보험금융연구 제34권 제1호 (2023. 2) pp. 65-99
DOI : https://doi.org/10.23842/jif.2023.34.1.003

Health Insurance Is Healthy: An Effect of Obtaining Medicare on Self-Rated Health

메디케어가 주관적 건강에 미치는 영향: 회귀불연속 분석을 이용하여

Jungtaek Lee*

I examine the causal effect of health insurance on self-rated health in the short run, based on a concept of the fuzzy regression discontinuity(RD) research design with the age of 65 as an instrumental variable. To focus on the causal effect of obtaining Medicare, I limit the sample to those without private insurance around the age of 65 - the Medicare eligibility starting age. First, the result shows that the proportion of those covered by health insurance increases by about 27 percentage points at that age. Second, the self-rated health of those newly covered by health insurance at the age of 65 improves. Third, although there is no discrete change in health care services, including surgery and inpatient service, elderly individuals increase their use of preventive care services. These results suggest that obtaining health insurance strengthens the assurance about getting medical and preventive care services and results in better self-rated health.

Key words: Health Insurance, Medicare, Health Care Services, Preventive Care Services, Self-Rated Health
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논문 투고일: 2022. 7. 17, 논문 최종 수정일: 2022. 12. 25, 논문 게재 확정일: 2023. 2. 16

I. Introduction

Since the implementation of the Patient Protection and Affordable Care Act(ACA), the number of uninsured individuals has been dramatically reduced. However, twenty-six million people, or eight percent of the entire population, still do not possess any health insurance in 2019(Keiser-Starkey and Lisa 2020). The ACA, signed into law by president Barak Obama in March 2010 includes a series of reforms regarding health and social welfare policy.[1] The consequences of being uninsured are well documented. As compared to those who have health insurance, the uninsured are more likely to go without needed medical care or receive lower quality care, and thereby experience worse health outcomes(Ayanian et al. 2000; Ayanian et al. 1993; Hadley, 2003; Osteen et al. 1994; Roetzheim et al. 1999). Lacking health insurance poses a serious financial threat to people, who are often at risk of incurring a larger burden of debt from accrued medical expenses(Himmelstein et al. 2005). Once the elderly individuals over the age of 65 were covered by Medicare, the health of the previously uninsured individuals improved significantly. By the age of 70, health differences, which refers to different probability of illness, injury, or mortality between uninsured and insured were reduced by half, emphasizing the importance of having access to health care services(McWilliams et al. 2017; Quesnel-Vallee 2004).

The mechanisms by which health insurance affects health outcomes are

1) One of the primary goal is to expand health insurance coverage to uninsured individuals. The ACA provides consumers with the right to purchase insurance coverage whenever they need it. Further, the ACA extends health insurance coverage by expanding Medicaid, which insures individuals in households with incomes up to 138% of federal poverty levels. In addition, health insurance coverage was expanded by allowing young adults to remain on their parents' insurance plans until their 26th birthday(Lee 2018).

diverse. First, easy access to health care and preventive care services is more likely to prevent and treat disease which can influence health. Medical interventions, such as medications and treatments, are clearly beneficial for health status(Sommers et al. 2012; Sommers et al. 2014). Second, health outcomes can improve with changes in behavioral risk factors which arise from the utilization of health care services, as individuals who regularly engage with these services learn how to improve and maintain their health status from their medical professionals(Dave and Kaestner 2009; Zweifel and Manning 2000). Improvement in health status from these processes can be implemented in the long-run perspective. On the other hand, the individual's health status can improve merely from the use of health care services which in turn provides the mental security of managing health. Within this context, health insurance plays an important role by providing easier access to health care services which will strengthen individuals' assurance in their health-managing ability. This confidence in effectively managing one's own health possibly may lead to a positive effect on self-rated health. Whether being covered by health insurance immediately affects health status needs to be considered empirically.

To shed light on these questions, I use the Medicare eligibility age of 65 as an exogenous shock to examine whether obtaining health insurance influences self-rated health shortly after turning the age of 65. Limiting the sample to those who have no private health insruance before and after the age of 65, I also focus on the causal effect of obtaining Medicare. Second, I examine the effect of health insurance on the utilization of type of access (health care and preventive care) as potential mechanism for improving self-rated health. I use the National Health Interview Survey(NHIS) to test above questions. The main objective of the NHIS is to monitor the health of

the United States population through the collection and analysis of data on a broad range of health topics.

This study makes an innovative contribution to the literature. I provide the first evidence of an effect of obtaining Medicare on self-rated health using RD research design. Estimating the effect of health insurance on self-rated health is empirically challenging, as the unobserved individual characteristics which influence self-rated health may also affect health insurance status. To address this endogeneity, I use the fact that all elderly individuals who reach the age of 65 are eligible for Medicare, and then I use the Medicare eligibility age of 65 as the cutoff value in a regression discontinuity design. I consider differences in self-rated health among the elderly people who are newly covered by the Medicare in a narrow margin around the age of 65.

II. Literature Review

A large amount of empirical studies has considered the relationship between health insurance and health outcomes. Previous studies have argued that health insurance is associated with the utilization of health care services. By using public health policies that led to exogenous variation in insurance coverage, such as implementation of the Affordable Care Act, Medicare, and Medicaid expansion, researchers found that obtaining health insurance increased health care services, including both inpatient and outpatient treatments(Anderson et al. 2012; Antwi et al. 2015; Card et al. 2008; Dafny and Gruber 2005; Finkelstein et al. 2012).

However, results on the health effects of health insurance are mixed. Sommers et al. (2012) used a difference-in-differences(DD) design to study

general Medicaid expansions in three states, and they found large mortality gains in New York, positive but insignificant gains in Arizona, and higher mortality in Maine. Sommers and other colleagues(2014) found large mortality gains in Massachusetts following its health insurance expansion in 2007. On the other hand, in the Oregon randomized health insurance experiment which also looked at the effect of Medicaid expansion, there were small, statistically insignificant short-term effects on mortality and other measures of health status(Allen et al. 2013; Finkelstein et al. 2012). Card et al. (2008) and Finkelstein and McKnight (2008) exploited the discontinuity in health insurance coverage at the age of 65, when all U.S. citizens and permanent residents become Medicare-eligible, in order to assess the impact of health insurance on mortality, but results showed that neither group of researchers found evidence of a decline in overall mortality at age 65. In general, improved mortality from obtaining health insurance is reflected over the long-term, whereas most researchers on the subject only took the short-term effects of health insurance coverage on mortality into consideration. Thus, despite a large volume of previous studies to find an increase in health care and preventive care services by health insurance, results on health-related outcomes are limited.

On the other hand, other strand of research found that uninsured cancer patients usually have poorer outcomes and are more likely to die prematurely than individuals with insurance because of delayed diagnosis(Lee-Feldstein et al. 2000). Uninsured individuals with chronic disease are less likely to receive appropriate health care services than individuals with health insurance(Institute of Medicine 2002). Easier access to health care services caused by health insurance may improve health outcomes. Previous studies found that when a lack of health insurance was associated with not receiving preventive services

or screenings, this often lead to delays in disease diagnosis and poor health outcomes(Baker et al. 2001; Goldman et al. 2001). In addition to the long-run mechanism by which health insurance affects health outcomes through access to health care services, health insurance can have an immediate impact on health status, such as self-rated health. I estimate the effect of health insurance on self-rated health. Self-rated health can improve with medical treatment, including medication, but the ability to use health care itself may also provide the chance to improve health.

Ⅲ. Data

I obtain information on health care services and self-rated health from the NHIS data. Estimating the impact of Medicare on health status requires detailed measures of health insurance status, and the NHIS contains questions on insurance status which confirm whether respondents are covered by public(i.e., Medicare or Medicaid) or private health insurances. The NHIS also has a series of subsets: Family, Person, and Sample Adult data files. I merge Sample Adult data with Family, and Person data files.

The primary sample in this analysis consists of older and elderly adults who were between the ages of 60 and 69, and the sample period ranges from 2004 to 2013 for 10 years. I cut the data off at 2014, as it was in the beginning of that year that the Affordable Care Act required individuals to have health insurance or pay a potential penalty. Along with this individual requirement, insurers were barred from refusing to sell insurance to individuals with preexisting conditions, including mental illnesses and substance abuse disorders. As a result, the proportion of the population who had no health

insurance was dramatically reduced to 10.4% in 2014. To prevent it from influencing the behavior of the elderly before the age of 65, I use the sample during the periods leading up to 2013.

To focus on the causal effect of obtaining Medicare, I also limit the sample to those who have no private insurance before and after the age of 65. As a result, I focus on the effect of being covered by Medicare. Private insurance can be provided to cover a range of out-of-pocket expenses not covered by Medicare(Part A and Part B). In 2016, eight in ten beneficiaries in Medicare had some types of supplemental insurance, such as employer-sponsored insurance, Medigap, and Medicare Advantage which offer standardized benefits along with Medicare and are sold by private insurance companies. However, about 19 percentage in traditional Medicare had no source of supplemental coverage(Cubanski et al. 2018). The multiple coverage rises at the age of 65 and that increase is concentrated on better educated or higher income individuals. Therefore those who are without private health insurance before the age of 65 are comparable with those who have only traditional Medicare after the age of 65.

One of the key variables for this study is health insurance status. The relevant question asks whether the respondents have any type of health insurance at the time of the interview(private, Medicare, Medicaid or any other coverage). This variable, Insurance, is a dummy variable that equals 1 if the respondent reports having any health insurance, and 0 if the respondent does not report having any health insurance.

I also focus on self-rated health as the measure of health status, as it is widely used as a reliable measurement of overall health status and as a significant independent predictor of morbidity, development of disability and mortality(DeSalvo et al. 2010; Benyamini et al. 2003).

Turning to outcome variables, I use three types of outcome variables: health outcome, health care service, and preventive care. A variable for health outcome focuses on self-rated health, and the data is gathered from a question for self-rated health, which asks respondents to rate their health as "excellent, very good, good, fair, or poor." I construct a dummy variable that is equal to 1 if their health are excellent or very good, and 0 otherwise.

Questions regarding health care service centered around four main questions. The first(second) asks whether the respondent has seen or talked to a health professional(a medical specialist) within the past 12 months. The third asks whether respondents were hospitalized overnight at any point during the past 12 months. The last question asks whether respondents had any surgery in the past 12 months. I also use questions about preventive care. The first question asks the respondent whether they had met a general doctor in two weeks. Though general doctors treat both acute and chronic illnesses, they focus on preventive care and health education for patients, supporting the role of medical specialists or health professionals. Measures for preventive care also include whether respondents had received a flu-shot and testing for their regular cholesterol or blood pressure in the past 12 months.

Age in months is the key variable in this research, and throughout the analysis, I limit analysis to individuals who were within around 60 months of their 65th birthdays. This variable enables me to use the regression discontinuity(RD) research design based on the knowledge of the rule which determines health insurance status in this population.

Ⅳ. Descriptive Statistics

The analysis in this study is based on the National Health Interview Survey data from the period between 2004 and 2013. The sample data set includes demographic characteristics and outcome variables. Demographic variables are as follows: age-in-months, gender, race, educational attainments, employment status, and insurance status. Outcome variables consists of three groups: health care services, preventive care services, and self-rated health.

〈Table 1〉 Descriptive statistics for variables at baseline
(National Health Interview Survey 2004~2013)

	Male	
	Before Age 65 (1)	*After Age 65* (2)
A. Demographics		
Married	.3504 [.4771]	.4279 [.4948]
Gender	.5388 [.4985]	.5398 [.4985]
White	.4709 [.4992]	.4917 [.5000]
High school graduate	.6454 [.4784]	.6693 [.4705]
Employed	.2451 [.4302]	.1765 [.3813]
Retirement	.2213 [.4152]	.5781 [.4939]
Insured	.6138 [.4869]	.9670 [.1787]
B. Outcomes		
Health Professional	.2745 [.4463]	.2826 [.4503]
Medical Specialist	.3391 [.4734]	.3834 [.4863]
Inpatient	.1373 [.3442]	.1286 [.3348]

Surgery	.1459 [.3531]	.1741 [.3792]
General Doctor	.7175 [.4503]	.7945 [.4041]
Flu-shot	.4087 [.4916]	.5216 [.4996]
Cholesterol	.7324 [.4428]	.8276 [.3778]
Blood Pressure	.8390 [.3676]	.9024 [.2969]
Self-Rated Health	.2744 [.4462]	.3771 [.4847]
Observation	6,010	6,992

Note: All statistics are based on a dataset created by Family, Person, and Sample Adult files from the NHIS for 2004~2013. Entries in each column are means of variables and standard errors are in brackets. Variables are as follows: *Married* variable indicates whether the respondent currently has been married. *Gender* variable is a dummy variable that equals 1 if a respondent are a male. *White* is a dummy variable that equals 1 if the respondent reports white as a racial ethnicity. *High School Graduate* variable is an indicator variable that is equal to 1 if respondents are high school graduates or above. *Employed* variable is a proportion of those who were working for pay. *Retirement* variable is a proportion of those who have been retired at the time of interview. *Insured* is a dummy variable that equals 1 if the respondent reports having any health insurance. *Health professional (Medical specialist or general doctor)* variable shows whether the respondent has been or talked to a health professional (Medical specialist or General Doctor). *Inpatient* variable asks whether respondents have utilized inpatient health care services. *Surgery* variable asks whether respondents have taken surgery. *Flu-shot* variable indicates whether respondent have had a flu vaccination during the past 12 months. *Blood pressure test* variable indicates whether respondents have been told by a doctor or other health professional that they had high blood pressure. Self-Rated Health is an indicator variable that equals 1 if respondents evaluated "Excellent" or "Very Good" for their health.

〈Table 1〉 reports summary statistics by age. I divide the sample into two groups based on the Medicare cutoff age of 65, with one group consisting of respondents aged 60 to 64, and the other group consisting of those aged 65 to 69. Predictably, the insured proportion increased across the age of 65. After age 65, those who are covered by Medicare sharply increases from 61.4% to 96.7%.

Panel B presents the sample proportions for health care and preventive care

services. Across the age of 65, the proportions of health care service utilization increase for outpatient services. Generally health care services increase across the age of 65. Contrary to general pattern, inpatient services decreases after the age of 65. Panel B also reports the mean proportions on all types of preventive care services. The elderly individuals, on average, increase their use of all types of preventive care including visit to general doctor, receiving flu-shot, cholesterol and blood pressure tests, as they approach the age of 65. As for preventive care, the elderly individuals after the age of 65 tend to generally utilize preventive care services at a higher rate than before age 65. Finally, the elderly people, on average, report better self-rated health than respondents under the age of 65. However, simple comparison between the sample of individuals aged 60 to 64 and individuals aged 65 to 69 would not capture the causal effect of Medicare health insurance.

Ⅴ. Methodology

Estimating the causal effect of health insurance on self-rated health can be empirically challenging. A wide scope of demographic variables, including marital status, educational attainment, race, and employment status may influence self-rated health and insurance status. The two groups, both insured and uninsured, may differ across those variables. As a result, differences in observed demographic variables between insured and uninsured can thus lead to differences in unobserved characteristics. Therefore, the effect of health insurance is not discernable from effects of unobserved characteristics. Moreover, if health insurance status is closely correlated with these unobserved characteristics, these characteristics may be also related with

health status. For example, those who have health insurance are more likely to have unobserved risk-averse behaviors, as well as higher incomes or education level, and all of these characteristics may affect health status. Because of these unobserved characteristics, health insurance could be both a cause and an effect of self-rated health or health care services, and these unobserved characteristics may lead to a biased estimator in an ordinary least squares regression.

To address omitted variable bias caused by unobserved characteristics, I use the fact that all adults are eligible for Medicare at the age of 65. I consider three sets of regressions. First, to show the effect of Medicare eligibility on health insurance status around age 65, I estimate the regression of reaching age 65 on health insurance status. Second, I perform the regression of reaching age 65 on self-rated health. Similar to instrumental variable regression, the discontinuity in self-rated health is the reduced-form estimate, and the discontinuity in health insurance status is the first-stage estimate. Finally, I construct a Wald-type estimate to capture the causal effects of health insurance on self-rated health by dividing the jump in the relationship between self-rated health and age 65 by the jump in the relationship between health insurance status and age 65. Within this framework, the instrument variable is the Medicare eligibility age of 65. I exploit an indicator variable equaling 1 if the respondent is aged 65 or older as an instrument for health insurance status to estimate the causal effect of health insurance on self-rated health, referred to as fuzzy regression discontinuity.

The Medicare eligibility structure and data enable me to estimate the causal effect of Medicare on health status using an RD design. Throughout this study, the analysis proceeds in two steps. I show smoothed figures to visually

examine discontinuities at the eligibility thresholds; and then to obtain estimates for the main causal effects, I follow standard RD methodology.

$$Y_{i1} = \alpha_{1k} X_i + \beta_{1k} T_i + \sum_{j=1}^{k} \gamma_{1j} (age_i^j) + \sum_{j=1}^{k} \delta_{1j} (T_i \times age_i^j) + \epsilon_{i1k} \quad (1)$$

$$Y_{i2} = \alpha_{2k} X_i + \beta_{2k} T_i + \sum_{j=1}^{k} \gamma_{2j} (age_i^j) + \sum_{j=1}^{k} \delta_{2j} (T_i \times age_i^j) + \epsilon_{i2k} \quad (2)$$

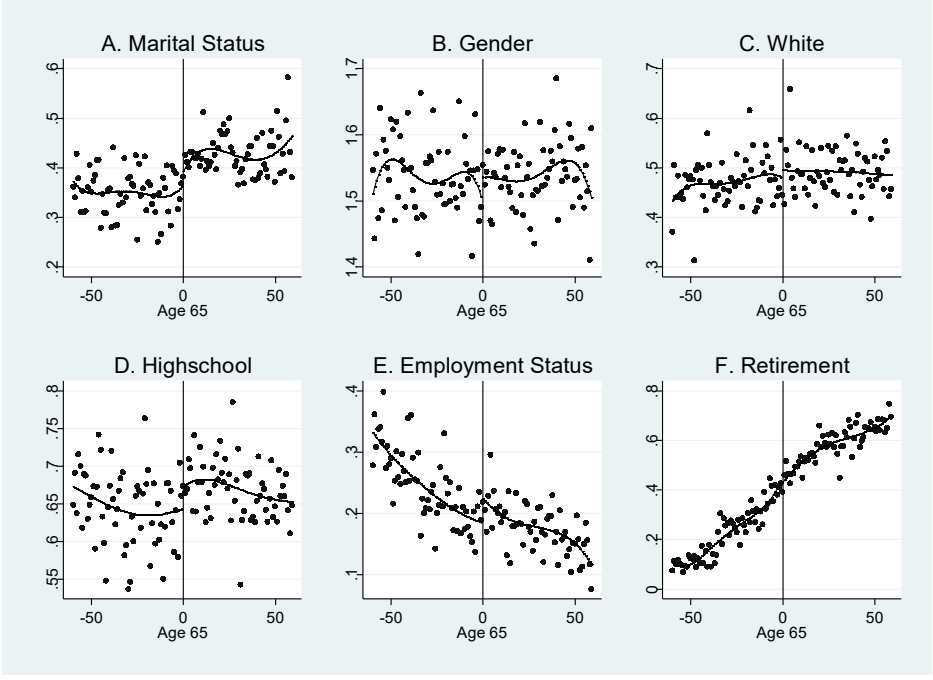
where Y_{i1} is a dummy variable that equals 1 if individual i is covered by health insurance and Y_{i2} is also a dummy variable that equals 1 if individual i's self-rated health has improved. The vector of observable characteristics, X_i, is the set of demographic control variables, including gender, marital status, race, education, income level and employment status as well as interview year and region fixed effect. T_i is an indicator variable of whether the individual i's age is greater than or equal to 65 years old and age_i indicates the number of months before and after an individual's 65th birthday. Finally, polynomial functions of age_i is a smooth control function of an age profile, which represents the trend for health insurance status. If polynomial functions of age_i is specified correctly, it will capture the dependence of all outcomes on all values of age from 60 to 69, and I can use this data to then estimate (1) and (2). However, there is no reason to believe that the true model is linear. For more robust results, I use the results in models with quadratic, cubic, and quartic polynomials in order to show that higher-order polynomial models are consistent with the results in the linear model.

Another method for estimating the smooth function of the age profile is to use a nonparametric model. However, if the insured proportion increased dramatically after an individual's 65th birthday, a boundary problem results in the overestimating of the treatment effects at age 65. Therefore, I implement a

local linear regression in order to reduce the bias in kernel regression, using the bandwidth selection procedures by Imbens and Kalyanaraman (2012) and Calonico, Cattaneo, and Titiunik (2014). Finally, for evaluating indirect mechanism to affect self-rated health, I also consider the effect of obtaining health insurance on health care services or preventive care.

Ⅵ. Validity of Regression Discontinuity Design

〈Figure 1〉 Observable Characteristics at age 65



Note: These figures show average ratio of those who are married, male, white, high school graduates or above, employed and retired in age in months. The markers represent the averages of variables at one-month intervals. The solid lines represent fitted regressions from the models that assume a cubic age profile, interacted with a dummy for age 65 or older.

〈Table 2〉 Differences in Observed Characteristics between Insured and Uninsured *(National Health Interview Survey 2004 ~ 2013)*

	Insured	*Uninsured*	*Difference between insured and uninsured*	*p-value for difference in means*	*Regression estimates of discrete jump at 65*	*p-value for difference in RD*
	(1)	(2)	(3)	(4)	(5)	(6)
Married	.3928 [.4884]	.3891 [.4876]	.0037 [.0108]	.730	.0272 [.0430]	.527
Sex	.5360 [.4987]	.5529 [.4973]	-.0169 [.0110]	.124	.0386 [.0444]	.385
White	.4906 [.4999]	.4471 [.4973]	.0435 [.0110]	.000***	.0169 [.0445]	.705
High school graduate	.6614 [.4732]	.6454 [.4785]	.0161 [.0105]	.125	.0294 [.0422]	.487
Employed	.1620 [.3685]	.3973 [.4894]	.2353 [.0087]	.000***	.0387 [.0360]	.282
Retirement	.4563 [.4981]	.2367 [.4251]	.2196 [.0107]	.000***	-.0203 [.0431]	.638
Observation	10,450	2,552	13,002	13,002	13,002	13,002

Note: All statistics are based on a dataset created by Family, Person, and Sample Adult files from the NHIS for 2004~2013. Entries in each column are means of variables and standard errors are in brackets. The control variables are as follows: *Married* variable indicates whether the respondent currently has been married. *White* is a dummy variable that equals 1 if the respondent reports white as a racial ethnicity. *High School Graduate* variable is an indicator variable that is equal to 1 if respondents are high school graduates or above. *Employed* variable is a proportion of those who were working for pay. *Retirement* variable is a proportion of those who have been retired at the time of interview. Columns (5) and (6) are regression discontinuity estimates with quartic polynomials and related p-values.

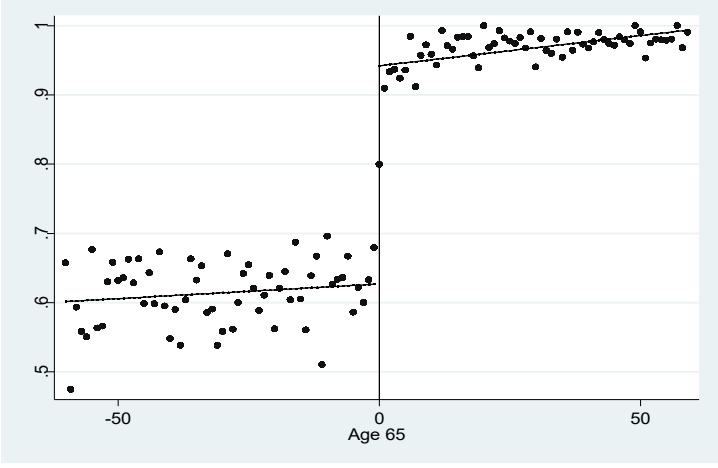
To evaluate the identification assumption, one common test for the validity of RD research design is to verify no discontinuities in all other observable characteristics than health insurance status is implemented by estimating the main equation (1). I examine whether the demographic variables, including marital status, proportions of white, high school graduates and retirement. Columns (1) and (2) in 〈Table 2〉 present the shares of those corresponding to each observed characteristics among the insured and uninsured. Columns (3) and (4) show differences in those characteristics between the two groups with p-values. The results imply that insured and uninsured groups have different

observed characteristics on average for individuals with and without limitation. The insured individuals are likely to have different demographic characteristics from the uninsured individuals. Despite the result that reflect differences between insured and uninsured, the observed characteristics do not jump at age 65. Columns (5) and (6) reflect no discrete jump at any of the observed characteristics. This finding suggests that factors other than health insurance status do not influence discontinuous changes in self-rated health at age 65. 〈Figure 1〉 shows smooth trends for all observed characteristics at age of 65 which is consistent with results in 〈Table 2〉.

Ⅶ. Results

1. Changes in Health Insurance Status at age 65

〈Figure 2〉 Health Insurance Status at age 65



Note: This figure shows average ratio of those who are covered by public or private insurance in age in months by gender. The markers represent the averages of variables at one-month intervals. The solid lines represent fitted regressions from the models that assume a linear age profile, interacted with a dummy for age 65 or older.

The first set of regressions pertains to the effect of reaching the Medicare eligibility age of 65 on health insurance status. This part provides the first-stage regression and the interpretation of the effect of reaching age 65, with the main finding revealing that the proportion of the insured individuals sharply increases due to Medicare.

〈Figure 2〉 presents how the insured proportion varies at around the age of 65. The figure shows the actual and fitted age profiles of health insurance status from a linear regression model estimated separately on each side of the cutoff value. The markers in the figure represent averages of the insured proportion by age in months, and the lines represent fitted regressions from models with a linear age profile fully interacting with a dummy for age 65 or older.

The figure implies that health insurance status is substantially affected by Medicare eligibility. In particular, 〈Figure 2〉 shows a sharp increase of about 20 to 30 percentage points in the insured proportions. The figure graphically demonstrates that Medicare eligibility substantially affects health insurance status among the elderly around the age of 65.

〈Table 3〉 Change at Age 65 in Insurance Coverage: 1st Stage
(National Health Interview Survey 2004~2013)

	Insured			
	(1)	R-squared F test	(2)	R-squared F test
Linear	.3155***	.1974	.3204***	.2360
	[.0138]	1002.98***	[.0145]	129.94***
Quadratic	.2889***	.1979	.2922***	.2363
	[.0215]	603.84***	[.0226]	120.06***
Triple	.2394***	.1985	.2517***	.2368
	[.0294]	434.25***	[.0309]	112.49***
Quartic	.2425***	.1988	.2767***	.2373
	[.0379]	337.86***	[.0398]	105.20***
LLR(IK)	.2604***	-	-	-

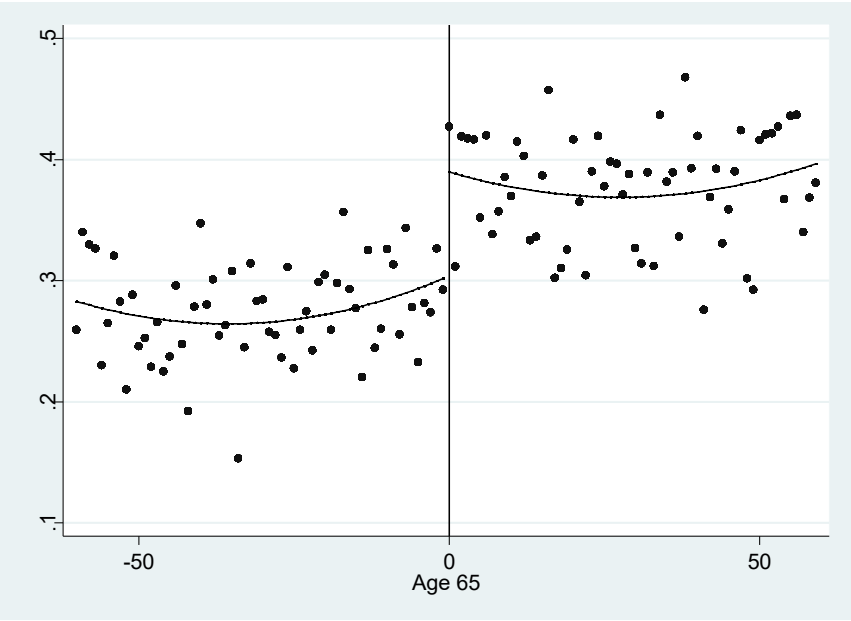
	[.0257]	-	-	-
LLR(CCT)	.2547***	-	-	-
	[.0281]	-	-	-
Control	-	-	√	-
Observation	13,002	13,002	10,996	10,996

Note: All statistics are based on a dataset created by Family, Person, and Sample Adult files from the NHIS for 2004 ~ 2013. All the estimates are coefficients on dummy variables that are equal to one if the respondent is at least 65 years old. The specification includes control variables: gender, marital status, educational attainment, employment status, race, region fixed effect and year fixed effect. The linear model includes age and its interaction with the dummy variable. The quadratic model includes age, age-squared variables, and their interactions with the dummy variables. The cubic model includes age, age-squared variables, age-tripled variables, and their interactions with the dummy variables. The quartic model includes age, age-squared variables, age-tripled variables, age-quartic variables and their interactions with the dummy variables. LLRs (Local Linear Regressions) are estimated using the bandwidth selection procedure proposed by Calonico, Cattaneo and Titiunik (2014) and Imbens and Kalyanaraman (2012) with an Epanechnikov kernel. Robust standard errors are presented in brackets. F-statistics indicates result of a test where the null hypothesis is that all of the regression coefficients are equal to zero. The statistical significance of each estimate is indicated as follows: *** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$. R-sqaures also shows how well the data fit the regression model.

The marginal effects obtained by estimating equation (1) are presented in 〈Table 3〉. All parametric models (linear, quadratic, triple, and quartic) show discrete increases in proportions of insured individuals at the age of 65. Column (2) shows the results of the parametric models with control variables, which have the same results as in column (1). The nonparametric local linear models with the bandwidth choice by Imbens and Kalyanaranman (2011) and Calonico et al. (2014) also show a discrete increase in insured proportions. The main regression results in columns (1) and (2) in 〈Table 3〉 are consistent with the graphical analysis in 〈Figure 2〉. As shown, the insured proportion increases by 24 to 32 percentage points at the age of 65, depending on specifications.

2. Changes in Self-Rated Health at age 65

〈Figure 3〉 Health Outcomes at age 65: Self-Rated Health



Note: This figure shows average ratio of those who answer "Excellent" or "Very Good" for their health status in age in months by gender. The markers represent the averages of variables at one-month intervals. The solid lines represent fitted regressions from the models that assume a quadratic age profile, interacted with a dummy for age 65 or older. A quadratic fit is imposed on either side of the cutoff age 0. Reported health represents recent reported health status, which is an indicator variable that is equal to 1 if respondents answer "Excellent" or "Very Good". Otherwise, it is 0.

〈Table 4〉 Change in Self-Rated Health at Age 65: The Reduced Form
(National Health Interview Survey 2004~2013)

	Reported Health Status			
	(1)	R-Squared F test	(2)	R-Squared F test
Linear	.0907***	.1190	.0583***	.1350
	[.0163]	53.12***	[.0166]	74.81***
Quadratic	.0858***	.1220	.0551**	.1306
	[.0246]	32.68***	[.0250]	69.30***
Triple	.1120***	.1231	.0786**	.1307
	[.0329]	23.63***	[.0334]	64.40***
Quartic	.1033**	.1242	.0565	.1308
	[.0415]	18.42***	[.0424]	60.12***
LLR(IK)	.0989***	-	-	-
	[.0257]	-	-	-
LLR(CCT)	.1071***	-	-	-
	[.0284]	-	-	-
Control	-	-	√	-
Observation	13,002	13,002	10,996	10,996

Note: All statistics are based on a dataset created by Family, Person, and Sample Adult files from the NHIS for 2004~2013. All the estimates are coefficients of dummy variables that are equal to one if the respondent is at least 65 years old. Specification in Columns (2) includes control variables: gender, marital status, educational attainment, employment status, race, and year fixed effect. The outcome variables are as follows: Recent Health Status is an indicator variable that equals 1 if respondents evaluated "Excellent" or "Very Good" for their health. The linear model includes age and its interaction with the dummy variable. The quadratic model includes age, age-squared variables, and their interactions with the dummy variables. The cubic model includes age, age-squared variables, age-tripled variables, and their interactions with the dummy variables. The quartic model includes age-quartic variables and their interactions with the dummy variables and variables that are used in the cubic model. LLRs (Local Linear Regressions) are estimated using the bandwidth selection procedure suggested by Calonico, Cattaneo and Titiunik (2014) and Imbens and Kalyanaraman (2012) with an Epanechnikov kernel. Robust standard errors are presented in brackets. F-statistics indicates result of a test where the null hypothesis is that all of the regression coefficients are equal to zero. The statistical significance of each estimate is indicated as follows: *** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$. R-sqaures also shows how well the data fit the regression model.

Focusing on the short-run effects of health insurance, I consider the effect of obtaining Medicare on self-rated health shortly after the age of 65. According to health self-efficacy theory, self-assurance in health management may have a positive effect on self-rated health. Health insurance can provide this confidence in taking care of health to the elderly persons who are newly covered by health insurance at the age of 65, as health insurance can allow for easy access to health care or preventive care services. In this study, the fact that the elderly individuals can utilize health care services whenever they need to is one of the hypotheses of health self-efficacy.

〈Figure 3〉 shows that there is a discrete increase in the proportion of respondents at around age of 65 who self-reported their health as "excellent" or "very good" at the time of the survey. Before the age of 65, self-reported health follows a constant trend and hovers around 30 percent, but after age 65, the proportion shows a discrete jump at the age of 65. When the elderly individuals reach the age of 65, their self-reported health sharply increases.

Consistent with 〈Figure 3〉, columns (1) and (2) in 〈Table 4〉 show that the proportion of those who evaluate their health as "excellent" or "very good" increases than before by approximately 6 to 11 percentage points at around the age of 65 in parametric and non-parametric regressions(except for quartic polynomial parametric model with control variables). However, these results in reduced forms do not reflect the causal relation between health insurance and self-rated health.

3. Results for the Second Stage

〈Table 5〉 The Causal Effects of Medicare on Self-Rated Health: The 2nd Stage
(National Health Interview Survey 2004~2013)

	Reported Health Status	
	(1)	(2)
1st Stage	.2741***	.2652***
	[.0228]	[.0253]
2nd Stage	.3679***	.4038***
	[.1018]	[.1172]
Kernel	IK	CCT
Observation	13,002	13,002

Note: All the estimates are based on a dataset created by the NHIS Sample Person and Adult files for 2004~2013. All the estimates are coefficients on dummy variables that are equal to one if the respondent is at least 65 years old. Coefficients (local linear regressions) are estimated using the bandwidth selection procedure suggested by Calonico, Cattaneo and Titiunik (2014) and Imbens and Kalyanaraman (2012) with an Epanechnikov kernel. The statistical significance of each estimate is indicated as follows: *** indicates $p < 0.01$, ** indicates $p < 0.05$, and * indicates $p < 0.1$.

So far, I have estimated the first stage, which considers the share of older adults who obtain health insurance at the age of 65, and the reduced form, which shows the change in self-rated health at age 65. I can identify the estimates, the causal effect of health insurance on self-rated health, by dividing the estimates of the first stage by those of the reduced form. This regression design is analogous to using the Medicare eligibility age of 65, as an instrumental variable to obtain the causal effect estimates in the second stage, which are referred to as Wald-type 2SLS estimates.

In the first stage and the reduced form, I used both parametric and nonparametric approaches, which in fact both need to choose optimal bandwidth, kernel and polynomial order. Parametric estimators use an infinite bandwidth, a uniform kernel, and a relatively high-order polynomial, while nonparametric estimators use a smaller bandwidth, a kernel that places more

weight near the threshold, and a lower-order polynomial.

Although there is no strict rule which decides which approach works better, estimates in parametric methods can lead to a bias in that all data far from the cutoff age are used. Therefore, a more modern approach is to use nonparametric methods to approximate the left and right-hand limits. However, when using the nonparametric kernel method, estimates suffer from the boundary problem, which leads to systematic bias. To overcome the boundary problem, I use 2SLS local linear regression. This regression is weighted least squares using observations to the left of the threshold. The linear term in the model eliminates boundary bias exhibited by local constant estimators.

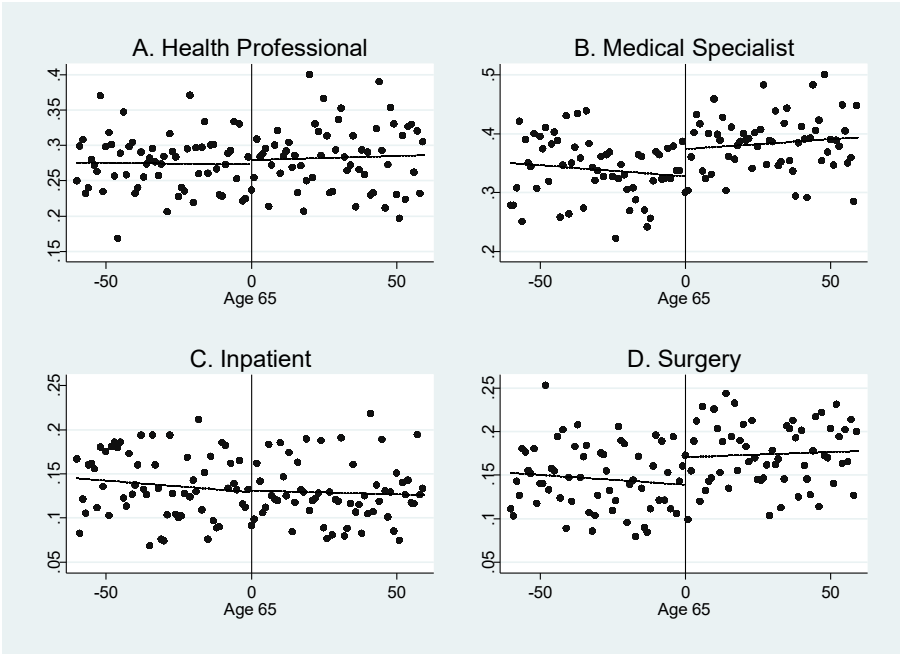
Coefficients in the 2SLS regression identify the LATE on compliers with treatment assignment. The results in the second stage show that the proportion of older adults who reported improved self-rated health increased at the cutoff age of 65, caused by the change in health insurance status form uninsured to insured. 〈Table 5〉 presents that for both IK and CCT bandwidth choices, coefficients in the second stage are positive and statistically significant in self-rated health. The proportion of those who rate their health as excellent or very good than before increases from 36.7 to 40.3 percentage points at the age of 65. In other words, the proportion of those who are covered by health insurance increases by about 27 percentage points. Among those who are newly covered by health insurance at the age of 65, self-rated health improves in 36.7 to 40.3 percent of those individuals; their self-rated health changed from good, fair, or poor to excellent or very good.

A few previous studies found a positive relationship between health insurance and health outcomes. However, they did not overcome the endogeneity problem; differences in unobserved characteristics may lead to differences in health outcomes. To address the endogeneity, other strand of

previous studies used a change in exogenous event that led to a change in health insurance coverage with econometric methods. Card et al. (2008) found mild improvements in self-rated health and no effect on mortality. Finkelstein and McKnight (2008) concluded that Medicare have no effect on health of those newly eligible for it. On the other hand, in this study, Medicare has an effect on self-rated health. Given that self-rated health improved right after the age of 65, Medicare significantly affects self-rated health in the short-run.

4. Robustness

〈Figure 4〉 Health Care Services at age 65



Note: Figures A to D in this figure show average ratio of those who have visited to health professional and medical specialist in age in months by gender. Figures E to H show average ratio of those who were hospitalized overnight (had some surgeries) during the past 12 months by gender. The markers represent the averages of variables at one-month intervals. The solid lines represent fitted regressions from the models that assume a linear age profile, interacted with a dummy for age 65 or older. A linear fit is imposed on either side of the cutoff age 0.

〈Table 6〉 The Causal Effects of Medicare on Health Care and Preventive Care Services: The 2nd Stage

(National Health Interview Survey 2004~2013)

	Health Professional		*Medical Specialist*		*Inpatient*		*Surgery*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1st Stage	.2808***	.2575***	.2587***	.2445***	.2991***	.2619***	.2616***	.2463***
	[.0209]	[.0275]	[.0273]	[.0322]	[.0168]	[.0262]	[.0263]	[.0306]
2nd Stage	-.0060	.0359	-.0599	-.1381	.0016	-.0533	.0003	-.0015
	[.0805]	[.1119]	[.1218]	[.1534]	[.0472]	[.0808]	[.0861]	[.1046]
Kernel	IK	CCT	IK	CCT	IK	CCT	IK	CCT
Observation	13,002	13,002	13,002	13,002	5,745	5,745	5,745	5,745
	General Doctor		*Flu-shot*		*Cholesterol*		*High Blood Pressure*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1st Stage	.2704***	.2439***	.2797***	.2527***	.2814***	.2651***	.2683***	.2593***
	[.0236]	[.0333]	[.0214]	[.0286]	[.0349]	[.0449]	[.0415]	[.0481]
2nd Stage	.2087**	.3669***	.1534*	.1730	.2369*	.2383	.2571**	.2646*
	[.0887]	[.1362]	[.0903]	[.1306]	[.1223]	[.1654]	[.1226]	[.1473]
Kernel	IK	CCT	IK	CCT	IK	CCT	IK	CCT
Observation	13,002	13,002	13,002	13,002	5,745	5,745	5,745	5,745

Note: All the estimates are based on a dataset created by the NHIS Sample Person and Adult files for 2004 ~ 2013. All the estimates are coefficients on dummy variables that are equal to one if the respondent is at least 65 years old. Coefficients (local linear regressions) are estimated using the bandwidth selection procedure suggested by Calonico, Cattaneo and Titiunik (2014) and Imbens and Kalyanaraman (2012) with an Epanechnikov kernel. The statistical significance of each estimate is indicated as follows: *** indicates p 〈 0.01, ** indicates p 〈 0.05, and * indicates p 〈 0.1.

Two main conclusions can be drawn from the previous results. First, among those who have no private health insurance, when reaching the Medicare-eligible age of 65, the proportion of insured individuals increased. Second, the positive effect of Medicare coverage on self-rated health exists; elderly individuals after age 65 show more clearer improvement in self-rated health than before age 65.

One potential explanation for these results is that health care or preventive care services can influence self-rated health. As Medicare allows easier access

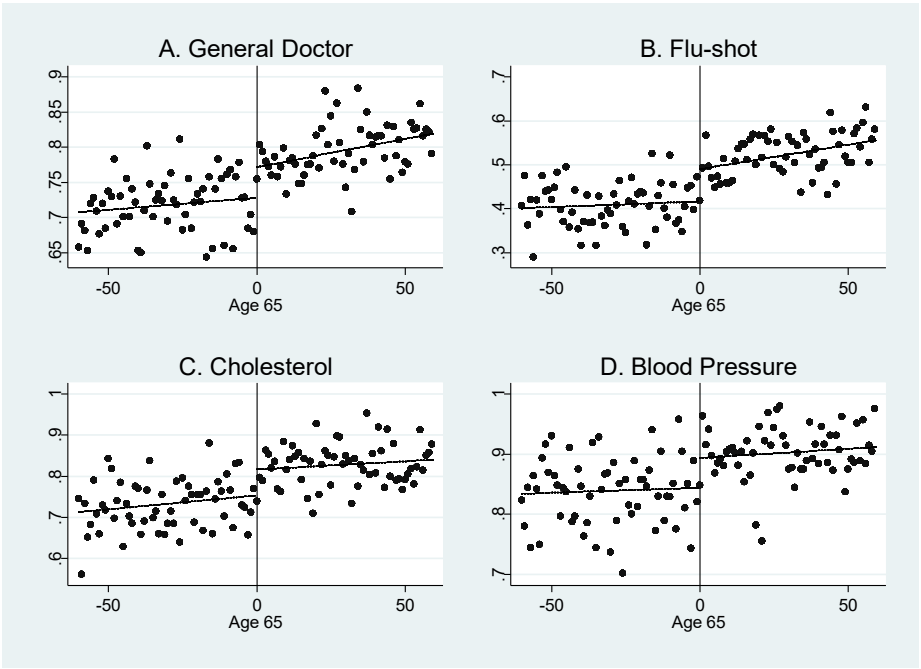
to health care and preventive care services, having Medicare may increase the utilization of those services, which may in turn may influence health.

In this section, I examine changes in the utilization of those services at the age of 65 to investigate potential effects on health outcomes. 〈Figure 4〉 shows the actual and fitted age profiles of health care services, such as visits to health professionals or medical specialists, and utilization of inpatient and surgery. The markers in the figures represent proportions of those who have utilized outpatient and inpatient services by age in months, and the lines represent fitted regression from models with a linear age profile fully interacted with a dummy for age 65 or older.

In Panel A of 〈Figure 4〉, the proportion of male elderly individuals who visited a health professional does not change and it also does not jump sharply at age 65. Panel B(Medical Specialist) show a slight different trend before and after the age of 65, but no clear jump at age 65. As a result, no discrete jump at age 65 implies that Medicare eligibility has no immediate effect on outpatient services at the age of 65. As for inpatients or surgery, I also observe patterns which are similar to that of outpatient service usage, with there being no discernible difference. Panel C presents the proportion of individuals who utilized inpatient services in age in months, and the markers are distributed widely with no pattern. Patterns of markers do not show any clear jump at the age of 65. Panel D shows the actual and fitted age profiles of whether or not receiving any surgery in the past 12 months by gender. Although the proportion of elderly individuals who took surgery increases smoothly across age 65, overall trends show no discrete jump at the age of 65. Results of Panel A in 〈Table 6〉 shows the coefficients for the 2SLS local linear regression. Consistent with 〈Figure 4〉, no coefficient in 〈Table 6〉 shows statistical significance, which implies that health insurance for elderly individuals does

not lead to sharp increases in health care service usage at the age of 65.

〈Figure 5〉 Preventive Care at age 65



Note: This figure A shows average ratio of those who have seen/talked to a general doctor during the past 12 months in age in months by gender. Others (B,C, and D) show average ratio of those who have taken flu-shot, cholesterol and blood pressure tests during the past 12 months in age in months by gender. The markers represent the averages of variables at one-month intervals. The solid lines represent fitted regressions from the models that assume a linear age profile, interacted with a dummy for age 65 or older. A linear fit is imposed on either side of the cutoff age 0.

〈Figure 5〉 shows the actual and fitted age profiles of preventive care, including visits to the general doctor, receiving flu-shots, and tests for cholesterol and blood pressure. The results are as follows: first, the proportion of visits to the general doctor also increases across age 65. Panel A also show a discrete jump at age 65. This type of pattern holds true for both flu-shots and tests for cholesterol or high blood pressure. As respondents grow older, the proportion of receiving flu-shot, testing for cholesterol and blood pressure

tend to increase. For the elderly individuals, graphically, there exists slight jumps at the age of 65 for flu-shots and tests for cholesterol and blood pressure.

Panel B in 〈Table 6〉 shows that there is a positive causal effect of health insurance on preventive care. Coefficients on whether visiting to general doctor or whether testing high blood pressure are positive and significant in the first and second stages. For flu-shot status and cholesterol test, coefficients on models with IK are positive and significant. The utilization of preventive care services for the elderly individuals are clearly influenced by obtaining of Medicare at the age of 65.

Becoming 65 leads to Medicare eligibility, which is likely to improve self-rated health. Despite that there is no discrete change in health care services including surgery and inpatient, self-rated health improves across the age of 65. Rather, the elderly individuals increases their use of preventive care services. Therefore, obtaining health insurance itself seems to increase the assurance of managing health which shows an discrete increase in preventive care services at the age of 65 and results in better self-rated health.

Ⅷ. Discussion and Conclusion

Considering the sample which consists of those who have no private health insurance before and after the age of 65, I found the proportion of those who are covered by health insurance increases by about 27 percentage points. Among those who are newly covered by health insurance at the age of 65, self-rated health improves in 37 to 41 percent of those individuals. As a result, I draw the main result from the analysis of this study: the existence of health

insurance improves self-rated health in the short-run.

The results in this study suggest that improvements in self-rated health are immediately implemented at the age of 65. However, while preventive care services increased sharply right after the age of 65, health care services did not show any discrete jump at the age of 65. Health care services cannot be attributed to better health in the short run.

Awareness of easily using health care or preventive care services can improve health in the short-run perspective. Health insurance, which enables older adults to have easy access to health care or preventive care services, can increase their assurance in self-managing health, which is a direct predictor of self-rated health. Despite that there is no discrete change in health care services including surgery and inpatient, the elderly individuals increases their use of preventive care services right after the age of 65. Although there are no direct medications or treatments through preventive care services, self-rated health improved sharply right after the age of 65. The confidence of self-managing health can have a positive effect on self-rated health.

To overcome the endogeneity caused by reverse causality or omitted variable bias, I used the age of 65 as an instrumental variable to examine the causal effect of health insurance on self-rated health, which is a concept of the fuzzy RD research design. I use the RD design to investigate some hypotheses of the potential effects of Medicare on self-rated health. For this study I test the health self-efficacy theory which hypothesizes that higher confidence in managing one's own health can improve health outcome, and I consider Medicare as a measure of this self-assurance due to the manner in which Medicare gives older adults easy access to health care or preventive care services.

The important limitations in this study are the following. The estimates of

the fuzzy RD research design are local in two senses: first they are local to the cutoff age 65. Estimates are specific to the elderly around the age of 65. While these estimates are likely to be generalized to the elderly individuals who are aged sixties or older, other age groups cannot be applied. Second, results apply only to compliers who become insured upon turning age 65 and these elderly individuals differ from the typical elderly individual in numerous ways. Nevertheless, these results will be useful for policy makers, as these results provide some information on how health insurance improves health status other than in conventional ways. Finally, estimates show the short-run response to a change in health insurance due to the Medicare eligibility. However, this can provide meaningful evidence that health insurance presents an assurance of managing one's health not in the long-run, but in the short-run. Results illustrate that the act of being covered by health insurance is important for health outcomes.

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요 약

본 연구는 건강보험이 주관적 건강 인식에 단기적으로 미치는 영향을 살펴본 연구이다. 내생성을 통제하기 위해 메디케어의 자격연령 65세를 도구변수로 사용한 경사형 회귀단절모형(Fuzzy Regression Discontinuity Regression)을 바탕으로 건강보험의 보장이 주관적 건강 인식에 미치는 영향을 살펴보았다. 표본은 65세 전후로 민간의료보험이 없는 노인층을 대상으로 하여 메디케어의 보장이 주관적 건강에 미치는 영향에 초점을 맞추었다. 본 연구의 결과는 다음과 같다. 첫째, 65세 전후로 건강보험에 보장되는 비율은 약 27% 가량 증가한다. 둘째, 65세에 새롭게 건강보험에 보장되는 사람들은 자기 자신이 평가한 주관적 건강이 향상된다. 셋째, 65세 전후 국지적으로 내원, 입원과 수술 등 의료이용의 급격한 증가가 없는 반면, 예방적 의료이용의 급격한 변화가 존재한다. 따라서 위와 같은 결과는, 건강보험에 보장됨으로써 필요할 때 언제든지 의료이용 혹은 예방의료 이용을 이용할 수 있다는 자각이 주관적 건강 인식에 영향을 줄 수 있다는 사실을 알 수 있다.

※ **국문색인어**: 메디케어, 의료이용, 예방적 의료이용, 주관적 건강