Policy Report 2016-09

The Effects of Private Health Insurance on Health Care Use

Hyeonung Shin

KIHASA
Korea Institute for Health and Social Affairs

The Effects of Private Health Insurance on Health Care Use

Hyeonung Shin, Senior Research Fellow

Korea Institute for Health and Social Affairs
Building D, 370 Sicheong-daero, Sejong city 30147 KOREA
http://www.kihasa.re.kr
ISBN: 978-89-6827-339-1 93330

Contents

List of Tables

List of Figures

I Introduction

I Introduction

Although the Korean government provides universal health insurance, the limited nature and range of the actual benefits it provides imposes a significant financial burden on households in terms of health care. Accordingly, the Korean government has been promoting private health insurance (PHI) as supplements to the National Health Insurance (NHI).

Since their introduction in Korea in the late 1970s until 2000, private health insurance plans (PHIPs) functioned as "fixed-benefit" indemnity plans that covered such health risks as lifestyle diseases and cancer. After 2001, with the launch in the previous year of the universal National Health Insurance, PHIPs have increasingly become indemnity insurance for out-of-pocket expenses, effectively supplementing the universal scheme (Oh, 2003; Jeong, 2006).

The proliferation of PHI is a double-edged sword, as it enhances the accessibility of healthcare on the one hand, and aggravates health inequality and the financial condition of the NHI, on the other (Park, 2010). PHIPs do serve to reduce individuals' out-of-pocket expenses, and thereby improve their access to healthcare. However, with more healthy and well-off people participating in PHIPs, they tend to aggravate health in-

equality and reduce the perceived cost of health care, encouraging moral hazard in health consumption and consequently weakening the fiscal condition of the NHI.

〈Table 1〉 Pros and Cons of PHIPs

Pros		Cons
Improved access to healthcare à less healthcare inequality	VS	Adverse selection à greater health inequality
Improved access to healthcare à greater range of needs satisfied		Moral hazard à increasing fiscal constraints

In recent years, the impact of PHIPs on health care usehas been an important topic of research in Korea (Kang et al., 2005; Jeong et al., 2006; Yun et al., 2008; and Lee et al., 2011). However, the lack of consistency in the data and methods employed by these numerous studies has made it impossible to establish a consensus on the significance of PHIPs and the extent to which they affect Korean consumers' access to, and use of, healthcare.

〈Table 2〉 Opinions Regarding the Impact of PHIPs on Healthcare Use

PHIPs affect use of health care by:		PHIPs do not affect use of healthcare because:
Triggering and increasing moral hazard among health care users	VS	They lose their effect on health care users' behavior when endogeneity is controlled
Reinforcing supplier-induced demand for health benefits and services		They have the opposite effect due to the selective bias of PHIP companies

As the Korean government continues to increase the range of benefits provided under the NHI and the PHI market in Korea continues to grow, it will become all the more necessary to clarify the respective roles of the public and private health insurance plans and find a rational way of balancing their roles. The established literature, however, points to different conclusions due to the differences in research objectives, sources of data used, targets analyzed, and methodologies. The existing studies, in other words, fail to provide reliable information for policymaking. It is therefore crucial to conduct reliable and valid research on the relationship between the NHI and PHIPs and provide a more objective basis for policymaking and public understanding.

This study, therefore, empirically analyzes the impact of PHIPs on the use of healthcare services, with a view to setting a rational division of roles between the NHI and PHI.

II

Literature Review

II Literature Review

As shown in Table 3, PHIPs can be distinguished, depending on differences in their coverage and whether the insured are also enrolled in the NHI, into four type: supplementary, complementary, duplicate, and substitutive (OECD, 2004).

PHIPs of the supplementary type, which provide additional coverage for health services not covered by public insurance, are becoming increasingly popular in Korea and other OECD countries.

Complementary PHIPs cover all or part of the user's co-payments for services that are reimbursable in part under a public health insurance plan. Complementary PHIPs are available in Sweden, Denmark, Luxembourg, and Ireland, among others. The "fixed-benefit" indemnity plans in Korea are PHIPs of the complementary type.

PHIPs of the duplicate type cover the same range of health benefits and services as the NHI, but use different channels and sources. These are found in the United Kingdom, Australia, and New Zealand.

The substitutive type allows individuals to choose between a public health insurance plan and a PHIP, and is found in Chile and Mexico. Germany also allows certain groups (e.g., high-income households) to choose a substitutive insurance plan.

〈Table 3〉 Types of PHIPs

			NHI enrollment	
			No	Yes
Scope of PHI coverage	Also covered by NHI	Benefits	Duplicate	Substitutive
		Out-of-pocket	Complementary	
	Not covered by NHI	No benefits	Supplementary	

Source: OECD (2004)

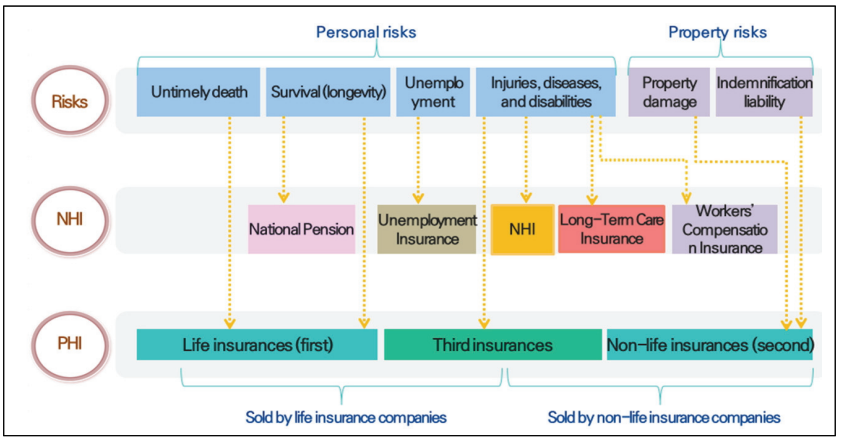
Korea's Insurance Business Act (IBA) divides PHIPs into three types, i.e., life insurance, non-life insurance (indemnity), and "third" insurance. PHIPs, to be specific, fall under the category of third insurance (Cho et al., 2011). The IBA defines a third insurance as a contract through which an insurance provider receives "money from the insured in return for promising the payment of agreed benefits to the insured for any disease, any injury and any nursing thereof or for indemnifying damage caused by such disease, such injury and such nursing for the insured" (Article 2.4).

〈Table 4〉 Types of Private Insurance in Korea

	Life insurance	Non-life insurance	Third insurance
Insurable risks	Survival or death	Property losses	Injuries, diseases, and nursing care
Duplicate insurances (insurable excess)	No	Yes	Yes, but only regarding benefits for actual expenses
Payment of insurable	Fixed benefit	Indemnity	Fixed benefit, indemnity
Eligibility	Persons to be insured against insurable risks	Persons entitled to reimbursements/indemnification	Same as non-life insurances
Term	Long-term	Short-term	Long-term

Source: Baek et al. (2011).

[Figure 1] Categorization of Private Insurances by Company and Risk Type



Source: Posting on a personal blog, http://gren26.blog.me/220400003981, rearranged.

Depending on how the insurance benefits are paid, PHIPs can be categorized as either fixed-benefit or indemnity plans (Cho et al., 2011).

Fixed-benefit plans provide agreed amounts of benefits upon the actualization of insurable health risks, regardless of whether the insured seek out and use available healthcare services. The goal of this type of insurance is to protect the insured against possible losses of income resulting from injuries or diseases, thereby filling any gap in theNHI. Indemnity PHIPs, on the other hand, compensate the insured for the actual amount of health care expenses they pay or actual losses to their income due to hospitalization or any other health care services they require. In Korea, indemnity PHIPs insure consumers against out-of-pocket expenses required under the NHI, as well

as against the costs of healthcare services priced by the Health Insurance Review Agency (HIRA) and individual medical institutions. All such PHIPs in Korea are designed according to the "negative principle," covering all diseases except for a handful of exceptions. However, there is the possibility that moral hazard could arise, such as situations where one holds multiple PHIPs and claims overlapping benefits or claims benefits for healthcare services one has not actually used. Indemnity plans may induce the latter kind of behavior, while fixed-benefit plans (particularly those that base the benefits amounts on daily inpatient care expenses) may encourage the former.

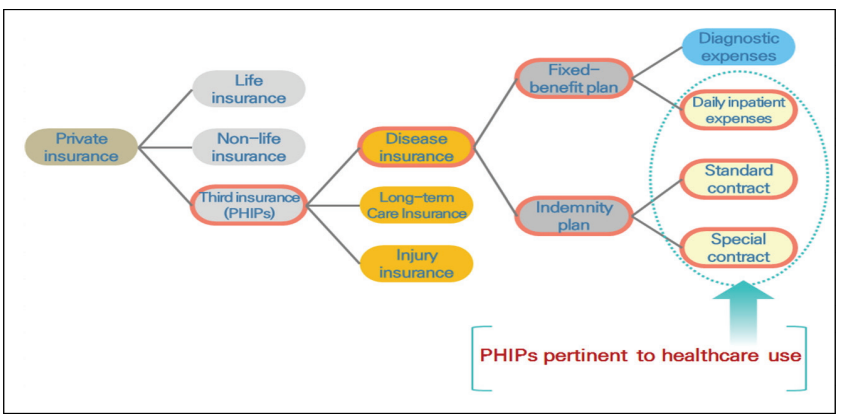
〈Table 5〉 Categorization of PHIPs by Payment Type

Type	Indemnity plans	Fixed-benefit plans	
		Daily hospitalization expenses	Diagnostic expenses
Purpose	To protect the insured against actual expenses or costs	To protect the insured against possible income losses due to injuries, diseases, etc.	
Scope of coverage	Negative list (enumerating risks not covered)	Positive list (enumerating risks covered)	
Insured risks	Hospitalization, outpatient services, and prescriptions	Hospitalization-centered (but also including diagnoses, surgery, care, and complications)	
Amount of benefits	Reimburse part of actual expenses/costs	Amount agreed upon contract	
Multiple insurance holders	Proportional reimbursements (so that the sum of all reimbursements do not exceed actual expenses)	Contract-defined amounts paid irrespective of the benefits amounts provided by other insurances	
Insurance basis	Actual use of healthcare services		Actualization of contract-defined health risks
		Factors that could possibly induce moral hazard	

Source: Cho et al. (2011) rearranged.

Fixed-benefit plans can be divided into those that base the benefits on diagnostic expenses and those that base the benefits on daily inpatient expenses. Indemnity PHIPs[1] can be divided into standard coverage and special coverage. The daily-hospitalization fixed-benefit PHIPs and both types of indemnity PHIPs are pertinent to our analysis.

[Figure 2] Types of PHIPs Pertinent to Analysis of Healthcare Use



In Korea, reimbursing PHIPs decide the amounts of benefits to be paid by subtracting the mandatory out-of-pocket expenses from the sum of the care or health insurance benefits stipulated by the NHI Act or Medical Care Assistance Act and the costs of healthcare services not covered or priced by the government.

1) That is, the indemnity type as defined after the standardization of indemnity PHIPs in 2009.

〈Table 6〉 Scope of Insurance under Reimbursing PHIPs

<table>
<tr><td rowspan="2"></td><td colspan="3">Healthcare services covered by NHI</td><td colspan="2">Healthcare services not covered by NHI</td></tr>
<tr><td colspan="2">Partial out-of-pocket expenses</td><td rowspan="2">Total out-of-pocket services (C)</td><td rowspan="2">Priced by HIRA (D)</td><td rowspan="2">Priced by medical institutions (E)</td></tr>
<tr><td>Care benefits (A)</td><td>Out-of-pocket services (B)</td></tr>
<tr><td>Who pays</td><td>NHIS* (A)</td><td colspan="4">Patient (B+C+D+E)</td></tr>
<tr><td>PHI insured</td><td>n/a (A)</td><td colspan="3">Insured (B+C+D)</td><td>n/a (E)*</td></tr>
</table>

Note: NHIS = National Health Insurance Service. Persons who entered PHI contracts prior to April 2013 can claim up to 40 percent of the expenses paid for services priced by individual medical institutions. Persons who entered PHI contracts later are not eligible.

Source: IBA, as summarized in Cho et al. (2011).

III

Methodology

1. Analysis model
2. Data for analysis
3. Variables
4. Testing instrumental variables

III Methodology

Based on our comprehensive analysis of the methods and data used in previous studies, we designed a system to empirically analyze the correlation between PHIPs and health care use in Korea.

First, most of the previous studies made use of secondary data that could possibly harbor recall bias. To avoid this issue, we matched the secondary data provided by medical panel surveys with the actual (primary) data provided by NHI claims compiled by the National Health Insurance Service (NHIS), and used the primary data.

Second, most of the previous studies relied on cross-sectional data or time-series data spanning periods of two to three years and lacked a sufficient number of samples. These limitations on their data made it impossible to identify and test the exact causal relationships involved. We therefore used panel (both cross-sectional and time-series) data over a period of six years so as to ensure a sufficient number of samples and the exactitude of the causal relationship identified.

Third, as the previous studies did not test or control for endogeneity, their results suffer from serious reliability issues. In this study, we first tested for possible endogeneity in order to determine the right models of analysis to use, thereby ensuring

the reliability of the analysis results. In particular, unlike the previous studies that focused solely on whether actual endogeneity was controlled, we paid attention even to the possibility of biases that could have arisen from controlling for endogeneity that did not exist in the first place.

Fourth, the previous studies used only a limited range of control variables, and therefore struggled to control for endogeneity and the overestimating tendency of their findings. In this study, to the extent necessary to prevent the problem of multicollinearity, we employed as many control variables as possible so as to enhance the precision of our endogeneity test results and the reliability of our analysis results.

Fifth, the previous studies focused on individual correlations between health care use and increases in health spending. This focus on individual correlations has made it difficult to gauge how PHIPs affect the total spending on health care because, in those studies, small amounts of health care spending coincided with probabilities for increases in medical spending, and vice versa. To avoid this problem, we used a two-part model to take into account the total health care use and total health spending and thereby analyze the total marginal effect. As a result, it is possible to use the findings of our study to estimate the extent to which PHIPs cause health expenses to increase (or decrease) on average.

The major independent variables of our analysis are whether

one holds a PHIP, or multiple PHIPs, and how many PHIPs one holds. The major dependent variables are the number of inpatient days, the number of outpatient visits (as measures of the volume of health care use) and the amount of health insurance benefits (as a measure of health spending).

1. Analysis model

1) Inpatient stay and outpatient visits

〈Table 7〉 Inpatient Days and Outpatient Visits as Dependent Variables

Independent variable	Dependent variable	Analysis model	
		Base model	Endogeneity and valid instrumental variables
PHI holders	Number of outpatient visits	NB2 negative binomial (Count data model)	2SRI-NB2 two-stage residual inclusion
	Number of inpatient days	NB2 negative binomial (Count data model)	2SRI-NB2 two-stage residual inclusion
Number of PHIPs held	Number of outpatient visits	NB2 negative binomial (Count data model)	2SRI-NB2 two-stage residual inclusion
	Number of inpatient days	NB2 negative binomial (Count data model)	2SRI-NB2 two-stage residual inclusion

Of the count data models, a negative binomial model combined with the Poisson model with error terms formed our base model. Where there were endogeneity and valid instrumental variables involved, we used a 2SRI-NB2, two-stage residual inclusion model. In the case of models whose dependent varia-

bles are count data indicated as non-negative integers, such as the number of outpatient visits, applying a linear regression analysis that assumes a normal distribution could lead to serious errors. For this reason, a count data model, and not a regression analysis model, is the proper choice with respect to count data.

The Poisson distribution is the most common count data model used. It represents the distribution of both the frequency and probability of a given event taking place randomly in a given period of time or space.

Lacking error terms, however, the Poisson distribution posits the rigid assumption that the mean and dispersion of the sample distribution ought to be identical. Over-dispersion, i.e., where dispersion exceeds the mean, is not uncommon in reality.

The over-dispersion of data could compromise the efficiency of the analysis model and undermine the reliability of the statistical hypotheses. In general, researchers seek to avoid this problem by using negative binomial models, which combine the Poisson distribution with error terms (Cameron and Trivedi, 1986).[2)]

2) Cameron, A. C., and Trivedi, P. K. "Econometric models based on count data: Comparisons and applications of some estimators and tests." *Journal of Applied Econometrics* (1986); 1: 29-53.

[Figure 3] Negative Binomial Model Formula

$$y_{it} \sim Poisson(\mu_{it}^{*})$$

where

$$\mu_{it}^{*} = E\{y_{it}|phi_{it}, x_{it}'\} = exp(\beta_1 phi_{it} + x_{it}'\beta + offset_{it} + \epsilon_{it})$$

and

$$e^{\epsilon_{it}} \sim \gamma\left(\frac{1}{\alpha}, \alpha\right)$$

Where there are endogeneity and valid instrumental variables, we use the 2SRI-NB2, two-stage residual inclusion model.

[Figure 4] 2SRI-NB2 Model Formula

$$E\{y_{it}|phi_{it}, x_{it}'\} = exp(\beta_1^{2SRI} phi_{it} + x_{it}'\beta^{2SRI} + \hat{v}_{it} + \epsilon_{it})$$

We estimated the average marginal effect (AME) using the finite-difference method in order to estimate the impact of PHIPs on the number of inpatient days.

[Figure 5] Average Marginal Effect Formula

$$AME = E\{y_{it}|phi_{it} = 1, x_{it}'\} - E\{y_{it}|phi_{it} = 0, x_{it}'\}.$$

2) Health insurance benefits

We analyze health insurance benefits as a dependent variable in a two-part model. Two-part models are used with respect to dependent variables, which, like health care spending, have zero values (e.g., where nohealth care spending is generated).

〈Table 8〉 Model of Analysis for NHI Benefits as Dependent Variables

Independent variables	Dependent variables	Model of analysis		
		Base model		With endogeneity and valid instrumental variables
PHI enrollment	NHI benefits: outpatient	Probability of use	Probit (Two-part expenditure model)	IV Probit
		Amount of spending	OLS (Two-part expenditure model)	efficient two step GMM
	NHI benefits: inpatient	Probability of use	Probit (Two-part expenditure model)	IV Probit
		Amount of spending	OLS (Two-part expenditure model)	efficient two step GMM
	NHI benefits: pharmacy use	Probability of use	Probit (Two-part expenditure model)	IV Probit
		Amount of spending	OLS (Two-part expenditure model)	efficient two step GMM
Number of PHIPs	NHI benefits: outpatient	Probability of use	Probit (Two-part expenditure model)	IV Probit
		Amount of spending	OLS (Two-part expenditure model)	efficient two step GMM
	NHI benefits:	Probability of use	Probit (Two-part expenditure	IV Probit

Independent variables	Dependent variables	Model of analysis		
		Base model		With endogeneity and valid instrumental variables
	inpatient		model)	
		Amount of spending	OLS (Two-part expenditure model)	efficient two step GMM
	NHI benefits: pharmacy use	Probability of use	Probit (Two-part expenditure model)	IV Probit
		Amount of spending	OLS (Two-part expenditure model)	efficient two step GMM

The two-part model assumes that, when individuals need health care services, they must first decide whether to obtain such services, and that health care spending arises only with respect to those who decide in favor of obtaining such services. Analysis based on this model thus proceeds in two parts. In the first, an instrumental-variable (IV) probit model is used to determine the probabilities of individuals using outpatient services, inpatient care, and pharmacy services. In the second, assuming that individuals have used health care services for the health care spending that has occurred, the health care spending per individual is estimated as a dependent variable.

[Figure 6] Two-Part Model Formula

$$\text{Part 1: } \Pr(hexp_{it} > 0 | phi, x') = \alpha_0 + \alpha_{phi} phi_{it} + x'_{it}\alpha + \varepsilon^1_{it}$$

$$\text{Part 2: } \ln(hexp_{it} | hexp_{it} > 0) = \beta_0 + \beta_{phi} phi_{it} + x'_{it}\beta + \varepsilon^2_{it}$$

Where there are endogeneity and valid instrumental variables, an IV probit model is used in Part 1, and an efficient, two-step GMM model is used in Part 2. In order to quantify the impact of PHIPs on health insurance benefit spending, the results of the two parts are combined and used to estimate the full marginal effect (FME).

[Figure 7] Full Marginal Effect on Health Care Spending

$$E(y|phi, x') = \beta_{phi}\Phi(\alpha_{phi} phi + x'\alpha) \cdot exp(\beta_{phi} phi + x'\beta) \cdot exp(\varepsilon^2) + \alpha_{phi}\phi(\alpha_{phi} phi + x'\alpha) \cdot exp(\beta_{phi} phi + x'\beta) \cdot exp(\varepsilon^2)$$

[Figure 8] Analysis of FME Effect on Health Care Spending Using Finite-Difference Method

$$\frac{\Delta E(y)}{\Delta phi} = \left[\beta_{phi}\Phi(\alpha_{phi} phi + x'\alpha) \cdot exp(\beta_{phi} phi + x'\beta) \cdot \frac{1}{N}\sum[exp(r)] + \alpha_{phi}\phi(\alpha_{phi} phi + x'\alpha) \cdot exp(\beta_{phi} phi + x'\beta) \cdot \frac{1}{N}\sum[exp(r)] \,|phi = 1\right] - \left[\beta_{phi}\Phi(\alpha_{phi} phi + x'\alpha) \cdot exp(\beta_{phi} phi + x'\beta) \cdot \frac{1}{N}\sum[exp(r)] + \alpha_{phi}\phi(\alpha_{phi} phi + x'\alpha) \cdot exp(\beta_{phi} phi + x'\beta) \cdot \frac{1}{N}\sum[exp(r)] \,|phi = 0\right]$$

2. Data for analysis

For our analysis, we obtained and matched the statistics provided by the Korea Health Panel Survey and the health insurance claims held by the NHIS. Most existing studies that rely on secondary sources use data on patients' out-of-pocket expenses only, inviting suspicion of possible recall bias in their data pools as a result. By combining the health panel and health insurance claim data, we were able to examine both the amounts of insurance benefits paid out by the NHIS and the out-of-pocket expenses paid by patients, and therefore to identify the true value of patients' health care use.

The health insurance claim data were used to determine the days of inpatient stay and the number of outpatient visits as well as the amount of spending involved, while the health panel data were used to identify the idiosyncratic variables of individuals that could affect their behavior in using health care services and PHIPs.

〈Table 9〉 Data for Analysis

Health panel data (for independent, control, and instrumental variables)	NHIS claims (for dependent variables)
Independent variables (number of individuals holding PHIPs and number of PHIPs per individual)	Dependent variables (days of inpatient stay and number of outpatient visits, health care spending)
Control variables (demographic, socioeconomic, and health-related characteristics; health hazards; survey years, etc.)	
Instrumental variables (probability of cancer and savings)	

3. Variables

1) Dependent variables

The final dependent variables used in this study are the number of inpatient days, the number of outpatient visits (both as indicators of health care use) and the amount of health care expenses. The health spending variable is subdivided into health insurance benefits and out-of-pocket expenses, each of which is subdivided further into outpatient, inpatient, and pharmacy expenses.

〈Table 10〉 Dependent Variables

Variable	Subcategory	
Number of inpatient days and outpatient visits	Inpatient days	
	Outpatient visits	
Health care spending	Health insurance benefits	Outpatient
		Inpatient
		Pharmacy
	Out-of-pocket expenses	Outpatient
		Inpatient
		Pharmacy

(1) Health care use (number of inpatient days and outpatient visits)

During the period of our analysis (2008-2013), the mean number of outpatient visits per capita per year was 16.5 days, and the mean number of inpatient days was 2.1. PHI holders had 14.4 days of outpatient visits a year each on average, about

seven days fewer than the 21.6 days of non-PHI holders. PHI holders were also hospitalized for 1.2 days a year, about three days fewer than the 4.1 days of non-PHI holders.

〈Table 11〉 Health Care Use Statistics (Cross-Sectional Weighted), 2008-2013

Variable	Overall (N=81,349)		PHI holders (N=54,069)		Non-PHI holders (N=27,280)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Outpatient visits	16.5	0.079	14.4	0.078	21.6	0.190
Inpatient days	2.1	0.062	1.2	0.036	4.2	0.192

The number of inpatient days increased overall from 2008 to 2013, and increased at an accelerated rate starting in 2011. This increase was more prominent among non-PHI holders than PHI holders.

(2) Health care spending (health insurance benefit payouts)

During the years 2008-2013, the health insurance payout per capita amounted to KRW 280,000 for outpatient services, KRW 240,000 for inpatient services, and KRW 190,000 for pharmacy and prescription services. Overall, non-PHI holders generated twice as much health care spending than did PHI holders on average. Furthermore, inpatient expenses for non-PHI holders amounted to KRW 410,000, almost 2.6 times more than the KRW 160,000 of PHI holders.

In the meantime, out-of-pocket expenses per capita were

KRW 110,000 for outpatient services, KRW 50,000 for inpatient services, and KRW 70,000 for pharmacy and prescription services. Here as well, PHI holders' out-of-pocket expenses were less than those of non-PHI holders. Yet both groups showed similar trends in their health care use. Outpatient and inpatient expenses, for example, increased rapidly for both, while pharmacy expenses began to decrease in 2012 due to the fall in the prices of drugs.

〈Table 12〉 Health Care Spending Statistics (Cross-Sectional Weighted), 2008-2013

(Unit: KRW)

Type	Overall (N=81,349)		PHI holders (N=54,069)		Non-PHI holders (N=27,280)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Insurance payouts						
Outpatient	282,809	3,203	227,121	2620	417,702	8,904
Inpatient	238,054	5,516	164,242	5349	416,849	13,681
Pharmacy	190,765	1,384	146,562	1458	297,836	3,100
Out-of-pocket						
Outpatient	107,428	628	101,722	639	121,249	1,493
Inpatient	49,900	1,172	34,765	870	86,563	3,402
Pharmacy	68,078	440	56,915	459	95,117	1,005

2) Independent variables

The independent variables used in this study are whether persons hold PHIPs, and if so, the number of PHIPs each holds. The former is a dichotomous variable, with persons holding one or more PHIPs given a value of one, and persons without any PHIPs given a value of zero. The number of PHIPs held per capita is a continuous variable. During the analysis period, 70.8

percent of the people surveyed had at least one PHI each.

From 2008 to 2012, the PHI-holding rate grew from 66.3 percent to 73.2 percent, before taking a slight drop to 73.1 percent in 2013. The average number of PHIPs held per capita was 1.35. This figure increased steadily as well, from 1.13 in 2008 to 1.51 in 2013.

〈Table 13〉 Summary Statistics on Independent Variables (Cross-Sectional Weighted)

Variable	Description	Avg.	S.D.
Whether people hold PHIPs	1 = holding one or more PHIPs; 0 = holding no PHIPs	70.8%	1.7%
Number of PHIPs per capita	Number of PHIPs held per capita (among people holding PHIPs)	1.4	0.5

3) Control variables

In this study, we also use a wide range of control variables, including the age, sex, education, marital status, economic indicators, region of residence, health insurance status, health status, health hazards, and annual fixed effect (survey years) of each surveyed individual. In previous studies, it was the limited range of control variables that made it difficult to control for endogeneity and overestimation.

To avoid these issues, we used as many control variables as possible without incurring multicollinearity, thereby enhancing the precision of our endogeneity test and the reliability of our analysis results. Our analysis shows that there are, indeed, no-

table differences between PHI holders and non-PHI holders in terms of the control variables, allowing us to infer decisive factors for joining PHIPs. For example, non-PHI holders tend to be older and in poorer health (and therefore more likely to use health care) than PHI holders. The average age of PHI holders was 42.9, about 10.8 years younger than the 53.7 years of non-PHI holders. Moreover, PHI holders suffered from 1.14 chronic illnesses each on average, as opposed to the 2.05 of non-PHI holders.

Table 14 also shows the surveyed people's awareness of the probability of cancer and annual savings, both of which are used as valid instrumental variables in this study.

〈Table 14〉 Control Variable Statistics (Cross-Sectional Weighted)

Variable	Description	Overall (N=62,910)		PHI holders (N=42,380)		Non-PHI holders (N=20,530)	
		Avg.	S.D.	Avg.	S.D.	Avg.	S.D.
Age	Age	45.9	0.070	42.9	0.069	53.7	0.171
Sex	1 = female; 0 = male	0.514	0.002	0.515	0.003	0.514	0.004
Education	(Comparator: less than elementary school)						
Elementary school	1 = with elementary school education; 0 = not with elementary school education	0.115	0.001	0.081	0.001	0.202	0.003
Middle school	1 = with middle school education; 0 = not with middle school education	0.095	0.001	0.089	0.001	0.112	0.002
High school	1 = with high school education; 0 = not with high school education	0.716	0.002	0.783	0.002	0.544	0.004
College	1 = with college education; 0 = not with college education	0.338	0.002	0.384	0.003	0.218	0.004
Marital status	(Comparator: married)						
Divorced/ separated	1 = divorced/separated/widowed; 0 = not divorced/separated/widowed	0.092	0.001	0.054	0.001	0.189	0.003
Unmarried	1 = unmarried; 0 = not unmarried	0.237	0.002	0.228	0.002	0.260	0.004
Economic status							
Household income	Total annual household income (in units of KRW 10,000)	4389	14.7	4866	17.7	3156	23.3
Economic activity	1 = currently economically active; 0 = currently economically inactive	0.619	0.002	0.674	0.003	0.476	0.004
Region of residence	(Comparator: Seoul)						
Daegu	1 = resident; 0 = not resident	0.049	0.001	0.047	0.001	0.055	0.001
Incheon	1 = resident; 0 = not resident	0.056	0.001	0.056	0.001	0.057	0.002
Gwangju	1 = resident; 0 = not resident	0.029	0.001	0.029	0.001	0.028	0.001
Daejeon	1 = resident; 0 = not resident	0.029	0.001	0.028	0.001	0.034	0.001
Ulsan	1 = resident; 0 = not resident	0.023	0.001	0.024	0.001	0.020	0.001

Variable	Description	Overall (N=62,910)		PHI holders (N=42,380)		Non-PHI holders (N=20,530)	
		Avg.	S.D.	Avg.	S.D.	Avg.	S.D.
Gyeonggi	1 = resident; 0 = not resident	0.235	0.002	0.248	0.002	0.201	0.003
Gangwon	1 = resident; 0 = not resident	0.029	0.001	0.026	0.001	0.037	0.001
Chungbuk	1 = resident; 0 = not resident	0.029	0.001	0.029	0.001	0.030	0.001
Chungnam	1 = resident; 0 = not resident	0.040	0.001	0.033	0.001	0.058	0.002
Jeonbuk	1 = resident; 0 = not resident	0.034	0.001	0.032	0.001	0.038	0.001
Jeonnam	1 = resident; 0 = not resident	0.035	0.001	0.033	0.001	0.039	0.001
Gyeongbuk	1 = resident; 0 = not resident	0.051	0.001	0.046	0.001	0.066	0.002
Gyeongnam	1 = resident; 0 = not resident	0.061	0.001	0.060	0.001	0.064	0.002
Jeju	1 = resident; 0 = not resident	0.011	0.000	0.011	0.000	0.010	0.001
Health insurance	(Comparator: health insurance beneficiaries)						
NHI benefits	1 = NHI beneficiary; 0 = not NHI beneficiary	0.036	0.001	0.014	0.001	0.092	0.002
PHIPs	1 = PHIP beneficiary; 0 = not PHIP beneficiary	0.006	0.000	0.003	0.000	0.011	0.001
Health status							
Disability	1 = one or more disabilities; 0 = no disability	0.054	0.001	0.030	0.001	0.115	0.002
Chronic diseases	Number of chronic diseases	1.392	0.008	1.137	0.008	2.052	0.018
Health condition	Subjectively assessed (0 = very poor, 100 = perfectly healthy)	66.1	0.115	68.2	0.130	60.8	0.229
Depression	1 = Having experienced, for two weeks or more consecutavely in the past year, sadness or depression serious enough to interfere with daily life 0 = Having had no such experiences	0.074	0.001	0.065	0.001	0.098	0.002
Health hazards							
Body mass index	BMI	23.0	0.015	23.0	0.017	22.8	0.029
Lack of exercise	1 = Not having engaged in rigorous or medium-level exercise in the past week; 0 = having engaged in exercise	0.534	0.002	0.498	0.003	0.626	0.004

Variable	Description	Overall (N=62,910)		PHI holders (N=42,380)		Non-PHI holders (N=20,530)	
		Avg.	S.D.	Avg.	S.D.	Avg.	S.D.
Smoking	1 = Currently smoking; 0 = Not smoking	0.236	0.002	0.239	0.002	0.228	0.004
Drinking	1 = Drinking heavily twice a week; 0 = Not drinking heavily	0.101	0.001	0.109	0.002	0.079	0.002
Survey year	(Comparator: 2009)						
2010	1 = surveyed in 2010; 0 = not surveyed in 2010	0.210	0.002	0.210	0.002	0.211	0.003
2011	1 = surveyed in 2011; 0 = not surveyed in 2011	0.203	0.002	0.205	0.002	0.197	0.003
2012	1 = surveyed in 2012; 0 = not surveyed in 2012	0.192	0.002	0.194	0.002	0.186	0.003
2013	1 = surveyed in 2013; 0 = not surveyed in 2013	0.179	0.002	0.182	0.002	0.170	0.003
IVs							
Cancer awareness	1 = Believes cancer could happen to anyone; 0 = Believes cancer is rare.	0.846	0.002	0.861	0.002	0.807	0.003
Savings	Annual savings (in units of KRW 10,000)	69.1	0.448	80.6	0.557	39.4	0.651

4. Testing instrumental variables

In an effort to eliminate possible bias and inconsistencies, caused by endogeneity, in the analysis results, we tested for endogeneity and the validity of the instrumental variables through the following process. In stage 1, we conducted the Durbin-Wu-Hausman (DWT) test to test for possible endogeneity in individuals holding PHIPs. In stage 2, we sought to control for endogeneity using the instrumental variable methodology. We browsed the instrumental variables involved, tested their strengths using the likelihood (LR) test, and tested their exclusion restrictions using the Lagrange multiplier (LM) test, thereby determining possible exogeneity regarding the independent variables.

Based on this multi-step analysis, we were able to finally select an optimal model for our dependent and independent variables.

1) Effect of holding PHIPs on health care use

In an effort to control for possible endogeneity in the variable of holding PHIPs, we tested the validity of the two final instrumental variables, i.e., cancer awareness and savings. This produced the following results.

First, our test on the strengths of the instrumental variables showed that they held great explanatory power in terms of both the number of outpatient visits and the number of inpatient

days (p 〈 .001). Second, our test on the exclusion restrictions of the instrumental variables showed that the null hypothesis was not dismissed with respect to both variables, confirming the validity of their instrumentality. Third, using the valid instrumental variables, we tested for possible exogeneity regarding holding PHIPs. With respect to the number of outpatient visits, the exogeneity null hypothesis remained intact, allowing us to conclude that there was no endogeneity of PHIPs, at least in that regard. On the other hand, the exogeneity null hypothesis was dismissed with respect to the number of inpatient days, leading to the conclusion that, in this regard, PHIPs held endogeneity (p 〈 .05). In other words, the NB2 analysis results regarding the number of outpatient visits (non-endogenous) were reliable, while the 2SRI-NB2 model provided more reliable results for the number of inpatient days (endogenous).

〈Table 15〉 Effect of PHIPs on Use of Outpatient and Inpatient Services (IV Validity Tests)

Dependent variable	Testing validity of IVs		Endogeneity test	Final model
	Stage 1: Strengths of instruments	Stage 2: Exclusion restrictions	Stage 3: Exogeneity	NB2 vs. 2SRI-NB2
Outpatient visits	$\chi_2^2 = 144$ ***	$\chi_2^2 = 4.68$	$\chi_1^2 = 0.10$	NB2
	●	●	×	
Hospitalization days	$\chi_2^2 = 144$ ***	$\chi_2^2 = 5.27$	$\chi_1^2 = 5.61$ *	2SRI-NB2
	●	●	●	

*p 〈 0.05.
***p 〈 0.001.

Based on the validity tests on the instrumental variables, we concluded that holding PHIPs held no endogeneity with respect to the number of outpatient visits, and thus estimated the AME using the NB2 model. This revealed that holding PHIPs increased the number of outpatient visits by 0.8 days per year on average, with statistical significance.

To estimate the AME of holding PHIPs on the number of inpatient days, we used the 2SRI-NB2 model instead. Our analysis revealed no statistically significant correlation between the two variables.

〈Table 16〉 Effect of PHIPs on Use of Outpatient and Inpatient Services: AMEs of Holding PHIPs

Dependent variable	AME	[95% C.I.]
Outpatient visits		
E [No. of outpatient visits]	0.792 ***a	[0.360, 1.223]
Inpatient days		
E [No. of inpatient days]	-0.144 b	[-0.586, 0.298]

***p 〈 0.001.

Notes: a. Marginal effects from the usual NB2 model; b. Marginal effects from the 2SRI-NB2 model.

2) Effect of the number of PHIPs on health care use

In an effort to control for the possible endogeneity of the number of PHIPs held by individuals on health care use, we tested the validity and endogeneity of the instrumental variables, i.e., cancer awareness and savings. First, our test on the strengths of these variables revealed them to hold great explanatory power regarding both dependent variables, i.e., the

number of outpatient visits and the number of inpatient days ($p < .001$). Second, our test on the exclusion restrictions of the instrumental variables showed that the null hypothesis was not dismissed with respect to both dependent variables, confirming the validity of both instrumental variables. Third, we tested for the possible exogeneity of the number of PHIPs using the valid instrumental variables. In this instance, the exogeneity null hypothesis was not dismissed with respect to the number of outpatient visits, confirming the lack of endogeneity in the number of PHIPs. However, the exogeneity null hypothesis was dismissed with respect to the number of inpatient days, leading to the conclusion of endogeneity ($p < .05$). In other words, the results of the NB2 analysis regarding the number of outpatient visits (non-endogenous) were reliable, while the 2SRI-NB2 model provided more reliable results regarding the number of inpatient days (endogenous).

〈Table 17〉 Effect of Number of PHIPs on Use of Outpatient and Inpatient Services (IV Validity Tests)

Dependent variable	Testing validity of IVs		Endogeneity test	Final model
	Stage 1: Strengths of instruments	Stage 2: Exclusion restrictions	Stage 3: Exogeneity	NB2 vs. 2SRI-NB2
Outpatient visits	$\chi_2^2 = 128$ ***	$\chi_2^2 = 1.23$	$\chi_1^2 = 0.13$	NB2
	●	●	×	
Inpatient days	$\chi_2^2 = 144$ ***	$\chi_2^2 = 4.57$	$\chi_1^2 = 5.32$ *	2SRI-NB2
	●	●	●	

*$p < 0.05$.
***$p < 0.001$.

Based on the resultsof the validity tests on the instrumental variables, we concluded that the number of PHIPs held no endogeneity with respect to the number of outpatient visits, and thus estimated the AME using the NB2 model. This revealed that holding PHIPs increased the number of outpatient visits by 0.4 days per year on average, with statistical significance.

To estimate the AME of the number of PHIPs on the number of inpatient days, we used the 2SRI-NB2 model instead. Our analysis revealed no statistically significant correlation between the two variables.

〈Table 18〉 Effect of Number of PHIPs on Use of Outpatient and Inpatient Services: AMEs of Number of PHIPs

Dependent variable	AME		[95% C.I.]
Outpatient visits			
E [No. of outpatient visits]	0.399	***a	[0.262, 0.535]
Inpatient days			
E [No. of inpatient days]	0.091	b	[-0.308, 0.491]

***p < 0.001.

Notes: a. Marginal effects from the usual NB2 model; b. Marginal effects from the 2SRI-NB2 model.

3) Effect of holding PHIPs on health spending

In an attempt to control for the possible endogeneity of holding PHIPs on the amount of health care spending, we tested the validity and endogeneity of the instrumental variables, i.e., cancer awareness and savings, and obtained the following results. First, our test on the strengths of the instrumental variables revealed that both hold great explanatory power in all

models, except for the out-of-pocket expenses forinpatient care. Second, our test on the exclusion restrictions of the instrumental variables did not lead to the dismissal of the null hypothesis. Third, we tested the exogeneity of holding PHIPs using the valid instrumental variables. The null hypothesis was not dismissed in any of the models, confirming the lack of endogeneity in holding PHIPs. In all models, we used the probit model for the first stage of analysis, and the ordinary least squares (OLS) model for the second.

〈Table 19〉 Effect of Holding PHIPs on Health Spending (IV Validity Tests)

Dependent variable	IV validity		Endogeneity	Final model
	Strengths of instruments	Exclusion restrictions	Exogeneity of PHIPs	Preferred models Probit vs. IV probit; OLS vs. efficient two-step GMM
Health insurance benefits				
Outpatient				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 144$ ***	$\chi_2^2 = 1.52$	$F(1, 62532) = 2.77$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2, 56254) = 92.4$ ***	$\chi_1^2 = 1.63$	$\chi_1^2 = 2.91$	**OLS**
Inpatient care				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 144$ ***	$\chi_2^2 = 1.12$	$F(1, 62532) = 3.57$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2, 56254) = 92.4$ ***	$\chi_1^2 = 0.04$	$\chi_1^2 = 0.10$	**OLS**
Pharmacy/prescription				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 144$ ***	$\chi_2^2 = 1.85$	$F(1, 62532) = 0.28$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2, 56254) = 92.4$ ***	$\chi_1^2 = 0.01$	$\chi_1^2 = 0.98$	**OLS**
Out-of-pocket expenses				
Outpatient				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 144$ ***	$\chi_2^2 = 4.22$	$F(1, 62532) = 0.06$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2, 56254) = 92.4$ ***	$\chi_1^2 = 1.99$	$\chi_1^2 = 1.21$	**OLS**
Inpatient				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 144$ ***	$\chi_2^2 = 12.9$ **	$F(1, 62532) = 4.49$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2, 56254) = 92.4$ ***	$\chi_1^2 = 0.99$	$\chi_1^2 = 1.66$	**OLS**

Dependent variable	IV validity		Endogeneity	Final model
	Strengths of instruments	Exclusion restrictions	Exogeneity of PHIPs	Preferred models Probit vs. IV probit; OLS vs. efficient two-step GMM
Pharmacy/prescription				
Stage I: Pr (Exp.>0)	$\chi^2_2 = 144$ ***	$\chi^2_2 = 1.58$	$F(1, 62532) = 0.18$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2, 56254) = 92.4$ ***	$\chi^2_1 = 0.01$	$\chi^2_1 = 0.98$	**OLS**

"Exp." = health care expenses.
***p < 0.001.

In the first stage of our analysis, holding PHIPs increased the probability of health insurance benefits by 2.2 percentage points. In the second stage, holding PHIPs increased the amount of health insurance benefits for outpatient visits, where applicable, by approximately 6.6 percentage points (={exp (0.064)-1}×100). Our analysis of the total marginal effect led to the conclusion that holding PHIPs increased the amount of health insurance benefits for outpatient services by KRW 8,718 per capita per year, and raised the health insurance benefits of PHIP holders by KRW 37,249 for inpatient expenses and by KRW 11,316 for pharmacy and prescription services per capita per year.

Regarding out-of-pocket expenses, holding PHIPs was shown, in the first stage of the analysis, to increase the probability of out-of-pocket expenses for inpatient care by 2.4 percentage points. In the second stage, concerning out-of-pocket expenses generated for inpatient care, holding PHIPs increased the amount of expenses by 12.2 percentage points (={exp

(0.115) -1}×100).

Our total marginal effect analysis revealed that holding PHIPs increased PHIP holders' out-of-pocket expenses by KRW 3,450, KRW 8,335, and KRW 3,706 for outpatient, inpatient, and pharmacy/prescription services, respectively, per PHIP holder per year.

〈Table 20〉 Effect of PHIPs on Health Spending: Total Marginal Effect of PHIPs

Dependent variable	Marginal effect	[95% C.I.]
Health insurance benefits		
Outpatient		
Stage I: Pr (Exp.>0)	0.022***	[0.017, 0.028] a
Stage II: E{logExp.|Exp.>0}	0.064***	[0.039, 0.089]
Stages I+II: E{Exp.}	8,718***	[6,336, 11,100] a
Inpatient		
Stage I: Pr (Exp.>0)	0.016***	[0.010, 0.023] a
Stage II: E{logExp.|Exp.>0}	−0.021	[−0.124, 0.082]
Stages I+II: E{Exp.}	37,249***	[21,258, 53,240] a
Pharmacy/prescription		
Stage I: Pr (Exp.>0)	0.030***	[0.023, 0.037] a
Stage II: E{logExp.|Exp.>0}	−0.003	[−0.031, 0.025]
Stages I+II: E{Exp.}	11,316***	[8,462, 14,171] a
Out-of-pocket expenses		
Outpatient		
Stage I: Pr (Exp.>0)	0.024***	[0.018, 0.029] a
Stage II: E{logExp.|Exp.>0}	0.115***	[0.089, 0.141]
Stages I+II: E{Exp.}	3,450***	[2,433, 4,466] a
Inpatient		
Stage I: Pr (Exp.>0)	0.017***	[0.010, 0.023] a
Stage II: E{logExp.|Exp.>0}	0.060	[−0.034, 0.155]
Stages I+II: E{Exp.}	8,335***	[4,921, 11,750] a
Pharmacy/prescription		
Stage I: Pr (Exp.>0)	0.031***	[0.024, 0.038] a
Stage II: E{logExp.|Exp.>0}	0.017	[−0.011, 0.045]
Stages I+II: E{Exp.}	3,706***	[2,808, 4,604] a

"Exp."= health care expenses.

***p < 0.001.

a: Bootstrapped confidence intervals based on bootstrapped standard errors from 1,000 repetitions.

4) Effect of the number of PHIPs on health care spending

Our tests on the validity and endogeneity of the instrumental variables, i.e., cancer awareness and savings, with respect to the number of PHIPs as an independent variable, led to the following results. First, our test on the strengths of the instrumental variables revealed that both have great explanatory power in all models. Second, our test on the exclusion restrictions of the instrumental variables did not lead to the dismissal of the null hypothesis. Third, we tested the exogeneity of the number of PHIPs using the valid instrumental variables. The null hypothesis was not dismissed in any of the models, confirming the lack of endogeneity in the number of PHIPs. In all models, we used the probit model for the first stage of analysis, and the OLS model for the second.

〈Table 21〉 Effect of Number of PHIPs on Health Spending (IV Validity Tests)

Dependent variable	IV validity		Endogeneity	Final model
	Strengths of instruments	Exclusion restrictions	Exogeneity of PHIPs	Preferred models Probit vs. IV probit; OLS vs. efficient two-step GMM
Health insurance benefits				
Outpatient				
Stage I: Pr (Exp.>0)	$\chi^2_2 = 109$ ***	$\chi^2_2 = 1.53$	$F(1,42157) = 1.05$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2,38510) = 49.2$***	$\chi^2_1 = 1.81$	$\chi^2_1 = 0.32$	**OLS**
Inpatient				
Stage I: Pr (Exp.>0)	$\chi^2_2 = 109$ ***	$\chi^2_2 = 5.62$	$F(1,42157) = 1.53$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2,38510) = 49.2$***	$\chi^2_1 = 0.27$	$\chi^2_1 = 0.66$	**OLS**
Pharmacy/prescription				
Stage I: Pr (Exp.>0)	$\chi^2_2 = 109$ ***	$\chi^2_2 = 1.12$	$F(1,42157) = 0.25$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2,38510) = 49.2$***	$\chi^2_1 = 0.68$	$\chi^2_1 = 0.98$	**OLS**

Dependent variable	IV validity		Endogeneity	Final model
	Strengths of instruments	Exclusion restrictions	Exogeneity of PHIPs	Preferred models Probit vs. IV probit; OLS vs. efficient two-step GMM
Out-of-pocket expenses				
Outpatient				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 109$ ***	$\chi_2^2 = 1.28$	$F(1,42157) = 1.78$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2,38510) = 49.2$ ***	$\chi_1^2 = 1.03$	$\chi_1^2 = 0.08$	**OLS**
Inpatient				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 109$ ***	$\chi_2^2 = 5.62$ **	$F(1,42157) = 1.78$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2,38510) = 49.2$ ***	$\chi_1^2 = 0.09$	$\chi_1^2 = 0.88$	**OLS**
Pharmacy/prescription				
Stage I: Pr (Exp.>0)	$\chi_2^2 = 109$ ***	$\chi_2^2 = 1.01$	$F(1,42157) = 0.33$	**Probit**
Stage II: E{logExp.|Exp.>0}	$F(2,38510) = 49.2$ ***	$\chi_1^2 = 0.38$	$\chi_1^2 = 0.16$	**OLS**

"Exp." = health care expenses.
***$p < 0.001$.

In the first stage of our analysis, the number of PHIPs increased the probability of health insurance benefits by 0.5 percentage points. In the second stage, the number of PHIPs increased the amount of health insurance benefits for outpatient visits, where applicable, by approximately 3.7 percentage points (={exp (0.036)-1}×100). Our analysis of the total marginal effect led to the conclusion that holding PHIPs increased the amount of health insurance benefits for outpatient services by KRW 15,157 per capita per year.

Concerning out-of-pocket expenses, the number of PHIPs was shown, in the first stage of the analysis, to increase the probability of out-of-pocket expenses for inpatient services by 0.9 percentage points. In the second, regarding out-of-pocket expenses generated for inpatient services, the number of PHIPs

increased the amount of expenses by 5.8 percentage points (={exp (0.056) -1}×100).

Our total marginal effect analysis revealed that the number of PHIPs increased PHIP holders' out-of-pocket inpatient expenses by KRW 4,355 per capita per year.

〈Table 22〉 Effect of Number of PHIPs on Health Spending: Total Marginal Effect of Holding PHIPs

Dependent variable	Marginal effect	[95% C.I.]
Health insurance benefits		
Outpatient		
Stage I: Pr (Exp.>0)	0.005***	[0.003, 0.007] a
Stage II: E{logExp.|Exp.>0}	0.036***	[0.026, 0.046]
Stages I+II: E{Exp.}	15,157***	[9493, 20821] a
Inpatient		
Stage I: Pr (Exp.>0)	0.009***	[0.007, 0.011] a
Stage II: E{logExp.|Exp.>0}	0.070***	[0.031, 0.109]
Stages I+II: E{Exp.}	38,318	[22881, 53755] a
Pharmacy/prescription		
Stage I: Pr (Exp.>0)	0.0068***	[0.004, 0.010] a
Stage II: E{logExp.|Exp.>0}	-0.0037	[-0.014, 0.007]
Stages I+II: E{Exp.}	-417	[-5635, 4801] a
Out-of-pocket expenses		
Outpatient		
Stage I: Pr (Exp.>0)	0.005***	[0.003, 0.007] a
Stage II: E{logExp.|Exp.>0}	0.043***	[0.033, 0.053]
Stages I+II: E{Exp.}	1,543	[-435, 3521] a
Inpatient		
Stage I: Pr (Exp.>0)	0.009***	[0.007, 0.011] a
Stage II: E{logExp.|Exp.>0}	0.056**	[0.019, 0.093]
Stages I+II: E{Exp.}	4,355***	[2136, 6574] a
Pharmacy/prescription		
Stage I: Pr (Exp.>0)	0.007***	[0.003, 0.011] a
Stage II: E{logExp.|Exp.>0}	-0.0002	[-0.010, 0.010]
Stages I+II: E{Exp.}	234	[-1201, 1669] a

"Exp."= health care expenses.

***p < 0.001.

a: Bootstrapped confidence intervals based on bootstrapped standard errors from 1,000 repetitions.

IV Policy implications

IV Policy implications

PHIPs do have the positive effect of reducing the direct financial burden on PHI holders, but they also induce PHIP holders to seek and obtain more healthcare services. Therefore, deciding the mutual roles and responsibilities of the NHI and PHIPs fairly and rationally is critical for the future of healthcare in Korea. As the demand for NHI coverage will continue to grow in the future, Korean policymakers need to devise appropriate means of policy intervention, with a view to enhancing NHI coverage, maximizing the positive effects, and controlling the possible side effects of PHIPs. In order to minimize the possible side effects of PHIPs on NHI spending and reduce the Korean public's out-of-pocket expenses for healthcare services, policymakers will also need to find ways of ensuring, amid increasing NHI coverage, that the unearned profits made by PHIPs be returned properly back to society.

In theory, health insurance, whether public or private, reduces the financial burden of healthcare, and could thereby induce moral hazard among health care consumers, encouraging them to over-utilize available health care services. Moreover, allowing the co-existence and flourishing of PHI alongside public health insurance could induce changes in the behavior of health care providers and influence the system and amounts

of benefits provided by public insurance.

In this study, we draw upon statistics provided by the Korea Health Panel Surveys as well as NHI claims so as to analyze how holding PHIPs affects consumer use of healthcare services and health care spending. Our analysis confirms a significant correlation between PHIPs and increases in the use of healthcare services and health care spending. Specifically, holding any number of PHIPs increases the number of outpatient visits by 0.8 days per capita per year holding one more PHIP increases this figure by an additional 0.4 days. However, holding any number of PHIPs and the number of PHIPs had no affect on the number of inpatient days. Individual preferences thus also play a role in the health care services they seek and obtain. Compared to outpatient visits, inpatient care is less influenced by individual choice, because inpatient care is granted, in most cases, only as a result of outpatient services.

In the meantime, both holding any number of PHIPs and the number of PHIPs had significant impact on health care spending, including health insurance benefits and out-of-pocket expenses alike. Holding any number of PHIPs increased the health insurance benefits for outpatient care, inpatient care, and pharmaceuticals by KRW 8,718, KRW 37,249, and KRW 11,316, respectively, per capita per year. The number of PHIPs, on the other hand, affected the amount of health benefits for outpatient services only, raising it by KRW 15,157. Meanwhile,

holding any number of PHIPs increased the out-of-pocket expenses for outpatient services, inpatient care, and pharmaceuticals by KRW 3,450, KRW 8,335, and KRW 3,706, respectively, per capita per year. The number of PHIPs affected out-of-pocket expenses for inpatient care only, raising it by KRW 4,355.

Our analysis confirms that, while PHIPs reduce the out-of-pocket expenses for PHIP holders, they also induce health care consumers to overutilize health care, and thereby exert an increasing fiscal burden on the NHI. It is therefore important for policymakers to find fair and rational ways of dividing the respective roles and responsibilities between PHIPs and the NHI, while minimizing the possible negative impacts that the former could exert on the latter.