DOES HEALTH INSURANCE AFFECT HEALTHCARE SERVICES UTILIZATION AND PROTECT CITIZENS FROM CATASTROPHIC HEALTH EXPENDITURE IN VIETNAM? EVIDENCE FROM HOUSEHOLD LIVING STANDARD SURVEY

Nguyen Thi Thu Thuong

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A thesis submitted in partial fulfilment of the requirement for the degree of Master of Public Health

By

Nguyen Thi Thu Thuong

Vietnam

Declaration:

Where other people's work has been used (either from a printed source, internet or any other source), this has been carefully acknowledged and referenced in accordance with departmental requirements. The thesis "Does health insurance affect healthcare services utilization and protect citizens from catastrophic health expenditure in Vietnam? Evidence from Household Living Standard Survey" is my own work.

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LIST OF ABBREVIATIONS

ATT	average treatment effect on the treated
CDs	Communicable diseases
CHC	Commune health center
CHE	Catastrophic health expenditure
CHE	Current health expenditure
DOH	Department of Health
FFS	Fee-for-service
GDP	Gross Domestic Product
GSO	General Statistics Office of Vietnam
HI	Health insurance
HS	Heavily subsidized
HSHI	heavily subsidized health insurance (he poor, near-poor and policy beneficiaries group)
LMIC	Low and middle-income countries
MoH	Ministry of Health
NCDs	Non-communicable diseases
NN	Nearest-neighbor matching
OOPs	Out-of-pocket health expenditures
PHB	Provincial Health Bureaus
PPP	Purchasing Power Parity
SHI	Social health insurance
UHC	Universal Healthcare Coverage
UHI	Universal health insurance
VHI	Voluntary health insurance
VHLSS	Vietnam Household Living Standards Survey
VSS	Vietnamese Social Security
WB	World Bank
WHO	World Health Organization

GLOSSARY OF TERMS

Adverse selection	is a situation when people who are high risk of illness and have a greater need to use health services tend to enroll in health insurance than healthy people.(1)
Capitation payment method	is a method of quarterly and monthly prepayment for service providers a pre-determined amount of money per capita for a predetermined range of services (usually primary health care services) (2)
Case-based or Diagnosis-related-groups payment method	is package payment according to pre-determined medical examination and treatment costs for each case based on diagnosis.
Catastrophic health expenditure	when out-of-pocket expenditure exceeds 40% of the household's capacity to pay
Copayment / cost sharing	is the regulation that a health insurance participant pays part of the cost of health services, in addition to the amount that the health insurance organization pays for that health service. (1)
Fee-for-service payment method	is a payment method including medical examination and treatment costs based on the price of medical examination and treatment services; and expenses for drugs, chemicals, medical supplies, blood etc. and other incurred costs which are applied for patients at medical examination and treatment facilities.
Formal sector	is a formal economic sector, managed by social institutions, and employees have formal labor relations through labor contracts.(1)
Fund pooling	is a function of the financial system, a collection of health financing sources, for example, health insurance contributions of individuals and organizations into a fund, with the purpose of share financial risks in a large community, so that large medical expenses are shared among individuals and households. (1)
Global budget payment method	Health care providers receive a specified amount of money from purchasers to cover the costs of the pre-agreed services that they provide for a specific period of time. It is calculated based on inputs, outputs or both. This method gives providers more flexibility in making spending decisions (2)
Impoverishment	occurs when a non-poor household turns to a poor after health payments
Informal sector	includes employees who do not have a formal labor relations (free labor, or labor without formal labor contracts). (1)
Integrated people-centred health services	people and communities are at the centre of health system, not disease. People are promoted to be responsible for their health (3)
Line item budget	The medical service provider receives a specified amount from purchasers to compensate input costs such as labor, drugs, supplies for a specific period of time. Providers have less flexibility (2).

Meritorious people	include people with meritorious services to the revolution; people directly involved in the resistance against the America to save the country; people participating in war of national defense, undertaking international missions in Cambodia etc.
Out-of-pocket expenditure	includes costs for check-ups, treatment, medicines, hospital fees and others (allowances for physicians, travel, expenditures for buying medical instruments/supplies, fees for on-demand services, expenditures for buying additional medicines, traveling, caring) relating to visits for check-up/treatment. OOPs also include expenses for self-treatment. OOPs are net of reimbursement paid by health insurance.
Provider payment mechanism	is "the way that health purchasers pay health care providers to deliver services"(2)
Universal Health Coverage	is to ensure that everyone has the right to access quality health care services anywhere, whenever they need without financial difficulties. It covers all essential services throughout life - from health promotion to prevention, treatment, rehabilitation and palliative care. (1)
User fee	a direct payment to a healthcare provider when using medical services (1)

INTRODUCTION

As a lecturer working at the Department of Medical Economics, Thai Nguyen University of Economics and Business Administration. I realize that health financing is very important to my training and research. I hope that I can convey knowledge about this field to my students, or to organize short-term training courses on health financing for managers at district hospitals. Besides, health insurance is one of the pillars of social security system in Vietnam. Health insurance can help vulnerable groups and those living in remote areas fairly access health care services based on their needs. Although Vietnam's population health insurance coverage has increased over the past years, people's out-of-pocket expenses remain high and tend to increase, making households incur huge medical costs beyond affordability, or catastrophic health expenditure. This makes country difficult to achieve the strategic health financing goals 2016-2020.

In 2014, the Vietnamese National Assembly issued a revised Health Insurance law with increased funding from the state budget for purchasing health insurance cards for some groups, changes in copayment rates, and other regulations. Therefore, using the Vietnam Household Living Standards Survey (VHLSS) 2016 and VHLSS 2014, I aimed to evaluate the impact of health insurance scheme on access to healthcare services across different groups and the association between health insurance, other structural and health system factors and the risk of suffering catastrophic health expenditure of households. Then, the study can provide policy makers recommendations to improve health insurance scheme in particular, and strengthen the health system in general.

This study consists of five chapters. Chapter 1 provides general information on socioeconomic, demographic, ethnic information, health system delivery, health financing, health needs, and health inequality in Vietnam. Chapter 2 includes problem statement, justification, objectives, and methodology. Chapter 3 presents study findings. Discussion of findings is included in chapter 4. Chapter 5 draws conclusion and offers recommendations to policy makers.

ABSTRACT

Background. Vietnam still experiences difficulties to achieve UHC because people's OOPs remain very high. One of the most recent reforms of the government is the enactment of revised Health insurance (HI) Law in 2014. So far, its impact has not been evaluated. I aimed to assess the effect of HI on health service utilization and its ability to protect households from catastrophic health expenditure (CHE).

Method. I used Vietnam Household Living Standards Survey (VHLSS) 2016 and VHLSS 2014 dataset. To assess the impact of the HI on the use of health services, I employed the propensity score matching method. To assess the association between risk of CHE and HI participation status and other structural factors, I used logistic regression.

Results. Overall, the HI scheme was estimated to increase healthcare utilization for enrollees across different subsamples, although the size of the effect is different. The greatest effect was found in the frequency of using outpatient care. I found that participation in HI scheme had the most effect on using healthcare services at district hospitals. The study found that HI had a protective effect on lowering the odds of incurring CHE for households, although this effect is not always statistically significant across different subsamples.

Conclusion. To ensure that Vietnamese citizens have access to quality health services, and without facing CHE, policy makers need to continue expanding HI coverage, while focusing on redesigning benefits package, provider payment method and minimizing cost-sharing. Besides, health system factors and demand issues need to be considered alongside.

Key words. Health insurance, healthcare utilization, benefits package, out-of-pocket expenditure, catastrophic health expenditure.

CHAPTER 1. BACKGROUND INFORMATION ON VIETNAM

1.1. Geographical, Demographic and socio-economic Context

Vietnam is located in Southeast Asia with land area of 310,070 square kilometers. Vietnam is a populous country with 95.5 million population in 2018, ranking 14th in the world (4). The country has 63 cities/provinces, divided into 6 geographical areas, namely Red River Delta, Northern Midlands and Mountains, North and South Central Coast, Central Highlands, South East and Mekong River Delta. Vietnam's topography consists of three quarters of mountains and hills (5). Urbanization rate is 30%. The ages of 15 to 60 predominate in Vietnam, and population aging is a challenge for the country (6, 7). Vietnam is a culturally diverse country with 54 ethnic groups, of which Kinh and Hoa are the main ethnic group making up 86.2% of the population (5). Vietnamese culture is heavily influenced by Chinese culture, in which family-orientation and interpersonal relationships are emphasized (5). The poverty rate in Vietnam decreased from 17.2% in 2012 to 9.8% in 2016 (4), but there are still large differences among provinces. About 60% of the working-age population works in informal sector (6). The unemployment rate is about 1.9% (4). Vietnam's GDP is 244.948 billion US$ in 2018, with an average growth rate over the past 10 years of 6.4%, Vietnam is one of the countries with the highest economic growth rate in Southeast Asia (4). GDP per capita is 2563.8 US$. Vietnam's Human Development Index is 0.694 in 2017, which is lower than Philippines, Thailand, and similar to Indonesia (8).

1.2. Health system context
1.2.1. *Health service delivery system.*

Vietnam's health system is a mixed system that includes both public and private healthcare providers (Figure 1.1). However, public health providers take the leading role in medical care, education and research. The service delivery system is divided into 4 levels, including: (I) central level (central and regional hospitals) under the direct management of the Ministry of Health (MoH); (II) provincial level of providers managed by the Provincial Health Bureaus (PHB); (III) district providers, managed by PHB; and (IV) commune-level providers under management of District Health Bureaus or District Health Center (9). The total number of health facilities in Vietnam is now 13,508. The central level consists of 47 facilities, provincial level - 459, district level - 982, commune level -11,083, other branches-755, private and semi-public hospitals – 182 (10). The district and commune level play a key role in primary care. About 40% of people choose public health facility for outpatient care, while the figure for inpatient admission is 96%(10). The number of beds per 1,000 inhabitants in 2015 is 2.6 (10), which is lower than the recommendation of WHO (3.9 beds/1000 population)(5). This has led to the overload of many hospitals at tertiary level. Number of doctors per 1,000 population in 2016 is 0.82 that is much lower than neighboring China (1.8 doctors/1000pop.) (4).
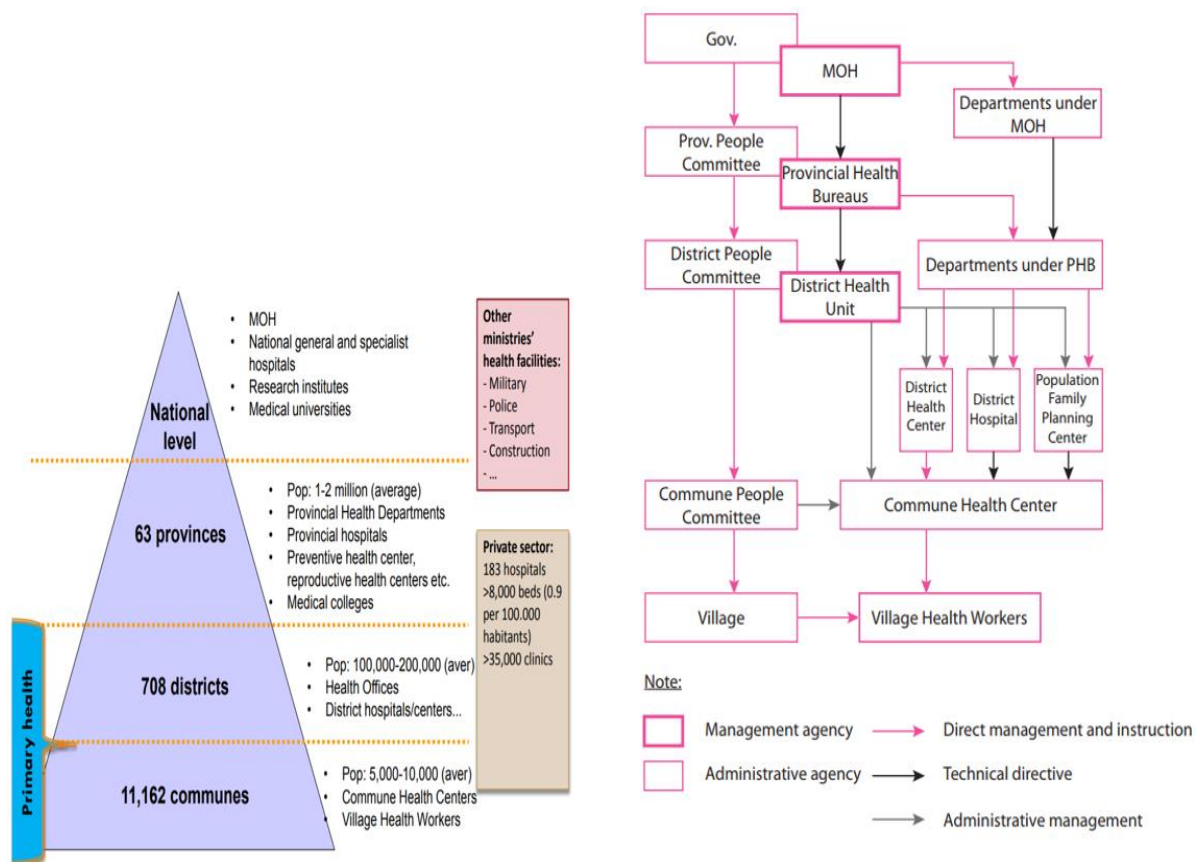
Figure 1.1. The organization of health system in Vietnam (9, 11)

Drug supply system. The system can provide adequate drugs across the country, covering both mountainous, island and remote areas. The average density of drug retail facilities is 2123 people per pharmaceutical outlet (13). The average per capita spending on medicine increased from 9.85US$/ person in 2005 to 34.48US$/person in 2014 (13). Vietnam imports most of drugs to meet the demand of people (13).

1.2.2. Health financing.

The main health sources and mechanisms of funding for healthcare providers are presented in Figure 1.2. The financial sources include state budget, health insurance fund and out-of-pocket expenditures (OOPs). The payment method of MoH or Department of Health (DOH) is global budget or line item budget, and that of social health insurance fund is fee-for-service (FFS) or capitation.
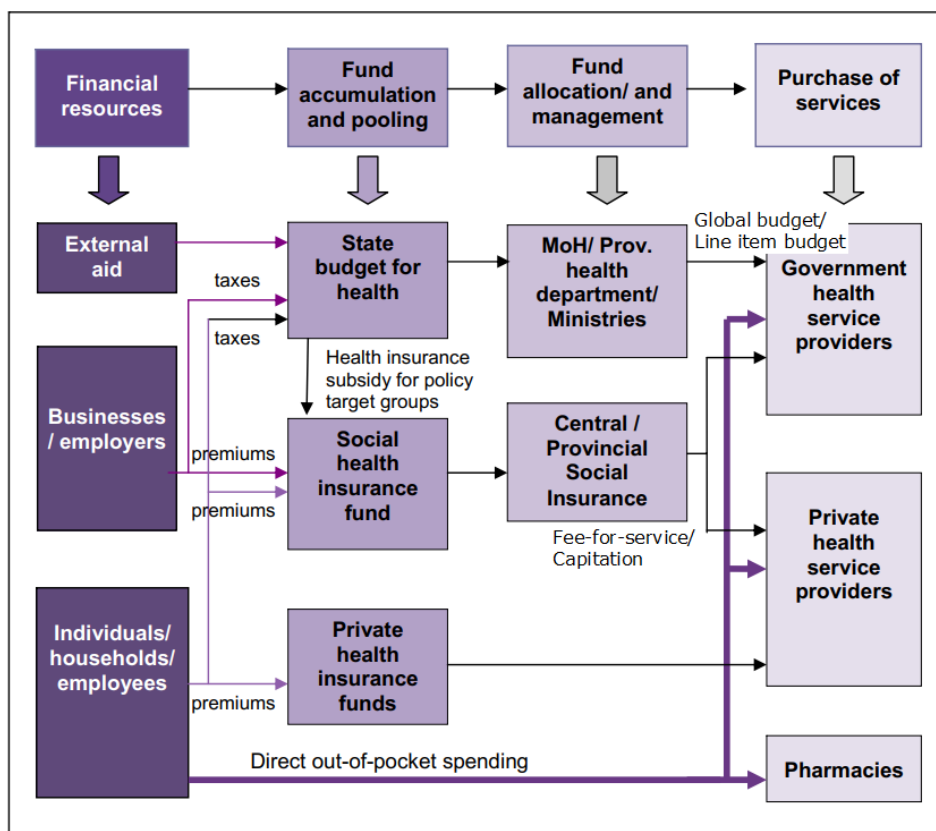
Figure 1.2. Health finance flows in Viet Nam (12)

1.2.3. Healthcare outcomes and health need.

Health status and healthcare indicators. Vietnam has achieved remarkable results in health care reflected in some basic health indicators: average life expectancy is 73, infant mortality rate (IMR) per 1,000 live births – 14.7, maternal mortality rate per 1,000 live births – 54, malnutrition rate of children under age 5 - 14.1%, fully vaccinated children – 90%, access to improved sanitation facilities – 75%, in 2015 (7, 10).

Health needs

Non-communicable diseases (NCDs). Vietnam is undergoing epidemiological transition with an increase in NCDs (13). There was a slight decrease from 25% in 2006 to 23% in 2015 in the share of hospital admission due to communicable diseases (CDs), while the figure for NCDs increased significantly from 62% to 66% in the same period (10). NCDs account for three-quarters of the causes of death. Common causes of death among NCDs are related to cardiovascular disease, and diabetes (10). The proportion of people diagnosed with hypertension is 43.1%, and that of people with diabetes is 31.1%. Only 13.6% of diagnosed people with hypertension follow treatment, and the figure for diabetes is 28.9% (7).

Cancer. Vietnam is experiencing a dramatic increase in the number of cancer patients (13). The prevalent cancers are liver, lung, stomach and breast. Cancer is often detected and treated in the late stages resulting in increased treatment costs. The ability to prolong life and enhance the quality of life is, thus, limited.

Re-emerging CDs. In 2014, measles outbreaks occurred with over 15,000 cases of infected children; dengue fever outbreak - with more than 90,626 cases (10).

Inequalities in health. In recent years, there is an increase in inequity in health between different regions, ethnic and income groups (9). For example, the percentage of children who had an episode of diarrhea among ethnic minority's households is 2.8 times higher than that of Kinh/Hoa households, and the figures for the lowest and highest quintile households are 5.2% and 15.4% respectively (14). There is also inequality in human resources for health. The number of doctors per 10,000 people in capital is 9, but in remote areas this rate is 1 (5). The number of doctors at the commune level is 1,995, while at the provincial level it is 5,304. The numbers of high degree nurses at these facilities are 140 and 1,920 respectively. The percentage of commune health station (CHS) with doctors is only 78% (10).

CHAPTER 2. PROBLEM STATEMENT, JUSTIFICATION, OBJECTIVES AND METHODOLOGY

2.1. Problem statement and justification

Access to basic health care services plays an important role in the overall well-being of people. Health care is not only considered an essential need but also a basic human right (15). However, in low and middle-income countries (LMIC) where poverty and inequalities affect health status and hinder the provision and access to health care, accessibility to health services remains highly restricted (15). Accordingly, Universal Healthcare Coverage (UHC) with non-profit health insurance (HI) scheme is one of the solutions and targets of many countries for increasing healthcare coverage and financial protection (16, 17).

In Vietnam, health insurance is considered an important financial mechanism to help citizens increase access to healthcare services as well as protect them from financial risks due to medical expenses(18). In 2014, revised Health Insurance Law was issued with implementation of Compulsory Health Insurance, and makes HI become the main mechanism to implement UHC(19). The government has shifted its focus from the supply side to demand side subsidies by paying for HI premiums for the poor, children and meritorious people(20). Vietnam has made great achievements in expanding HI coverage, which has sharply increased from 47.8% in 2008 to 80% in 2016(21). However, HI coverage is still low in some groups, such as the near-poor at 55%. People enrolling in voluntary health insurance (VHI) were 34% in 2014(1). Therefore, the target of 90.7% HI coverage in 2020 set up by the Government according to Decision 1167 seems difficult to achieve because of inability to extend the coverage(6).

In the early 1990s, OOPs constituted more than 60% of total health spending(6), leading to adverse impacts on equity and financial protection of population. This figure has reduced significantly to 33% in in the early 2000s. However, it is on the increase in recent years and reached 45% in 2016 (22). Additionally, OOPs in Vietnam are higher in comparison with other countries in Asia such as China (32.4%), Malaysia(36.6%), Thailand (11.7%) (23). According to WHO, it is difficult to obtain UHC if OOPs exceed 20% of total health spending(24). High OOPs might not only put poor households who have low income, savings or assets, but also wealthy households at risk of catastrophic health expenditure (CHE) and impoverishment. CHE forces households to cut spending on basic needs such as foods, clothes, education, and then reducing household living standards. In 2011, the CHE rate in Vietnam was quite high with 9.8%(20). These conditions create difficulties in achieving Health Financing Strategy 2016-2025 of Vietnam–reduction in OOPs to 30% and catastrophic health costs to 2%(1).

To date, a large and growing body of literature has investigated the impact of health insurance on healthcare utilization in LMIC(25). The positive impact of health insurance on access and utilization has been demonstrated in the studies of Hangoma et al. (2018)(26), Balamiento, (2018) (15), Zhao (2014) (27), Sparrow et al. (2010) (28). However, in the study on the impact of medical insurance for the poor in Georgia Bauhoff et al. (2010)(29) indicated that there is no impact of the program on utilization of health services. Similarly, one study by Thornton et al. (2010) (30) about the impact of social security HI for the informal sector workers in Nicaragua found that there are no increase on use of services among the newly insured. This inconsistency may be due to the fact that these empirical studies were carried out in different settings with different health financing mechanisms and health seeking behaviours.

In Vietnam, a considerable amount of literature has been published on evaluating the impact of non-profit health insurance programs on utilization of healthcare services. Similarly, the research results are not always consistent. Wagstaff, (2010) (31) found that while health insurance program for the poor has had no impact on healthcare utilization, while Sepehri et. al (2006) (32) investigated that the insured have a higher hospital stay than those without insurance. Nguyen (2011) (33) showed that VHI increases outpatient and inpatient visits among people having insurance.

With regard to the role of HI in financial protection, the negative association between having HI and incidence of CHE has been studied in many countries. For example, a study in Turkey (34) found that risk pooling protects the insured from CHE. Likewise, Mekonen et.al (2018)(35) demonstrated that community based HI in Ethiopia reduce CHE rate by 23.2%. Similarly, Sene and Cisse (2015) (36) investigated that an increase in the number of HI participants in household reduces CHE in Senegal. In Vietnam, there are some studies on the relationship between HI and CHE (37 -39).

The change in utilization of healthcare services can be explained by a number of factors. While moral hazard is likely to increase utilization, the increase may also be the result of the cross-subsidy from the rich to the poor, and from those with low-risk to those with high-risk of disease(31). Additionally, non-price factors such as geographical distance or education level can create barriers to access to health facilities among the insured who living in remote areas. The belief of citizens about traditional treatment may also prevent them using health services. Skepticism over quality of the registered health facilities (nearest) likely makes insured individuals switch to using private health services. Importantly, every change in HI policy can affect these factors and behavior of seeking and using health services of citizens. How did the changes in HI Law issued in 2014 by Vietnamese National Assembly affect the use of health services? This question has not been

answered so far. To my knowledge, until now there has been no quantitative study evaluating this impact in Vietnam. Therefore, examining the impact of health insurance program has been crucial because it will offer policy makers useful information to improve the Health Insurance scheme in Vietnam making healthcare services available and affordable to citizens, especially to disadvantaged people.

Besides, whether increasing the use of medical services is always positive if this increase is due to supplier-induced demand of health providers, for example. Consequently, the OOPs increases. Whether household's resources will keep pace with the increase of OOPs, and whether HI is always a miracle to save the household from CHE. That question prompted me to study the effect of HI and other determinants on the risk of CHE.

2.2. Study objectives

General objective. Evaluating the impact of health insurance in Vietnam on healthcare utilization of citizens and its association with household's catastrophic health expenditure in order to offer recommendations to policy makers to improve the Health Insurance scheme and strengthen health system.

Specific objectives

1. To analyze the current health financing situation and health insurance reforms in Vietnam
2. To examine the impact of health insurance on healthcare services utilization among different groups in Vietnam.
3. To evaluate the association between health insurance and probability of incurring catastrophic health expenditure of Vietnamese households.
4. To provide recommendations to policy makers for further improvement of the health insurance scheme and strengthen health system in Vietnam.

2.3. Methodology

2.3.1. Conceptual framework

In this study, I analyzed the social and individual determinants affecting health service utilization and CHE based on the Andersen's behavioral model (1995) (40) (Appendix 2.1) and other references (41-44). This is well-validated theoretical framework which has been broadly applied to illustrate the use of medical services in different settings (27, 41, 45, 46).

In this model, the use of health services is defined by the interaction of four components: environment, population characteristics, health behavior and outcomes.

The health system and external environment are the parts of environment determinant. While the former includes policies, resources and organizations, the later embraces, for example, country's regions, place of living (rural or urban areas) (27, 47).

In terms of population characteristics, predisposing factors may comprise demographic and social characteristics. The enabling factors might consist of income or expenditure, health insurance and other assets of households.

These factors promote or prevent health services utilization depending on the need for such services. Examples of health care need are self-reported or actual health status (46, 48). Deciding whether or not to use medical services, how to use it may be affected by these factors

Next the outcomes, including consumer satisfaction are likely to influence continued or further use of these services.

My study used secondary data from the VHLSS survey of GSO, therefore, some factors were not included in the dataset, such as some components of health system (drugs, human resources, information system etc.), evaluated health status, consumer satisfaction, and these factors were excluded in the adapted framework. In Anderson's model, health insurance was only one of the enabling factors affecting health-seeking behavior. As this study aims to assess the impact of HI on the use of medical services of individuals, and its association with financial health risk of households, so health insurance is the focus of the research model. Besides, Anderson's model has included many overlapping relationships, which need to be processed by advanced econometric models. Therefore, I adjusted the model to make it more simple and suitable for research purposes and objectives. Figure 2.1 presents the adapted conceptual framework from Anderson's behavioral model.

Confounding variables

- Predisposing factors
Age
Gender
Ethnicity
Marital status
Education level
Occupation status
Household size
Household composition.

- Enabling factors
Expenditure
Number of motorcycles
Number of telephones
Number of radio, TV or computer
Total residential area (m2)

- Need factors
Illness status in last 12 months
Number of illness times in last 12 months
Number of illness days in last 12 months
- External environment
Place of residence
Region

Health insurance

Use of health services
- Frequency of outpatient and inpatient visits.
- Health services utilization at health facilities (community health centers, district hospital, public and private health facilities…)
- Reasons for visiting health facilities /types of visit (medical treatment, health

Financial burden
- OOPs
- Catastrophic health expenditure

Figure 2.1. Conceptual framework for evaluating impact of UHC on healthcare utilization and financial protection, adapted from Andersen's behavioral model (41)

2.3.2. Data

In order to assess the impact of universal health insurance coverage on the use of health services and CHE, the study used the Vietnam Household Living Standards Survey (VHLSS) 2016 and VHLSS 2014. The surveys were carried out every two years by the General Statistics Office of Vietnam (GSO) with technical assistance and funding from the World Bank (WB). The VHLSS 2014 included 9,399 households and 35,920 individuals from 3,130 communes. The VHLSS 2016 embraced 9,399 households with 35,793 individuals, selected from 3,133 communes in which 50% of the enumeration areas were selected from the VHLSS 2014 and 50% were newly selected from the master sample. The details of information on sampling methods and questionaries' are provided in VHLSS handbook (49). The data are secondary, anonymous and available at GSO of Vietnam; therefore, there was no need for ethical approval.

2.3.3. Empirical framework

A. For health care utilization

One of the objectives of this study is to assess the impact of participation in HI on the use of health services. When evaluating policies, we encounter problems such as selection bias, which means that enrollment in HI scheme is not random for some groups such as the informal sector workers, the farmers, the elderly or the near-poor due to the voluntary per se of the program (50-52). There are confounding factors that may affect the participation in HI. If these characteristics are systematically correlated with the outcome variables, it may lead to biased estimates (50,53). For instance, potential health risks, age and income can simultaneously affect demands for health services and health insurance enrollment(53,54). Although we do not face the self-selection problem in estimating effect of the HI program on the poor, the assignment is not random, because they are selected through predefined criteria (55).

In this study, the effect of the HI scheme can be estimated by comparing the use of health services when people join HI and when they do not participate. However, in observational research it is difficult to estimate this effect because we do not know how the insured would have used medical services if they had not enrolled in HI. Accordingly, I employed the propensity score matching (PSM) method which was introduced by Rosenbaum and Rubin(56) to address this problem. This method was appied in a number of studies such as Mebratie et al. (2019) (53); Balamiento (2018) (54), Gustafsson-Wright et al. (2018)(57) and Nguyen (2011) (33). The PSM builds a statistical comparison group based on the likelihood of involving in the HI program, depending on the observed traits. This probability is defined as propensity scores (50). The PSM based on two assumptions.

First, participation in program is completely based on observable features, which is called unconfoundedness (50):

$$(Y_i^T, Y_i^C) \perp T_i \mid X_i$$

where, T_i is treatment variable, $T_i = 1$ if the individual participate in the HI program, $T_i = 0$ otherwise. Y_i^T, Y_i^C stand for outcomes variables of interest for the enrolled (treatment group) and the non-enrolled (control group); X_i presents covariates affecting both self-selection and outcome variables

The second assumption is the common support, which is the area where the propensity scores of both the treatment group and control group are estimated. It is assumed that the probability of enrollment, conditional on the covariates X belongs to 0 and 1, $0 < P(T_i = 1 \mid X_i) < 1$ (50). Every enrolled individual will be compared to the corresponding non-enrolled which has the same propensity scores; then the average difference in outcomes between the two groups is calculated to determine the effectiveness of the intervention program. This effect is the average treatment effect on the treated-ATT. The ATT can be defined as follows (50,58):

$$ATT_{PSM} = E_{P(X)|T=1}\{E[Y_i^T|T_i = 1, P(X)] - E[Y_i^C|T_i = 0, P(X)]\} \quad (1)$$

where, $P(X)$ represent propensity scores, given the observed characteristics of participants and nonparticipants, which are estimated from logit regression in this study.

I used different matching estimators to check the robustness of estimation results including nearest-neighbor matching (NNM), kernel matching and radius caliper matching. The NNM method matches the HI participants with non-participants who have the closest propensity score(50). Kernel matching is a non-parametric estimation method that uses the average weight of all uninsured people to create a counterfactual match for each enrollment(50). Radius matching algorithm employs "threshold on the maximum propensity score distance"(50) between each enrollee and all non-enrollees within the radius. I used default in number of neighbors. The caliper is determined by dividing the standard deviation of the propensity score by 4 (59). I also conducted a balancing test after matching to check whether there is systematic differences in the distribution of covariates between treatment and control group. I also compared pseudo R^2 and p-values of the likelihood ratio test from logistic regression before and after matching. The distribution of common support was also used to check the quality of matching.

Treatment and control groups

Control groups are those who are non-insured in 2016

Treatment groups. To evaluate whether the impacts of HI participation on a number of outcome variables are heterogeneous across the entitlement categories, and to lessen the possibility of mismatching, I divided the insured into two subgroups, classified as voluntary health insurance subsample (VHI), heavily subsidized (HS) subsamples based on the amendments of HI policy. The full sample includes all individuals having HI. The treatment group is also derived from VHLSS 2016 dataset.

Outcome variables

I assess the impact of the HI scheme on the frequency of outpatient and inpatient visits, frequency of healthcare utilization at public and private health facilities, at different levels of providers, and types of visit.

Explanatory variables

To ensure that explanatory variables are exogenous with participation in health insurance (33, 53, 50, 60), the covariates in 2014 VHLSS were used instead of 2016 VHLSS- pre-treatment variables. Explanatory variables should contain covariates which affect simultaneously the treatment (enrollment) status and the outcomes of interest (33, 58).

Explanatory variable were chosen based on Andersen behavioral model, which is presented in my conceptual framework (Figure 2.1). These control variables have been used in a large and growing volume of public studies (15, 27, 31, 33, 41, 43, 47, 53, 61). The definition of variables is provided in Appendix 2.2.

B. For catastrophic health expenditure.

I used a multinomial logistic regression model to analyze the association between HI and the incidence of household's CHE with cross-sectional data of 2016. One of the advantages of the regression model is that it allows us to consider the effects of all determinants affecting CHE of households. The model is defined as follows:

$$\log\left(\frac{\rho_i}{1-\rho_i}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} \dots + u_j \tag{2}$$

Where ρ_i is the probability of household experiencing CHE. There are different methods of measuring the incidence of CHE(62). In this study, I used the method proposed by WHO where a household incurs CHE when OOPs are greater than 40% of its capacity to pay. I followed the steps in WHO guidelines to calculate CHE of household(63). Selected independent variables are based on adapted conceptual framework of Andersen' behavioral model above. The definition of these variable are presented in Appendix 2.3. I used software STATA (version 14) to process and analyze data.

After removing missing observations, the remaining number of observations used in my study is as follows:

Table 2.1. The number of observations used in this study

	VHLSS 2014	VHLSS 2016	VHLSS 2014-2016
Individual level	17,848	17,080	4,900
Households level		7,173	

CHAPTER 3. FINDINGS AND DISCUSSION

3.1. Health financing situation and health insurance reform in Vietnam

3.1.1. Health financing situation in Vietnam

In 2016, current health expenditure (CHE) accounted for 6% of GDP, which was quite similar with neighboring countries and other LMIC, for example, China 5%, Cambodia 6%, Myanmar 5%, and Philippines 4%. The share of government health expenditure in GDP has slightly fluctuated around 3% during the last 10 years (22). As WHO guidance, if this share is less than 5%, the health system depends much on OOPs (24,64). The absolute amount of public expenditure per capita in PPP international $ increased from 69 in 2005 to 169 in 2016 (22), which has surpassed the benchmark of 86$ (24). This confirms the efforts of the Vietnamese government to achieve UHC. However, Vietnam has moved away from some benchmarks for UHC. For example, about 45% of total health expenditure came from OOPs, while the benchmark proposed by WHO is 15-20%. In the period 2005-2016, share of public health spending (state budget and SHI) experienced a significant decline from 58% in 2005 to 49% in 2016. Additionally, government health expenditure as a share of total government spending remained stable at 9% (22). Consequently, share of OOPs in total health spending went up substantially from 37% to 45% between 2005 and 2016 (Figure 3.1).
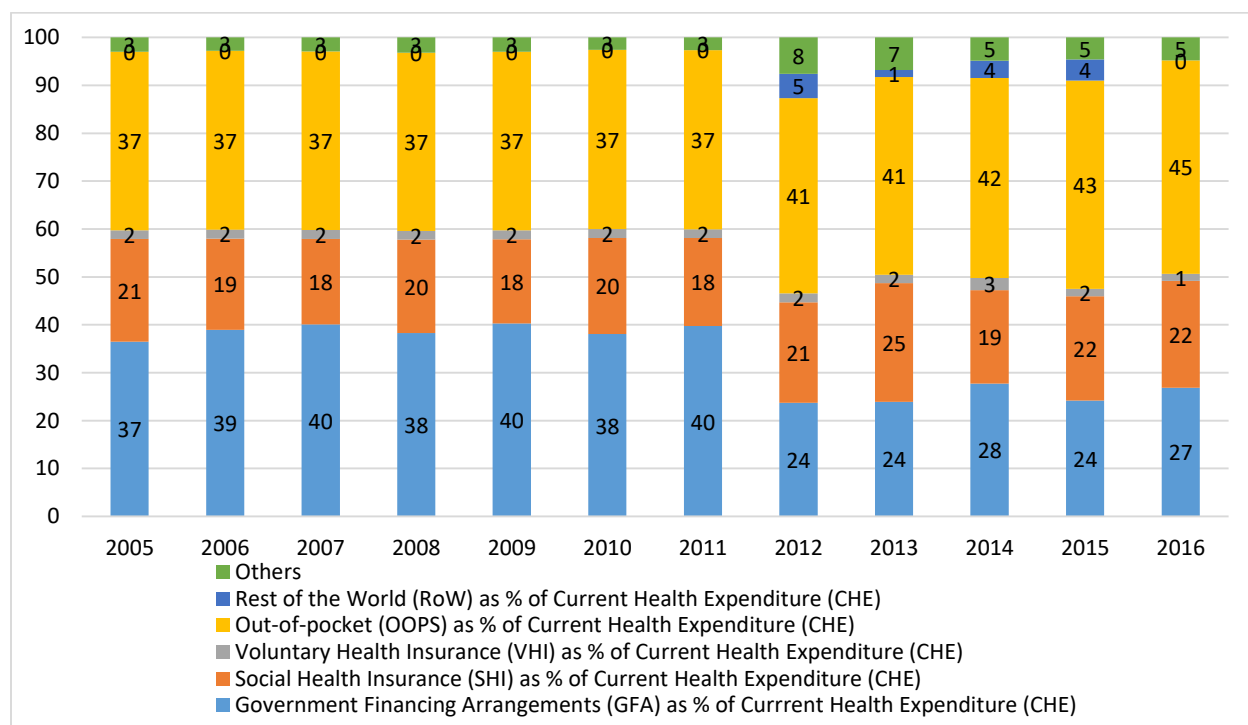
Figure 3.1. Structure of health financing resources, 2005-2016 (22)

3.1.2. Health insurance reform in Vietnam

UHC is a policy goal that many countries are aiming to achieve. It includes three dimensions: (i) fairness (medical examination and treatment according to needs but not affordability), (ii) financial protection (protecting citizens from CHE or impoverishment because of high OOPs), (iii) effective and comprehensive access to quality health services (ensuring that physicians or other qualified health workers correctly diagnose, prescribe, and treat appropriately and reasonably) (65). Furthermore, in order to attain UHC, the necessary financial resources must be raised in a sustainable way and allocated effectively and efficiently(65). Like many LMIC, Vietnam has approved HI as one of the possible options to achieve this goal.

The process of implementing universal health insurance (UHI) in Vietnam has achieved considerable results with a rapidly increasing HI coverage (Figure 3.2). HI policy was first introduced in Vietnam in 1992, aiming to cover civil servants, employees in large and medium size private enterprises. In 1993 (after one year of implementing the policy) the number of people covered by HI just accounted for 5.3%, by 2016, this figure increased to about 80%. This is because over the past 25 years, the government has adopted a number of policies to expand HI coverage, removing financial barriers and boosting access to healthcare services. One of them was the Decision 139 in 2002 with the formulation of the Health Care Fund for the Poor (HCFP)(65). In 2005, Decree 63 was adopted, which added some compulsory enrollment groups. Besides, under the Decree full subsidies for the purchase of HI cards for the poor and ethnic minorities were provided. As a result, the number of people having HI increased sharply from 28.4% in 2005 to 42% in 2007(66). In 2009, the HI Law was enacted, forming a national/ social health insurance scheme. Some groups have received heavy subsidies from the Vietnamese government. Therefore, the enrollment rate increased from about 52.8% in 2009 to about 60% in 2010(66).

					Remaining populations			
					Farmers, workers in the sectors of agriculture, forestry, fishery and salt producers			
				Students and pupils				
			Children under 6 years old, the near-poor					
		DECREE 63. Employees at non-state owned enterprises having less than 10 workers, cooperative and legal entitles; the poor and veterans						
	DECREE 58. Member of the Congress and People's Council; pre-school teachers, meritorious people, socially protected people; dependents of army officers and soldiers; foreign students							
DECREE 299. Employees and employers in enterprises having more than 10 workers, civil servant, pensioner, socially aided people, staff of international representative organizations								
1992	1998	2005	2009	2010	2012	2014	2015	2016
5.3%	12.5%	28.4%	52.8%	60%	66.4%	71.5%	76.5%	80%

Figure 3.2. Health insurance coverage expansion, 1992 – 2016 (21, 66)

In 2014, the Vietnamese government enacted the Revised HI Law(19), and the National Assembly passed Decree 105/2014/NĐ-CP Guidance on implementing the HI Law (67) which stipulated the eligible group of population, premium contributions, subsidy level from the state budget, determined co-payment and the participant's benefits. Vietnamese Social Security (VSS) is responsible for managing health insurance funds. In principle, Vietnam's HI applies a single-payer with a single financing pool and integrated benefit package (65). The summary of revised Vietnamese HI scheme is presented in Appendix 3.1. Enrollment in HI is based on individual level, not on household level, except group whose subscription is designed on family unit. This means that within a household, members might join different HI programs with diverse premiums and subsidy levels, and be entitled for several copayment rates. According to the revised Law, Vietnam HI membership is compulsory(19). However, the government have been facing challenge when monitoring and compelling informal sector workers to contribute. As a result, health insurance scheme in Vietnam is still a compound of compulsory and voluntary programs (6).

In terms of HI coverage structure by entitlement group, groups with full or partial subsidies from the government constitute the highest proportion of enrollees, accounting for 70% (Figure 3.3) (13).
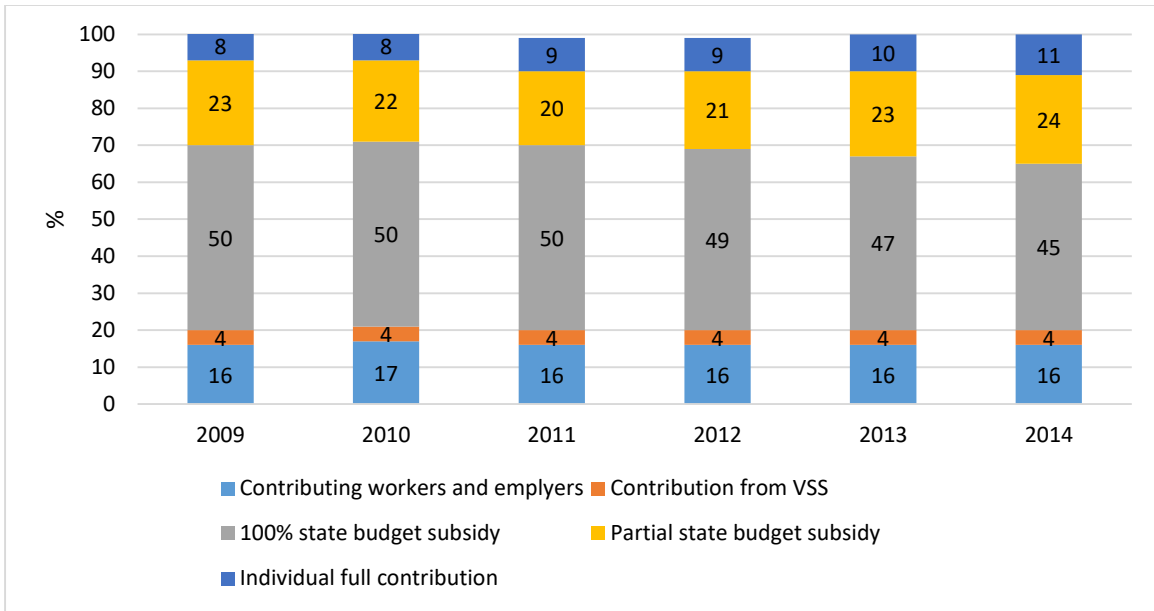
Figure 3.3. Trends and structure of health insurance coverage by entitlement group, 2009 – 2014 (13)

The increased trends in HI coverage rate were seen in most groups from 2011 to 2014 (Figure 3.4). Civil servants, retirees, the poor and ethnic minorities had the highest coverage rate with almost 100%, followed by children aged under 6 and student with around 95% in 2014, and by the near-poor with about 55%. Nevertheless, the coverage rate among voluntary groups was just above 30%(13). One of the reasons for low HI participation rate of enterprises group (about 50%) is due to the lack of compliance with HI enrollment such as such as evading HI premiums (65).
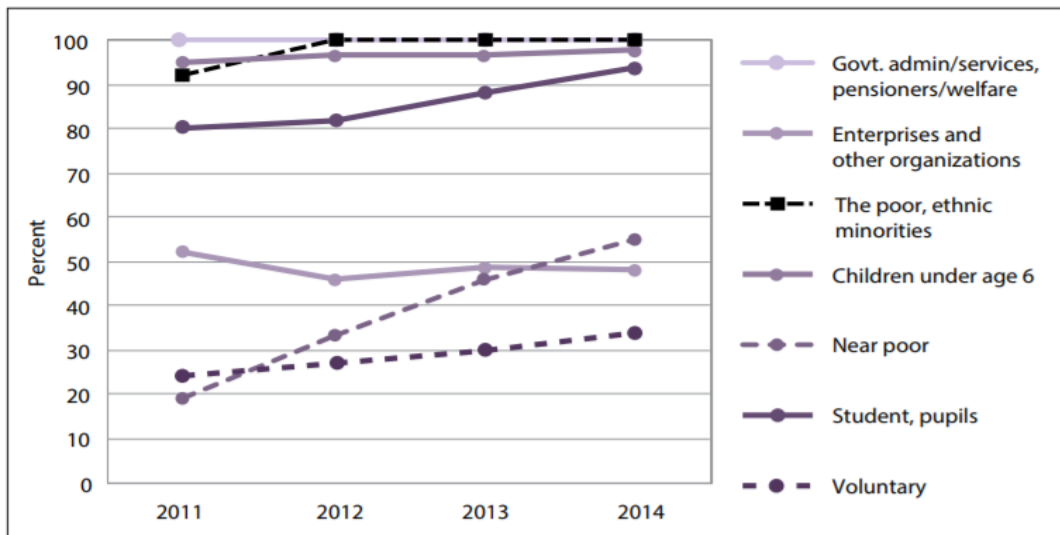
Figure 3.4. Health insurance coverage rate by target group in the period 2011 – 2014 (13)

16

In terms of benefit packages, HI includes curative and preventive healthcare services: medical examination, treatment, functional rehabilitation, pregnancy check-ups and delivery, screening, early diagnosis of some diseases (19), except for primary healthcare services covered by national target programs such as vaccination, counseling, education and health promotion, surveillance and prevention infectious diseases, maternal and child health care (6,65). Health facilities covered by HI including public and small number of selected private facilities having contract with VSS(6). According to the revised HI Law 2014, there were changes in the benefits packages. The entitlements have been extended for the enrollees, for example, transporting patients from district hospital to higher levels for some entitlement groups. Besides, the Law stipulates that the insured can visit any health facility at district and commune levels without referring letter (6,13,19). There were also some adjustments in co-payment rate (Appendix 3.1.). For instance, the poor, the ethnic minorities, the policy beneficiaries (meritorious people, war veterans etc.), people living in socio-economic difficulties areas and islands are exempted from co-payment and are entitled to free medical services; co-payment rate for the near-poor reduces from 20% to 5% (6,19). With regard to provider payment methods, in Vietnam, there are three types of payment mechanisms: fee-for-service (FFS), capitation and Case-based or Diagnostic-related groups (DRGs). The most popular method is FFS, Capitation is applied mainly at district hospitals, and DRGs method is piloted in some provinces.

3.2. Impact of health insurance on healthcare utilization among different groups in Vietnam

First, this section analyses characteristics of individuals enrolling in HI scheme and those without HI and their healthcare utilization. Second, I presented the estimated results of the impact of the health insurance (HI) scheme on the use of medical services using PSM method.

3.2.1. Summary statistics

The descriptive analysis on predisposing, enabling, need and external environment determinants across subsamples was presented in Appendix 3.2.

With regard to predisposing factors, the differences were seen in many dimensions.

Age: In general, the enrolled were considerably younger than the non-enrolled, but this pattern was diverse for VHI participants and those joining HSHI programs. This can be explained by the fact that while the entire sample also includes free health insurance for children under 6 years old and compulsory HI for civil servants and other formal sector workers, the

subsamples include VHI and the non-poor groups whose insurance contribution is not mandatory. Therefore, the older with more potential health risks are more likely to join the scheme.

More females than males participated in VHI. This may be due to the fact that in Vietnam women often join union organizations (for example women union), so they have more information about the benefits of HI participation. The incidence of enrollment was more popular among Kinh than ethnic minorities, the same pattern held for the married people as compared to the unmarried.

About 45.1% the insured of HSHI did not finish primary school, while the figure for noninsured was 26.5%. In relation to occupation status, the proportion of unskilled workers in the uninsured group was higher than that in the VHI group with 41.1% and 32.7% respectively, but lower than that in the HI group with heavily subsidies (44.4%) (Figure 3.5).

The rate of access to clean water was highest among VHI group (82.8%), followed by the noninsured group (77.6%). The lowest rate was seen in HSHI group (63.7%). It can be explained by the fact that most of the insured in VHI group live in urban area (35.8%).
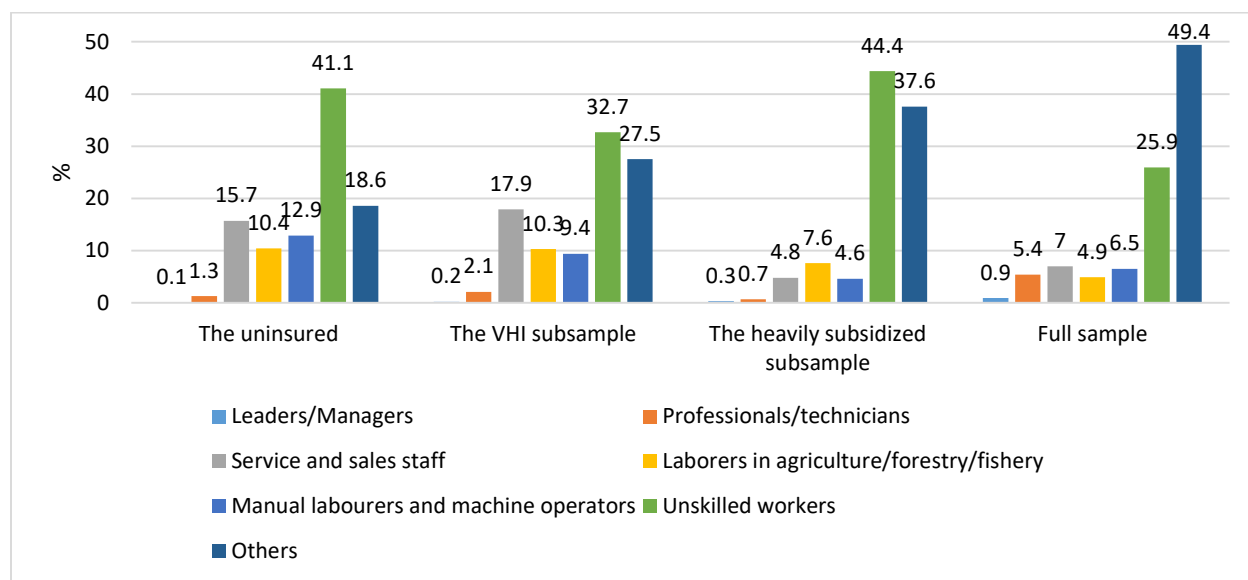
Figure 3.5. Rate of participation or non-participation in HI across different samples by occupation status, 2014, mean

In terms of enabling factors, most of people without insurance belong to the second and the third quintiles with 24% and 21%, respectively (Figure 3.6). Among the VHI, the share increases with wealth with 25.7% in fifth quintile. The HSHI program have a majority of the poor (40.1% in the first quintile). In the sample of all insured, all quintiles were evenly represented. Similarly, the insured of VHI group had more assets such as motorcycles, telephones, television, radio, computer and residential area than the control group.

However, the pattern was different for the heavily subsidized group. Obviously, this group embraces the poor, the near-poor and the policy beneficiaries, who derive great support from the government for premium contribution, thus the insured in this group possess less assets.
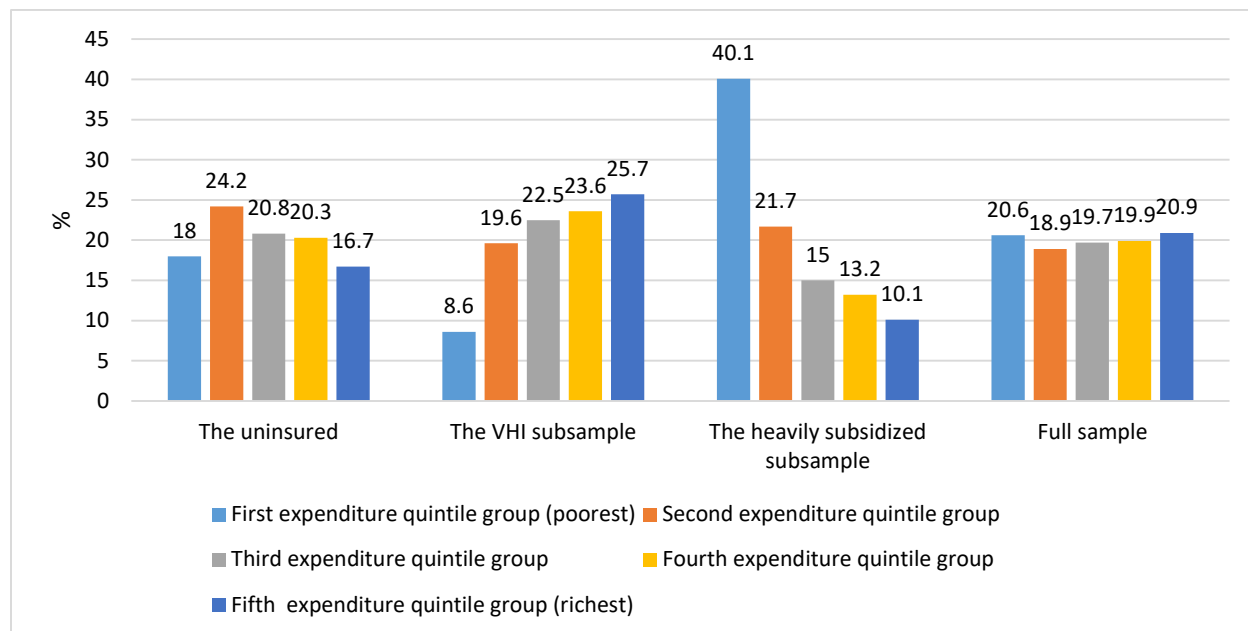
Figure 3.6. Rate of participation or non-participation in HI across different samples by expenditure quintile groups, 2014, mean

With regard to the need factors, compared to the non-insured the incidence of illness, number of illness times in last 12 months among the insured of different groups were higher, which may be partly explained by the adverse selection. This may be due to difference in recall, difference in age composition, urban or rural residence, or different way of expressing themselves about past diseases. Especially, the number of illness days among the enrollees of HSHI was very high with 7.1 days. On one hand, the near-poor who receive 70% subsidy from the government for contribution tend to buy HI more when they face risk of illness. It might also reveal that the vulnerable groups experience larger burden of disease, or that there is some moral hazard involved. Compared to the participants of VHI and HSHI groups, those of entire sample experienced less illness days (4.2 days per year). In the whole sample, there are the compulsory insurance participants who have to submit themselves to periodic examination at the workplace and usually come from higher socioeconomic status group. Therefore, they might have better health status.

In relation to external environment determinants, most of the insured from HSHI group lived in rural area (84.1%). There were also differences in HI

uptake rate across samples according to Viet Nam's socio-economic regions (Figure 3.7).
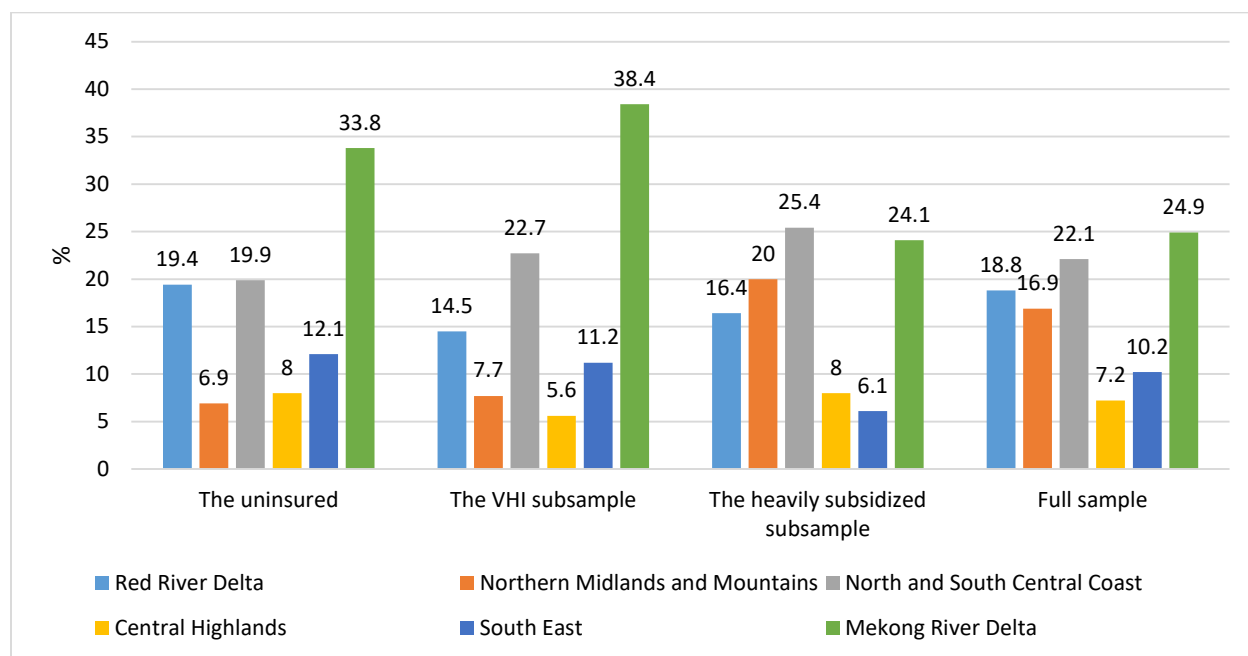
Figure 3.7. Rate of participation or non-participation in HI across different samples by region, 2014, mean

The statistic description of trends and patterns in utilization of different health services at health facilities before and after issuing revised HI Law for different HI and noninsured groups of interest is provided in Appendix 3.3. The frequency of using outpatient health care was high for both the insured and uninsured ranging from 2.3 to 3.4 per person in last 12 months. However, the number of outpatient visits was highest among VHI group. In relation to inpatient services, the HI groups tended to use more intensively compared to uninsured group. The enrollees visited district hospitals more than the provincial hospital. They also sought care at state health facilities intensively, whereas those without insurance often visited private providers. Furthermore, most of the insured and uninsured decided to visit providers when they needed medical treatment, while it was relatively low for health check-up and consultation with the average of about 2.2 and 0.5, respectively, in the last 12 months.

3.2.2. Estimated effects of health insurance reform on healthcare utilization outcomes

The PSM method includes steps as follows. Firstly, I used logistic regression to calculate propensity scores. At the second stage, I applied different matching algorithms to estimate ATTs. Thirdly, I conducted a quality check of the matching.

Before applying PSM method, I did descriptive statistics and checked for differences in means between different treatment groups and control group. The means comparison test between the insured and the uninsured with regard to characteristics that may affect both the probability to enroll in different health insurance programs and the outcome variables are essential, especially when participation is still voluntary among some groups in Vietnam. Descriptive statistics showed that there were significant differences in a number of predisposing, enabling, need and external environment factors across the participating and non-participating groups Appendix 3.4.).

At the first stage of PSM method, I estimated the factors affecting probability to enroll in HI scheme by using a logit model for VHI subsample, HSHI subsample and full sample. The models performed well because the percentage of correctly predictions was quite high ranging from 66% to 84% (Appendix 3.5). The results indicated that variables influencing probability of engaging in HI program vary depending on the treatment subsamples. In general, age, gender, ethnicity, marital status, education level, occupation, household size, household composition, expenditure, assets, number of illness days, place of residence were factors determining the odds of participating in HI scheme.

At the second stage, I estimated average treatment effect on the treated (ATT) of the HI scheme for a range of outcomes across different groups using PSM method (Table 3.1). The results demonstrated that ATT of participation in HI scheme significantly increased healthcare utilization in terms of outpatient and inpatient care, different level of providers, and types of visits. In relation to type of providers, the policy had positive impact on using public health facilities, while reduced the frequency of private health facilities utilization. The estimated results were rather similar and almost statistically significant for all matching algorithms.

There was a statistically significant positive impact of the policy on the frequency of using outpatient health services across all subpopulations. The estimated results showed that the HI scheme has increased the number of outpatient visits for the enrolled between 0.86 and 1.29. The greatest impact has been found on participants of HSHI group with 1.29 visits per person per year. Similarly, an increase between 0.08 and 0.16 in the number of inpatient admissions was because of participation in HI. Interestingly, the highest

increase in the frequency of using inpatient care among the insured of the poor, near-poor or policy beneficiaries was due to the policy (0.16 in NN1 matching algorithm). The figure was also high for VHI group. However, the impact was not statistically significant for the entire sample, except for NN1 matching estimator.

Obviously, the increased ATT of HI program in the frequency of outpatient and inpatient visits stemmed from significant positive impacts on the use of commune health stations and hospitals, especially district hospitals. However, the magnitude of ATT of HI participation varied from VHI group to group of mixed insurance participants (full sample). For example, the HI program was responsible for increases of 0.92 in the number of visits at district hospital for the former, and just about 0.64 for the later. Besides, the HI program has increased the frequency of use of services at commune health stations by the HSHI subsample more than other groups (0.53 in kernel and radius matching).

In relation to types of providers, the HI scheme results in substitution effect which means that the decline of from 0.39 to 0.51 in frequency of visiting private health facilities among the insured transferred to the growth between 0.67 and 1.87 in their intensity of seeking medical services at public facilities. This shift was pronounced among participants of VHI, followed by the highly subsidized groups.

In terms of types of visits, the scheme contributed to significant increases from 0.84 to 1.07 in the number of visits for medical treatment among VHI participants, and about 0.89-1.23 among the poor, near-poor and policy beneficiaries group. The increased impact held for number of visits at health facilities to do health checks, fluctuating around 0.2 across different HI participation groups.

Table 3.1. Estimated average treatment effects on treated (ATT) of HI scheme on healthcare utilization across different samples with PSM method

Outcome variable	Matching algorithm	VHI subsample		Highly subsidized subsample		Full sample	
		ATT	SE	ATT	SE	ATT	SE
Number of outpatient visits	NN1	0.991 ***	0.214	1.289***	0.266	0.897***	0.188
	Kernel	1.199***	0.193	1.179***	0.197	0.859***	0.141
	Radius	1.177***	0.190	1.173***	0.196	0.866***	0.145
Number of inpatient visits	NN1	0.127***	0.034	0.156***	0.058	0.112***	0.041
	Kernel	0.107***	0.037	0.082*	0.045	0.051	0.031
	Radius	0.106***	0.036	0.083*	0.044	0.041	0.032
	NN1	0.170***	0.069	0.310***	0.079	0.209***	0.055

Number of visits at commune health station	Kernel	0.123**	0.061	0.527***	0.080	0.414***	0.047
	Radius	0.129**	0.060	0.528***	0.079	0.417***	0.048
Number of visits at district hospital	NN1	0.920***	0.161	1.019***	0.167	0.641***	0.107
	Kernel	1.075***	0.145	0.863***	0.129	0.627***	0.085
	Radius	1.086***	0.144	0.868***	0.129	0.617***	0.087
Number of visits at provincial hospital	NN1	0.476***	0.122	0.308***	0.128	0.367***	0.102
	Kernel	0.567***	0.114	0.209*	0.108	0.221***	0.085
	Radius	0.548***	0.112	0.202*	0.108	0.193*	0.088
Number of visits at state health facilities	NN1	1.455***	0.192	1.321***	0.197	1.085***	0.141
	Kernel	1.669***	0.173	1.162***	0.162	0.916***	0.116
	Radius	1.661***	0.171	1.160***	0.162	0.879***	0.119
Number of visits at private health facilities	NN1	-0.475***	0.146	-0.448***	1.415	-0.433***	0.125
	Kernel	-0.482***	0.134	-0.474***	0.139	-0.426***	0.117
	Radius	-0.511***	0.130	-0.473***	0.138	-0.395***	0.121
Number of visits at health facility for medical treatment	NN1	0.838***	0.211	1.233***	0.271	0.800***	0.191
	Kernel	1.074***	0.195	0.901***	0.205	0.634***	0.147
	Radius	1.031***	0.191	0.889***	0.204	0.636***	0.151
Number of visits at health facility for consultation and health check	NN1	0.240***	0.101	0.231**	0.098	0.157**	0.074
	Kernel	0.338***	0.219	0.362***	0.083	0.243***	0.061
	Radius	0.238***	0.083	0.364***	0.083	0.238***	0.063
Observations		Treated	Control	Treated	Control	Treated	Control
	Before matching	1022	760	1204	760	4106	760
After matching	NN1	575	760	480	760	750	760
	Kernel	1002	760	1173	760	4093	760
	Radius	1002	760	1173	760	4093	760

SE: Standard error. *** p<0.01, ** p<0.05, * p<0.1

Next, I checked the quality of matching process and robustness. First, I did covariate-balancing tests. The results showed that across different matching algorithms there were sharp reductions in standardized mean bias ranging between 69.54% and 86.14% (Table 3.2). Rosenbaum and Rubin suggested that if the reduction is higher than 20%, the matching method can lower the selection bias sufficiently (59). Likewise, there was a reduction in the pseudo-R^2 for all matching estimators across different samples. Besides, the hypothesis H_0 for no systematic difference in the distribution of covariates between the treatment and control groups after matching was not rejected for VHI and HSHI subsamples, and for the full sample with NN1 (column 7 Table 3.2). This means that chosen matching methods ensure validated estimation

results for these subpopulations. In addition, the t-tests for balance of means in matched the treated and untreated groups in VHI and HSHI subpopulations showed insignificant differences for most of the covariates (Appendix 3.6). This indicated a good balancing.

Table 3.2. Statistical tests to evaluate the matching

Matching algorithm	Mean bias		% |bias| reduction	Pseudo-R^2		p-value of likelihood ratio	
	Before matching	After matching		Unmatched	Matched	Unmatched	Matched
VHI subsample							
NN1	13.6	3.4	73.53	0.118	0.013	0.000	0.990
Kernel	13.6	2.9	78.67	0.118	0.010	0.000	0.918
Radius	13.6	2.4	82.35	0.118	0.007	0.000	0.996
Heavily subsidized subsample							
NN1	20.2	2.8	86.14	0.209	0.011	0.000	0.999
Kernel	20.2	3.8	81.19	0.209	0.013	0.000	0.144
Radius	20.2	4.1	79.70	0.209	0.014	0.000	0.110
Full sample							
NN1	17.4	4.7	72.99	0.136	0.021	0.000	0.252
Kernel	17.4	5.3	69.54	0.136	0.028	0.000	0.000
Radius	17.4	5.0	71.26	0.136	0.026	0.000	0.000

The selection bias, which may be due to weak common/overlapping support, also affect the effectiveness of PSM method (50). The distributions between the VHI and noninsured groups, the insured of HSHI and noninsured groups were generally similar (Figure 3.8). However, the distribution between all the insured in the entire sample and the noninsured was not very similar. Although it was quite similar at the lower range of the estimated propensity scores, it varied at the higher range, resulting in observations in the insured group that might not find appropriate comparison in the other. It may be because the number of HI participants is large (4106) while that of HI nonparticipants is small (760). However, after matching the distribution of propensity scores overlapped. This means that the deviations decreased.

the enrollees of VHI — — — the noninsured

the enrollees of heavily subsidized programs — — — the noninsured
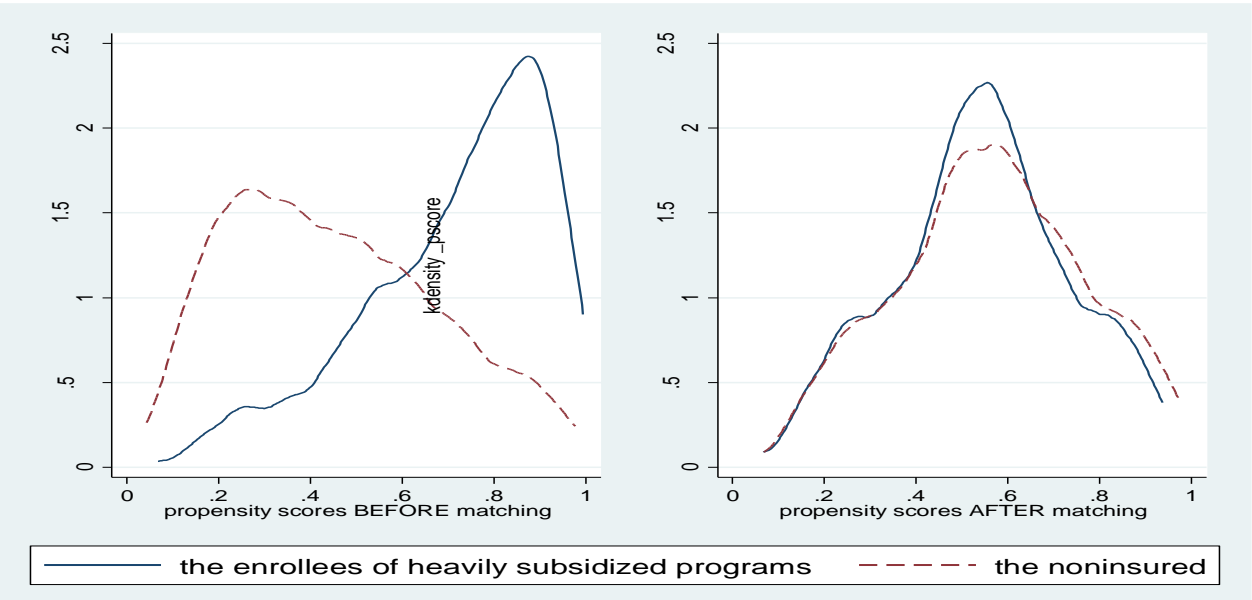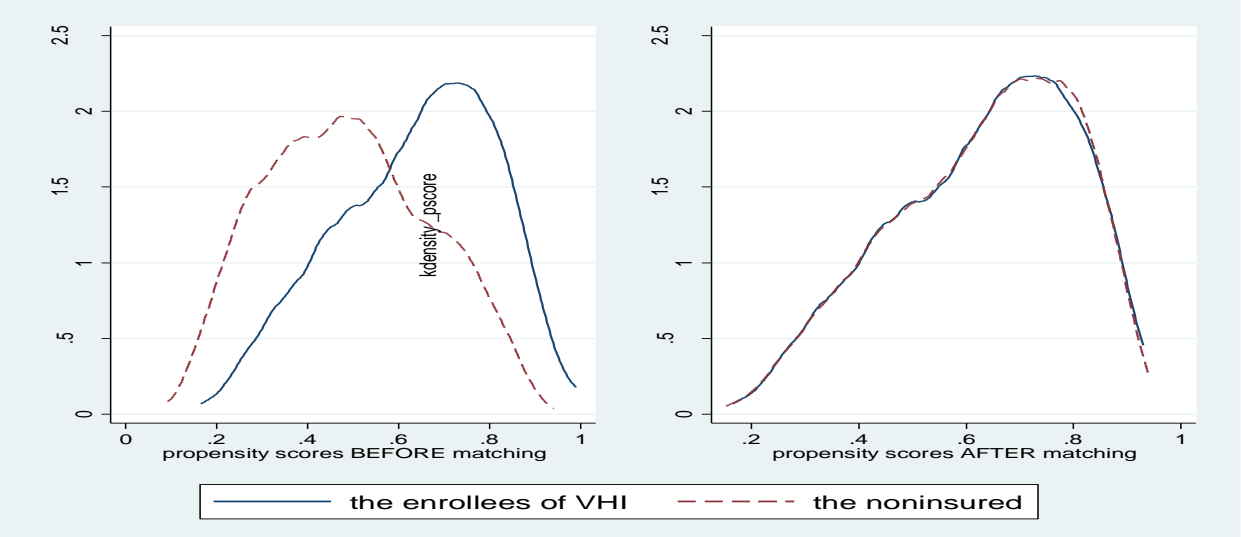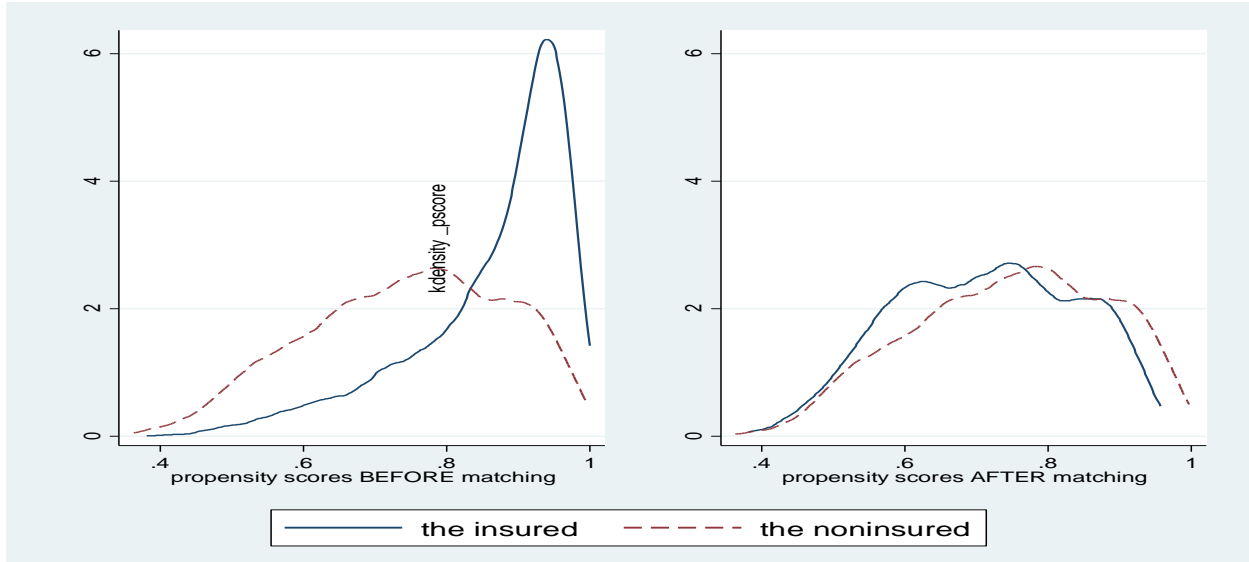
Figure 3.8. Common support assumption test to assess the distribution of Propensity Scores before and after matching.

3.3. Association between health insurance and catastrophic health expenditure in Vietnam

The burden of OOPs is likely to result in catastrophic health expenditure (CHE) that households may be confronted with. Protecting households from CHE is one of the measures of effectiveness of pre-payment mechanism. Therefore, analysis of CHE has provided important arguments for improving HI scheme in Vietnam.

According to WHO(63), the catastrophic health expenditure (CHE) is measured at household level, therefore I did not use observations at individual level above to estimate the effect of policy in this section. Non-commercial HI is considered as a fundamental mechanism for attaining UHC, especially in LMIC (68). Nevertheless, apart from successfully carrying out the HI policy, interventions to deal with social determinants of health are necessary to be examined (68). Therefore, in this section, I used multinomial logistic regression model with VHLSS 2016 dataset to identify predisposing, enabling, need, health seeking behavior and external environment determinants, with special attention given to HI factor that affect the probability of encountering CHE at the 40% threshold across households.

3.3.1. Descriptive statistics

Descriptive statistics for households suffering and not suffering CHE are provided in appendix 3.7. About 46.6% household heads were aged above 60 in households experiencing CHE, whereas it was 24.6% in the comparison

group. Male-headed households were more dominant among households without incurring CHE in comparison with those facing CHE, accounting for above 74.8%. Among household with CHE, 73.1% of household heads were married, and 51.9% did not finish primary school. Additionally, share of people aged above 60 in households faced with CHE was significantly higher than that in household without facing CHE (38.3% and 29.2%, respectively).

The HI participation status varied significantly between households facing CHE and those without CHE. For example, 36.2% of households suffering CHE only participated in heavily subsidized HI program while 21,5 % of households that did not suffer CHE who participated in this program. Regarding distribution of share of household members having HI, there was quite a similarity among households encountering CHE and those who did not. The rate of household with above two third of members joining HI was prevalent for both household with and without incurring CHE (above 73%).

Compared to households not confronting CHE, those experiencing CHE had remarkably higher incidence of illness (61% vs. 23%), and number of self-reported illness days in last 12 months (48 vs. 40 days), more sought care at public health facilities, used medical services more intensively. Self-treatment was prevalent for both groups with above 90%. Of households enduring CHE, about 76.3% dwelt in rural area.

Table 3.3 shows the distribution of health expenditure across different quintile groups. There was a direct relationship between heath expenditure and economic status. The wealthier the citizens were, the greater budget they allocated for health. For example, compared to the poorest, the richest paid more than 10.8 times of their OOPs, and their ability to pay was 15.4 times higher. However, the massive health expenditure went with high affordability has made the capacity to pay out of pocket among households not different, accounting for around 12 % across different quintile groups.

Nevertheless, the pattern slightly varied in term of CHE. There was a slight decrease in CHE with rising consumption quintile. While the average CHE rate was 9.9%, it was 11.2% for the poorest. Compared to other developing countries, the CHE incidence in Vietnam was higher than that of Laos, Thailand, Indonesia, Philippines, and Ghana. However, it was lower than that of China, India, Egypt and Nigeria(69).

The CHE can result in impoverishment, which occurs when a non-poor household turns to a poor after health payments(63). I found that the mean incidence of impoverishment was 1.53% for the whole sample with the highest incidence being seen in the lowest quintile households (3.7%).

Table 3.3. Indicators of household health expenditure among different consumption expenditure quintiles in 2016

Indicator	Household consumption expenditure quintile					
	Q1 (poorest)	Q 2	Q3	Q4	Q5 (richest)	All
Average OOPs of household in the last 12 months (US$)	58.0	119.7	182.1	291.4	627.5	255.7
Average capacity to pay of household in the last 12 months (US$)	343.4	757.1	1252.1	2026.7	5281.5	1931.9
Share of household's OOPs in total consumption expenditure (%)	12.0	12.3	11.9	12.6	12.4	12.2
Share of OOPs in capacity to pay of household (%)	16.9	15.8	14.5	14.4	11.9	13.2
Household experiencing CHE (%)	11.2	10.1	9.1	9.4	9.7	9.9
Impoverishment (%)	6.75	0.56	0.07	0.21	0.07	1.53

Exchange rate in 2016: 22156 VND= 1US$

The study considered HI participation status among households suffering CHE according to expenditure quintiles, urban and rural (Figures 3.9, 3.10, 3.11). The results showed that among households who did not participate in any HI program and incurred CHE, those from the lowest quintile accounted for the highest proportion (30%). The patterns of HI enrollment were completely opposite between quintile groups when they enrolled in VHI or HSHI programs. Among households incurring CHE and participating in VHI, those from the fifth quintile were the most prevalent (26.3%). However, when households enrolled in heavily subsidized HI programs, those from the poorest quintile group were most involved with 37.7%.

Figure 3.9. Rate of participation in different types of HI according to consumption expenditure quintile among households experiencing CHE, Vietnam, 2016, mean.
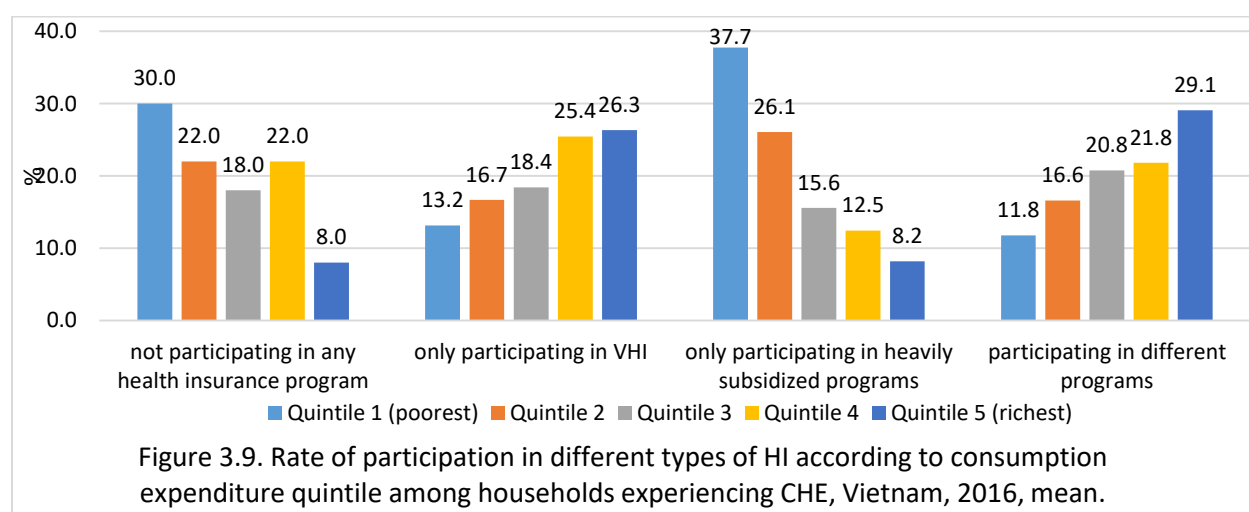
Regarding HI coverage by household, it can be seen that among households suffering CHE there was a difference between share of household members

joining HI and consumption quintile group. For instance, among households up to 1/3 of members participating in HI and incurring CHE, those from the forth quintile accounted for the highest proportion (42.9%) (Figure 3.10). However, when HI coverage increased, the share of forth quintile households made up only 17.3%.

Figure 3.10. Household HI coverage rate according to consumption expenditure quintile among households experiencing CHE, Vietnam, 2016, mean
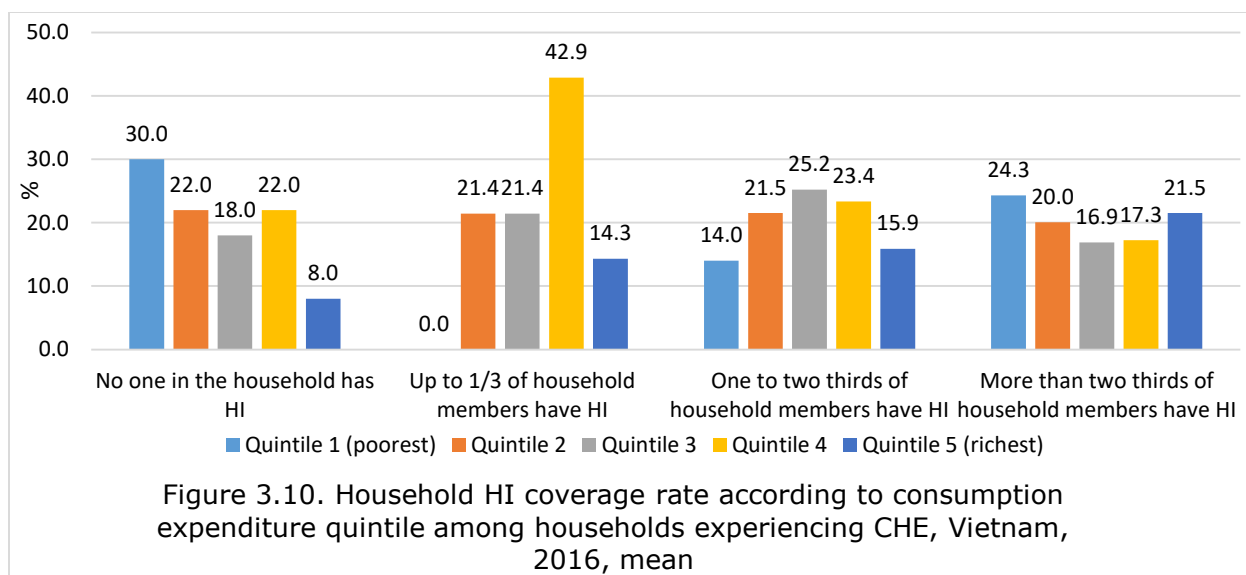
The study found that households enrolling in HSHI programs made up the highest proportion (41.3%) among those living in rural area and incurring CHE (Figure 3.11). Nonetheless, among households suffering CHE, there was not much difference in place of residence and proportion of household members having HI.

Figure . Incidence of catastrophic health expanditure across urban and rural areas according to health insurance status , Vietnam, 2016

Figure . Incidence of catastrophic health expanditure insurance across urban and rural areas according to share of household members having health , Vietnam, 2016
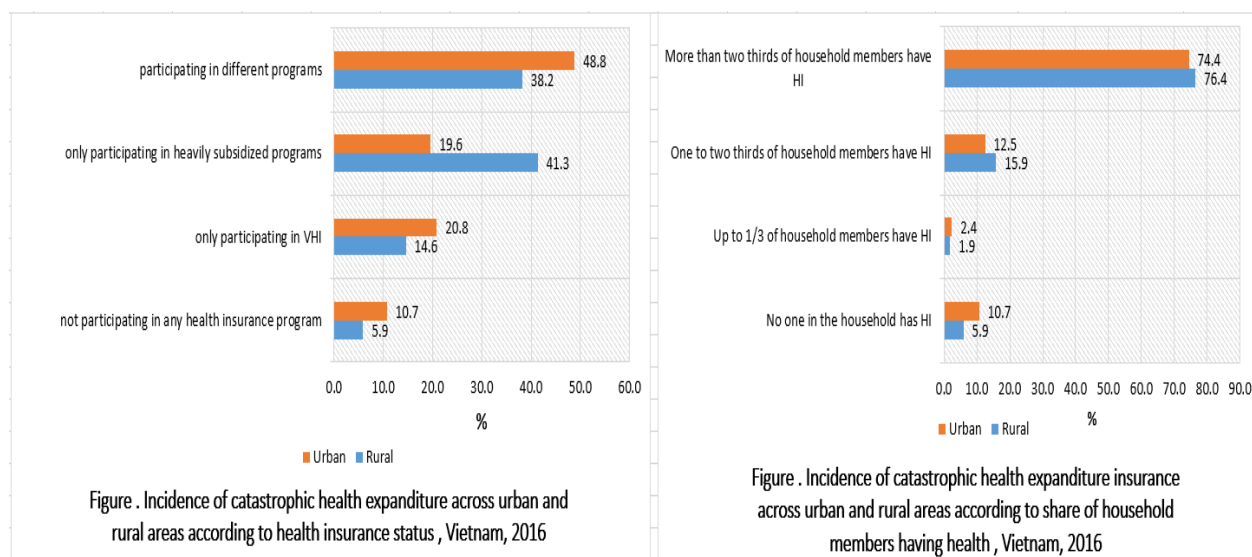
Figure 3.11. Rate of households suffering CHE, living in urban or rural areas participating in different HI programs, Vietnam, 2016, mean

3.3.2. Findings of logistic regression

The results of multinomial logistic regression of factors associated with CHE are illustrated in Table 3.4. The odds ratio (OR) less than 1 reduces the probability of CHE, otherwise increases the probability. The model 1 differs from model 2 in term of HI variable.

In general, the estimates show that most variables were statistically significant. With regard to predisposing factors, age of household head, educational level, household size, household composition, housing area all had an effect on household's probability to bear CHE. For example, compared to households where the head's age was below 30, those with household head' age of 51-60 were more likely to experience CHE (OR=3.13; 95%CI 1.53-6.38). Households where the head finished the vocational school had about 0.7 lower odds of having CHE than household where household head had no education. Household where heads were employed were less likely to suffer CHE than those with unemployed heads (OR=0.68, 95%CI 0.556-0.838). Household size is a protective factor with OR <1. For every increase in one member the odds of suffering CHE reduced by a factor of 0.78. However, the proportion of children aged under 6 and the proportion of elderly aged above 60 were risk factors (OR>1).

Table 3.4. Multinomial logistic regression of catastrophic health expenditure

	Model 1				Model 2			
	OR	Std. Err.	95% CI LC	UC	OR	Std. Err.	95% CI LC	UC
Predisposing factors								
Age of household head (ref: age <=30)								
31-40	2.500**	0.916	1.219	5.128	2.469**	0.903	1.206	5.057
41-50	2.397**	0.888	1.160	4.953	2.391**	0.883	1.159	4.933
51-60	3.129***	1.138	1.534	6.380	3.064***	1.111	1.506	6.238
>=61	2.805***	1.077	1.321	5.955	2.808***	1.076	1.325	5.950
Gender of household head (male vs female)	0.756**	0.105	0.575	0.993	0.773*	0.107	0.589	1.015
Ethnicity (Kinh and Hoa=1, Ethnic minority=0)	1.210	0.211	0.859	1.704	1.067	0.183	0.762	1.494
Marital status (Married=1, others=0)	1.218	0.192	0.895	1.659	1.184	0.185	0.871	1.610
Education level of household head (ref: Not complete primary school)								
Primary school	0.789*	0.111	0.599	1.041	0.800	0.112	0.608	1.054
Lower secondary	1.199	0.160	0.922	1.558	1.174	0.156	0.904	1.524
Upper secondary	1.214	0.255	0.803	1.833	1.141	0.240	0.755	1.723
Vocational school	0.699*	0.151	0.458	1.068	0.657*	0.141	0.431	1.002
College, University, Master, PhD.	0.772	0.208	0.455	1.310	0.719	0.192	0.427	1.213
Household head's employment (employed vs unemployed)	0.682***	0.072	0.556	0.838	0.687***	0.072	0.560	0.843
Household size	0.781***	0.034	0.717	0.852	0.764***	0.033	0.701	0.833
Share of children aged under 6	2.739**	1.362	1.034	7.257	1.268	0.587	0.512	3.143

	OR	SE	LC	UC	OR	SE	LC	UC
Share of elderly aged above 60	2.524***	0.593	1.592	4.000	2.617***	0.613	1.654	4.143
Enabling factors								
Consumption expenditure quintile (ref: poorest quintile)								
2nd quintile	1.281	0.193	0.953	1.722	1.208	0.181	0.901	1.619
3rd quintile	1.410**	0.231	1.022	1.944	1.254	0.202	0.914	1.720
4th quintile	1.671***	0.288	1.192	2.344	1.475**	0.250	1.058	2.057
5th quintile	1.840***	0.352	1.265	2.677	1.615***	0.302	1.119	2.329
Health insurance status of household (ref: Household does not participate in any health insurance program)								
Household only participates in VHI	0.491***	0.104	0.325	0.743				
Household only participates in heavily subsidized programs	0.691***	0.139	0.466	1.025				
Household participates in different programs	0.364***	0.075	0.243	0.546				
Share of household members having health insurance (ref: No one in the household has HI)								
Up to 1/3 of household members have HI					0.478**	0.168	0.240	0.951
One to two thirds of household members have HI)					0.587**	0.126	0.385	0.895
More than two thirds of household members have HI)					0.499***	0.095	0.344	0.725
Total residential area	0.997***	0.001	0.995	0.999	0.996***	0.001	0.994	0.998
Need factors								
Illness status in last 12 months (yes vs no)	3.534***	0.385	2.855	4.376	3.487***	0.378	2.819	4.312
Number of illness days in last 12 months	1.003***	0.001	1.001	1.004	1.003***	0.001	1.002	1.004
Health behavior								
Health care utilization (ref: at public health facilities)								
Private health facilities	0.615***	0.111	0.433	0.875	0.610***	0.109	0.430	0.867
Both public and private health facilities	0.931	0.109	0.740	1.170	0.921	0.107	0.733	1.157
Number of outpatient visits in last 12 months	1.021***	0.005	1.011	1.031	1.021***	0.005	1.011	1.031
Number of inpatient admissions in last 12 months	1.292***	0.037	1.222	1.366	1.300***	0.037	1.230	1.375
Self-treatment (yes vs no)	1.202	0.233	0.822	1.756	1.170	0.225	0.802	1.706
External environment								
Place of residence (urban vs rural)	0.705***	0.087	0.554	0.897	0.675***	0.082	0.531	0.856
Region (ref: Red River Delta)								
Northern Midlands and Mountains	0.773	0.154	0.523	1.143	0.800	0.158	0.543	1.179
North and South Central Coast	0.595***	0.099	0.430	0.823	0.629***	0.103	0.456	0.867
Central Highlands	0.920	0.224	0.571	1.482	0.967	0.233	0.603	1.552
South East	0.483***	0.106	0.315	0.742	0.479***	0.104	0.313	0.732
Mekong River Delta	0.969	0.165	0.694	1.353	0.980	0.165	0.705	1.363
Constant	0.068***	0.033	0.026	0.178	0.091***	0.045	0.035	0.239
Pseudo R2	0.200				0.204			
% correctly predicted	90.62				90.49			
Hosmer-Lemeshow, p-value	0.057				0.150			
Observations	7,173							

*** p<0.01, ** p<0.05, * p<0.1, CI- confidence interval; LC, UC - lower and upper CI

Considering enabling factors, there were correlations between consumption expenditure, health insurance status of household, total residential area and risk of CHE. Notably, the study found that households from highest expenditure quintile were about 1.84 times more likely to suffer CHE than those from the poorest quintile. Importantly, health insurance programs were protective factors. Households where all members participated in VHI or health insurance programs heavily subsidized, or households enrolled simultaneously in different programs were less likely to encounter CHE compared to those without health insurance with OR of 0.49; 0.69 and 0.34 respectively. Furthermore, risk of CHE varied according to the share of household members possessing HI. While households with one to two thirds of members having HI had a 0.48 lower odds of experiencing CHE than those had no HI, households with more than two thirds of members participating in HI scheme were 0.50 times lower than those without HI.

Regarding the need factors, household with at least one time being sick in last 12 months had about 3.5 times more chance of facing CHE than their counterpart. Similarly, the number of illness days in last 12 months was a risk factor for experiencing CHE with OR>1.

In terms of health seeking behavior, surprisingly, visiting private health providers reduced the likelihood of encountering CHE compared with visiting state providers (OR=0.62, 95%CI 0.43- 0.87). Besides, I found that every additional outpatient or inpatient visit increased the odds of coping with CHE by a factor of 1.02 and 1.29 respectively. Compared to households who seek check-up or treatment at health providers those who treated themselves were more likely to confront CHE, although this was not statistically significant.

With regard to external environment, the study found that households living in urban area had lower odds of incurring CHE compared to those who live in rural area (OR=0.62, 95%CI 0.42-0.91). In addition, there was also association between region and the probability of confronting CHE.

3.3.3. Sensitivity analyses

The study carried out sensitivity analyses to check the correlation between health insurance and probability of experiencing CHE in different subsamples including outpatient and inpatient care, rural and urban.

The sensitivity analysis for outpatient and inpatient subsamples is presented in Appendix 3.8. Surprisingly, in relation to outpatient subpopulation, household only participating in heavily subsidized programs was no longer statistically significant in reducing odds of CHE. However, for both outpatient and inpatient subsamples households participating in different health insurance programs had 0.38 and 0.25 lower odds of suffering CHE respectively compared with those without HI. With regard to proportion of

household members having HI, for outpatient subsample, only households, where more than 2/3 of members had HI reduced the odds of confronting CHE. Nevertheless, for inpatient subsample, households with more than 1/3 members having HI can lessen the probability of encountering CHE. Surprisingly, households visiting private health providers for inpatient care now were more likely to incur CHE than those hospitalized in public health facilities.

Appendix 3.9. illustrates the sensitive analysis for urban and rural subsamples. The households living in urban area and participating in any health insurance program were less likely to experience CHE in comparison to those without HI. Notwithstanding, there was no statistically significant association between enrollment in VHI and the odds of suffering CHE in rural subsample. The same pattern held for households enrolling in heavily subsidized programs. Only with participating in different HI programs were the households in rural area less likely to incur CHE in comparison with those without HI. In relation to share of household members obtaining HI, households with more than 1/3 of members having HI and inhabiting in urban area were less likely to incur CHE compared to those without HI. On the other hand, for households dwelling in rural area, HI coverage was no longer a protective factor. This makes me doubt about the effectiveness of HI policy in Vietnam in ensuring equity and sharing financial risks for some groups, although I need to consider other factors. There was a surprising result in urban and rural subpopulation that compared to households visiting public health providers those seeking care at private facilities had about 0.38 and 0.68 lower odds of undergoing CHE respectively.

CHAPTER 4: DISCUSSION

4.1. Health insurance and healthcare utilization

The study found that health insurance policy had positive impact on outpatient and inpatient care utilization, although the size of impact varied in terms of level of providers, and types of visits, and according to HI groups. Indeed, a number of studies in Vietnam and other countries have demonstrated that having HI leads to increased use of healthcare services (15, 33, 52, 53, 61, 70-76). Using PSM Sparrow et al.(2013) (55) found that the HI program for the poor Askeskin in Indonesia increased the number of outpatient visits.

4.1.1. HI and outpatient and inpatient care

The study found that ATTs of HI program on the frequency of outpatient and inpatient services utilization across VHI and HSHI subpopulations were higher than that of the whole sample. These results could be because participants in the first two HI programs had higher average age (50 years old – Appendix 3.2), higher illness days (7 days per year) than those in the whole sample (4 days). In addition, according to the revised HI Law 2014 (19), the poor are entitled to 100% free of user fee, and the near-poor - 95%, thus may reduce financial barriers to access to medical services. Consequently, there could be some moral hazard. Additionally, the study examined that the effect of HI policy on outpatient examination was greater than that of inpatient care. This may be because the hospitalization requires a relative to accompany and care and other indirect costs may arise such as travel costs, informal costs, or some hospital services and medicines may not be covered by HI, leading to more OOPs. Therefore, they are likely to delay inpatient admissions.

4.1.2. HI and healthcare utilization at different levels of provider

The study showed that HI participation increased healthcare services at all levels of provider, and the impact was the highest for district hospitals. This can be explained by the fact that before the revised HI Law 2014, the insured had to visit health providers designated in HI card; otherwise, they had to pay the full cost of the examination. However, after the revised HI Law has been enacted, the enrollees can go to any district and commune health facility(19). Another possible explanation is that the capitation payment method which is implemented differently in Vietnam from international features, puts the district hospitals at risk of bearing the full cost of referring patients to the higher healthcare level, therefore, they try to keep the patients (65). Additionally, the study found that the impact of HI on the health services utilization at commune level was lowest. This might be because that most services there are predominantly funded through general revenues, so there

was not big difference between the insured and matched uninsured individuals.

Considering the heterogeneous effects of the HI scheme on visiting commune health station across subpopulations, the largest estimated effects were observed in the HSHI group. Similar results were found in other studies (6, 65, 77). The World Bank revealed that in Vietnam, the people from lowest quintile and ethnic minorities made up a significant share of commune health station visits (65, 77). In my study, the proportion of enrollees of HSHI living in rural area was 84.1%, which was much higher than that of VHI participants dwelling in this area (65.3%). Besides, 23.7% of participants HSHI are ethnic minority, whereas the figure for the voluntary insured is only 2% (Appendix 3.2). Therefore, they may have less choice of alternative health facilities than those joining VHI.

The study also found that the effect of HI on using medical services at provincial hospital were lower than that of at district hospital across different HI groups. In fact, if the insured receive care from higher level without referral letter they have to pay higher co-payment rates, for example, 40% of medical expenditures at provincial hospitals, and 60% - at central hospitals for inpatient care, and they have to pay full cost of the examination for outpatient care (6, 19).

4.1.3. HI and types of provider and types of visit

The study also found the HI program produced substitution effect between public and private health facilities among the insured. In particular, the decrease in consuming private care has been compensated by an increase in consuming public care. This might be because in Vietnam, only a small number of private hospitals are covered by HI (6).

With regards to type of visits, I found that the ATTs of HI scheme on frequency of visits at health facility for treatment was higher than that for preventive consultation and health check-up. It is possible that health check-up is not part of HI benefits package, while its importance is undeniable. This suggests that the MoH and VSS need to cover cost of health checkups. Besides, although preventive consultation is basic medical package at CHS and financed by state budget, the frequency of using services at CHS among different groups is modest (Appendix 3.3).

4.2. Catastrophic health expenditure

4.2.1. HI and CHE

The study found that households enrolling in VHI, HSHI programs, or in mixed HI programs were less likely to suffer CHE than those without HI. Similarly, when more than one third of household members enrolled in HI scheme, HI had a protective effect. This is consistent with a series of studies in Vietnam (37, 72, 78) and other countries, for example, China (79), Indonesia (80), Philippines (81), Turkey (34), Ethiopia (35), Senegal (36). This positive association can be explained by the reforms in HI policy in Vietnam. In 2014, the revised HI Law was passed which has increased the entitlements for the enrolled, reduced co-payment for some groups, or fully subsidized for the poor and some disadvantaged groups, and subsidized 70% of contribution for the near-poor, or reduced premium for additional member of household when they purchase HI based on family unit subscription (19, 67). However, my result is contrary to that of Hoang et al. (2013) (8) and Ahmed et al. (2018) (10) who found that in Vietnam, having HI did not significantly lower the probability of incurring CHE. This inconsistency may be due to the way the HI variable was chosen. The authors included binary variable "Household with at least one health insurance enrollee" in the regression instead of using categorical variables HI. Obviously, there is a difference in the financial protection role of HI from CHE between households where only one member enrolls in HI and those with all or almost members covered by HI.

4.2.2. HI and CHE in rural area

The results of sensitivity analysis show that in rural area, there was no statistically significant difference between households participating in VHI, HSHI programs and non-participating households in relation to decreased risk of CHE. Likewise, in rural area, more than one third of household members having HI had no statistically significance in lowering odds of CHE compared to those without HI. A possible explanation for this might be that there is low uptake of medical services at health facilities and intensive use of self-medication in remote areas, which might be caused by accessibility, accommodation or availability barriers or by quality of health services provided (82). Patients have to pay for medicines outside health facility, which is attributable to shortage of essential medicines. In rural area, only one-third of essential medicines are available at CHS, this figure for district hospital is 50% (77). Tran et al. (2016) (82) in a cross-sectional study in remote and mountainous areas found that about 20% of interviewees treated themselves without seeking care at health providers, and they usually visited traditional healers and used traditional medicine. Besides, Somanathan et al. (2014) (65) indicated that there is disproportion in allocation of health workers and financial resources across regions, for instance, in the poorest region of Vietnam, only one-third of commune health stations have a medical doctor.

Another study in Vietnam found that non-optimal working conditions such as the insufficiency of medical equipment and training opportunities, and restriction in using up-to-date methods of diagnosis and treatment are prevalent in health facilities in rural area (83). This affects quality of primary care in rural area. Consequently, the insured dwelling in this area tend to bypass the gate-keepers and go to tertiary level (84) and incur higher co-payment or other non-medical expenditures.

I tried to assess the association between using health services in rural area among households with HI and odds of CHE, using interaction term between place of residence and frequency of outpatient care utilization. The estimated result showed that intensity of outpatient visits increased the likelihood of incurring CHE among insured households in rural area (OR>1) (Table 3.5). This does not happen for the insured households in urban area. This means that my hypothesis of skipping primary line and bearing additional copayment and other costs above seems reasonable.

Table 3.5. Logistic regression result for interaction terms between place of residence and frequency of outpatient care utilization

Dependent variable: CHE	Odds Ratio	Std. Err.	P>z	[95% Conf. Interval]	
Rural*Number of outpatient visits in last 12 months	1.018	0.004	0.000	1.009	1.027
Urban*Number of outpatient visits in last 12 months	1.004	0.007	0.545	0.990	1.018
_cons	0.098	0.005	0.000	0.089	0.108
Observations: 6790 households with any type of HI					

To address the heterogeneity in availability and quality of health care services, health insurance scheme in Philippines involves private sector in primary and secondary care to encourage the provision of Primary Care benefits in rural area. Vouchers and contracting have been used as an effective mechanism to engage the private sector in underserved areas in the Asia Pacific countries(85). Besides, Vietnamese government can design special catastrophic medical insurance program to protect households from CHE and impoverishment, which is successful in reducing CHE incidence in China(86). This package aimed to reimburse patients when the difference between their medical expenditures and insurance reimbursement exceeds a predetermined threshold (86).

4.2.3. HI and CHE toward outpatient and inpatient care utilization

Notably, the sensitivity analysis for outpatient care showed that the likelihood of lowering CHE among households joining HSHI programs was not statistically different from the uninsured households. Nevertheless, for outpatient care, household's enrollment in any HI programs continued to be a protective factor. This finding was also reported by Michael (2014) (52). The author found that HI for ethnic minorities, the poor and farmers has no impact on the reduction of CHE rate. There are two possible explanations for my results. First, about 41% of households who experienced CHE, participated in HSHI program and came from rural area (Figure 3.10). Therefore, they are likely to encounter the issues mentioned above. Second, there is no statistically significant difference in frequency of using outpatient care between households participated in HSHI and those without HI (Table 3.6).

Table 3.6. HI participation status and outpatient services utilization among households with or without incurring CHE.

Dependent variable: Number of outpatient visits in last 12 months	Coef.	Std. Err.	P>t	[95% Conf. Interval]	
Health insurance of household (ref: Household does not participate in any health insurance program)					
Household only participates in VHI	1.681	0.491	0.001	0.718	2.644
Household only participates in heavily subsidized programs	0.522	0.476	0.272	-0.410	1.454
Household participates in different programs	2.493	0.448	0.000	1.614	3.371

However, compared to noninsured households, more than two thirds of household members having HI was always a protective factor from CHE, except for households in rural area. This suggest that to achieve UHC, the policy makers in Vietnam should continue expanding HI coverage and focus on health delivery system in rural area.

4.2.4. Health system and structural factors and CHE

4.2.4.1. Predisposing factors

With regard to the predisposing factors associated with CHE, the study found that the likelihood of experiencing CHE increased significantly in households where household head aged above 50, household with high proportion of people aged above 60 and aged below 6. These results are in agreement with those obtained in Vietnam by Hoang et al. (2012) (38), Ahmed et al. (2018) (39), Giang et al. (2019) (72). These results may be explained by the fact that Vietnam is facing population aging with the fastest aging rate in the world (7). The senior citizens require more health care, because they are at higher

risk of burden of disease, especially NCDs(6), while about 15.1% of the elderly do not have HI (Appendix 3.2). Besides, the elderly may have less income.

Therefore, Vietnamese government can support them in buying HI card. If the premiums are relied on funds of VSS, it will affect the financial sustainability of the fund. HI contributions for the elderly could be publicly financed from earmarked taxes, such as excise tax on tobacco, alcohol and sugary beverages. It has a positive influence not only in economics but also in public health. They are evidence- based "best buy" interventions proposed by WHO to prevent and control NCDs(87). Additionally, Vietnam needs to focus more on health service provision at grassroots level to meet timely health needs and speedy aging, including NCDs prevention services. Besides, integrated people-centred health services could be possible option to address this problem.

With regards to children under 6 years of age as a risk factor of CHE, they are more prone to acute/chronic infections, thus, they need more medical care. Although infants have free HI card, parents often take them to private health providers not covered by HI for outpatient care because of the perception that their kids will receive better treatment there, or of its convenience (18).

The study found that household size was a protective factor. This result is in line with that of previous studies (38, 79, 80). One possible hypothesis is that Vietnam has a traditional multi-generational family model, so members can take care of each other, providing material and spiritual support when they are sick, hence, social network and social capital need to be promoted. The study also found that occupation status was strongly associated with a decreased risk of CHE. Obviously, when household heads are employed they can easily join HI scheme.

4.2.4.2. Enabling factors

In terms of enabling factors, the odds of incurring CHE was higher among wealthier households. This study supports evidence from previous findings in Vietnam (38, 39, 65, 88), Myanmar (89), Nigeria (90). This may reveal the fact that the poor are less likely to transfer a part of their living expenses to health, which has prevented them from seeking necessary medical services, leading to reduction in the risk of CHE (39). There are also some explanations for this result. Preference of well-off people for advanced medical technology increases their cost sharing and then OOPs. Furthermore, drug-"brand addiction" in combination with medical price inflation, overconsumption of pharmaceuticals, and stock-out of medicines in hospitals are likely to make pharmaceuticals constitute a disproportionately large proportion of OOPs

among affluent households (29, 45, 53, 58). Besides, HI does not the ceiling of cost sharing (65). Additionally, Decree 85/2012/ND-CP(91) of the Government on financial autonomy of hospitals inspires healthcare providers to maximize their revenues by attracting more patients and more services, retaining patients and referring them to higher level facilities only when indispensable (77). Fear of not being referred to higher level of care, the perception of poor quality of first contact for primary care are possible to make wealthier people skip this line and go directly to health facilities where they believe that they might derive accurate diagnosis and treatment (63, 80). Consequently, they need to pay additional co-payment for inpatient care or 100% of copayment for outpatient care at higher level without referral.

4.2.4.3. Need factors

Considering need factors, the study examined that illness status was a leading determinant of risk of CHE. This result is consistent with other studies (72, 79, 80, 92, 93). Because of illness status, people need more healthcare, leading to increase in probability of incurring CHE. This result is also likely to be related to the fact that there are about 20% of citizens not covered by HI. This means that they have to pay all medical costs by their OOPs. This suggests that expanding HI coverage is one of the possible options that the government can do in the short term. Besides, allocating more money to preventive activities to cope with epidemiological transition is what Vietnamese government can do in the medium term plan. Additionally, Vietnamese policy makers need to design evidence-based HI benefits package, including burdensome disease, cost-effectiveness of interventions, and financial protection for patients, financial sustainability of HI scheme criteria combined with transparency and accountability. These criteria have been used to define benefits package in Malaysia (94) and Philippines (81).

4.2.4.4. Health seeking behavior

In relation to health seeking behavior, the result demonstrated that households visiting private health facilities were less likely to suffer CHE compared with those seeking care at public health facilities. This result contradicts other findings in Vietnam (39) and Indonesia (80). However, the sensitivity analysis for inpatient care showed a diverse pattern. These differences can be partly explained by the fact that the notion of "public hospital" in Vietnam is dubious because the hospitals engage in profit maximization while rivaling with lower level health facilities (95). Currently, two types of healthcare services are common in a number of public hospitals in Vietnam, which are services reimbursed by HI for general public and premium services not covered by HI and based on willingness to pay for

affluent citizens and those who do not want to line up waiting(84). Although services, health workers and medical equipment and infrastructure are publicly financed, users have to pay for consuming them.

The study also found that the likelihood of encountering CHE increased substantially along with the rise in the number of hospitalization and outpatient care. These results further support the findings of Ahmed et al. (2018) (39), Zeng et al. (2018)(74), Yazdi-Feyzabadi et al.(2018) (96) and Jaya (2013) (80). It is possible that in Vietnam, like in many countries in the East Asia Pacific region line-item budgets provider payment mechanisms, based on bed rates, are applied which motivate hospitals to receive and hold patients longer (65). Besides, in Vietnam, the main payment method from HI system or by out-of-pocket of patient is fee-for-service (FFS). This triggers a supply-induced demand problem, which means that health care providers may be tempted to offer non-necessary diagnosis and treatment services to patient. As a result, the OOPs of patients for inpatient admission and outpatient care escalate.

It can thus be suggested that to promote generic drug prescriptions, rational medical services designation and stimulate preventive care, a mixed payment mechanism should be applied. This mechanism has been applied In Thailand, which is mix of capitation for outpatient care, and global budget and DRGs for inpatient care (65, 97) . It is implemented with the combination of hospital quality accreditation, random medical audit, monitoring utilization rates, and conducting patient and provider satisfaction surveys (65).

This study has been unable to demonstrate the association between self-treatment and the probability of incurring CHE. A possible explanation for this is that, while self-treatment can make illness worse and lead to the increase in treatment costs and then the odds of CHE (80), having self-treatment enables the population to avoid unnecessary costly prescriptions of doctors and attracting patients to their private clinics (77), which may lower odds of CHE.

Relevance of the analytical framework

Adapted framework of Andersen's behavioral model was very helpful, providing me with a comprehensive view of the factors that influence the use of health services with the central focus on HI factor. The model helped me to analyze factors affecting insurance participation and health service use, and financial burdens in finding part. The model helped me understand the relationship of these factors deeply, and guided me to form a logical and critical view for the discussion part.

Limitations of the study

There are some limitations in my study. Firstly, there could be measurement errors in the VHLSS surveys used. Some questions were based on self-reporting by interviewees, such as the number of outpatient and inpatient visits, number of visits at health facilities in the past 12 months, out-of-pocket expenditure for outpatient care and for inpatient admissions, which can lead to inevitable and differential recall biases. Secondly, the variables used in the econometric model are mainly addressing the demand side. The variables addressing the supply side and external environment, such as the number of health facilities, health workers, and availability of drugs in every commune or district, local budgets for health, epidemic diseases and local disease control, natural disasters, environmental pollution, as well as local socio-economic conditions should be investigated in future research. Thirdly, due to time and budget constraints I could not conduct a survey or qualitative study to assess the impact of qualitative factors, such as attitudes of health staff, the insured patients and non-insured's satisfaction with medical services on healthcare utilization, as well as service providers' perception, views of local authorities and policy makers. Such primary data could have helped to create more insights into views of stakeholders. I hope future research will help me fill this gap. Finally, in relation to using PSM method to measure causal effect of the HI scheme, the estimated results may be biased if variables affecting both the outcome and treatment status are omitted: unobserved confounders. Finally, the interval after the revision of the law may have been short to evaluate its impacts. Future research may address these issues by using longitudinal data with other specifications such as instrumental variables or difference-in-difference.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1. Conclusions

Vietnam as well as many other LMIC have chosen health insurance as a means to achieve the goal of UHC. It means that all people regardless of income, physical barriers, ethnicity and region can access quality health services without having to bear enormous expenses. The Government of Vietnam always strives by reforming HI policies and HI Law to expand coverage, increase HI benefits package and reduce cost-sharing. Specifically, the most recent revised HI law in 2014, the government has continued to expand support to disadvantaged groups such as the poor, the near-poor, ethnic minorities and others in contribution premiums. There are also amendments in co-payment policy. A revised law introduces the family subscription unit for voluntary participants. To find out if the HI scheme has an impact on the use of health services, and protects Vietnamese citizens from CHE, or whether there are other factors should be taken into account, I have conducted this quantitative research. I used the dataset of VHLSS 2014 and VHLSS 2016.

First, to measure the effect of the HI program I used PSM method to control for observed confounding factors that could affect the selection of HI participation, or when the assignment of policy was not random. The factors used for the PSM were selected based on Anderson's model. This model is widely employed in health seeking behavior studies. This study has shown that the HI scheme had a positive impact on the healthcare utilization. However, the magnitude of influence on outpatient and inpatient care, types of providers and types of visits was heterogeneous. It was also different between VHI and HSHI groups. The program has affected use of outpatient services more than inpatient services. The program most affected the use of health services at the district level. In terms of using health services at commune level, the HI scheme had the most effect on the HSHI groups. These findings underscore the important role of grassroots level. Policy makers need to prioritize investment of resources at this level to improve health outcomes of citizens, especially the disadvantaged groups. I also found substitution effect of using private health services for state health services. My results were consistent with a numbers of other studies.

Next, to assess the financial protection capacity of HI scheme in terms of CHE, I used a multivariate logistic regression model. The advantage of this approach is to allow me to explain the effect of HI, and other variables, which are equally important for policy makers in designing a comprehensive HI scheme. Compared to previous studies in Vietnam, in this study I have divided households having health insurance by type of insurance, and level of coverage. The results show that generally, households participating in HI scheme were less likely to incur CHE than those who did not. However, when

I did sensitivity analysis I found that there was no statistically significant association between participation in heavily subsidized programs and risk of CHE for outpatient care. This suggests that expanding coverage does not always come with financial protection for households. Therefore, designing a comprehensive HI benefits package, an effective payment method, especially in the context of financial autonomy of hospitals is essential. This study has identified the factors reducing the likelihood of bearing CHE such as households with male, high education levels, employed heads, household size, assets, and households living in urban areas. Nevertheless, age of household head, share of members aged under 6 or above 60 years old, the wealthier households, illness status, number of outpatient and inpatient visits were risk factors. It suggests that the policy makers need to boost health system in general, including demand issues, and consider HI policy in the context of predisposing, enabling, need factors, and external environment.

5.2. RECOMMENDATIONS

5.2.1. Recommendations on improving HI scheme.

The government

The government should expand HI coverage by increasing the subsidy level from 70% to 100% of insurance premiums for the near-poor, because they are still encountering barriers in accessing medical services. This can also help avoid adverse selection problem. The government should support purchasing HI for the elderly who are vulnerable to risks of disease.

The government should develop a policy of full exemption of copayment for the near poor to reduce their OOPs and CHE. In fact, the threshold for dividing the poor and the near-poor is not very precise. Subsidies for travel and meals costs related to access to healthcare services of disadvantaged groups should be considered. To protect households from CHE, the government can introduce threshold copayment policy. This means that patients do not have to pay cost sharing if their monthly payments have passed a particular threshold.

To increase the budget for subsidies mentioned above, the government should increase excise taxes on health-damaging goods such as cigarettes, alcohol and sugary drinks, and then these revenues must be earmarked for HI fund. It not only increases revenue for the fund, but also reduces the risk of illness, accident, and medical needs. Besides, the government can provide a roadmap to gradually increase premiums of compulsory participants. This option may be feasible because Vietnam's economy has grown strongly in recent years.

MoH, VSS

VSS should provide more information; enhance education and awareness of citizens on the benefits of HI enrollment and using HI card, on how to register for family-based enrollment and how to pay premiums, especially those living in rural area and informal workers. Having a clear understanding of the policy, they will actively and voluntarily participate in HI scheme. As a result, the revenue of HI fund will increase in a sustainable way. Communication should be also strengthened to ensure that the insured perceive the role of gatekeepers and the scope of benefits package.

MoH and VSS need to design a reasonable HI benefits package based on evidence and consensus of stakeholders. The MOH is responsible for developing clinical content, representatives of medical service providers and researchers, and VSS are responsible for calculating cost effectiveness and implementation costs. VSS needs to provide adequate funding, full subsidies and repayments for this benefits package to avoid the need for medical facilities to charge additional fees to cover their costs.

MoH and VSS need to reform provider payment methods by combining different methods. For example, commune level may apply capitation method as it offers public health services in general; capitation should be implemented for outpatient care and case-based payment for inpatient treatment at district hospitals; case-based payment method can also be applied to inpatient treatment in all state hospitals except for high-tech facilities.

Strengthen control of drug and pharmaceutical prices. Reduce the copayment for the use of generic drugs to change patient's preference for expensive drugs, and stimulate the consumption of generic drugs. Promotion is needed to eliminate prejudice against locally produced and generic drugs.

5.2.2. Recommendations on strengthening the health system

In order to improve the effectiveness and fairness of access to health services, the completion of HI scheme should be done in parallel with boosting efficiency of primary care. The government should introduce more preferential policies on strengthening grassroots level to increase availability and quality of primary health care. For example, integrate the "principle of family medicine" into the commune health centers, and develop family doctor model in the community. Principles of family medicine are comprehensive, continuous preventive health care for individuals, households, and communities. The MoH can mobilize experts from central hospitals and universities to organize training family medicine qualification for doctors working at commune health stations, especially in rural area. At the same time, continue to implement staff rotation policy. The MoH can improve the quality of medical care at all levels through issuing practice certificates, quality accreditation and clinical

practice guidelines, addressing unreasonable use of medicines problem via guidance on medical care practices.

In the context that Vietnam's public budget is still limited, promoting public-private cooperation can mobilize private finance, increase accessibility, efficiency in providing health services to the citizens, and address overcrowding problem in public facilities. The government can create incentives for private sector invest in CHS infrastructure such as tax and land rent relief, and engage them in providing preventive medical services through voucher and contracting mechanism.

Coordination between the MoH, Ministry of Education, Ministry of Finance, Ministry of Science and Technology in promoting policy research, clinical trials, applied research to achieve overall goals of health system.

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APPENDIX

Appendix 2.1. Andersen' behavioral model(40)
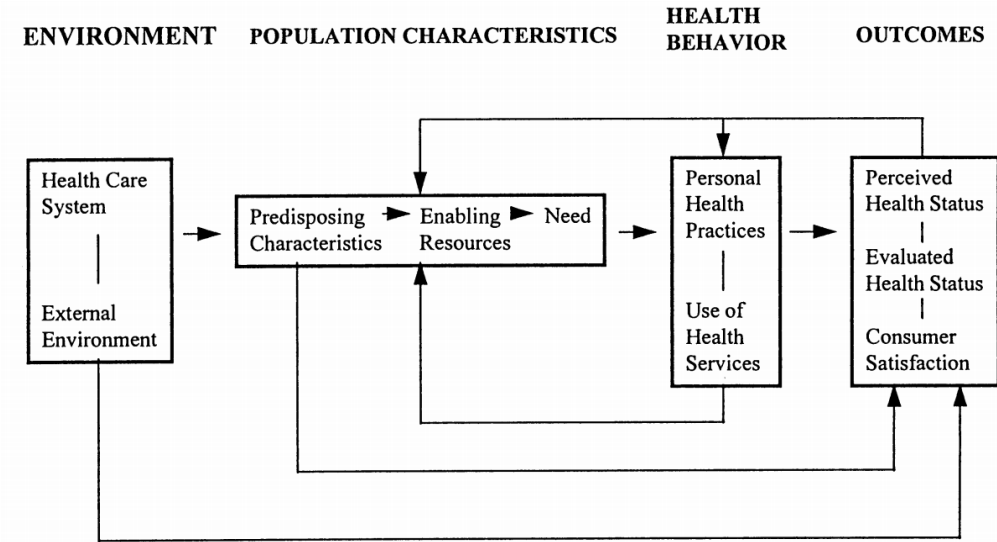
Appendix 2.2. Definition of variables in evaluating impact of HI on healthcare utilization

Variables	Description
Treatment status	HI participation status of household member which is pre-categorized from the VHLSS dataset
Participation in VHI	Whether the household member participates in VHI (equals to 1 if yes / 0 if he or she does not participate in any health insurance program)
Participation in heavily subsidized programs	Whether the household member participates in HI program for the poor, the near-poor, policy beneficiaries (for example meritorious people) (equals to 1 if yes / 0 if he or she does not participate in any health insurance program)
Participation in HI	Whether the household member participates in any HI program (equals to 1 if yes / 0 if he or she does not participate in any health insurance program)
Outcome variables	
Number of outpatient visits	Number of outpatient visits at any health facilities that individual goes in the last 12 months
Number of inpatient visits	Number of inpatient visits at any health facilities that individual goes in the last 12 months
Number of visits at commune health center	Number of visits at commune health center that individual goes in the last 12 months
Number of visits at district hospital	Number of visits at district hospital that individual goes in the last 12 months
Number of visits at provincial hospital	Number of visits at provincial hospital that individual goes in the last 12 months
Number of visits at state health facilities	Number of visits at state health facilities that individual goes in the last 12 months
Number of visits at private health facilities	Number of visits at private health facilities that individual goes in the last 12 months
Number of visits at health facility for medical treatment	Number of visits at health facility for medical treatment that individual goes in the last 12 months
Number of visits at health facility for health check and consultation	Number of visits at health facility for health check and consultation that individual goes in the last 12 months
Explanatory variables	
Predisposing factors	
Age group	Age of household members/individual (ordinal variable) equals
<=30	1 if individual belongs to age group equal or below 30
31-40	2 if individual belongs to age group 31-40
41-50	3 if individual belongs to age group 41-50
51-60	4 if individual belongs to age group 51-60
>=61	5 if individual belongs to age group equal to or above 60
Gender (male)	Gender of individual (1 if male / 0 if female)
Ethnicity (Kinh and Hoa)	Whether individual belongs to ethnic Kinh/Hoa group (equals to 1 if yes / 0 if the individual belongs to a different ethnic minority group)
Marital status (married)	Marital status of individual (1 if married/0 otherwise)
Education level	Education level of individual (ordinal variable) equals
Not complete primary school	1 if individual does not finish primary school
Primary school	2 if individual graduated primary school
Lower secondary	3 if individual graduated lower secondary school
Upper secondary	4 if individual graduated upper secondary school
Vocational school	5 if individual graduated vocational school

College, University, Master, PhD.	6 if individual graduated College, University, Master, PhD.
Occupation status	Occupation status of individual (categorical variable) equals
Leaders/Managers	1 if individual works as a leader or manager
Professionals/technicians	2 if individual works as a professional or technician
Service or sales staff	3 if individual works as a service or sales staff
Laborers in agriculture/forestry/fishery	4 if individual works in agriculture or forestry or fishery
Manual labourers or machine operators	5 if individual works as a manual labourer or machine operator
Unskilled workers	6 if individual work as a unskilled worker
Others	7 if individual does other job/ or individual is not in the labor force
Household size	Total household members (continuous variable)
Household composition	
Share of children below 6 years old	Share of children below 6 years old in the household (continuous variable)
Share of the elder above 60 years old	Share of the elder above 60 years old in the household (continuous variable)
Access to clear water	Whether the household has access to clean water (1 if yes / 0 if no)
Toilet access	Whether the household has access to toilet (1 if yes / 0 if no)
Enabling factors	
Expenditure quintiles	Based on household consumption expenditure data in last 12 months I ranked each individual in the household by their score, then, I divided the ranking into 5 equal parts, from quintile 1 to quintile 5. Each quintile group accounted for 20% of the sample. It is ordinal variable, and equals
First expenditure quintile group (poorest)	1 if individual belongs to the first expenditure quintile (poorest)
Second expenditure quintile group	2 if individual belongs to the second expenditure quintile
Third expenditure quintile group	3 if individual belongs to the third expenditure quintile
Fourth expenditure quintile group	4 if individual belongs to the fourth expenditure quintile
Fifth expenditure quintile group (richest)	5 if individual belongs to the fifth expenditure quintile (richest)
Number of motorcycles	The number of motorcycles that household possesses (continuous variable)
Number of telephones	The number of telephones that household possesses (continuous variable)
Number of radio, TV or computer	The number of radio, TV or computer that household possesses(continuous variable)
Total residential area (m^2)	The total residential area that household has (m^2) (continuous variable)
Need factors	
Illness status in last 12 months	Whether individual had illness or severe injury in the last 12 months (1 if yes / 0 if no)
Number of illness times in last 12 months	Number of times that individual had illness or severe injury in the last 12 months (continuous variable)
Number of illness days in last 12 months	Number of days that individual had illness or severe injury in the last 12 months (continuous variable)
External environment	
Place of residence (urban)	Whether individual lives in urban area (1 if yes / 0 if he or she lives in rural area)
Region	The region where individual lives (categorical variable). It equals
Red River Delta	1 if individual lives in Red River Delta region

Northern Midlands and Mountains	2 if individual lives in Northern Midlands and Mountains
North and South Central Coast	3 if individual lives in North and South Central Coast
Central Highlands	4 if individual lives in Central Highlands
South East	5 if individual lives in South East
Mekong River Delta	6 if individual lives in Mekong River Delta

Appendix 2.3. Definition of variables in multinomial logistic regression

Variables	Description
Variables	**Description**
Dependent variable	Incidence of catastrophic health expenditure of household. It equals 1 if household experiences CHE, 0 otherwise
Explanatory variables	
Predisposing factors	
Age group	Age of household head (ordinal variable) equals
<=30	1 if household head belongs to age group equal or below 30
31-40	2 if household head belongs to age group 31-40
41-50	3 if household head belongs to age group 41-50
51-60	4 if household head belongs to age group 51-60
>=61	5 if household head belongs to age group equal to or above 60
Gender (male)	Gender of household head (1 if male / 0 if female)
Ethnicity (Kinh and Hoa)	Whether household head belongs to ethnic Kinh/Hoa group (equals to 1 if yes / 0 if the household head belongs to a different ethnic minority group)
Marital status (married)	Marital status of household head (1 if married/0 otherwise)
Education level	Education level of household head (ordinal variable) equals
Not complete primary school	1 if household head does not finish primary school
Primary school	2 if household head graduated primary school
Lower secondary	3 if household head graduated lower secondary school
Upper secondary	4 if household head graduated upper secondary school
Vocational school	5 if household head graduated vocational school
College, University, Master, PhD.	6 if individual graduated College, University, Master, PhD.
Household head's employment	Whether the household head is employed (1 if yes / 0 if no)
Household size	Total household members (continuous variable)
Household composition	
Share of children below 6 years old	Share of children below 6 years old in the household (continuous variable)
Share of the elder above 60 years old	Share of the elder above 60 years old in the household (continuous variable)
Access to clear water	Whether the household has access to clean water (1 if yes / 0 if no)
Toilet access	Whether the household has access to toilet (1 if yes / 0 if no)
Enabling factors	
Expenditure quintiles	Based on household consumption expenditure data in last 12 months I ranked each household by their score, then, I divided the ranking into 5 equal parts, from quintile 1 to quintile 5. Each quintile group accounted for 20% of the sample. It is ordinal variable, and equals
First expenditure quintile group (poorest)	1 if household I belongs to the first expenditure quintile (poorest)
Second expenditure quintile group	2 if household belongs to the second expenditure quintile
Third expenditure quintile group	3 if household belongs to the third expenditure quintile
Fourth expenditure quintile group	4 if household belongs to the fourth expenditure quintile
Fifth expenditure quintile group (richest)	5 if household belongs to the fifth expenditure quintile (richest)
Health insurance status of household	Health insurance status of household (categorical variable). It equals

Household does not participate in any health insurance program	1 if household does not participate in any health insurance program
Household only participates in VHI	2 if household only participates in VHI
Household only participates in heavily subsidized programs	3 if household only participates in heavily subsidized programs
Household participates in different programs	4 if household participates in any HI programs
Share of household members having health insurance	Share of household members having health insurance (ordinal variable). It equals
No one in the household has HI	1 if no one in the household has HI
Up to 1/3 of household members have HI	2 if up to 1/3 of household members have HI
One to two thirds of household members have HI	3 if one to two thirds of household members have HI
More than two thirds of household members have HI	4 if more than two thirds of household members have HI
Number of motorcycles	The number of motorcycles that household possesses (continuous variable)
Number of telephones	The number of telephones that household possesses (continuous variable)
Number of radio, TV or computer	The number of radio, TV or computer that household possesses(continuous variable)
Total residential area (m^2)	The total residential area that household has (m^2) (continuous variable)
Need factors	
Illness status in last 12 months	Whether household had member who had illness or severe injury in the last 12 months (1 if yes / 0 if no)
Number of illness days in last 12 months	Total number of illness or severe injury days of all household members in the last 12 months (continuous variable)
Health behavior	
Health care utilization	Health care utilization of household (categorical variable). It equals
Public health facilities	1 if household only uses health services at public health facilities
Private health facilities	2 if household only uses health services at private health facilities
Both public and private health facilities	3 if household uses health services at both public and private health facilities
Number of outpatient visits in last 12 months	Total number of outpatient visits of all household members in the last 12 months
Number of inpatient admissions in last 12 months	Total number of inpatient visits of all household members in the last 12 months
Self-treatment (yes vs no)	Whether household members treat themselves (without prescription) in the last 12 months (1 if yes / 0 if no)
External environment	
Place of residence (urban)	Whether household lives in urban area (1 if yes / 0 if he or she lives in rural area)
Region	The region where household lives (categorical variable). It equals
Red River Delta	1 if household lives in Red River Delta region
Northern Midlands and Mountains	2 if household lives in Northern Midlands and Mountains
North and South Central Coast	3 if household lives in North and South Central Coast
Central Highlands	4 if household lives in Central Highlands
South East	5 if household lives in South East
Mekong River Delta	6 if household lives in Mekong River Delta

Appendix 3.1. Health insurance of target groups in Vietnam after adopting revised HI Law (98)(21)(88)

Target groups	Description	Premium and subsidies	Co-payment rate
First group- contributions are made by employees and employers	-Employees with an indefinite term labor contract, and those signing labor contracts from 3 months or more. -Employers of enterprises. - Civil servants and public employees	4.5% of payroll tax (3% employers, 1.5% employees)	20%
Second group- contributions are 100% subsidized by the government	- People from poor households, and those from ethnic minority - People living in areas with difficult socio-economic conditions. Meritorious people. Children under 6 years old. - People serving in the army and the police	100% subsidy by the government (the premium contribution is equal to 4.5% of the monthly salary, or 4.5% of minimum salary depending on each target group)	reduced from 5% to 0% (Exempted from co-payment and are entitled to use free medical examination and treatment services)
Third group - contributions are partly subsidized by the government	- The near-poor	Minimum subsidy level is 70% of minimum salary	reduced from 20% to 5%
	- Student	Minimum subsidy level is 30% of minimum salary	20%
	- Households working in agriculture, forestry, fishery with medium income	Minimum subsidy level is 50% of minimum salary	20%
Forth group- contributions are paid by social insurance fund	- Retirees	- 4.5% of monthly pension	20%
	- People receiving monthly social insurance benefits due to labor accidents, occupational diseases.	- 4.5% of minimum salary	20%
	- Female employees are on leave during maternity regime	- 4.5% of the monthly salary before the maternity leave	20%
Fifth group - contributions are based on unit subscription of the family	Informal sector	- The first person contributes a premium of 4.5% of minimum salary. - The second person pays 70% of the of the first person's contribution. - The third person pays 60% of the first person's contribution. - The fourth person contributes 50% of the first person's contribution. - The fifth person pays 40% of the first person's contribution.	20%

Copayment rate when the insured go to health facilities without referral	District hospital (inpatient treatment)	Provincial hospital (inpatient treatment)	Central hospital (inpatient treatment)
Before January 1st, 2016	30%	40%	60%
January 1st, 2016	0%	40%	60%
	100% copayment for outpatient care		

Appendix 3.2. Descriptive statistics for the insured and the non-insured of different health insurance programs in 2014

Variables	The non-insured (Control group) N=3,618 (1)		The insured of VHI subsample (Treatment group) N=2,716 (2)			The insured of heavily subsidized subsample (Treatment group) N=3,746 (3)			The insured of full sample (Treatment group) N=13,462 (4)		
	n	%	n	%	P-value H0: (2)=(1)	n	%	P-value H0: (3)=(1)	n	%	P-value H0: (4)=(1)
Predisposing factors											
Age	Mean 41.7	Std. Dev 16.23	Mean 51.0	Std. Dev 15.15	0.000	Mean 50.0	Std. Dev 23.2	0.000	Mean 36.76	Std. Dev 25.90	0.000
Age group					0.000			0.000			0.000
<=30	859	23.7	303	11.2		833	22.2		5,743	42.7	
31-40	774	21.4	354	13.0		431	11.5		1,365	10.1	
41-50	925	25.6	592	21.8		499	13.3		1,626	12.1	
51-60	650	18.0	746	27.5		637	17.0		1,935	14.4	
>=61	410	11.3	721	26.6		1,346	35.9		2,793	20.8	
Gender (male)	1,462	40.4	865	31.9	0.000	1,597	42.6	0.053	5,754	42.7	0.011
Ethnicity (Kinh and Hoa)	3,427	94.72	2,672	98.4	0.000	2,648	70.7	0.000	11,111	82.5	0.000
Marital status (married)	2,762	76.3	2,166	79.8	0.001	2,762	76.3	0.000	6,929	51.5	0.000
Education level					0.000						0.000
Not complete primary school	960	26.5	724	26.7		1,691	45.1		5,975	44.4	
Primary school	1,114	30.8	777	28.6		915	24.4		2,565	19.1	
Lower secondary	1,014	28.0	691	25.4		715	19.1		2,188	16.3	
Upper secondary	286	7.9	269	9.9		172	4.6		881	6.5	
Vocational school	170	4.7	149	5.5		175	4.7		897	6.7	
College, University, Master, PhD.	74	2.1	106	3.9		78	2.1		956	7.1	
Occupation status					0.000			0.000			0.000
Leaders/Managers	2	0.1	5	0.2		12	0.3		125	0.9	
Professionals/technicians	46	1.3	56	2.1		26	0.7		720	5.4	
Service and sales staff	568	15.7	487	17.9		180	4.8		948	7.0	
Laborers in agriculture/forestry/fishery	376	10.4	279	10.3		283	7.6		660	4.9	
Manual labourers and machine operators	467	12.9	254	9.4		173	4.6		869	6.5	
Unskilled workers	1,488	41.1	888	32.7		1,663	44.4		3,486	25.9	
Others	671	18.6	747	27.5		1,409	37.6		6,654	49.4	
Household size	Mean 4.15	Std. Dev 1.5	Mean 4.05	Std. Dev 1.7	0.012	Mean 4.1	Std. Dev 1.9	0.065	Mean 4.3	Std. Dev 1.7	0.000
Household composition											
Share of children below 6 years old	Mean 7.9%	Std. Dev 12.7%	Mean 7.0%	Std. Dev 11.7%	0.119	Mean 7.5%	Std. Dev 12.5%	0.327	Mean 10.9%	Std. Dev 14.3%	0.000

Appendix 3.2. continuing											
Variables	**The non-insured (Control group) N=3,618 (1)**		**The insured of VHI subsample (Treatment group) N=2,716 (2)**			**The insured of heavily subsidized subsample (Treatment group) N=3,746 (3)**			**The insured of full sample (Treatment group) N=13,462 (4)**		
	n	**%**	**n**	**%**	**P-value H_0: (2)=(1)**	**n**	**%**	**P-value H_0: (3)=(1)**	**n**	**%**	**P-value H_0: (4)=(1)**
Share of the elder above 60 years old	Mean 11.3%	Std. Dev 22.8%	Mean 18.5%	Std. Dev 27.9%	0.000	Mean 25.7%	Std. Dev 34.6%	0.000	Mean 17.0%	Std. Dev 28.0%	0.000
Access to clear water	2,807	77.6	2,248	82.8	0.000	2,386	63.7	0.000	10,093	74.9	0.001
Toilet access	2,364	65.3	2,126	78.3	0.000	1,690	45.1	0.000	8,853	65.8	0.634
Enabling factors											
Expenditure quintiles					0.000			0.000			0.000
First expenditure quintile group (poorest)	651	18.0	233	8.6		1,501	40.1		2,767	20.6	
Second expenditure quintile group	876	24.2	532	19.6		812	21.7		2,543	18.9	
Third expenditure quintile group	754	20.8	612	22.5		563	15.0		2,657	19.7	
Fourth expenditure quintile group	734	20.3	640	23.6		493	13.2		2,684	19.9	
Fifth expenditure quintile group (richest)	603	16.7	699	25.7		377	10.1		2,811	20.9	
Number of motorcycles	Mean 1.3	Std. Dev 0.9	Mean 1.5	Std. Dev 0.9	0.00	Mean 1.0	Std. Dev 0.81	0.000	Mean 1.4	Std. Dev 0.9	0.397
Number of telephones	Mean 1.8	Std. Dev 1.1	Mean 2.0	Std. Dev 1.2	0.000	Mean 1.3	Std. Dev 1.0	0.000	Mean 1.7	Std. Dev 1.1	0.379
Number of radio, TV or computer	Mean 1.2	Std. Dev 0.6	Mean 1.4	Std. Dev 0.7	0.000	Mean 1.0	Std. Dev 0.6	0.013	Mean 1.3	Std. Dev 0.8	0.000
Total residential area (m^2)	Mean 81.3	Std. Dev 47.3	Mean 93.8	Std. Dev 55.8	0.000	Mean 69.4	Std. Dev 43.1	0.000	Mean 84.1	Std. Dev 53.4	0.005
Need factors											
Illness status in last 12 months	538	14.9	553	20.4	0.000	961	25.7	0.000	2,578	19.2	0.000
Number of illness times in last 12 months	Mean 0.2	Std. Dev 0.6	Mean 0.3	Std. Dev 0.8	0.000	Mean 0.5	Std. Dev 1.3	0.000	Mean 0.3	Std. Dev 1.1	0.000
Number of illness days in last 12 months	Mean 2.6	Std. Dev 13.2	Mean 4.4	Std. Dev 16.6	0.000	Mean 7.1	Std. Dev 28.8	0.000	Mean 4.2	Std. Dev 20.3	0.000
External environment											
Place of residence (urban)	896	24.8	941	34.7	0.000	561	15.9	0.000	4,059	30.15	0.000
Region					0.000			0.000			0.000
Red River Delta	701	19.4	393	14.5		616	16.4		2,525	18.8	
Northern Midlands and Mountains	250	6.9	208	7.7		748	20.0		2,280	16.9	
North and South Central Coast	718	19.9	616	22.7		950	25.4		2,968	22.1	
Central Highlands	290	8.0	151	5.6		301	8.0		962	7.2	
South East	436	12.1	304	11.2		230	6.1		1,370	10.2	
Mekong River Delta	1,223	33.8	1,044	38.4		901	24.1		3,357	24.9	

Appendix 3.3. Healthcare utilization across different samples in 2014 and 2016, (Mean)

Outcome variables (in last 12 months)	The non-insured		The insured of VHI subsample		The insured of heavily subsidized subsample		The insured of full sample	
	2014	2016	2014	2016	2014	2016	2014	2016
Number of outpatient visits	2.288	2.344	3.432	3.162	2.648	2.722	2.668	2.621
Number of inpatient visits	0.174	0.154	0.243	0.287	0.351	0.353	0.261	0.273
Number of visits at commune health station	0.272	0.226	0.301	0.292	0.866	0.774	0.645	0.566
Number of visits at district hospital	0.344	0.347	1.43	1.263	0.914	1.053	0.873	0.868
Number of visits at provincial hospital	0.431	0.42	0.927	0.918	0.534	0.62	0.59	0.631
Number of visits at state health facilities	0.828	0.801	2.453	2.255	1.486	1.743	1.529	1.563
Number of visits at private health facilities	1.216	1.321	0.719	0.713	0.584	0.479	0.66	0.657
Number of visits at health facility for medical treatment	1.972	2.043	3.057	2.765	2.341	2.396	2.184	2.157
Number of visits at health facility for health check and consultation	0.324	0.314	0.426	0.511	0.574	0.596	0.48	0.496
Number of observations	**3618**	**2696**	**2716**	**3299**	**3746**	**4227**	**13462**	**15152**

Appendix 3.4. Descriptive statistics across different treatment and control groups before matching

Variables	The non-insured (Control group) N=760 (1)		The insured of VHI subsample (Treatment group) N=1022 (2)			The insured of heavily subsidized subsample (Treatment group) N=1209 (3)			The insured of full sample (Treatment group) N=4140 (4)		
	n	%	n	%	P-value H0: (2)=(1)	n	%	P-value H0: (3)=(1)	n	%	P-value H0: (4)=(1)
Predisposing factors											
Age	Mean 44.7	Std. Dev 16.2	Mean 53.3	Std. Dev 14.6	0.000	Mean 53.9	Std. Dev 21.8	0.000	Mean 42.1	Std. Dev 25.6	0.006
Age group					0.000			0.000			0.000
<=30	124	16.3	66	6.5		171	14.1		1,318	31.8	
31-40	173	22.8	123	12.0		120	9.9		405	9.8	
41-50	196	25.8	223	21.8		159	13.2		560	13.5	
51-60	152	20.0	294	28.8		249	20.6		765	18.5	
>=61	115	15.1	316	30.9		510	42.2		1,092	26.4	
Gender (male)	307	40.4	331	32.4	0.000	504	41.7	0.570	1669	40.3	0.967
Ethnicity (Kinh and Hoa)	727	95.7	999	97.8	0.012	952	78.7	0.000	3577	86.4	0.000
Marital status (married)	559	78.8	809	79.2	0.861	780	64.5	0.000	2369	57.2	0.000
Education level					*0.654*			*0.000*			0.000
Not complete primary school	230	30.3	329	32.2		558	46.2		1,828	44.2	
Primary school	205	27.0	266	26.0		290	24.0		850	20.5	
Lower secondary	222	29.2	268	26.2		208	17.2		669	16.2	
Upper secondary	51	6.7	80	7.8		64	5.3		250	6.0	
Vocational school	38	5.0	57	5.6		62	5.1		289	7.0	
College, University, Master, PhD.	14	1.8	22	2.2		27	2.2		254	6.1	
Occupation status					0.000			0.000			0.000
Leaders/Managers	0	0	1	0.1		5	0.4		32	0.8	
Professionals/technicians	11	1.5	19	1.9		9	0.7		177	4.3	
Service and sales staff	114	15.0	177	17.3		89	7.4		350	8.5	
Laborers in agriculture/forestry/fishery	83	10.9	110	10.8		118	9.8		279	6.7	
Manual labourers and machine operators	113	14.9	97	9.5		57	4.7		283	6.8	
Unskilled workers	291	38.3	341	33.4		502	41.5		1,180	28.5	
Others	148	19.5	277	27.1		429	35.5		1,839	44.4	
Household size	Mean 3.97	Std. Dev 1.5	Mean 3.93	Std. Dev 1.6	0.617	Mean 3.83	Std. Dev 1.86	0.067	Mean 4.1	Std. Dev 1.7	0.081
Household composition											
Share of children below 6 years old	Mean 7.4%	Std. Dev 13.0%	Mean 6.1%	Std. Dev 11.2%	0.006	Mean 7.4%	Std. Dev 11.9	0.382	Mean 10.2%	Std. Dev 14.1%	0.000

							%				
Share of the elder above 60 years old	Mean 12.4%	Std. Dev 25.1%	Mean 21.60%	Std. Dev 31.2%	0.000	Mean 30.5%	Std. Dev 37.6%	0.000	Mean 20.8	Std. Dev 31.7	0.000
Access to clear water	582	76.6	855	83.7	0.000	775	64.1	0.000	3093	74.7	0.274
Toilet access	524	68.9	806	78.9	0.000	626	51.8	0.000	2815	68.0	0.605
Enabling factors											
Expenditure quintiles					0.000			0.000			0.000
First expenditure quintile group (poorest)	131	17.2	129	12.6		444	36.7		852	20.6	
Second expenditure quintile group	196	25.8	191	18.7		230	19.0		781	18.9	
Third expenditure quintile group	167	22.0	229	22.4		201	16.6		815	19.7	
Fourth expenditure quintile group	159	20.9	221	21.6		170	14.1		819	19.8	
Fifth expenditure quintile group (richest)	107	14.1	252	24.7		164	13.6		873	21.1	
Number of motorcycles	Mean 1.3	Std. Dev 0.84	Mean 1.5	Std. Dev 0.88	0.001	Mean 1.0	Std. Dev 0.85	0.000	Mean 1.34	Std. Dev 0.89	0.572
Number of telephones	Mean 1.7	Std. Dev 1.0	Mean 1.9	Std. Dev 1.1	0.000	Mean 1.4	Std. Dev 1.1	0.000	Mean 1.8	Std. Dev 1.1	0.109
Number of radio, TV or computer	Mean 1.2	Std. Dev 0.5	Mean 1.4	Std. Dev 0.8	0.000	Mean 1.1	Std. Dev 0.6	0.013	Mean 1.3	Std. Dev 0.76	0.000
Total residential area (m^2)	Mean 81.2	Std. Dev 45.1	Mean 90.4	Std. Dev 59.2	0.000	Mean 74.0	Std. Dev 45.9	0.000	Mean 84.4	Std. Dev 53.9	0.128
Need factors											
Illness status in last 12 months	85	11.2	209	20.4	0.000	289	23.9	0.000	759	18.3	0.000
Number of illness times in last 12 months	Mean 0.16	Std. Dev 0.55	Mean 0.36	Std. Dev 0.9	0.000	Mean 0.5	Std. Dev 1.4	0.000	Mean 0.34	Std. Dev 1.08	0.000
Number of illness days in last 12 months	Mean 1.52	Std. Dev 9.82	Mean 5.05	Std. Dev 24.8	0.000	Mean 4.98	Std. Dev 14.4	0.000	Mean 4.38	Std. Dev 19.7	0.000
External environment											
Place of residence (urban)	193	25.4	366	35.8	0.000	179	14.8	0.000	1243	30.0	0.010
Region					0.364			0.000			0.000
Red River Delta	145	19.1	190	18.6		201	16.6		788	19.0	
Northern Midlands and Mountains	41	5.4	75	7.3		191	15.8		607	14.7	
North and South Central Coast	138	18.2	196	19.2		340	28.1		885	21.4	
Central Highlands	51	6.7	58	5.7		71	5.9		240	5.8	
South East	80	10.5	123	12.0		74	6.1		470	11.4	
Mekong River Delta	305	40.1	380	37.2		332	27.5		1,150	27.8	

Appendix 3.5. Logit regression estimates of propensity scores for participation in HI scheme.

Variables	The insured of VHI subsample (Treatment group) N=1022		The insured of heavily subsidized subsample (Treatment group) N=1209		The insured of full sample (Treatment group) N=4140	
	OR	SE	OR	SE	OR	SE
Predisposing factors						
Age group (*ref: age <=30*)						
31-40	1.315	0.295	1.013	0.229	0.492***	0.083
41-50	1.721**	0.379	1.310	0.291	0.649***	0.110
51-60	2.917***	0.614	2.968***	0.632	0.985	0.162
>=61	3.941***	0.967	3.756***	0.880	0.879	0.168
Gender (male)	0.763**	0.088	1.201	0.142	0.998	0.089
Ethnicity (Kinh and Hoa)	2.074**	0.672	0.242***	0.056	0.334***	0.073
Marital status (married)	1.199	0.181	0.645***	0.101	0.606***	0.078
Education level (ref: Not complete primary school)						
Primary school	0.960	0.142	1.180	0.179	0.899	0.106
Lower secondary	0.850	0.135	0.703**	0.118	0.570***	0.072
Upper secondary	1.239	0.289	1.251	0.322	0.856	0.164
Vocational school	0.853	0.242	0.932	0.269	1.128	0.244
College, University, Master, PhD.	0.713	0.324	2.528*	1.216	1.401	0.504
Occupation status (ref: Professionals/technicians)						
Service and sales staff	1.055	0.502	0.472	0.293	1.462	0.588
Laborers in agriculture/forestry/fishery	1.075	0.206	0.630**	0.136	0.522***	0.087
Manual labourers and machine operators	1.038	0.221	0.613**	0.139	0.571***	0.104
Unskilled workers	0.889	0.192	0.397***	0.095	0.486***	0.084
Others	0.963	0.159	0.687**	0.113	0.561***	0.078
Household size	0.879***	0.044	1.120**	0.054	0.987	0.036
Household composition						
Share of children below 6 years old	1.124	0.591	1.470	0.758	2.270**	0.898
Share of the elder above 60 years old	1.795**	0.522	2.245***	0.670	2.656***	0.662
Access to clear water	1.151	0.164	0.736**	0.098	0.976	0.106
Toilet access	1.129	0.153	0.787*	0.106	0.925	0.101
Enabling factors						
Expenditure quintiles (ref: First expenditure quintile group (poorest))						
Second expenditure quintile group	1.220	0.232	0.461***	0.081	0.832	0.118

Third expenditure quintile group	1.602**	0.324	0.522***	0.102	1.023	0.159
Fourth expenditure quintile group	1.431*	0.303	0.488***	0.101	1.026	0.169
Fifth expenditure quintile group (richest)	2.112***	0.510	0.617**	0.151	1.383*	0.265
Number of motorcycles	1.066	0.094	0.846*	0.079	1.007	0.071
Number of telephones	1.162**	0.081	1.089	0.076	1.073	0.058
Number of radio, TV or computer	1.492***	0.171	1.351**	0.165	1.380***	0.122
Total residential area (m^2)	1.000	0.001	0.999	0.001	0.999	0.001
Need factors						
Illness status in last 12 months	1.072	0.283	1.285	0.322	1.045	0.240
Number of illness times in last 12 months	1.352**	0.192	1.148	0.144	1.187	0.154
Number of illness days in last 12 months	1.006	0.006	1.012	0.008	1.011	0.008
External environment						
Place of residence (urban)	1.185	0.153	0.495***	0.078	0.968	0.106
Region (ref: Red River Delta)						
Northern Midlands and Mountains	1.801**	0.459	2.167***	0.548	2.158***	0.455
North and South Central Coast	1.075	0.201	1.816***	0.338	1.127	0.165
Central Highlands	0.745	0.193	1.264	0.335	0.849	0.171
South East	1.049	0.226	0.751	0.185	1.042	0.180
Mekong River Delta	1.130	0.189	0.706**	0.125	0.703***	0.093
Observations	1781		1964		4866	
% correctly predicted	65.97		76.48		84.24	

Appendix 3.6. Tests for selection bias after matching

Variable	VHI subsample			Heavily subsidized subsample			Full sample		
	Matched sample		t-test p-Value	Matched sample		t-test p-Value	Matched sample		t-test p-Value
Age group	Treated	Control		Treated	Control		Treated	Control	
31-40	0.123	0.131	0.577	0.166	0.150	0.524	0.099	0.091	0.229
41-50	0.223	0.227	0.797	0.219	0.215	0.872	0.136	0.146	0.169
51-60	0.280	0.279	0.932	0.246	0.252	0.818	0.182	0.182	0.953
>=61	0.308	0.291	0.391	0.192	0.252	0.031	0.262	0.317	0
Gender (male)	0.320	0.305	0.462	0.387	0.431	0.176	0.399	0.373	0.013
Ethnicity (Kinh and Hoa)	0.977	0.967	0.187	0.929	0.927	0.898	0.864	0.874	0.16
Marital status (married)	0.790	0.764	0.152	0.723	0.728	0.882	0.569	0.565	0.747
Education level									
Primary school	0.262	0.267	0.831	0.272	0.283	0.711	0.207	0.220	0.157
Lower secondary	0.260	0.256	0.81	0.226	0.254	0.312	0.162	0.139	0.005
Upper secondary	0.079	0.070	0.461	0.066	0.049	0.254	0.060	0.073	0.02
Vocational school	0.052	0.045	0.463	0.040	0.042	0.867	0.069	0.070	0.829
College, University, Master, PhD.	0.022	0.019	0.603	0.015	0.020	0.614	0.057	0.066	0.083
Occupation status									
Professionals/technicians	0.019	0.014	0.406	0.009	0.007	0.705	0.043	0.048	0.261
Service and sales staff	0.173	0.184	0.514	0.093	0.097	0.821	0.086	0.089	0.538
Laborers in agriculture /forestry/fishery	0.110	0.114	0.778	0.137	0.111	0.226	0.068	0.094	0
Manual labourers and machine operators	0.097	0.090	0.623	0.100	0.108	0.663	0.069	0.064	0.357
Unskilled workers	0.338	0.339	0.968	0.414	0.425	0.736	0.288	0.287	0.901
Others	0.263	0.259	0.806	0.248	0.252	0.878	0.446	0.417	0.009
Household size	3.915	3.924	0.906	3.976	4.016	0.709	4.088	4.007	0.035
Share of children below 6 years old	0.059	0.059	0.951	0.078	0.071	0.417	0.103	0.080	0
Share of the elder above 60 years old	0.218	0.215	0.842	0.163	0.188	0.193	0.207	0.243	0
Access to clear water	0.833	0.826	0.646	0.735	0.726	0.765	0.747	0.802	0
Toilet access	0.784	0.764	0.271	0.628	0.626	0.945	0.678	0.696	0.075
Expenditure quintiles									
Second expenditure quintile group	0.191	0.189	0.938	0.261	0.246	0.593	0.190	0.193	0.676
Third expenditure quintile group	0.228	0.232	0.817	0.179	0.199	0.445	0.197	0.178	0.025
Fourth expenditure quintile group	0.213	0.201	0.516	0.192	0.184	0.734	0.197	0.170	0.002
Fifth expenditure quintile group (richest)	0.241	0.234	0.726	0.157	0.146	0.643	0.208	0.233	0.008
Number of motorcycles	1.442	1.423	0.647	1.230	1.226	0.938	1.339	1.315	0.229
Number of telephones	1.912	1.916	0.944	1.657	1.681	0.735	1.751	1.747	0.869
Number of radio, TV or computer	1.355	1.340	0.601	1.162	1.162	1	1.297	1.249	0.002

Total residential area (m^2)	90.332	89.704	0.795	78.022	79.159	0.694	84.238	83.621	0.575
Illness status in last 12 months	0.193	0.201	0.65	0.168	0.142	0.27	0.179	0.192	0.146
Number of illness times in last 12 months	0.308	0.337	0.438	0.228	0.215	0.754	0.320	0.309	0.571
Number of illness days in last 12 months	2.954	4.427	0.06	3.033	2.274	0.339	3.681	3.303	0.239
Place of residence (urban)	0.348	0.346	0.917	0.197	0.199	0.934	0.298	0.338	0
Region									
Northern Midlands and Mountains	0.073	0.066	0.532	0.044	0.082	0.02	0.147	0.127	0.008
North and South Central Coast	0.193	0.196	0.851	0.239	0.219	0.477	0.213	0.196	0.062
Central Highlands	0.056	0.049	0.471	0.071	0.055	0.339	0.059	0.068	0.078
South East	0.118	0.110	0.599	0.077	0.084	0.715	0.111	0.131	0.006
Mekong River Delta	0.379	0.412	0.139	0.396	0.383	0.683	0.280	0.328	0

Appendix 3.7. Descriptive statistics of households according to catastrophic health expenditure status, 2016

	CHE =1 N = 710		CHE = 0 N = 6,471		*p*
	n	**%**	**n**	**%**	
Predisposing factors					
Age of household head					0.000
age <=30	10	1.41	290	4.48	
31-40	82	11.55	1,207	18.65	
41-50	115	16.2	1,674	25.87	
51-60	172	24.23	1,709	26.41	
>=61	331	46.62	1,591	24.59	
Gender of household head (male)	485	68.31	4838	74.76	0.000
Ethnicity (Kinh and Hoa)	619	87.18	5369	82.97	0.004
Marital status (Married)	519	73.10	5213	80.56	0.000
Education level of household head					0.013
Not complete primary school	369	51.97	3,574	55.23	
Primary school	102	14.37	938	14.5	
Lower secondary	134	18.87	920	14.22	
Upper secondary	42	5.92	334	5.16	
Vocational school	38	5.35	383	5.92	
College, University, Master, PhD.	25	3.52	322	4.98	
Household size	Mean 3.27	Stand. Dev. 1.64	Mean 3.96	Stand. Dev. 1.60	0.000
Share of children aged under 6	Mean 5.84%	Stand. Dev. 11.71%	Mean 8.68%	Stand. Dev. 13.19%	0.000
Share of elderly aged above 60	Mean 38.28%	Stand. Dev. 40.88%	Mean 17.13%	Stand. Dev. 29.17%	0.000
Household head's employment (employed)	408	57.46	4458	68.89	0.000
Consumption expenditure quintile					0.350
1st quintile *(poorest quintile)*	161	22.68	1,276	19.72	
2nd quintile	145	20.42	1,291	19.95	
3rd quintile	130	18.31	1,306	20.18	
4th quintile	135	19.01	1,301	20.11	
5th quintile *(richest quintile)*	139	19.58	1,297	20.04	
Total residential area, m^2	Mean 75.06	Stand. Dev. 50.69	Mean 85.25	Stand. Dev. 53.10	0.000
Health insurance status of household					0.000
Household does not participate in any health insurance program	50	7.04	341	5.27	
Household only participates in VHI	114	16.06	1,109	17.14	
Household only participates in heavily subsidized programs	257	36.2	1,391	21.5	

Household participates in different programs	289	40.7	3,630	56.1	
Share of household members having health insurance					0.011
No one in the household has HI	50	7.04	341	5.27	
Up to 1/3 of household members have HI	14	1.97	235	3.63	
One to two thirds of household members have HI	107	15.07	1,125	17.39	
More than two thirds of household members have HI	539	75.92	4,770	73.71	
Need factors					
Illness status in last 12 months (yes)	433	60.99	1,503	23.23	0.000
Number of illness days in last 12 months	Mean 47.58	Stand. Dev. 112.23	Mean 8.30	Stand. Dev. 40.42	0.000
Health behavior					
Health care utilization					0.000
Public health facilities	474	66.76	3,863	59.7	
Private health facilities	47	6.62	980	15.14	
Both public and private health facilities	189	26.62	1,628	25.16	
Number of outpatient visits in last 12 months	Mean 7.59	Stand. Dev. 11.10	Mean 6.28	Stand. Dev. 8.15	0.000
Number of inpatient admissions in last 12 months	Mean 1.74	Stand. Dev. 2.44	Mean 0.51	Stand. Dev. 1.20	0.000
Self-treatment (yes)	663	93.38	6,008	92.85	0.598
External environment					
Place of residence (urban)	168	23.66	1,994	30.81	0.000
Region					0.000
Red River Delta	190	26.76	1,237	19.12	
Northern Midlands and Mountains	98	13.8	1,090	16.84	
North and South Central Coast	146	20.56	1,438	22.22	
Central Highlands	44	6.2	452	6.99	
South East	53	7.46	792	12.24	
Mekong River Delta	179	25.21	1,462	22.59	

Appendix 3.8. Sensitivity analysis between outpatient and inpatient subsamples

	Outpatient		Inpatient	
	Model 1	Model 2	Model 1	Model 2
Predisposing factors				
Age of household head (ref: age <=30)				
31-40	1.504	1.551	4.538*	4.514*
41-50	1.811	1.841	2.051	2.002
51-60	2.102	2.090	3.610	3.475
>=61	1.800	1.830	3.123	3.342
Gender of household head (male vs female)	0.771	0.795	0.930	0.952
Ethnicity (Kinh and Hoa=1, Ethnic minority=0)	1.587	1.216	0.862	0.895
Marital status (Married=1, others=0)	1.054	1.037	1.489	1.450
Education level of household head (ref: Not complete primary school)				
Primary school	1.019	1.007	1.209	1.353
Lower secondary	1.486*	1.417	1.448	1.390
Upper secondary	1.460	1.344	1.896	1.981
Vocational school	0.687	0.696	1.174	1.064
College, University, Master, PhD.	1.050	1.012	0.203	0.178
Household head's employment (employed vs unemployed)	0.394***	0.377***	1.189	1.158
Household size	0.736***	0.714***	0.842*	0.829*
Share of children aged under 6	2.114	0.880	0.676	0.412
Share of elderly aged above 60	2.237**	2.497**	2.644*	2.081
Enabling factors				
Consumption expenditure quintile (ref: poorest quintile)				
2nd quintile	1.004	0.911	1.406	1.433
3rd quintile	1.415	1.203	1.105	1.166
4th quintile	1.078	0.940	1.422	1.535
5th quintile	0.930	0.768	2.736**	2.831**
Total residential area	0.999	0.999	0.995*	0.995*
Health insurance of household (ref: Household does not participate in any health insurance program)				
Household only participates in VHI	0.396***		0.382*	
Household only participates in heavily subsidized programs	0.987		0.284**	
Household participates in different programs	0.386***		0.250***	
Share of household members having health insurance (ref: No one in the household has HI)				
Up to 1/3 of household members have HI		0.657		0.232
One to two thirds of household members have HI		0.598		0.218***
More than two thirds of household members have HI		0.576**		0.326**
Need factors				
Illness status in last 12 months (yes vs no)	2.342***	2.257***	2.164***	2.199***
Number of illness days in last 12 months	1.001***	1.001***	1.010***	1.010***
Health behavior				

Health care utilization (ref: at public health facilities)				
Private health facilities	0.702	0.690	2.507*	2.242
Both public and private health facilities	1.396*	1.379*	1.468	1.528
Number of outpatient visits in last 12 months	1.044***	1.045***	omitted	omitted
Number of inpatient admissions in last 12 months	omitted	omitted	1.093*	1.087*
Self-treatment (yes vs no)	1.222	1.168	0.590	0.570
External environment				
Place of residence (urban vs rural)	0.805	0.712*	0.745	0.726
Region (ref: Red River Delta)				
Northern Midlands and Mountains	0.930	0.937	0.455**	0.437**
North and South Central Coast	0.681	0.710	0.454**	0.443**
Central Highlands	1.013	1.034	0.671	0.642
South East	0.447**	0.417***	0.473	0.501
Mekong River Delta	0.964	0.917	1.018	0.999
Pseudo R2	0.161	0.148	0.212	0.212
% correctly predicted	95.34	95.30	82.23	82.38
Hosmer-Lemeshow, p-value	0.227	0.065	0.802	0.959
Observations	4,810	4,810	648	648

Appendix 3.9. Sensitivity analysis between urban and rural subsamples

	Urban area		Rural area	
	Model 1	**Model 2**	**Model 1**	**Model 2**
Predisposing factors				
Age of household head (ref: age <=30)				
31-40	0.384*	0.389*	2.680***	2.605**
41-50	0.859	0.875	2.167**	2.123**
51-60	0.957	0.942	3.031***	2.952***
>=61	-	-	2.376**	2.361**
Gender of household head (male vs female)	0.597**	0.605**	0.775	0.789
Ethnicity (Kinh and Hoa=1, Ethnic minority=0)	1.339	1.340	1.244	1.070
Marital status (Married=1, others=0)	1.103	1.070	1.310	1.285
Education level of household head (ref: Not complete primary school)				
Primary school	0.732	0.755	0.773	0.780
Lower secondary	0.545*	0.538*	1.447**	1.419**
Upper secondary	0.886	0.880	1.313	1.220
Vocational school	0.884	0.863	0.543**	0.513**
College, University, Master, PhD.	0.762	0.744	0.651	0.611
Household head's employment (employed vs unemployed)	0.513***	0.525***	0.748**	0.745**
Household size	0.787**	0.768***	0.778***	0.763***
Share of children aged under 6	0.996	0.686	3.686**	1.587
Share of elderly aged above 60	3.025**	3.205**	2.601***	2.715***
Enabling factors				
Consumption expenditure quintile (ref: poorest quintile)				
2nd quintile	1.410	1.345	0.748	0.745
3rd quintile	1.118	1.042	0.748**	0.745
4th quintile	2.174	2.015	0.748**	0.745*
5th quintile	2.248**	2.069*	0.748***	0.745**
Total residential area	0.997*	0.997*	0.996***	0.995***
Health insurance of household (ref: Household does not participate in any health insurance program)				
Household only participates in VHI	0.192***		0.660	
Household only participates in heavily subsidized programs	0.228***		0.994	
Household participates in different programs	0.147***		0.517*	
Share of household members having health insurance (ref: No one in the household has HI)				
Up to 1/3 of household members have HI		0.192***		0.608
One to two thirds of household members have HI		0.228***		0.839
More than two thirds of household members have HI		0.147***		0.718
Need factors				
Illness status in last 12 months (yes vs no)	3.420***	3.495***	3.637***	3.563***
Number of illness days in last 12 months	1.002	1.001	1.003***	1.003***
Health behavior				
Health care utilization (ref: at public health facilities)				

Private health facilities	0.389**	0.374***	0.687*	0.685*
Both public and private health facilities	0.690	0.671	1.016	1.012
Number of outpatient visits in last 12 months	1.031***	1.031***	1.016***	1.017***
Number of inpatient admissions in last 12 months	1.455***	1.465***	1.265***	1.272***
Self-treatment (yes vs no)	1.083	1.028	1.213	1.196
External environment				
Place of residence (urban vs rural)	omitted	omitted	omitted	omitted
Region (ref: Red River Delta)				
Northern Midlands and Mountains	0.466*	0.453*	0.848	0.895
North and South Central Coast	0.767	0.783	0.558***	0.596***
Central Highlands	2.482**	2.486**	0.690	0.737
South East	0.309***	0.314***	0.665	0.650*
Mekong River Delta	1.567	1.631	0.912	0.916
Pseudo R2	0.252	0.252	0.203	0.198
% correctly predicted	92.24	92.29	90.00	89.92
Hosmer-Lemeshow, p-value	0.249	0.129	0.141	0.214
Observations	2,113	2,113	5,011	5,011