussion

The sample size was 7,470, with 1,243 who did not have any supplementary PHI (only NHI) and 6,227 who were enrolled in PHI plans (PHI + NHI). After matching, 50.0% of the 2,390 respondents had PHI.

Demographic characteristics of the sample are as follows. Before matching, there were a higher proportion

of females among those with PHI, with 47.78% male and 52.22% female, compared to 54.79% male and 45.21% female among those without PHI. Average age was 43.7 in the PHI group and 42.6 in the non-PHI group. Among those with PHI and those without PHI, 75.96% and 51.01% were married, respectively. The proportion of those with college degrees was 36.73% in the PHI group and 28.72% in the non-PHI group. Distribution of income quartiles was higher in the PHI group (3.7 ± 1.2) than in the non-PHI group (3.0 ± 1.3). We found that 68.32% of the PHI group were still in the labor force, compared to 60.02% of the non-PHI group.

As for health-related characteristics, a higher proportion of the PHI group (50.92%) had a diagnosis of a chronic disease compared to the non-PHI group (44.49%). Among those with PHI, 81.99% participated in physical activity compared to 77.56% among those without PHI. Finally, 48.97% of those with PHI rated their health as “good” compared to 45.09% of those without PHI. After matching, there were no significant differences in demographic or health-related factors between the PHI and non-PHI group [Table 1].

We observed the effect of enrollment in supplementary PHI on personal medical expenditure. After matching, enrollment in PHI was found to increase medical expenditure in the pooled OLS model, but the effect was not significant in the fixed-effects panel model. Unlike the pooled OLS model, the panel data analysis, which controls for unobserved factors, found that total individual medical expenditure did not increase due to enrollment itself. The results were similar before and after matching.

Table 1: Basic Characteristics of Participants

		Before matching (n=7,470)			After matching (n=2,390)		
		Without PHI (n=1,243)	With PHI (n=6,227)	p-value	Without PHI (n=1,195)	With PHI (n=1,195)	p-value
		%	%		%	%	
Gender	Male	54.79	47.78	<.001	52.72	52.97	0.902
	Female	45.21	52.22		47.28	47.03	
Age	mean ± SD	42.6 ± 14.0	43.7 ± 11.8	0.005	44.5 ± 14.0	44.3 ± 13.7	0.724
Marriage	No	48.99	24.04	<.001	43.6	47.03	0.092
	Yes	51.01	75.96		56.4	52.97	
Education	Middle school	24.30	18.18	<.001	27.28	27.45	
	High school	46.98	45.09		44.18	45.86	
	University	28.72	36.73		28.54	26.69	

Conted...

Income	mean \pm SD	3.0 \pm 1.3	3.7 \pm 1.2	0.220	3.0 \pm 1.3	2.9 \pm 1.2	0.220
	1st quintile	13.77	4.15		13.05	11.63	
	2nd quintile	24.96	15.17		25.1	28.7	
	3rd quintile	26.49	22.53		27.45	25.86	
	4th quintile	17.95	27.59		17.99	22.26	
	5th quintile	16.83	30.58		16.4	11.55	
Employment status	Economically active	60.02	68.32	<.001	63.51	61.76	0.375
	Inactive/unemployed	39.98	31.68		36.49	38.24	
Chronic disease	Yes	44.49	50.92	<.001	48.03	48.28	0.902
	No	55.51	49.08		51.97	51.72	
Smoking status	None-smoker	60.05	62.84	0.024	60.17	60.08	0.908
	Ex-smoker	12.82	13.77		13.31	12.8	
	Current smoker	27.12	23.39		26.53	27.11	
Physical activity	No	22.44	18.01	<.001	21.92	21.51	0.804
	Yes	77.56	81.99		78.08	78.49	
Self-rated health	Good	45.09	48.97	<.001	44.72	46.93	0.303
	Fair	41.94	41.94		42.08	41.9	
	Bad	12.97	9.09		13.21	11.17	
Total medical expenditure	Log	7.8 \pm 5.9	9.7 \pm 5.0	<.001	8.3 \pm 5.8	9.0 \pm 5.4	0.002
Out-of-pocket expenditures	Log	3.0 \pm 5.1	4.1 \pm 5.6	<.001	3.3 \pm 5.2	3.9 \pm 5.2	0.005
Unmet medical needs	No	86.89	83.82	0.013	87.21	81.86	0.001
	Yes	13.11	16.18		12.79	18.14	

PHI: private health insurance

As Table 2 shows, aside from PHI enrollment, those who were older, married, or had a chronic disease or a lack of physical activity had increased medical expenditure. In addition, no significant relationship was found between the type of PHI (non-enrollment, fixed-benefit, indemnity) and individual medical expenditure, with similar trends in statistical significance before and after matching, as shown in Table 2.

Next, we analyzed the effect of supplementary PHI on OOP expenses. After matching, the effect of enrollment in PHI on OOP expenditure was found to be statistically significant in the pooled OLS model. Enrollment in PHI had a significant impact on OOP expenditure in the panel data analysis as well, but the regression coefficient was smaller in the panel data analysis model than in the OLS model, as shown in Table 3.

Table 2: Effect of Private Health Insurance on Total Medical Care Expenditure

		Pooled OLS model		Fixed effect panel model		Pooled OLS model		Fixed effect panel model	
		β	p-value	β	p-value	β	p-value	β	p-value
PHI (ref. without PHI)	With PHI	0.979***	<.001	0.059	0.752				
PHI types (ref. without PHI)	Fixed-benefit type					0.728***	<.001	0.189	0.325
	Indemnity type					1.242***	<.001	0.214	0.277
Gender (ref. Female)	Male	1.437***	<.001	(omitted)		1.413***	<.001	(omitted)	

Conted...

Age		0.040***	<.001	0.135***	<.001	0.042***	<.001	0.132***	<.001
Marriage (ref. No)	Yes	1.309***	<.001	1.643***	<.001	1.314***	<.001	1.638***	<.001
Education (ref. Middle school)	High school	-0.347***	<.001	0.94	0.551	-0.367***	<.001	0.944	0.55
	University	-0.305**	0.001	1.23	0.439	-0.322***	0.001	1.229	0.439
Income (ref. 1st quintile)	2nd quintile	0.138	0.3	0.042	0.784	0.123	0.355	0.039	0.796
	3rd quintile	0.376**	0.004	0.233	0.152	0.352**	0.007	0.231	0.155
	4th quintile	0.485***	<.001	0.098	0.574	0.447***	0.001	0.096	0.581
	5th quintile	0.729***	<.001	0.237	0.209	0.689***	<.001	0.235	0.214
Employment status (ref. Economically active)	Inactive/unemployed	0.276***	<.001	-0.16	0.137	0.293***	<.001	-0.16	0.137
Chronic disease (ref. Yes)	No	-2.958***	<.001	-0.533***	<.001	-2.950***	<.001	-0.532***	<.001
Self-rated health (ref. Good)	Fair	0.469***	<.001	0.111	0.076	0.482***	<.001	0.111	0.077
	Bad	1.383***	<.001	0.217	0.054	1.387***	<.001	0.216	0.055
Physical activity (ref. No)	Yes	-0.078	0.32	-0.265**	0.001	-0.075	0.337	-0.265**	0.001
Constant		6.492***	<.001	1.972	0.234	6.470***	<.001	2.005	0.23
	sigma_u			3.8106926				3.8018073	
	sigma_e			3.276563				3.2765463	
	rho			0.57493915				0.57380027	
	Hausman test			448.95	<.001			454.51	<.001

PHI: private health insurance; * p<.05; ** p<.01; *** p<.001

The effects on OOP expenditure varied by type of PHI. The following are results from the matched fixed-effects panel model. Compared to those without supplementary PHI plans, OOP expenditure increased by 58.6% (Coefficient=0.586, p-value=0.033) for those enrolled in fixed-benefit type insurance plans, and by 108.2% (Coefficient=1.082, p-value<.001) for those enrolled in indemnity-type insurance plans. Both types contributed to an increase in OOP, but the degree of contribution was greater for indemnity-type insurance plans. Covariates associated with increased OOP expenditure in the matched panel data analysis were older age, marriage, chronic disease, and poor self-rated health [Table 3].

Finally, we analyzed the impact of PHI on the experience of unmet medical needs. One of the important benefits that we expect from PHI is improved access to healthcare services when one needs them. The

cases where healthcare was necessary but not utilized were considered to represent unmet medical needs. In the matched fixed-effects panel model, no significant relationship was found between enrollment in PHI and unmet medical needs. Table 4 illustrates that the type of health insurance also did not have any impact on unmet medical needs, and the same results were found in pooled OLS regression results and non-matching analysis [Table 4].

In this study, 83.4% of the participants were covered by PHI in 2011. In the preceding study, the PHI coverage rate was 60% on an individual basis in 2008¹³. The above analysis found that PHI had a positive and statistically significant influence on OOP expenditure, and this finding implies that there is a moral hazard for PHI subscribers in medical utilization. Indemnity-type insurance plans, in particular, had a large effect on OOP expenditure. This result is consistent with previous studies in which PHI

adoption was associated with higher healthcare utilization, and specifically, with an indemnity plan^{9, 13}. In Korea, there is a large deviation in PHI coverage depending on income, the presence of disease, and age¹⁴. In this situation, the increase of medical demand due to the moral hazard of PHI subscribers may have a negative impact on

NHI finances⁴. The present study also showed that older age, marriage, chronic illness, and poor subjective health status increase OOP expenditure. These results correlate with previous findings suggesting that the higher the age of a patient with chronic disease, the higher the OOP expenditure, outpatient visits, and inpatient days⁴.

Table 3: Effect of Private Health Insurance on Out-Of-Pocket Expenditure

		Pooled OLS model		Fixed effect panel model		Pooled OLS model		Fixed effect panel model	
		β	p-value	β	p-value	β	p-value	β	p-value
PHI (ref. without PHI)	With PHI	1.056***	<.001	0.658*	0.014				
PHI types (ref. without PHI)	Fixed-benefit type					0.732***	<.001	0.586*	0.033
	Indemnity type					1.525***	<.001	1.082***	<.001
Gender (ref. Female)	Male	1.592***	<.001	(omitted)		1.552***	<.001	(omitted)	
Age		0.048***	<.001	0.399***	<.001	0.051***	<.001	0.382***	<.001
Marriage (ref. No)	Yes	0.644***	<.001	1.068*	0.012	0.632***	<.001	1.037*	0.014
Education (ref. Middle school)	High school	-0.443***	<.001	1.641	0.468	-0.480***	<.001	1.618	0.474
	University	-0.655***	<.001	2.126	0.35	-0.687***	<.001	2.092	0.358
Income (ref. 1st quintile)	2nd quintile	0.412*	0.018	0.18	0.407	0.383*	0.027	0.173	0.424
	3rd quintile	0.842***	<.001	0.346	0.138	0.799***	<.001	0.336	0.149
	4th quintile	1.152***	<.001	0.227	0.364	1.087***	<.001	0.213	0.393
	5th quintile	1.466***	<.001	0.386	0.154	1.396***	<.001	0.37	0.172
Employment status (ref. Economically active)	Inactive/unemployed	0.507***	<.001	-0.156	0.309	0.535***	<.001	-0.157	0.306
Chronic disease (ref. Yes)	No	-2.439***	<.001	-0.548**	0.006	-2.427***	<.001	-0.545**	0.006
Self-rated health (ref. Good)	Fair	0.559***	<.001	0.163	0.07	0.578***	<.001	0.164	0.068
	Bad	2.213***	<.001	0.403*	0.012	2.225***	<.001	0.402*	0.012
Physical activity (ref. No)	Yes	-0.049	0.629	-0.193	0.099	-0.046	0.652	-0.189	0.107
Constant		1.310***	<.001	-15.576***	<.001	1.234***	<.001	-14.850***	<.001
	sigma_u			5.539799				5.3845681	
	sigma_e			4.6934805				4.6921483	
	rho			0.58214075				0.5683919	
	Hausman test			386.34	<.001			376.06	<.001

PHI: private health insurance; * p<.05; ** p<.01; *** p<.001

On the other hand, this study provides little evidence of a positive association between PHI and unmet medical needs. In a system such as Korea's, where universal health coverage is provided by the public sector, PHI's supplementary nature does not contribute greatly to the reduction of unmet medical needs. This result is consistent with previous studies which reported that there is no

significant correlation between PHI and unmet medical needs¹⁵ but is not consistent with an earlier study which suggested that those who have PHI are less likely to experience unmet healthcare needs, particularly for those who have financial barriers^{11, 16}. However, the results of the present study seem to be more credible because we used propensity score matching to reduce the endogeneity issues,

and a panel data analysis to examine the longitudinal effect of PHI on healthcare utilization and expenditure. The results show that supplementary PHI increased OOP expenditure but failed to decrease unmet medical needs, which implies that rather than providing coverage for essential services, PHI increases healthcare utilization rates at the point of use. Additional analyses of the contribution of supplementary PHI and exploration of policy alternatives are required to address Korea’s rapid increase in medical expenditure. Some of the study limitations are as follows. First, due to the matching procedures, the sample size has been reduced by around half to match the number of those without PHI. Also, there may be errors due to missing medical

expenditure values or input errors. However, the matching procedure was essential to control for endogeneity between enrollment in PHI and healthcare utilization. Medical expenditure information was collected from objective data sources, such as receipts, which reduces the risk of recall bias and implies more reliability than survey response-based data. Also, despite the variety of PHI plans and products with a wide spectrum of coverage based on contracting types, we simplified PHI plans into three types: non-enrollment, fixed-benefit, and indemnity. Careful analysis of the results is required because we grouped both fixed-benefit and indemnity types of insurance together as, simply, indemnity-type insurance.

Table 4: Effect of PHI on Unmet Medical Needs

		Pooled OLS model		Fixed effect panel model		Pooled OLS model		Fixed effect panel model	
		OR	CI	OR	CI	OR	CI	OR	CI
PHI (ref. without PHI)	With PHI	1.054	[0.952,1.166]	1.083	[0.759,1.546]				
PHI types (ref. without PHI)	Fixed-benefit type					1.074	[0.969,1.190]	1.194	[0.831,1.716]
	Indemnity type					1.069	[0.956,1.194]	1.04	[0.715,1.512]
Gender (ref. Female)	Male	1.198***	[1.105,1.299]	1	[1,1]	1.197***	[1.104,1.299]	1	[1,1]
Age		0.997	[0.993,1.002]	0.885***	[0.845,0.927]	0.997	[0.993,1.002]	0.888***	[0.847,0.931]
Marriage (ref. No)	Yes	0.95	[0.860,1.049]	0.578	[0.320,1.042]	0.949	[0.860,1.048]	0.584	[0.324,1.054]
Education (ref. Middle school)	High school	0.884*	[0.791,0.987]	(omitted)		0.884*	[0.792,0.987]	(omitted)	
	University	0.868*	[0.765,0.985]	(omitted)		0.868*	[0.765,0.985]	(omitted)	
Income (ref. 1st quintile)	2nd quintile	0.789**	[0.673,0.926]	0.887	[0.680,1.158]	0.787**	[0.671,0.924]	0.885	[0.679,1.156]
	3rd quintile	0.731***	[0.625,0.856]	0.913	[0.686,1.216]	0.729***	[0.623,0.854]	0.912	[0.685,1.214]
	4th quintile	0.636***	[0.542,0.746]	0.822	[0.604,1.119]	0.633***	[0.539,0.743]	0.824	[0.605,1.121]
	5th quintile	0.560***	[0.476,0.659]	0.783	[0.557,1.099]	0.557***	[0.474,0.656]	0.784	[0.558,1.101]
Employment status (ref. Economically active)	Inactive/unemployed	0.698***	[0.638,0.764]	0.989	[0.801,1.221]	0.698***	[0.638,0.764]	0.99	[0.801,1.222]
Chronic disease (ref. Yes)	No	1.039	[0.951,1.137]	0.922	[0.707,1.203]	1.04	[0.951,1.138]	0.922	[0.707,1.202]
Self-rated health (ref. Good)	Fair	1.924***	[1.766,2.097]	1.745***	[1.539,1.977]	1.925***	[1.767,2.098]	1.746***	[1.540,1.978]
	Bad	3.416***	[3.031,3.849]	2.403***	[1.986,2.907]	3.417***	[3.032,3.850]	2.403***	[1.986,2.908]
Physical activity (ref. No)	Yes	1.132*	[1.018,1.258]	1.222*	[1.046,1.427]	1.132*	[1.018,1.258]	1.223*	[1.047,1.429]
	Hausman test			15.51	0.0166			15.51	0.0166

PHI: private health insurance; * p<.05; ** p<.01; *** p<.001

Conclusion

This study is an empirical analysis of the effects of PHI (enrollment and type) on medical expenditure and the experience of unmet medical needs after adjusting for health status confounders and time-variant factors. The effects of PHI on total medical expenditure and unmet

medical needs are not significant after controlling for endogeneity issues. However, it was found that PHI had a significant effect on the increase of OOP payment at point of use, including payments for non-NHI covered services.

The result reflects that the moral hazard under PHI exists partially, and at the same time, PHI does

not contribute to improving access to necessary care. Therefore, we need to closely monitor the impact of PHI on healthcare expenditure and try to find a way to meet unmet medical needs through reforming NHI with PHI.

Based on the results of this study, it is necessary to look closely at the interactions between PHI subscriptions and medical utilization, and to continuously monitor how the effect of PHI on unmet medical needs and medical utilization changes in such situations. In addition, it is necessary to merge the information about the subscribers held by PHI insurance companies with the information accumulated by NHI, to clearly demonstrate the relationship between PHI coverage and medical expenditure.

Ethical Clearance: Not required

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES

- Choi Y, Kim JH, Yoo KB, Cho KH, Choi JW, Lee TH, et al. The effect of cost-sharing in private health insurance on the utilization of health care services between private insurance purchasers and non-purchasers: a study of the Korean health panel survey (2008–2012). *BMC Health Services Research*. 2015 Oct;15(1):489-99. DOI: 10.1186/s12913-015-1153-0
- Organisation for Economic Co-operation and development. *Health at a glance 2017: OECD Indicators*. [Internet] Paris: OECD Publishing; 2016 [cited 2018 Oct 20] Available from: http://dx.doi.org/10.1787/health_glance-2017-en
- Organisation for Economic Co-operation and development. *OECD Factbook 2015-2016: Economic, Environmental and Social Statistics*. [Internet] Paris: OECD Publishing; 2016 [cited 2018 Oct 20] Available from: <https://doi.org/10.1787/factbook-2015-94-en>
- Lee HB, Nam SW. An empirical study of private health insurance and healthcare utilization. *Korean J Insur Med*. 2013;95(1):1-24. <http://www.papersearch.net/thesis/article.asp?key=3154369>.
- Ruger JP. The moral foundations of health insurance, *QJM*. 2007 Jan;100(1):53-7. DOI:10.1093/qjmed/hcl130
- Jeon BY, Kwon SM. Effect of private health insurance on health care utilization in a universal public insurance system: a case of South Korea. *Health Policy*. 2013 Nov;113(1):69-76. DOI: 10.1016/j.healthpol.2011.05.007
- Sohn, MS, Jung, MS. Effects of public and private health insurance on medical service utilization in the national health insurance system: national panel study in the republic of Korea. *BMC Health Services research*. 2016 Sep;16(1):503-13. DOI:10.1186/s12913-016-1746-2
- Ryu DH, Sin K, Doo YT. Enrollment in private medical insurance and utilization of medical services among children and adolescents: data from the 2009-2012 Korea health panel surveys. *Journal of Preventive Medicine and Public Health*. 2016 Mar;49(2):118-28. DOI:10.3961/jpmph.16.003
- You CH, Kwon YD, Choi JH, Kang SW. Analysis of effect of indemnity private health insurance on medical utilization using instrumental variable regression. *The Journal of the Korea Contents Association*. 2018;18(1):268-76. DOI:10.5392/JKCA.2018.18.01.268
- Lee JE, Kim TH. Association of supplementary private health insurance with unmet health care needs. *J Korea Soc Health Informatics Stat*. 2014;39(1):91-104. <https://e-jhis.org/upload/pdf/21400583.pdf>
- Huh SI, Lee SY. Impact of complementary private health insurance on public health spending in Korea. *Health Policy and Management*. 2007;17(2):1-17. DOI:10.4332 /KJHPA.2007.17.2.001 http://www.koreascience.or.kr/search/articlepdf_ocean.jsp?admNo=BGHJBH_2007_v17n2_1
- Born B, Breitung J. Testing for serial correlation in fixed-effects panel models. *Econometric Reviews*. 2016;35(7):1290-1316. DOI: 10.1080/07474938.2014.976524
- You CH, Kwon YD, Choi JH, Kang SW. The effects of supplementary private health insurance on healthcare utilization and expenditures: indemnity vs. fixed-benefit. *Korean Soc Secur Stud*. 2011;27(1): 277-92. https://www.researchgate.net/profile/Young_Dae_Kwon/publication/284616832_

The_effect_of_supplementary_private_health_insurance_on_healthcare_utilization_and_expenditures_indemnity_vs_fixed-benefit/links/5663176508ae4931cd5ed93b/The-effect-of-supplementary-private-health-insurance-on-healthcare-utilization-and-expenditures-indemnity-vs-fixed-benefit.pdf

14. Park SB, Jung KH. The determinants of private health insurance and its effects on medical utilization in Korea. *Korean Insur J.* 2011;88(1):23-49. <http://www.papersearch.net/thesis/article.asp?key=2908310>
15. Kang SW, You CH, Oh EH, Kwon YD. The impact of having private health insurance on healthcare utilization with controlling for endogeneity. *Korean J Health Econ Policy.* 2010;16(1):139-59. <http://www.papersearch.net/thesis/article.asp?key=2861105>
16. Kim YS, Lee J, Moon Y, Kim KJ, Lee K, Choi J et al. Unmet healthcare needs of elderly people in Korea. *BMC Geriatrics.* 2018 Apr;18(1):98-107. DOI:10.1186/s12877-018-0786-3.