Assessing the effect of household survey designs on the accuracy of out-of-pocket health expenditures measurement in Vietnam

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Dedicated to my grandfather, Mr. Tran Van Que (1923 – 2015) and my parents Mr. Le Khac Coi and Mrs.Tran My Lien

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List of abbreviations

BMGF	Bill and Melinda Gates Foundation
CAPI	Computer Assisted Personal Interview
CE	Catastrophic Health Expenditure
COICOP	Classification of Individual Consumption according to purpose.
DHS	Demographic and Health Survey
GDP	Gross Domestic Product
GBD	Global Burden of disease
GSO	General Statistical Office
HBS	Household Budget Survey
HCES	Household Consumption and Expenditure Survey
HDSS	Health and Demographic Surveillance System
HES	Health Expenditure Survey
HHS	Household Health Survey
HIC	High Income Country
HIES	Household Income and Expenditure Survey
ICD-10	International Classification of Disease tenth edition
ICPC-2	International Classification of Primary Care second edition
iHOPE	INDEPTH-Network Household Out-of-pocket Expenditure
LMIC	Low and Middle-income Countries
LSMS	Living Standards Measurement Survey
MOH	Ministry of Health
NHA	National Health Accounts
NHIA	the National Health Insurance Authority
SHI	Social Health Insurance
NHRC	Navrongo Health Research Centre
OOPs	Out-of-Pocket Health Spending
SAGE	Study on Global Ageing and Adult Health
SDG	Sustainable Development Goal
SES	Socio-economic Status
SHA	System of Health Accounts
SWIFT	Survey of Wellbeing via Instant and Frequent Tracking
THE	Total Health Expenditures
UHC	Universal Health Coverage
VHLSS	Vietnam Household Living Standards Survey
WHO	World Health Organization
WHS	World Health Survey

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Summary

Relevance of the study: Out-of-pocket payments (OOPs) are direct payments that patients or customers pay to healthcare providers when receiving health services, excluding any pre-payments or reimbursement by health insurance. In several low and middle-income countries (LMICs), OOPs contribute a substantial proportion of the total health expenditures (40-50%) due to the relative lack of prepayment mechanisms. These expenditures are a significant burden on household resources. Therefore measuring OOPs is important for tracking financial risk protection in health and monitoring the country progress of universal health coverage. Household surveys are the primary source of data for estimating household OOPs in most LMICs due to the absence of routine and transactional medical records. In these surveys, there are substantial variations in survey designs such as the choice of recall period and the mode of data collection, which hinder the effort of producing internationally comparable data on health expenditures. The lack of information on utilization of services that linked to diseases in these surveys also lead to concerns about the reliability of estimating household OOPs by disease for resource allocation on health interventions and health financing programs. This thesis has three objectives:

- To assess the effect of recall period on the accuracy of out-of-pocket measurement for inpatient services using provider data as gold standard in Vietnam.
- To compare a face-to-face survey with a mobile phone survey in measuring out-of-pocket health expenditures estimated in Vietnam
- To assess the validity of diseases-specific OOPs estimates related to hospital services obtained from a households' survey in Vietnam comparing them to those reported by health care providers.

Methods: This is a cross-sectional study conducted in Bavi district, Vietnam. In this study, out-of-pocket payments were derived from two sources of data: household surveys and provider data. Provider data was considered to be the 'gold standard'. Household data obtained from a household health survey developed within the study. The household health survey had different versions of questionnaires to explore different aspects of study designs. We linked the household transactions with their corresponding ones in the hospital data to compare the estimated OOPs from the two sources. The analyses focused on the Bland-Altman method for assessing agreement between the two methods of measurement. Regression models were performed to identify factors associated with correct recall of amount of OOPs and diseases.

Results: Overall, the household reported higher OOPs for inpatient services than did the provider. In terms of recall period, despite both the 6-month and 12-month recall periods suffering from recall biases, the OOPs estimates for inpatient care were more accurate and reliable compared to the provider data in the longer recall period. The results revealed telescoping was the underlying driver of recall biases. The six-month recall period suffered more forward telescoping which resulted in a higher risk of over-reporting the amount of OOPs, while the 12-month recall period was more likely to under-report OOPs due to backward telescoping. When comparing between the face-to-face survey and the mobile phone survey, we found no evidence of the difference in OOPs estimates between the two methods even though OOPs were slightly higher in the mobile phone survey in most of spending categories. The results suggested that mobile phone survey could be an alternative tool for collecting information on health expenditures for inpatient services. In the third objective, 71% of admissions could be linked between households and provider had diseases agreed with provider. The pattern of diseases was similar between households and hospital. Overall, households reported higher OOPs by diseases than provider did. We observed the dispensary of the median OOPs by diseases and the disease-specific OOPs proportion to the annual inpatient OOPs between households and providers when estimating OOPs with or without costs for medications. The respondents' characteristics, the availability of discharge summaries, the respondent's recall of diseases and treatment period were predictors for the likelihood of reporting a correct disease.

Conclusions: This research has produced evidence to suggest an improved health expenditure tool using existing instruments. Our findings suggests that:

1. The 12-month recall period for inpatient care will produce more accurate and reliable OOPs in household surveys;
2. The mobile phone survey can serve as an alternative tool for collecting information on health expenditures, particularly inpatient services
3. Measuring disease-specific OOPs using information from household survey is challenging. Respondent selection and memory aids such as discharge summaries plays an important role in improvement the accuracy of information on disease and OOPs from household surveys.

Thesis outline

This doctoral thesis comprises six chapters. Each chapter describes in detail the main activities undertaken in this research work. Chapter 1 gives a detailed description of the background to the research and addresses the challenges that relate to OOPs measurements. Chapter 1 concludes by identifying the current knowledge gaps and elaborating the rationale for this research work. Chapter 2 is dedicated to the research methodology. Chapters 3, 4 and 5 present results of the key research questions. Chapter 3 specifically tests and validates the effect of recall period for the accuracy of household response for measuring out-of-pocket health expenditures. Chapter 4 compares and validates the face-to-face survey and the mobile phone survey on collecting information on health expenditures. Chapter 5 focuses on assessing the validity of disease-specific OOPs for inpatient services comparing to hospital records. The general discussions and conclusions of this thesis are contained in Chapter 6. This chapter highlights the key findings, contributions and recommendations of the study.

1. CHAPTER ONE: INTRODUCTION

1.1 Out-of-pocket payments and its situation in globe and in Vietnam

According to the World Health Organization (WHO), the definition of out-of-pocket payments (OOPs) is direct payments that patients or customers pay to health care providers when receiving health services, excluding any pre-payments or reimbursement by health insurance. When the reliance of health system on OOPs becomes heavy, the accessibility of the population to health care could be affected due to the direct payments that can be high enough to cause catastrophic health expenditures (CHE) for households. Catastrophic health expenditure is defined as the OOPs for health care has reached a certain level of a household's income with the consequences that the household must forego expenditure on the needs of basic living [1]. The consequence of suffering catastrophic payments is that people cannot afford health services. It might have negative impact on health care seeking behavior of people, especially the poor such as refusal of getting treatment or bad selection providers (illegal or unlicensed ones) [2-6].

In many low and middle-income countries (LMICs), OOPs has been dominant proportion of total health expenditures due to the relative lack of prepayment mechanism and are a significant burden on household resources (LMICs) [7-9]. In the absence of health insurance and other social safety nets to protect against the catastrophic costs of health care, households face a risk of incurring large medical expenditures if they fall ill and would lead to disruption to their living standards [9, 10]. In 2016, the world reached $8 trillion for health spending and the LMICs had the highest share of health spending from OOPs that accounted for more than 50% [11]. In 2010, 808 million people suffering from catastrophic payments on health every year at the 10% threshold and Asia has the highest number of people facing catastrophic payments. About 122 million people globally were pushed into poverty due to medical expenses at the 2011 PPP $3.10-a-day poverty line in 2011 and approximately 90% of them reside in low-and-middle income countries (LMICs) [7, 12]. In a study on financial protection in South East Asia region, 242.7 million people experienced catastrophic costs of healthcare at the 10% threshold, and 56.4 million at the 25% threshold. About 58 million people were impoverished at the 2011 PPP $1.90 poverty line and 64.2 million people at the $3.10 due to out-of-pocket spending on health[13]. Like other LMICs, Vietnam has been facing difficulties in offering affordable health care for citizens, especially the poor and vulnerable. With the initiation of user fees in 1989 [14], OOPs have been the dominant health-financing source and the increase in overall health

spending has been driven by an increase in out-of-pocket (OOP) spending. [9, 15-17]. In Vietnam, although more than 80% of population were covered by health insurance in 2017 according to WHO, OOPs as a share of the total health expenditure have been always high, ranging from 50% to 70% [9, 14, 17-19]. High OOPs can lead patients to pay a significant proportion of their income for treatment and result in catastrophic health expenditures (CHE). Many studies have conducted to estimate the catastrophic health expenditures. In a multi-country analysis in 2003, Xu.K stated that about 10.5% of Vietnamese household with catastrophic health expenditures [5]. In a report on catastrophic health expenditures using the data from Living standards survey 2002 -2010 in Vietnam, the percentage of households faced with CHE was 3.9% in 2010 and 2.5% families in Vietnam was impoverished due to medical expenses in the same year [20].

Reducing OOPs have been a challenge for years in many LMICs. In 2015, the United Nations General Assembly adopted 17 Sustainable Development Goals (SDGs) including one goal, SDG 3, which focuses specifically on ensuring healthy lives and promoting well-being for all at all ages [7, 21]. Target 3.8 of SDG 3 – achieving universal health coverage (UHC), including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all – is the key to attaining the entire goal [7, 21]. Monitoring of target 3.8 is incomplete unless it tracks two aspects of UHC, financial protection and coverage of essential health services [7, 21]. Measuring OOPs is important given that it constitutes the largest source of health care financing in developing countries and an important indicator for tracking financial risk protection in health and monitoring the country progress of universal health coverage [22].

Out-of-pocket health expenditure is generally collected from household surveys and is among the most difficult indicators to measure in the context of National Health Accounts (NHA) [23]. Therefore, the accuracy of OOPs measurement is critical since incorrect OOP estimate can affect the credibility of total current health spending estimates in NHA statistics that is an otherwise important indicator for policy makers [23].

1.2 Sources of data for Out-of-pocket health expenditures measurements in developing countries and in Vietnam

1.2.1 Existing sources of data for measuring OOPs in developing countries

Currently, in many countries or territories, there are four main data sources for measuring OOPs. The first three are all household consumption and expenditure surveys that are known as (i) Household Budget Survey (HBS); (ii) Living Standard Measurement Surveys (LSMS); (iii) Household Income and Expenditure Surveys (HIES) [24, 25]. While household budget surveys (HBS) and household income and expenditure survey (HIES) are primarily designed to collect data that enables the calculation of consumer price indices or the compilation of national accounts, the Living standard measurement surveys (LSMS) conducted in developing countries is to measure and monitor poverty or track progress in its eradication which is the first SDG Goal. Hereafter we refer to all these surveys as Household Consumption and Expenditures Survey (HCES) following the terminology adopted by Smith et al [26]. A generic structure (Figure 1.1) that is consistent with all HCES that collect information on health expenditures in both the expenditure module and a health care utilization module at both individual and household level [27].

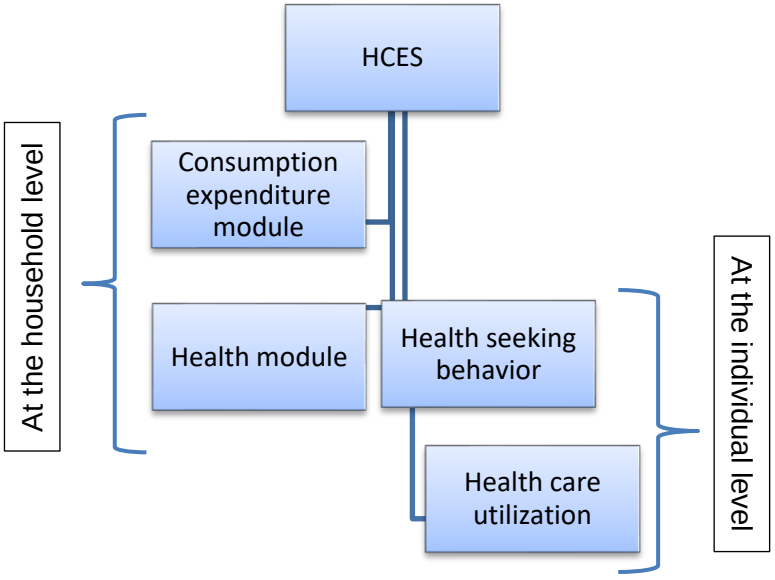


Figure 1-1. Generic structure of Household Consumption and Expenditure Survey (HCES)

The fourth source is health surveys that are named as (i) World Health Survey (WHS); (ii) Study on Global Ageing and Adult Health (SAGE) ; (iii) Demographic and Health Surveys (DHS); (iv) Household health expenditure and utilization surveys (HEUS). Those surveys are designed to collect data on health spending but different instruments are developed to collect information according to the focus of the surveys. For instance, the World Health Survey (WHS) and the Study on Global Ageing and Adult Health (SAGE) both conducted by WHO have a module on household expenditures and in addition, information on health spending is collected within a utilization module. On the other hand, the Demographic and Health Surveys (DHS) focus only on household spending on health but not on non-medical items, and has

developed a module on out-of-pocket health expenditures gathering information on expenses at the individual level conditional on utilization, for all inpatient members of the households but just one randomly selected outpatient. Household health expenditure and utilization surveys which are funded by donors (e.g. WHO, USAID, The World Bank) with the aim at narrowing down the information gap in some countries where no other survey can be used to inform health policy dialogue are designed very detail to collection not only household expenditures but also coping strategies for cost of health care.

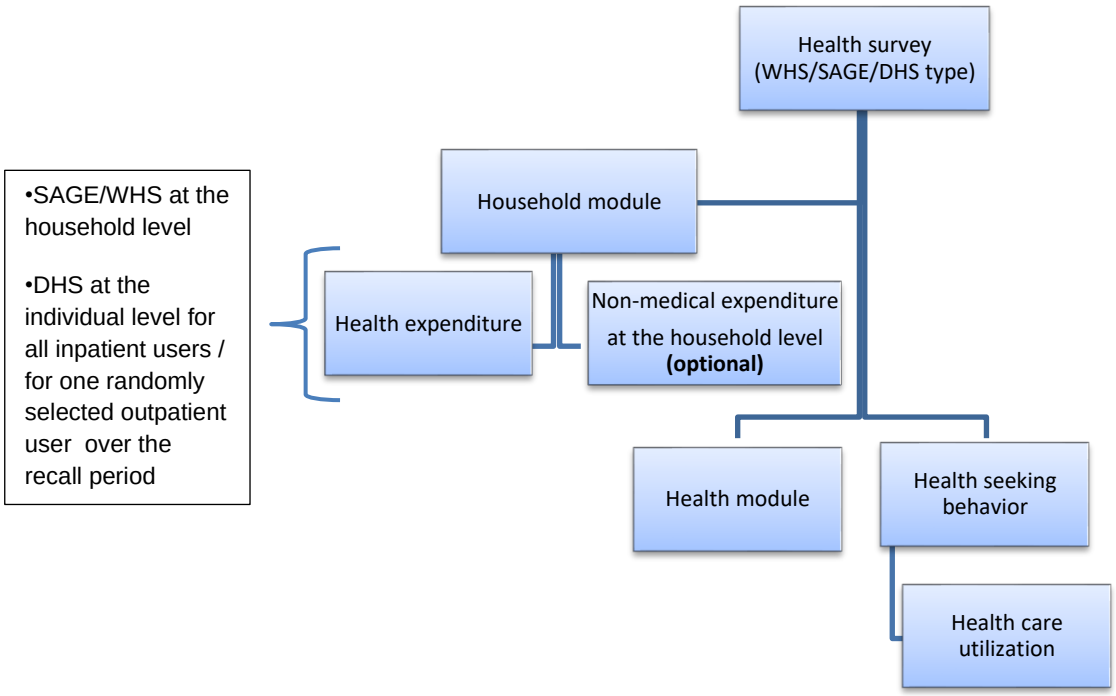


Figure 1-2: Structure of the Health Survey

1.2.2 Existing sources of data for measuring OOPs in Vietnam

Vietnam Household Living Standard Survey (VHLSS)

In the implementation of the Party and State policy "Doi moi", the General Statistical Office (GSO) has conducted many household living standards surveys to collect information on the living standards of all social societies to serve policy-making and socio-economic development planning. Since 2002, Vietnam Household living standard Survey (VHLSS) has been conducted (in every two- year) to monitor systematically the living standard of Vietnam's societies. These surveys' results are used to assess the implementation of Comprehensive Poverty Alleviation and Growth Strategy approved by the Government Prime Minister and evaluate the achievement of Millennium Development Goals (MDGs) and the Socio-economic Development Goals set out by Vietnamese Government.

VHLSS included all the keynote contents reflecting the living standards of the population. It collected data in relation to demographic characteristics of the household members, the education background, professional/ technical level of each member, income, expenditures, use of medical facilities of all kinds, employment, housing and amenity as possession, personal effects, utilities (power and water supply), sanitation and participation in the poverty alleviation program. Household questionnaires and communes/wards questionnaires of the VHLSS were designed more scientifically to ensure feasibility. Sample of the VHLSS is selected in the way to represent the entire country.

Vietnam Demographic and Health Survey (VDHS)

The 2002 Vietnam Demographic and Health Survey (VNDHS 2002) was the third DHS survey to be implemented in Vietnam, following similar surveys in 1988 and 1997. The main objective of the VNDHS 2002 was to obtain current information on demographic conditions, family planning, infant and child mortality, and health-related information about breastfeeding, antenatal care, child immunizations, common children's diseases, and HIV/AIDS.

The 2002 Vietnam Demographic and Health Survey (VNDHS 2002) is a nationally representative sample survey of 5,665 ever married women age 15-49 selected from 205 sample points (clusters) throughout Vietnam. It provides information on levels of fertility, family planning knowledge and use, infant and child mortality, and indicators of maternal and child health. The survey was designed to measure change in reproductive health indicators over the five years since the VNDHS 1997. Data collection for the survey took place from 1 October to 21 December 2002.

1.3 Challenges in the use of household surveys to estimate household out-of-pocket expenditures

National health accounts commonly use direct derivation of estimates from reported data in household surveys to estimate household out-of-pocket spending for health [28]. The accurate measurement of OOPs is undoubtedly important to establish health accounts as we have learnt from the previous section. However it is fact that these household surveys varies across different types of instruments and even within the same type of surveys questions may vary from country to country which is difficult for obtaining reliable estimates of OOPs and for validity and comparability of the data across countries. Moreover, another limitation of the existing national surveys, especially HCES is that they collect a broad range of information but not health specified data, especially OOPs. Thus, it raises question on to what extend the accuracy of OOPs estimation derived from collected data of these surveys [25, 29, 30].

Non-sampling errors of household surveys – Recall period

Most of national household surveys are retrospective surveys that require respondents to recall an events happened within a given time period in the past. Memory fades, resulting in respondents having more difficulty recalling an activity when there is a long time period intervening between an event and the survey. Thus, the most common non-sampling error is memory errors, which is associated with the choice of recall period. People may fail to accurately recall when an event occurred, thus reporting it to have occurred in the wrong time period, or forget that it had occurred in the period in question. They can fail to recall correctly the number of times an event occurred in a given time period, or fail to correctly report the actual amount of expenditure associated with a particular event. Recall period, thus is one of the most important non-sampling errors of survey instruments that need investigating. Several studies have been conducted to find out the effect of recall periods on the estimation of total OOPs on healthcare [24, 25, 28, 29, 31-35]. In a study evaluating the methods for measuring out of pocket payment and catastrophic, the average annual out of pocket estimate for health spending was larger when shorter recall period (4 weeks) applied rather than longer recall period (12 months)[35]. A study analysing the effect of survey design on health expenditure found that the length of recall period had an effect on the result of health expenditure share in which the longer the period, the smaller the health expenditure estimate [33]. In 2009, Lu et al examined the impact of a one-month compared to 11-month recall period on the estimates of OOPs for hospitalization and found out that 39 out of 43 countries in the World Health Survey reported higher average annual health spending for the shorter compared to the longer recall period [29]. The same pattern was observed in the Nepal Living Standard Study with one and 12-month recall periods [29]. Heijink et al conducted a literature review of 90 household surveys from low-income countries and also found that the shorter recall period produced higher estimates of total health expenditure when the difference in the length of the recall periods was greater than one month [24]. They also reported that the probability of misreporting increases when the recall period increases [24]. Lavado et al quantified the effect of recall period on estimated total health expenditure share of the household consumption by assessing 214 household surveys across 78 territories. Their finding was consistent with existing literature: the longer the recall period was, the smaller the health expenditure share [25]. While studies have indicated that shorter recall periods tend to produce larger annual estimates, it is not known which lead to the most accurate estimates. It raises a research question "Which recall period, 6-month and 12-month collect more accurate and reliable information for estimating

OOPs for inpatient services?" In this thesis, we investigate the effect of recall period for estimating inpatient OOPs by using provider data to validate the reported OOPs in a household survey with two recall periods of 6 and 12 months for inpatient OOPs.

Non-regularity of household surveys – Mode of data collection

Another important consideration that must be considered when using data from household surveys for estimating out-of-pocket health expenditures is their periodicity. National household surveys are costly to undertake an annual basis. The interval or time period between national surveys is usually long. Health surveys such as the DHS are conducted every 5 year, SAGE every 3 to 4 year. In Vietnam, Household Living Standard Survey is carried out every 2 year. In addition, the data collected by household surveys typically takes a long time to be processed and become available. This reason points the need for developing alternative methods that cut costs and time for collecting data for estimating OOPs.

Data collection is one of the most important stages in conducting a research. It is a process of gathering and measuring information on variables of interest, in an established systematic method that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. During last decades, the collection of data in surveys has undergone a transformation. Advances in technology which made inexpensive phone handsets available and rapidly growing network coverage in many LMICs have enabled the mobile phone as a new tool for collecting high-frequency and, oftentimes, low-cost survey data in LMICs [36, 37]. The last 10 years have witnessed an emerging interest in the use of new technologies to gather high-quality, high-frequency survey data on the living conditions and perceptions of populations in LMICs. Some surveys that used mobile phone to collect data on tracking food security in refugee camps (WFP 2015), running nationally representative multipurpose citizen panels (for example, the World Bank's Listening to Africa Initiative and the Sauti za Wananchi [Voices of Citizens] survey in Kenya and Tanzania), monitoring the harvest expectations of farmers [38], or tracking changes in welfare [39, 40]. Thus, we are convinced that mobile phone survey could be the answer to address the emerging need of developing an alternative tool for household surveys to provider data timely in annual basis for out-of-pocket health expenditures measurements. There are several studies comparing interviews in person or via mobile phone in terms of the quality of data such as response rate, completeness of questionnaires; data collection efficiency such as cost-effectiveness, time consuming and respondents 'perspective. Findings from these studies favoured mobile phone interview in collecting data at frequent basis (weekly or monthly) or at

real time basis [36, 37, 41-44]. However, to the best of our knowledge, no study applied validation approach to compare the face-to-face with the mobile phone survey for collecting household health expenditures by using data from provider as "gold standard". Hence, in this thesis, we developed a questionnaire module on health expenditures and interviewed it in either a face-to-face survey or a mobile phone survey. Then, this thesis compares and validates the accuracy of reported OOPs by two methods: (i) the face-to-face survey and (ii) the mobile phone survey using both data from households and hospital.

The emerging need of tracking OOPs paid for diseases - Disease-specific out-of-pocket health expenditures

Private payments, in the form of OOPs are a dominant health-financing source and a major financial burden for households in many health systems, particularly in LMICs. [6-8, 14, 23, 45-48]. As other developing countries, the share of household out-of-pocket (OOP) payments for health in Vietnam, despite its rapid decrease in recent years, is still very high and accounts for some 45-55% of total health expenditures. [6-8, 14, 23, 45-48] . OOPs are inequitable, regressive and can be a source of financial hardship because they depend exclusively upon household's capacity to pay. Therefore, they directly relate to the underlying severity of health conditions in the delivery of health services. From both an equity perspective as well as a resource allocation perspective, an important question is therefore to what extent OOP health expenditures contribute to pay for the services that address diseases [49, 50]?

Many studies on disease-specific health spending in developed countries have good recording health system using linked registration data from provider to estimate and measure health accounts [32, 51]. However, this application is facing difficulty in implementation in LMICs due to the poor recording system and the heavy reliance of health financing on out-of-pocket health expenditures (OOPs). As a result, in the absence of routine, administrative or transactional data, estimation of OOPs must often rely on the use of national household survey data. The data sources currently used for estimation of OOPs for national health accounts in Vietnam is Vietnam Household Living Standard Surveys. As in many Living standard surveys, in the VHLSS, there is a separate health care module asking about health seeking behaviour, health care utilization and related OOPs. There is some information on reasons to use services, but unlike other surveys, these are linked to the type of care received (e.g. preventive, curative) rather than the type of disease. It is therefore not possible to distribute OOPs across diseases.

In other countries, information on utilization of services is sometimes linked to diseases but the list is limited and does not cover the main categories of communicable and non-communicable diseases the population is exposed to. Realizing the challenges to map OOPs to diseases in household surveys and in Vietnam, the thesis developed and experimented a survey questionnaire for household health surveys with a module on utilization of services linked to broad categories of diseases that could be mapped to the 2011 System of Health Account (SHA 2011) [50]. The study investigated predictors associated with the likelihood of reporting a correct disease and assessed to assess the validity of diseases specific OOPs estimates related to hospital services by comparing to the hospital records.

1.4 Health care system in Vietnam

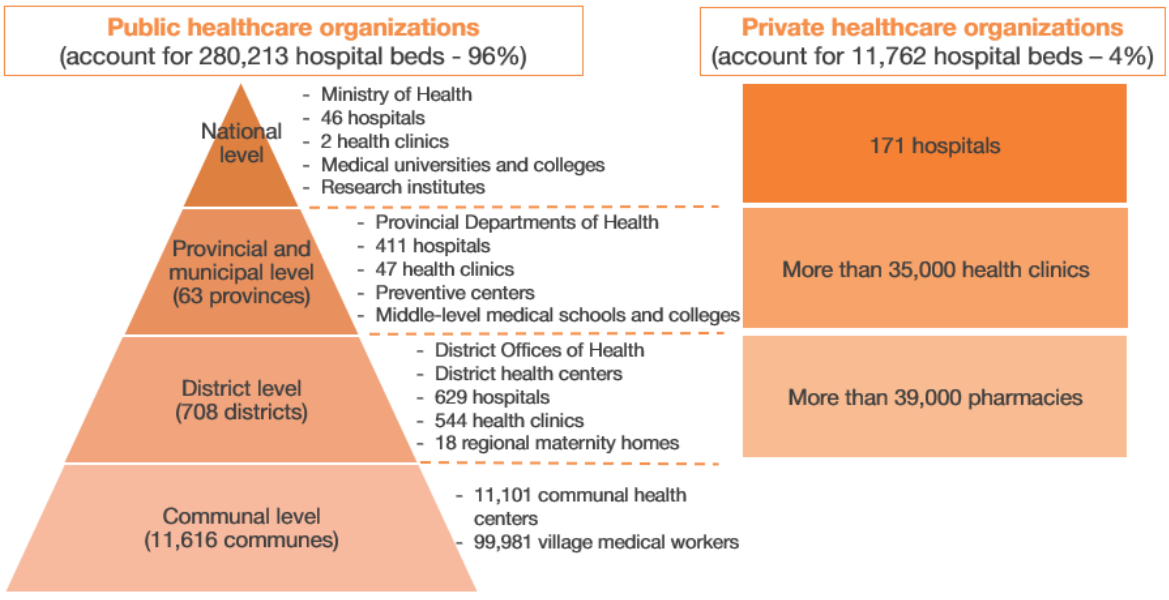
Health financing

Vietnam is a Southeast Asia country with the total population of 97.2 million people, of which approximately 35.92% live in urban areas [52]. It has been 75 years since its independence in 1945 and Vietnam health sector witnessed some dramatic changes in health care system and health financing. From 1945 to 1989, the health care system was centrally organized and fully subsidized by the government; therefore, health care services were provided free of charge from tertiary to primary levels [53, 54]. In 1986, the Vietnamese Government launched an economic reform known as 'Doi Moi'. Since then, the country has been moving from a centrally planned economy to being market orientated. As part of these general reforms, Vietnam health care system also transformed from a fully public services system to mixed public-private provider system since the introduction of private practice and user fees for services in 1989 [53-55]. Over the past three decades, Vietnam has made considerable progress in improving economic and social well-being and has become a lower middle-income country in 2007.

Both total spending and public spending on health in Vietnam has increased substantially. Total health spending in Vietnam was 5.9 percent of GDP in 2016, comparable to countries at a similar level of income. In 2017, total health expenditure per capita was US$129.6 [56]. OOP remains a large share of overall health system financing in Vietnam. Between 2000 and 2016, public spending as a share of total health spending has increased gradually but remains around the 40 percent range. The increase in public spending on health has come from two main sources: domestic government spending on health and social health insurance expenditure. Out-of-pocket (OOP) expenditure remains a large share of total health expenditures which accounted for 45% in 2017 [55, 56].

Health care system

Vietnam has a mixed public-private provider system. Vietnam has centralize public health care system including four levels: national, provincial, district, and communal level (Figure 1.2). National health care organizations are mainly concentrated in two biggest cities of Vietnam (Hanoi and Ho Chi Minh City) with 38 out of 46 central hospitals. National-level providers include national general and specialized hospitals, national research institutes, training institutions, pharmaceutical companies. These facilities are under the management of the Ministry of Health. Provincial-level providers include municipal and provincial hospitals. These include general hospitals and specialized hospitals such as paediatric hospitals, obstetrics and gynaecology hospitals, hospitals of ophthalmology, and other specialized health centres such as preventive medicine centres and mother and child's health protection centres. District-level providers include district general hospitals responsible for curative services, emergency services and treatment for common diseases and preventive. Communal-level providers mostly include Commune Health Centres (CHC) that are responsible for primary curative, preventive care, health education and awareness of health programs such as maternal and child healthcare programs [53, 57].



Source: BDG Vietnam

Figure 1-3: Vietnam's public and private health care system

The public sector remains the predominant health care provider, though the private sector has expanded in the last decade. In 2016, the private section accounted for 4% of total hospital beds

(Figure 1.3). From 2004 to 2016, thanks to the government investment incentives for private health sector such as tax exemption, the number of private hospitals increased from 40 to 171 as well as thousands of private clinics. Most of private hospitals are located in big cities such as Hanoi, Ho Chi Minh and Da Nang. Although private provider only account for 4% of inpatient care, they provider 60% of outpatient care [57].

Health insurance

Vietnam has made great progress in improving its health system. Since 1990, together with the changes made in socioeconomic policies, multiple reforms have been taking place in Vietnam's health sector. Vietnam first piloted health insurance in 1989 and began implementing the Social Health Insurance (SHI) in 1992 with the purposes of acquiring more resources for the public health sectors; contributing to alleviating the poverty as well as providing financial protection from catastrophic costs. The Law of Health Insurance has been enforced since July 2009 with three main health insurance schemes: (i) compulsory scheme for civil servants, pensioners, employees of public and private enterprises, students; (ii) exempted/subsidized schemes which aims at the poor, children under 6, minorities, other vulnerable groups; (iii) voluntary schemes for self-employed and family-employed workers, dependents and relatives of employees and other remained groups. In 2014, in order to expand the coverage to achieve the universal coverage target by 2020, Law on Health Insurance was amended to be mandated health insurance for all citizens [58]. As a result, health insurance coverage has expanded from 5% in 1993 to 60% in 2010, and reached nearly 87% in 2018 [55].

The benefit packages provided to the insurer people include inpatient and outpatient services at all health care levels, laboratory exams, x-ray, and other diagnostic imaging procedures. Some expensive high-tech health services, such as open-heart surgery, are also covered by the social health insurance. The preventive care services, however, are not covered in the SHI benefit packages, and they are paid by either government budget via national preventive care programs or by out-of-pocket money of the beneficiaries. Regarding health facilities, the insured participants are eligible not only for the public health facilities, but also for the private facilities that have contracts with the health insurance agencies.

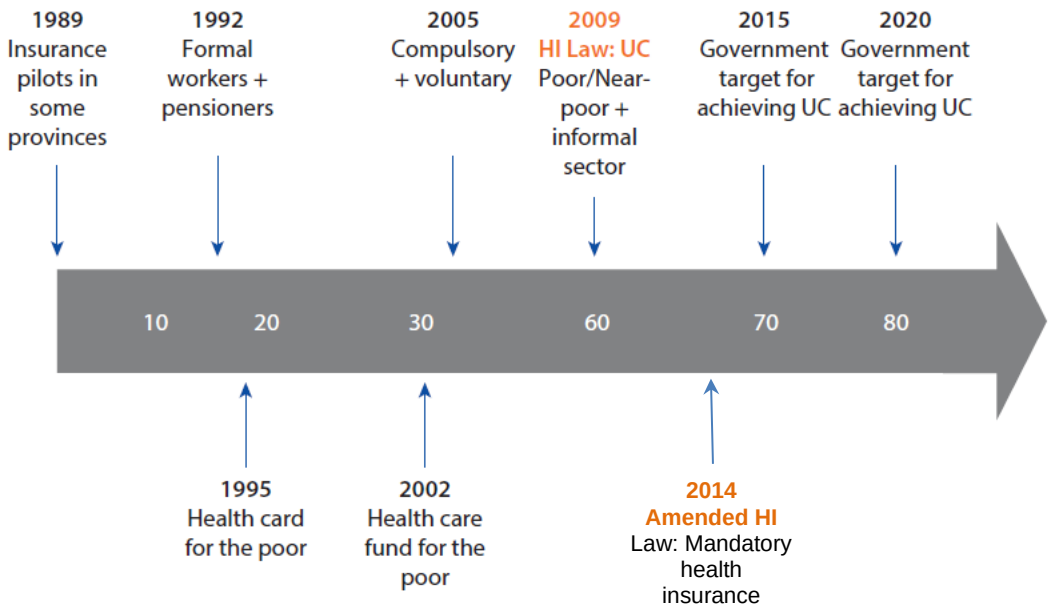


Figure 1-4:The evolution of SHI in Vietnam

The level of the costs covered by the SHI depends on the group with a variation of 100% -95% -80% of the total health expenditure. No co-payment charged for services provided at commune health stations (only outpatient), including child delivery services. For insured patients who bypass lower-level referral facilities, the co-payments will be higher.

1.5 The INDEPTH Network project - Household Out-of-Pocket Health Expenditures Tracking for Disease Specific Health Account and Universal Health Coverage Measure: Developing Household OOP Measurement Methodology (iHOPE) project

The INDEPTH Network platform provides a unique opportunity to implement research designs that are able to validate results and assess which questions are best suited to measuring out-of-pocket health expenditures. The Network is one of the world's biggest longitudinal data gathering Network. It has currently 53 Health and Demographic Surveillance System sites (HDSSs) in 20 countries across Africa, Asia and the Pacific region.

The main objective of the iHOPE project is to develop alternative instruments and approaches to collecting household data that will improve the measurement of OOPs in the framework of national health accounting and consistent with the guidelines for system of health accounting. The project is a methodological study that make use of existing national survey instruments (i.e. Household Consumption and Expenditures Surveys and Household Health Survey) from

Burkina Faso, Ghana and Viet Nam, with the aim of repurposing them to be sensitive to the non-sampling errors that have been identified as potential sources of bias influencing reliability and comparability of health expenditure data. The project leverages the INDEPTH platform in these three countries to provide data from different settings and zones to be able to compare estimates in such manner. The project was funded by the Bill and Melinda Gates foundation (BMGF) with technical support from WHO and the Swiss Tropical and Public health Institute of the University of Basel, Switzerland.

This thesis however focuses on the implementation of the iHOPE project in Vietnam. The iHOPE project was implemented in Vietnam by the Filabavi Demographic and Health Surveilance System Site (Filabavi HDSS) and Hanoi Medical University. The project leveraged on the structure of the Vietnam Household living standards survey 2014 (VHLSS 2014) instrument implemented by the Vietnam General Statistic Office. The Filabavi HDSS platform provides the opportunity to be able to identify and track household expenditures with the aim of validating such expenditures within the health system in Bavi district, Vietnam using provider records. The project was implemented to collected out-of-pocket health expenditures bearing in mind the prevailing health system and health care financing scheme.

1.6 Objectives of the study

General aim

In the context of the iHOPE project, the main aim is to assess the effect of household survey designs on the accuracy of household responses for measuring out-of-pocket health expenditures in Vietnam

Specific objectives

Given the above aim, this doctoral study focus on answering three following important objectives of the iHOPE project implemented in Vietnam:

1. To investigate the effect of recall period on estimates of out-of-pocket health expenditures for inpatient services
2. To compare the out-of-pocket estimates for inpatient services by face-to-face and mobile phone survey

3. To assess the validity of diseases specific OOPs estimates related to hospital services from a household survey.

1.7 Research questions

In summary, this doctoral thesis focuses on investigating these research questions as follow:

1. Which recall period for inpatient services in a household survey (6-month vs 12-month) measures OOPs that are more accurate? What are the underlying driver of the recall biases?
2. Which mode of data collection (face-to-face vs mobile phone) estimates OOPs that are more accurate? Can the mobile phone survey be an alternative tool for collecting OOPs?
3. To what extent does the accuracy of estimating disease-specific OOPs for inpatient services using household survey as source of data? Is household survey reliable source of data for estimating disease-specific OOPs for inpatient services? What predictors do associate with the likelihood of reporting a correct disease for inpatient services?

2. CHAPTER TWO: METHODOLOGY

2.1 Study setting

The study was conducted in Bavi District, Hanoi, Vietnam. Bavi District is a northern rural district with 31 communes and an estimated population of 282,600 in 2018. There is one public hospital, three poly-clinics, 32 commune health centers (CHC) and about 600 private providers and drugstores. CHCs serve as medical hubs for outpatient care, preventive care and medicines. The public hospital and three poly-clinics provide all types of services including inpatient care, outpatient care, and preventive care. Most of the private health providers provide either outpatient care, medicines or both.

The Filabavi Health and Demographic Surveillance System (Filabavi HDSS) site was established in 1998 in Bavi district to conduct surveillance for basic health data and socio-economic status of households and to serve as a sampling frame for community health research and training [59, 60]. The population under HDSS, which accounts for 15% of Bavi population, is approximately 38,000 inhabitants with about 8,000 households residing in 11 communes. The overall design of Filabavi was to create a study base representative of the population in the District, through a census survey for every two year.

Table 2-1: Summary of basic activities and statistics of the Filabavi HDSS sites

	FilaBavi, Vietnam
Started	1998
Population	8,000 households with 38, 000 people reside in 11 communes.
Routine data collection	Data collected by paper Births, deaths, migrations, marriages, pregnancies. SES indicators updated, including on income and consumptions Every two data collection. Last time collected was in 2017
Relevant data collection experience	Collection of all total household expenditure including inpatient and outpatient data Health conditions self-reported (every member of the household). Over last month any one sick, reason (diagnosis, symptoms), payments.

Figure 2-1: Map of the Filabavi Demographic and Health Surveillance System site with geographic characteristics

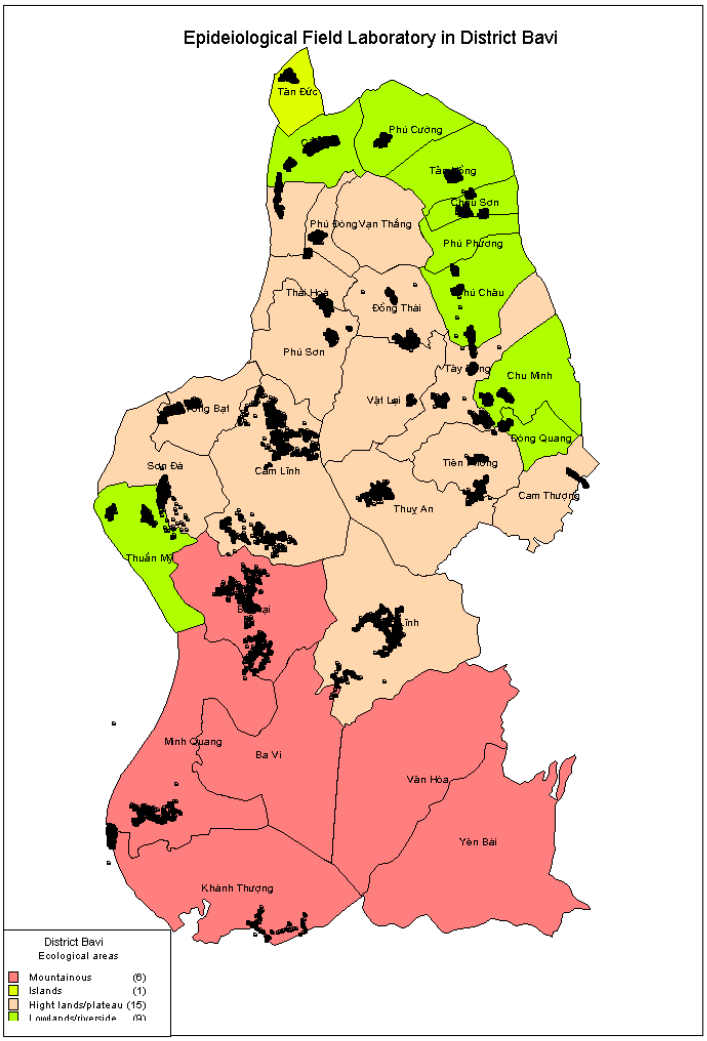


Table 2-2:Summary of Health provider characteristics at Bavi District, Vietnam

Characteristics	Vietnam
Average travel time to nearest health facility	5.5km to nearest District Hospital and 1.6km to commune health centre
Proportion of households with access to cell phones	85%
Number of rounds of DSS data collection	4 per year
Number of Health facilities at the HDSS site	1-general district hospital, 31-commune health stations, 3-regional polyclinics, >600 private facilities including Pharmacies, private clinics, drugs stores and traditional healers
GPS available	health facilities, households

Types of Health insurance available at HDSS site	National Social Health Insurance
Health insurance coverage at the HDSS site (2014)	51.9%
Co-payments for the insured	Yes
Proportion of individuals attending Public health facilities for In-patient cases	94%
Proportion of individuals attending Private health facilities for out-patient cases	40%
Disease classification type in hospital setting (district hospital)	ICD-10
In community health center	**
In other outpatient care settings	**
Recording system in hospital setting (district hospital)	Paper & Electronic
In community health center	Paper
In other outpatient care settings	Paper

*** No conventional disease classification method adopted*

2.2 Study design

In this cross-sectional study, household data were compared with provider data with assumption that provider data is closer to reality to assess the effect of household survey designs on the accuracy of household responses for measuring out-of-pocket health expenditures of inpatient services in Vietnam.

The fieldwork of the iHOPE project started in Jan 2015 and ended in December 2019 with three phases: (i) reviewing and developing survey tools; (ii) first data collection round and (iii) second data collection round. Data for this study was obtained from the first round, from June 2017 until April 2018.

In this study, outpatients and inpatients were sampled using different approaches due to the difference in the proportion of households incurring expenditures for these services and the large number of providers. The proportion of households incurring outpatient expenditures within 4 weeks is 44% that is 4 times the proportion of inpatients (11%). Moreover, Bavi has more than 600 providers of all kinds, which makes it infeasible to collect all data from them to derive the comparing data.

Study design for the outpatient OOPS – Community sampling

For the outpatient sample, a community sampling approach was used, with six versions of the questionnaire (4 of Household Health Survey and 2 of Mobile phone survey). Households were randomized and interviewed with one of the six versions. GIS mapping of providers was conducted in order to map out the intensity of health care facilities in Bavi district. After studying the GIS map of provider and clusters, in order to narrow down the spreading of providers and increase matching success, 5 communes having relative low intensity of providers (104 providers of all kinds) and being isolated by natural boundaries (river along the border of district) were selected out of 11 communes to conduct outpatient household interviews. Provider data were collected one month before outpatient household interview and include full name of patients/buyers, age, gender, resident address, diagnosis/symptoms, name of drugs, costs on medical services/drugs. After finishing outpatient household interview and provider data collection, households were identified and linked with provider data for validation. All outpatient households belonging to Filabavi HDSS were asked about health expenditure on all services (inpatient, outpatient, preventive and medicines). This design focuses on the second objective of this study.

Study design for inpatient OOPs – Provider sampling

A provider sampling approach was used, with four versions of questionnaires (2 of Household Health Survey and 2 of Mobile phone survey) for inpatient OOPs. Households with inpatient episodes were identified before interview by sampling from inpatient data obtained from the hospital. Inpatient households were interviewed by either a face-to-face survey or a mobile phone survey. This approach was designed to test the choice of recall period on telescoping effect and recall bias for inpatient services (6-month and 12-month). Thus, households with inpatient events were recruited for interview as follows: for 6 months recall, households with inpatient transactions from 1 month ago to 9 months ago were selected; for 12 months recall, households with inpatient even from 1 month ago to 15 months ago were selected. Health utilization and expenditures of all members for all services were elicited. Households enrolled for the inpatient interviews could be from any of communes of Bavi district (expect for the five communes of outpatient sample) and do not necessarily belong to the HDSS. This design focuses on the first and the third objectives of this study but the sample is still a part of data for the second objective.

2.3 Sample calculation

Provider sample

The study area was narrowed down to five communes in order to minimize the number of providers where data needs to be collected. The most common factor influencing health-seeking behavior is easy access to health facilities, especially drugs stores [61]. Thus, we decided the provider selection criteria as follows:

- Private pharmacies and drug store: 1km from households
- Private clinics: 3 -5km from households and 1 big private clinics

Besides those were selected, some facilities with good reputation in the area were included in the sample. All public facilities in five communes (5 CHCs, 2 public clinics) and outpatient care unit at district hospital were selected. Thus, among 103 providers selected for provider data collection, 79 (77%) providers agreed to participate in the study. Then, about 5 (6%) providers dropped out during data collection.

Household sample

Sample size calculations for estimating agreement were based on the precision of the estimates for the overall bias and limits of agreement. It is usually not easy to define the precision required but Bland suggests a rule of thumb that 100-200 observations are adequate for assessing agreement [62-64] for each version.

Outpatient sample calculation

From the statistics of our census at Filabavi HDSS, about 44% of total households incurred out-of-pocket health expenditures for outpatient services. We assumed that the proportion of household incurring outpatient spending within 4 weeks was similar and used this as parameter to calculate the household sample size for each version to ensure our sample will had 100 households having outpatient spending. One hundred were required based on a rule of thumb by Bland and Altman for assessing agreement between the questionnaire version and the provider data. The total sample size required was determined by adding the numbers for the separate versions leading to an overall requirement for 2067 households:

Table 2-3: Sample calculation for outpatient household interview

Parameter	Calculation
Proportion of household incurring outpatient spending (4 weeks)	44%
Expected number per 100 who have outpatient spending with recall periods	2 weeks: 22 – 44 4 weeks: 44

Number needed to estimate bias and variability for one questionnaire version to get approx. 100 who have outpatient spending (assuming mid-point of interval in row above)	2 weeks: 100*100/33 = 303 4 weeks: 100*100/44 = 227
Number needed to estimate bias and variability for one questionnaire version to get approx. 100 who have outpatient spending (assuming 10% of non-response and 20% of unmatching)	2 weeks: 303 + 10% non- response + 20% unmatching = 394 4 weeks: 227 + 10% non-response + 20% unmatching = 295
Household Health Survey – 4 versions – Recall 2w/4w	394 x 2 + 295 x 2 = 1378
Mobile phone Survey – 2 versions – Recall 2w/4w	394 + 295 = 689
Total sample	1378 + 689 = 2067

Inpatient sample calculation

For the inpatient household interview, households were sampled and selected using provider sampling for both a face-to-face and mobile phone survey. From hospital data, patients with inpatient episodes incurred up to 9 months for the 6-month recall period and 15 months for the 12-month recall period were sampled to identify the households for inpatient household interview. For the face-to-face interview, based on the Bland-Altman method to assess the agreement between different questionnaire versions and practical constraint of the fieldwork, we recruited 50 households for each month of recall period. For the mobile phone survey, for feasibility each questionnaire version had 50 households.

Recall period	Calculation
12 months (HH with inpatient transactions happened from 1 – 15 months ago)	Face-to-face: 15 recall months x 50 = 750 Mobile phone: 50
6 months (HH with inpatient transactions happened from 1 – 9 months ago)	Face-to-face: 9 recall months x 50 = 450 Mobile phone: 50
Total sample	1200 + 100 = 1300

Table 2-4: Sample calculation for inpatient household interview

2.4 Study instruments

The cross-sectional household surveys will follow the data collection methods of the Vietnam Household Living standard survey (VHLSS) implemented in Vietnam. While the method of data collection will follow the national guidelines, the questionnaire will not be the same. For the purpose of this project, we developed survey instruments adapting from VHLSS 2014 and

the revised Classification of Individual Consumption according to Purpose 2018 (COICOP 2018).

Vietnam Household Living Standard Survey (VHLSS) is a national cross-sectional survey of General Statistics Office of Vietnam that conducted since 1992 to present. This survey collects information of about 30,000 households national wide. In this study, VHLSS 2014 was served as the platform to develop the two components which are called Household Health Survey (HHS) and Mobile phone survey (Survey of Wellbeing via Instant and Frequent Tracking - SWIFT).

COICOP (Classifications of Individual Consumption according to Purpose) is a classification developed by United Nations Statistics Division to classify and analyze individual consumption expenditures spent in households and general government according to their purpose. It is mainly used for consumer price indices and household budget survey. In household budget survey, COICOP consists of 12 divisions and health is sixth division that categorizes into three sub-division: (i) medical products, appliances and equipment; (ii) outpatient services; (iii) hospital services. In this study, the revised COICOP was incorporated into the study instrument as a new level of disaggregation for general consumption expenditures (food, non-food frequent and non-food less-frequent expenditures) and for health expenditures to be validated accuracy and efficiency.

Household Health Survey (HHS)

The HHS in Vietnam relied heavily on VHLSS and the COICOP classifications. The health survey for Vietnam has two components: (i) Household questionnaire; (ii) Individual questionnaire (Figure 2.2).

The structure of the HHS – Household level questionnaires partially follows the structure of VHLSS, but other sections have been introduced to make it a multi-purpose survey:

1. Household roster: demographic characteristics, education, and occupation.
2. Housing and durables
3. Expenditures: Non-medical expenditures questionnaires are incorporated and interviewed before health expenditures. There were 2 versions of non-medical expenditure questionnaires with different number of items (31 items and 42 items) (Appendix 1). The health expenditure questionnaires in this section was in a single version with 11 health items with 2 recall periods for each type of service (Appendix 2).
4. Risk module: Household medical expenditures risk perception and risk attitude.

5. Health insurance: investigate health insurance enrolment, continual or drop-out.
6. Participation in Aid Schemes.

The household roster, the modules on housing conditions and durables; and participation in aid schemes were similar to those currently used in VHLSS 2014. The other sections were developed in the framework of this iHOPE project.

HHS – Individual level questionnaires collects data on provider type, direct costs, diagnoses, service types, coping strategies, informal payment, and transportation expenses of household for sick episodes or health service utilization within the recall period. There are four groups of health services:

A. Hospital inpatient services (curative and long-term care) – Recall period was either 6 months or 12 months

B. Preventive care (immunization, family planning, regular health examination) – Recall period was either 3 months or 6 months

C. Outpatient services (both dental and other curative/regular services) – Recall period was either 2 weeks or 4 weeks

D. Medicines (herbal and western) – Recall period was either 2 weeks or 4 weeks

E. Medical products – Recall period was either 2 weeks or 4 weeks

F. Assistive products – Recall period was either 6 months or 12 months

The household health surveys were designed to be sensitive to different survey features: the choice of recall period (2 recalls) and the number of non-medical items (2 lists of items). Thus, in total, we had four versions of household health survey questionnaire.

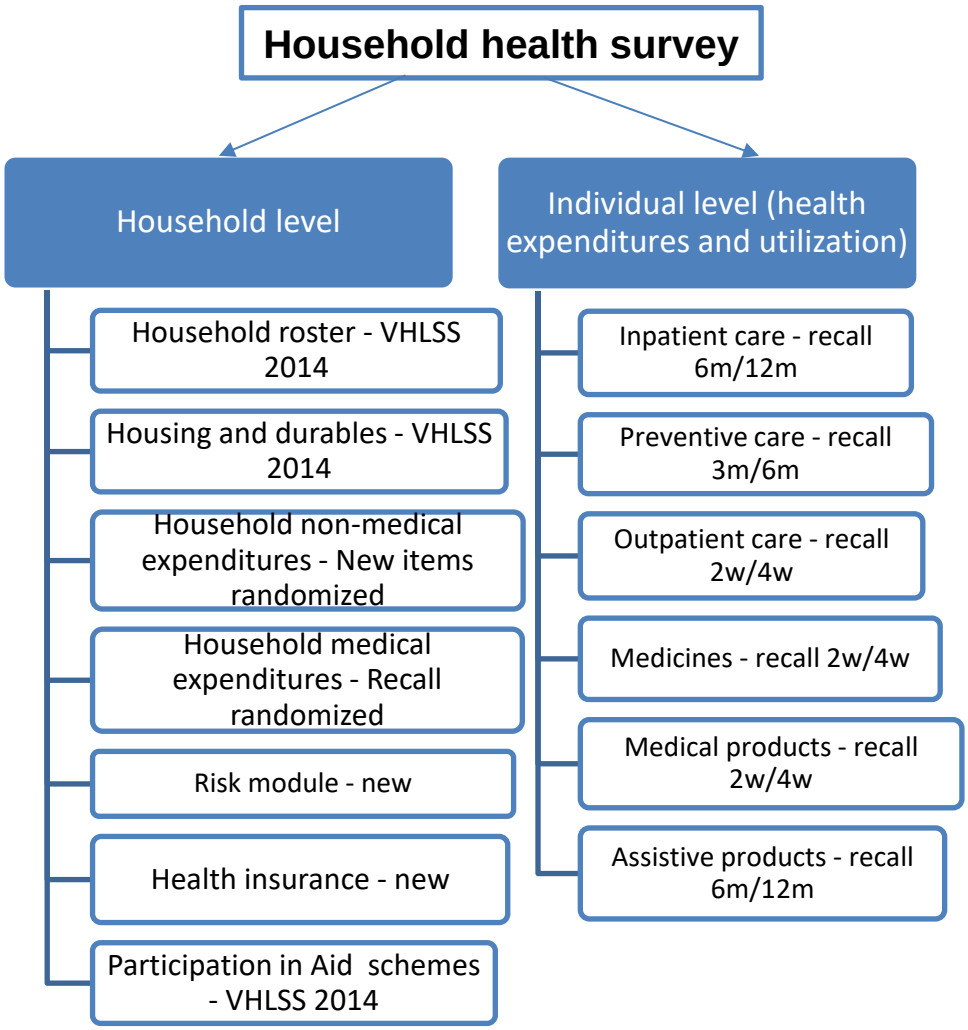
Recall period for OOPs

In HCES type that previously discussed like VHLSS, the focus for different spending categories has been last 30 days and last 12 months as this is the most frequent recall period in HCES that also include a health seeking behavior module. Yet, some of the evidence reviewed suggests that last 30 days is too long for services that do not require overnight stay. In addition, some surveys do use a 6-month recall period that is also adopted in DHS surveys. Hence, recall periods would be randomized using last 4 weeks versus last 2 weeks for services that do not require overnight stay and last 6 months versus last 12 months for those requesting so. The choice of the recall period will be validated with the provider information.

Disease attribution

In order to attribute OOPs to diseases, the study introduced a series of sequential questions used to identify reasons for using outpatient and inpatient services in the corresponding individual level questionnaires. A first screening question would group reasons into five first broad categories. For each broad category more specific questions were asked to map to more specific diseases (e.g. from physical symptoms or physical illness to cardiovascular disease) (Appendix 3).The grouping follows the Global burden of disease classification**.** Only those selecting a specific system were asked details for that particular system. For those requiring an overnight stay, there was a request to see discharge documents so that the interviewer could note the reason of the hospitalization.

Figure 2-2: Structure of household health survey



Mobile phone survey (SWIFT)

Mobile phone (SWIFT) instrument was designed to test a proxy method for estimating household general expenditure through assets SWIFT modeling. Household expenditure survey of the VHLSS 2014 were be modeled in order to identify a set of housings and assets

prominently explained by the expenditure [65]. The thesis focuses on household health expenditures. A set of questions on household health expenditures that were the same for the household-level health expenditures module of the face-to-face survey was also incorporated in the SWIFT survey (Appendix 4). This initiation helps to check whether a mobile phone survey can be applied for the ongoing national level household and health surveys so that household out-of-pocket health expenditure time series data can be generated.

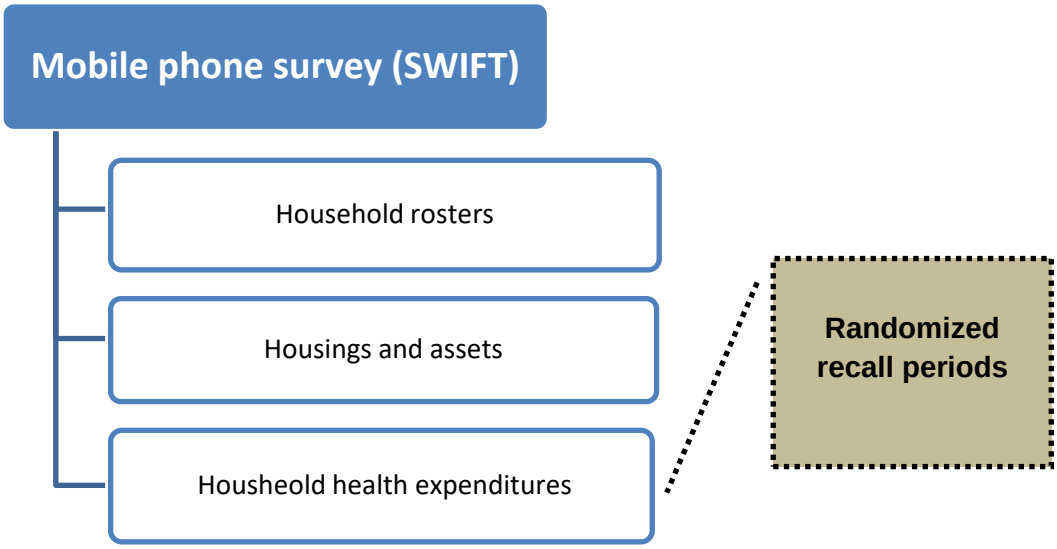


Figure 2-3: Structure of mobile phone survey (SWIFT)

2.5 Data collection

There were three methods of data collection: household interviews at the community level, the mobile phone interview, the health provider data retrieval.

Household data collection

Household data collection were conducted from June 2017 to April 2018 for both the face-to-face and the mobile phone surveys using tablets. Survey instruments were programmed into the tablets using the Commcare platform. Trained interviewers were authorized to download the questionnaires into tablets for interviews.

Face-to-face interview

In this study, we conducted two different approaches for outpatient care and inpatient care. Although the study instruments were the same for both services, the data collection was carried out slight differently in terms of time of fieldwork, sampling method and sample population.

Outpatient households' data collection

The target sample for outpatient household interview was 2067 households. In the five selected communes, we have 3000 households belonged to Filabavi HDSS (called Filabavi households from now) which meet the sample size we need. The data collection lasted for 6 months (from June to Nov 2017). Five communes were divided into 4 areas based on close proximity and convenience and households in each area were interviewed for 4 weeks to 6 weeks depending on the number of households of each area.

Inpatient households' data collection

The sample of inpatient household interview is 1200 households. Separate samples were used for outpatient and inpatient, thus inpatient household interview was conducted at other communes of Bavi district, except for the five communes of outpatient household sample.

Firstly, the list of inpatient with information on demographic characteristics (name, age, gender, address) and admission date from hospital records was distributed to surveyors to identify and recruit households having at least one inpatient episode within 9 months or 15 months since the date of interview. We relied on a convenient approach, which meant that the surveyors self-identified households with the help of the village health workers based on their knowledge and familiarity with the clusters. Inpatient data collection started in September 2017 and finished in April 2018.

Mobile phone interview

Mobile phones were used to collect data on household information, assets and health expenditures using the short questionnaire as described in section 2.4. iHOPE project was already in contact with the World Bank team that conducted SWIFT (surveys of well-being via instant and frequent tracking). The data collection method was followed the SWIFT approach and technical guidelines [65]. First, field surveyors visited households to get their consent on participating in the mobile phone survey, their phone numbers and basis information on household roster by tablets. The information was uploaded to the Commcare server for the mobile phone interviews that were scheduled in 2 weeks later. A call center was set up in the Filabavi HDSS office. A program was developed to automatically schedule the time for calling home-visited households. The mobile phone interviewers downloaded the households information from the server and got notifications when the time for calling the households came.

Provider data collection

With the assumption that the provider records is the closet data to the reality, the study consider them as the "gold standard". In order to ensure information of individual's health care utilization such as reasons for seeking care, date of service, diseases/symptoms/conditions, cost of service are available on a timely and consistent manner that minimizes measurement error, a brief intervention was created and carried out to improve the recording of such data at the providers.

For providers outside the hospital setting, especially private health care providers without any recording system in the study area, a generic template was developed for the different types of health providers (Appendix 5). The template was designed with basic information and identifiers (name, address, date of visit, reason for consultation, received services, health insurance status (if applicable) and cost of treatment/service) in order to make it possible for the project to obtain the provider level data and also track the patients/clients back to their communities to collect the household data. The rationale for keeping the new template basic is to ensure simplicity in completing it so that the health care providers can accept it. The templates were distributed to health providers for collecting information four weeks before the start of household survey with the aim at capturing all outpatient episodes utilized by households for validation.

For provider inside the hospital setting, here we only have a public district hospital, the provider data were generated from the recording system of the hospital. We obtained all patient records for both outpatient and inpatient services. The information available in the hospital records included: patients name, gender, age, address, hospital admission and discharge date, duration of inpatient stay, diagnosis, health insurance status, expenses on medical fees, drugs, diagnostic tests, surgery, total expenditures, total expenses paid by patient to the hospital (i.e. out-of-pocket health expenditures), and total expenses covered by health insurance. The hospital used the 10th International Classification of Disease (ICD 10) (Appendix 6) to classify disease and diagnosis. Because we applied different approaches for outpatient and inpatient care, thus the data were given to us from the hospital in the different manner. For outpatient services, data from hospital were acquired after the fieldwork completed with all participants' consent on accessing their information at the providers. For inpatient care, we applied retrospective approach and provider sampling, thus at first we obtained only the identifier information (name, age, gender, address, admission date) from hospital records to identify the inpatients for households recruitment. After the household survey was completed and the work on linking household data with hospital data was done, the rest of information of the linked individuals was given to us from the hospital.

Pharmacies/Drug stores were also distributed the standardized template for improving data collection at these facilities (Appendix 7).

Figure below shows the entire process of obtaining the health provider level data.

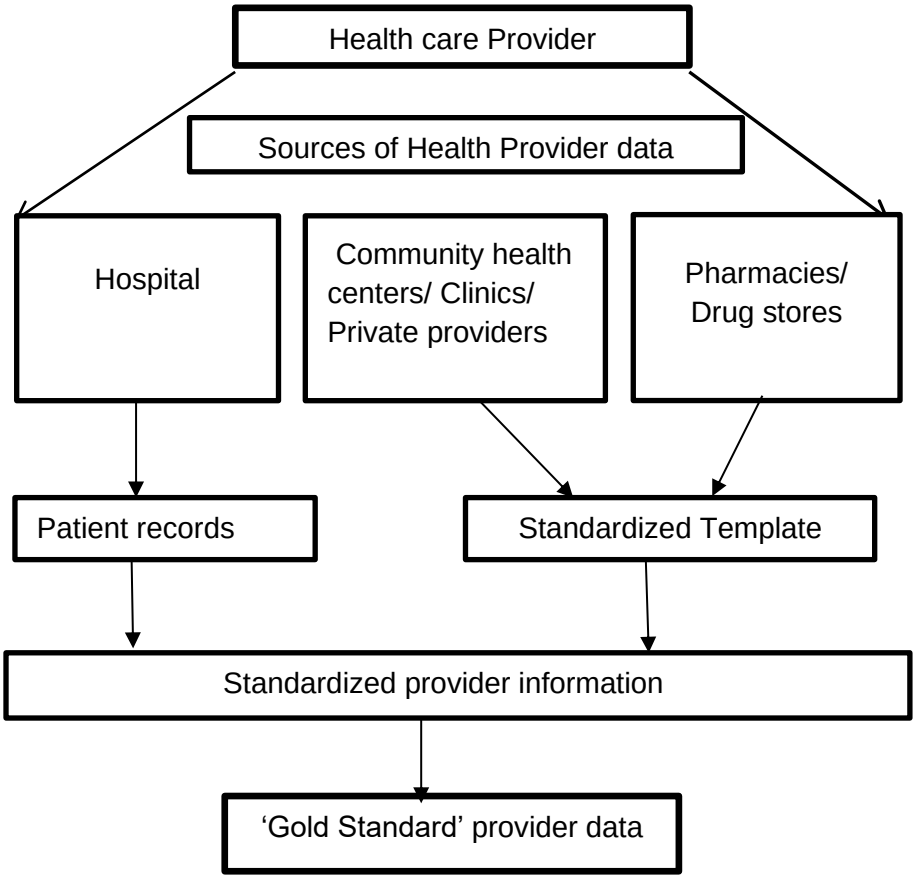


Figure 2-4: Structure of Health provider data collection process

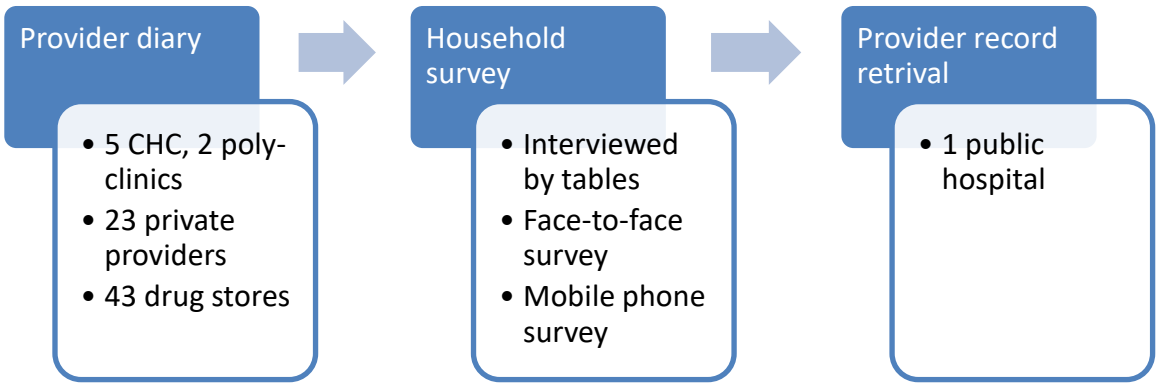


Figure 2-5: Summary of the data collection methods, tools and field work

2.6 Analytical approach

The overall aim of this thesis is to assess the effect of different household survey designs on the accuracy of measuring OOPs. We developed and used different versions of the household

questionnaires, which differed in questions chosen to address specific objectives (the choice of recall period and mode of data collection). Households were randomly assigned to one of the questionnaire versions. To answer the questions of which questionnaire version provided a more accurate estimate of OOPs at the household level, we compared the OOPs reported by households with the corresponding OOPs in hospital records, which was considered as the 'gold standard'. The thesis used the approach proposed by Bland-Altman for assessing agreement between two quantitative measurements from two data sources.

There are two useful measures of agreement when using the Bland-Altman analytical approach: the overall bias (how well the methods agree on average) and the variability (how well the methods agree for individual households).

To estimate the overall bias for each measurement of study design, we calculated the mean ratio of household to provider OOPs. We quantified the variability of the individual ratios using 95% limits of agreement that give the range in which we expect 95% of ratios to lie.

To compare the agreement between questionnaire version and the provider for two different study designs, we followed Bland-Altman [63] by fitting a regression model with the log-transformed ratios of the household to provider OOPs as the outcome variable. The questionnaire version is an explanatory variable.

We estimated the effect of questionnaire version on variability using the residuals of the previous regression model as the outcome and including the questionnaire version as an explanatory variable. The residuals are the differences between the observed ratios and predicted ratios.

Data were collected in communes of Bavi district; we included a random effect in both regression to account for this.

Besides the Bland-Altman method, in Chapter 3 multinomial regressions were performed to quantify the effect of recall period on the reported health expenditures and explored the underlying driver of the recall biases of forward and backward telescoping and failing to remember.

In the chapter 5, the primary objective is to assess the accuracy of OOPs estimates by disease for inpatient care. First, the proportion of admissions by diseases reported by households were compared to the public hospital records. Secondly, we estimated disease-specific OOPs reported by households and compared to hospital records. Logistic regression was performed to predict the relationship between the likelihood of reporting a correct disease and some

factors like respondents reported themselves, gender and marital status of respondents, the availability of discharge summaries, treatment period, and recall period.

2.7 Ethical considerations

The Ethical Review Board of Hanoi Medical University, Vietnam (HMU IRB) approved for the conduct of the study. Informed consent was also obtained from all study participants before data collection was conducted.

3. CHAPTER THREE: Investigating the effect of recall period on estimates of inpatient out-of-pocket expenditure from household surveys in Vietnam

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3.1. Abstract

Out-of-pocket payments (OOPs), direct payments by households or individuals for healthcare are part of the health financing landscape. Data on OOPs is needed to monitor progress in financial risk protection, and the evaluation of health financing policies. In low-and-middle-income countries, estimates of OOPs rely heavily on self-reported data from household surveys. These surveys require respondents to recall events in the past and can suffer from recall biases. This study investigates the effect of recall period on the agreement of the amount and timing of inpatient OOPs between household reports and provider records in Bavi, Vietnam.

We recruited 1397 households for interview using records from the district hospital. The households were interviewed with identical questionnaires except that the recall period was either 12 or 6 months. We linked household with provider data and excluded medicine costs from both household and provider OOPs since they could be purchased outside the hospital. We estimated the effect of recall period on the overall mean and variability of ratios of household to hospital reported OOPs using the Bland-Altman approach for method comparison. We estimated the effect of recall period on whether a transaction was recalled correctly in expenditure and time using multinomial regression.

The households reported higher amounts of OOPs than did the hospital for both recall periods. There was no evidence of an effect of recall period on the mean of the ratios of household- to hospital-reported OOPs, although the confidence intervals are not inconsistent with previous studies indicating higher OOPs for shorter recall periods. The geometric mean ratio for the 6-month period was estimated to be a multiple of 1.4 (95% CI 0.9, 2.1) times that of the 12-month period. Similarly, there was no evidence of an effect of recall period on the risk of reporting lower or higher amounts than provider OOPs.

The occurrence and timing of inpatient stays generally recalled well, with 70% remembered in the correct month declining slightly over time. Respondents for 6-month recall period had a significantly lower risk of failing to report the event (RR 0.8 (0.7, 1.0)).

The results suggest the best recall period may depend on whether the purpose of a survey is for the recall of the timing of events, in which case the 6 month period may be better, or the amounts of OOPs, where there was no significant difference and the provider records are not a gold standard but the 12 month period had a tendency to be in closer agreement with the provider OOPs.

3.2 Introduction

Out-of-pocket payments (OOPs) are direct payments that individuals pay to health care providers when receiving health services and products, but exclude any payments covered by health insurance or pre-payments. [66]. OOPs are a source of financial hardship and in many low and middle income countries (LMICs) constitute the largest source of health care financing [7-9]. Inaccurate OOP estimates can affect the credibility of total current health spending estimates in National Health Accounts (NHA) statistics, an important indicator of progress towards universal health coverage for policy makers [32, 50].

OOPs are commonly measured by household surveys [24, 25, 29, 67]. These surveys collect data on expenditure mostly using retrospective questions which refer to a period of time preceding the date of interview. The survey results may be affected by recall biases [68-70]. People may fail to accurately recall when an event occurred, which may lead to the event being incorrectly included or not included in the recall period. They may fail to recall the actual amount of expenditure for an event. Or they may fail to recall the event at all.

Studies have shown that shorter recall periods generally lead to larger estimates of annual out of pocket payments in household surveys [24, 25, 29, 33, 35] They may also lead to greater imprecision for infrequent expenses. It is not known whether shorter or longer recall periods lead to the most accurate estimates overall, or the relative contributions of different types of recall errors. Provider records provide a second source of information on OOPs, although they are not a gold standard. In this study, we assess agreement between the household survey and provider OOPs for inpatient care for two recall periods of 6 and 12 months. We also estimate the effect of recall period on the amount of OOPs and timing of transactions.

3.3 Methods

3.3.1 Study setting

The study was conducted in Bavi District, Hanoi, Vietnam. Bavi District is a northern rural district with 31 communes and an estimated population of 282,600 in 2018. There is one public hospital, three poly-clinics, 32 commune health centers (CHC) and about 600 private providers and drugstores. CHCs serve as medical hubs for outpatient care, preventive care and medicines. The public hospital and three poly-clinics provide all types of services including inpatient care, outpatient care, and preventive care. Most of the private health providers provide either outpatient care, medicines or both. This study uses provider records from the public hospital.

The Ethical Review Board of Hanoi Medical University (HMU-IRB) approved the study in Ethical approval certificate no 182 issued on 10 August 2015. Informed consent was obtained in written form with signatures from all recruited households.

3.3.2 Study design

We compare the agreement of OOPs for inpatient care from household surveys and the public hospital records for two different recall periods. From provider records, we identified the households with at least one inpatient transaction and assigned them to a 6-month or 12-month recall period. To assess the agreement between the survey OOPs and those reported in hospital records, a database with linked records for the household-reported inpatient transaction and their corresponding health records from the provider was created.

In order to investigate the effect of recall period on whether a transaction was reported accurately in time, the timing of interviews was carefully managed so that there were an equal number of households with an inpatient episode one month, two months and every month up to either 9 or 15 months previously (the recall periods plus three months). This design allowed the study to investigate telescoping. Telescoping refers to a temporal displacement of events. Two types are distinguished: backward telescoping occurs when the event is perceived to have happened farther back than it did while forward telescoping happens when the event is perceived to have occurred more recently (12).

3.3.3 Study population and sampling

The study population comprised all households in Bavi district. The households, which were located in 16 out of the 32 communes in the district, were sampled from the medical records of the Bavi district hospital, the main inpatient care provider.

A list of individuals who had been admitted to the hospital was obtained from hospital records. The field surveyors, with help from village health workers, identified the households that had at least one inpatient in the list to recruit for interview. Inpatients were identified based on their demographic characteristics (full name, gender, age, and commune) by the interviewers. We restricted the individuals to those living in 16 of the 32 communes in the district because the available surveyors were familiar with these communes (since they used to be part of the health and demographic surveillance system) and could identify the households of the inpatients. The 16 communes were scattered across the district. In order to investigate recall by the time since the inpatient transaction happened, households with an inpatient episode occurring each number of months up to either 9 months prior to the interview (for the 6 month recall periods) or up to

15 months prior (for the 12 month recall period) were sampled. The two questionnaire versions were assigned to households alternately for months one to nine and for months 10-15 were allocated only to the 12 months recall period. They were not randomly assigned and some of the transactions in the 12 month recall group may have occurred in a different time of year compared to the 6 month group. We do not know if the season of the transaction affects recall. The sample size was based on recommendations on the precision for estimating the agreement between households and provider data using the Bland-Altman method (16, 17) and practical constraints on the field work. We sampled 50 households for each number of months between admission and the date of the interview in each recall period arm.

3.3.4 Survey instrument

The survey instrument developed in this study was based on the Vietnam Household Living Standard Survey 2014 and the 2018 Classifications of Individual Consumption according to Purpose (COICOP). The Vietnam Households Living Standard Survey (VHLSS) is a national cross-sectional survey conducted recurrently by the General Statistics Office of Vietnam since 1992 [14]. The survey instrument was adapted from the structure and content of VHLSS 2014 for questions on household roster, household non-medical consumption, housings and durables, and aid schemes participation [14]. The questions on household medical expenditures were drawn from division 6 for health in 2018 COICOP. The questionnaires have two parts, one for household-level and one for individual-level questions. All the sections and questions are the same for two versions of household survey: only the recall periods for the health items were different. The present study is based on OOPs collected through the individual level questionnaire.

3.3.5 Data collection

Household survey:

The household data was collected between September 2017 and April 2018. The person most knowledgeable about health utilization and expenses who was at home when the interviewer called was identified. They could be the household head, the inpatient, or another household member. The following interview rules were applied: (1) Interviewers could not inform the respondent about the inpatient transaction that was used to identify the household; (2) When asking the respondent to recall the date of the event, the interviewer had to give landmarks for the exact reference period (for example: within the last 12 months, from December 2016 to December 2017); (3) If the households kept patient records or any documents that helped recall

the event, they could be used; (4) Interviewers had to complete the survey questionnaires and ask about out-of-pocket expenditures for all health services and products (outpatient, inpatient, preventive, assistive products and medicines) for all household members in order to have data on the total household OOPs for health care. Out of pocket expenditure for inpatient care reported by the household could include payments related to the same episode but from different providers (e.g. medicine purchased outside the public hospital.). The patients only know about and pay for the costs not covered by health insurance which may include informal user chargers. In addition, non-medical expenses related to an inpatient episode are common in Vietnam. In the survey, we asked about informal payments and all non-medical expenses such as transportation costs, costs for meals and accommodation of caretakers, other non-medical costs. All of these were excluded from the household-reported OOPs to focus on the formal user chargers that were more likely to be found in the hospital records.

All household surveys were conducted face-to-face using tablets. Survey instruments were programmed into the tablets using the Commcare platform. Trained interviewers were authorized to download the questionnaires into tablets for interviews.

Provider data:

We obtained all hospital records from May 2016 to April 2018. The information available in the hospital records included: patients name, gender, age, address, hospital admission and discharge date, duration of inpatient stay, diagnosis, health insurance status, expenses on medical fees, drugs, diagnostic tests, surgery, total expenditures, expenses paid by patient to the hospital (i.e. out-of-pocket health expenditures), and expenses covered by health insurance. We excluded costs covered by health insurance.

3.3.6 Matching procedures

The inpatient services to be matched included the inpatient stay which had led to the selection of the household from the provider records and the additional inpatient stays for all the household members. Before matching, all out- of-pocket payments reported by the respondents and related to services from other providers were excluded.

Matching was conducted based on the demographic characteristics of the inpatient (full name, gender, commune and age) and the service date. An age difference between the inpatient in household and provider data was allowed up to a maximum of 2 years. The date of service

reported by provider had to be delivered before the interview date and services had to be delivered within 450 days for 12-month recall or 270 days for 6-month recall.

The first step of the matching procedure was to match the household-reported inpatient stays with the provider data. This was carried out for households reporting at least one admission. When using demographic characteristics of the inpatients for matching, a household inpatient transaction could be matched with more than one record from the hospital records. We narrowed down the best match by selecting the matched transaction having the minimum difference in days between household reported date of service and hospital admission date. We do not think this would cause a substantial bias between recall periods because the time differences between reported date and provider date in both groups were small: 70% of reported transactions were recalled in the same month as the provider. This first dataset included paired transactions and transactions reported by households that were not found in the provider records.

Secondly, matching was conducted for all members of all recruited households. We used the demographic information from the household roster to link to the provider data. We applied the same condition of age and the date of service as the previous step. The matching outcome for each household member was either that the household member could be linked with a transaction in provider data, or they could not. We identified transactions for both the reported inpatients and other household members that the respondents had not reported.

Thirdly, the final matched dataset for transactions included (1) paired transactions; (2) transactions reported by households but could not be found in provider data; (3) transactions were not reported by households but could be found in provider data.

Lastly, from the matched transaction data, a paired dataset at the household level was produced by aggregating the OOPs for all individuals and inpatient episodes within households for both the household and provider. For transactions of an inpatient not recalled by the respondents but in hospital records, we considered the household OOPs to be zero. Similarly, for transactions of a reported inpatient not recorded by provider but reported by the respondents we considered the provider OOPs to be zero.

In order to have a measure of OOPs which was more comparable to those captured by the hospital records, we excluded informal reported payments, non-medical and other expenses. A small proportion of matched transactions had missing values for these and were excluded since the medical costs could not be derived from the total costs

We excluded medicine costs from both household and provider reported OOPs since households may have bought their medicines from other providers. With transactions with missing values of medicine costs, we replaced the missing values with 60% of the total household-reported OOPs, the median proportion of those with known medicine costs less than the total.

3.3.7 Data analysis

We estimated the monthly mean reported OOPs for the households and providers for records which were in the matched dataset. We plotted the monthly mean square errors and the confidence interval by categories of provider OOPs.

We then assessed the agreement between the matched household and provider OOPs using the Bland-Altman approach (19). We first assessed agreement between household- and provider-reported OOPs at the household level for each recall period separately. For the overall agreement, we calculated the mean of the ratios of household to provider OOPs. We use the ratio rather than the difference because the difference was heavily dependent on the amount of provider OOPs, but the ratio was reasonably constant and could be summarized easily. The ratios had a skewed distribution, so they were log-transformed, first adding 1 to both household and provider values to avoid zeros. The mean of the log ratios was exponentiated to give the geometric mean ratio. We quantified the variability of the individual ratios using 95% limits of agreement which give the range in which we expect 95% of ratios to lie. While the variability was constant over most of the range of the provider OOPs, there was substantial variation in the ratios for very small provider OOPs due to the large impact that small fluctuations can have if the denominator is small. Therefore, to check if the small amounts are obscuring patterns due to the large variation, we categorized households into two groups based on the value of provider OOPs: households with the amount of OOPs from provider records less than or equal to 100 thousand VND (USD 4.4 – in the rest of the paper referred to as the low provider OOPs group) and households with the amount of OOPs from provider records greater than 100 thousand VND (USD 4.4 – in the rest of the paper referred to as the higher provider OOPs group).

We then estimated the impact of recall period on the mean ratio and the variability following Bland & Altman (19) . For the mean ratio we fitted a regression model with the log-transformed ratios as the outcome variable and the recall period as an explanatory variable. We estimated the effect of recall period on variability using the absolute value of residuals (the distance of the residuals of the previous regression model from zero) as the outcome and including the

recall period as an explanatory variable (17, 19). We included a random effect in both regressions to account for the clustering of the households within the communes.

We estimated the risk of reporting transaction OOPs as greater, less than or not more than a small difference from the provider OOPs. A small difference was defined as the absolute difference between household OOPs and provider OOPs not exceeding 20% of the corresponding provider OOPs. A multinomial regression was performed with recall period as an explanatory variable and adjusting for low/higher OOPs amount group (defined with a cut-off of 50,000 VND (USD 2.2)). We also tested for a different effect of recall period depending on OOPs group using interaction terms.

To investigate whether the timing of the transactions was correctly recalled, we categorized transactions as (1) those remembered in the correct month; (2) those telescoped forward into a later month; (3) those telescoped backward into an earlier month; (4) those which were not reported. We plotted these proportions by month since the transaction actually occurred.

We estimated the impact of recall period on timing using multinomial regression. The dependent variable had three categories: (1) recall in the correct survey recall period (6 or 12 months), (2) forward telescoping and (3) failing to report the transaction or backward telescoping.

3.4 Results

3.4.1 Description analysis of sample

Matching household and provider records

In total, we recruited 835 and 562 households for the 12- and 6-month recall periods respectively. There were 750 and 517 households reporting at least one inpatient transaction, respectively. The household respondents reported 948 transactions for the 12-month recall period and 641 for the 6-month group (Table 1).

Overall, 84% of the transactions reported by the households could be linked to the provider. There were an additional 437 and 223 transactions reported by the provider but not the households in the 12- and 6-month recall periods, respectively.

The proportion of households with all transactions linked was 60% overall. About 20% of households had some of the transactions linked to provider records, and about 20% of households did not have any linked transactions. After matching and excluding records with

missing values, there were 736 (88%) households for the 12 month and 474 (84%) for the 6-month recall periods.

Table 3-1: Status of matching by different levels

	12-month recall **N (%)**	**6-month recall** **N (%)**
Transaction level		
# reported transactions by HHs*	948	641
# transactions linked with provider (paired transactions)	791	521
# transactions reported by HHs* but not in provider data	85	65
# transaction not recalled by HHs* but in provider data	437	223
Total transactions after matching	1313	809
Total transactions after excluding records with missing values	1175	694
Household level		
# HHs recruited from provider sampling	835 (100%)	562 (100%)
# HHs reported at least 1 transaction	750 (90%)	517 (92%)
# HHs having all transactions linked with provider	480 (57%)	341 (60%)
# HHs having some of transactions linked with provider	177 (21%)	102 (18%)
# HHs having transactions but none linked with provider	160 (19%)	106 (19%)

HHs that did not report any transactions and had no transactions in the provider data	18 (2%)	13 (2%)
Total HHs after matching	817 (98%)	549 (98%)
Total HHs after excluding those with missing values	736 (88%)	474 (84%)

*HHs = households

Socio-demographic characteristics

The demographic characteristics of the heads of household were similar for two recall periods (Table 3.2). Overall 75% of the household heads were male and more than 80% of them were married. Approximately 60% of the household heads were between 20 and 60 years old, and about 85% had attended secondary school or above. In 60% of cases, the household respondents were not the head of the household and 75% of them were female (S1 Table).

Table 3-2: Characteristics of head of household

	12 - month recall		**6 - month recall**	
	n	**(%)**	**n**	**(%)**
Total number of households	736		474	
Gender				
Male	550	76	357	76
Female	176	24	115	24
Marital status				
Married	602	83	392	83
Age group head				
20-59	440	61	293	62
60 – 69	160	22	102	22
70 – 79	81	11	54	11
80+	45	6	23	5
Education				
Illiterature to read/write	27	4	14	3
Primary school	86	12	56	12
Secondary school	362	50	270	57
Highschool and above	251	34	130	28
Occupation				
Farmer	178	24	126	27
Office staff	41	6	11	2
Manual workers	209	28	151	32
Business	77	10	49	10
Retired/Elderly	135	18	75	16
Homework	48	6.5	32	7
Other	48	6.5	30	6

Religion				
None	705	99	496	99.5
Catholic	8	1	2	0.5
Household size				
1 person	51	7	33	7
2-5 persons	550	76	357	75
>= 6 persons	128	17	85	18

Note: 1% of sample was missing when merging households to household roster to get information of the head of household.

3.4.2 Effect of recall period on the reported OOPs for inpatient care

3.4.2.1 Measuring agreement between household and provider-reported OOPs amounts

In general, the OOPs reported by the households were higher than those of the provider (Table 3-3). How much greater depended on the level of provider OOPs: for very small amounts (the lower OOPs group) the geometric mean ratios were 3.7 and 4.5, driven by large ratios occurring when small amount or zeros are compared to positive amounts reported by the household. For the higher OOPs group (household with amount of OOPs from provider over 100 thousand VND - USD 4.4) the mean ratios were smaller than 1 (Table 3-3).

The arithmetic mean of monthly household-reported OOPs with or without medicines costs for the 6-month recall period was generally higher than that of 12-month period (S2 Table). We observed an increase in monthly mean square errors in both recall periods over the categories of monthly provider OOPs. The 6-month recall period tended to have higher monthly mean square errors than the 12-month overall (S1 Figure).

There was no evidence of an effect of recall period overall on the mean ratio of household to provider OOPs, although the confidence intervals do not rule out an increase in the 6-month period.

The variability, measured by the 95% limits of agreement, also varied by level of provider OOPs, and were especially wide for the lower OOP category. There was no evidence of an effect of recall period on the variability in either the categories of provider OOPs or the full matched sample.

We conducted a sensitivity analysis which included the medicine costs in both household and provider OOPs. We found a similar pattern of estimates (S3 Table).

We found that both categories of provider OOP amounts contributed substantially to the total reported OOPs. The higher OOPs group contributed up to 69% of household-reported OOPs and 98% of provider-reported OOPs (S4 Table)

Table 3-3: Mean and variability of the ratios of household to provider OOPs at the household level

Household samples	Recall period	Number of households	Geometric mean ratio	95% limits of agreement	Estimated effect of recall period on the mean ratio: the ratio of the mean ratios(95% CI)	Estimated effect of recall period on variabilty: the ratio of the standard deviations(95% CI)
All samples	12-month	736	1.1	0.001 – 855		
	6-month	474	1.6	0.003 - 1047	1.4 (0.9 – 2.1) P = 0.07	1.0 (0.7 – 1.4) P = 0.9
Lower provider OOPs[1]	12-month	492	3.7	0.02 – 838		
	6-month	335	4.5	0.02 - 1250	1.3 (0.9 – 1.9) P = 0.2	1.1 (0.9 – 1.4) P = 0.1
Higher provider OOPs[2]	12-month	244	0.1	0.0002 – 46.3		
	6-month	139	0.14	0.0005 – 41.7	1.4 (0.8 – 2.6) P = 0.2	0.8 (0.6 – 1.0) P = 0.06

[1] Households with provider-reported OOPs less than or equal to USD 4.4
[2] Households with provider-reported OOPs greater than USD 4.4
Note: Limits of agreement refer to the range in which 95% of the individual matched pair ratios are expected to lie. Low/higher provider OOPs and interaction term were significant at p-value <0.01 in the likelihood ratio test.

3.4.2.2 The effect of recall period on whether a transaction was reported with the correct amount of OOPs

There was no evidence of a difference in the risk for reporting OOPs higher or lower than the provider OOPs by recall period. (Table 3-4).

Table 3-4: Effect of recall period on the risk of the reported OOP value for transactions being greater or less than the provider OOP amount

Variables	Relative risk for higher than provider[6] versus small or no difference[5]	Relative risk for lower than provider[6] versus small or no difference[5]
Effect of recall period overall[1]		
6-month compared to 12-month recall period	1.1 (0.9 – 1.4)	0.8 (0.6 – 1.1)
Effect of recall period by provider OOPs categories[2]		
6-month compared to 12-month recall period for the lower provider OOPs group[3]	1.2 (0.9 – 1.5)	0.2 (0.05 – 1.1)

6-month compared to 12-month recall period for the higher provider OOPs group[4]	1.1 (0.6 – 2.0)	0.9 (0.5 – 1.6)

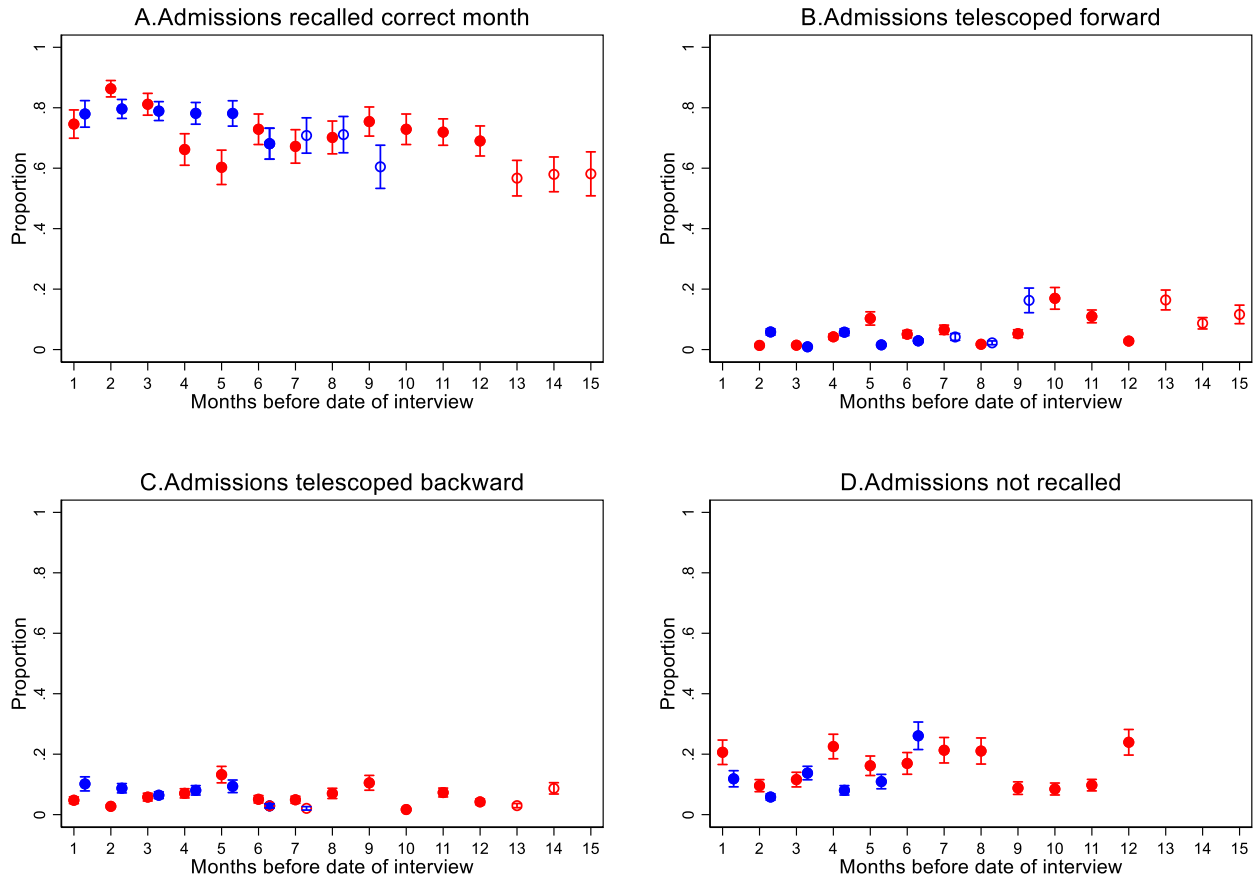
[1] Other variables in adjusted model: respondent role, gender of respondent
[2] Other variables in adjusted model: respondent role, gender of respondent, lower/higher provider OOPs group, interaction term of recall period and lower/higher provider OOPs group. Lower/higher provider OOPs and interaction term were significant at p-value <0.01.
[3] Transactions with provider-reported OOPs less than or equal to USD 2.2
[4] Transactions with provider-reported OOPs greater than USD 2.2
[5] A small difference was defined as the absolute difference between household and provider OOPs being less than or equal to 20% of the provider OOPs of the corresponding transaction.
[6]Greater or less than provider OOPs was defined as the absolute difference of OOPs being greater or less than 20% of the provider OOPs

A sensitivity analysis including medicine costs in both household and provider OOPs found that. The direction of results shared the same pattern as the main analysis, albeit with some borderline significant results. (S5 Table).

3.4.3 Recall errors in the timing of the transaction

3.4.3.1 Recall of the transaction within the correct month

Overall, 70% of transactions were correctly remembered as taking place in the month when they occurred (Fig 3-1) . The proportions of transactions recalled in the correct month slightly decreased by time since the transaction for both recall periods. Forward telescoping, where the event is perceived to be more recent than it was, was low up to eight months prior to the interview for both recall periods and increased slightly for admissions before eight months earlier. The proportion of transactions with backward telescoping, where the event is recalled as being further in the past than it was, was low in both periods. The proportion of matched admissions not recalled by the household respondent was 30% overall with small fluctuations over time. (Fig 3-1).



Dots: proportion of admissions; Error bars: 95% confidence intervals
Red shaded dots: 12-month recall period from 1 to 12 months since transaction date.
Red unshaded dot: 12-month recall period from 13 to 15 months since transaction date.
Blue shaded dot: 6-month recall period from 1 to 6 months since transaction date
Blue unshaded dot: 6-month recall period from 7 to 9 months since transaction date

Figure 3-1: Recall errors by the time difference between the admission and the interview

3.4.3.2 The effect of recall period on whether a transaction was correctly reported as being in the specified recall period

There was some borderline evidence of a lower risk of failing to remember in the 6-month recall period, particularly for the higher provider OOPs group. (Table 3-5). There was no evidence of a difference in forward telescoping by recall period.

The sensitivity analysis including medicine costs produced similar results (S4 Table).

Table 3-5: Relative risk of forward telescoping or failing to recall a transaction compared to correct recall.

Variables	**Forward telescoping[5] versus remember transaction in the correct recall period**	**Failing to remember[6] versus remember transaction in the correct recall period**

	Relative risk	Relative risk
Effect of recall period overall[1]		
6-month (vs 12-month) recall	1.2 (0.9 – 1.6)	0.8 (0.7 – 1.0)
Effect of recall period by provider OOPs categories[2]		
6-month (vs 12-month) recall period low provider OOPs group[3]	1.3 (0.9 – 1.7)	0.9 (0.7 – 1.2)
6-month (vs 12-month) recall period of high provider OOPs[4]	- [7]	0.5 (0.4 – 0.8)

[1] Other variables in adjusted model: respondent role, gender of respondent
[2] Other variables in adjusted model: respondent role, gender of respondent, lower/higher provider OOPs group, interaction term of recall period and lower/higher provider OOPs group.
[3] Transactions with provider-reported OOPs <= USD 2.2
[4] Transactions with provider-reported OOPs > USD 2.2
[5]Forward telescoping was defined as recalling transactions which incurred outside the time period as occurring during the recall period.
[6]Failing to remember/ Backward telescoping was defined as not remembering the transaction/ perceived transactions which incurred within the given time periods (6 months/12 months) outside the recall period.
[7]Very few observations with forward telescoping in the higher provider OOPs category

3.5 Discussion

Measuring out-of-pocket health expenditure is important: it constitutes the largest source of health care financing in developing countries, is a barrier to equitably access to health services, and can lead to financial hardships (20). OOPs are among the most difficult indicators to measure in the context of National Health Accounts (NHA) (21). Incorrect OOP estimates can affect the credibility of total current health spending estimates in NHA statistics, an important indicator for policy makers (21). The purpose of this study was to investigate the effect of the recall period on whether an inpatient transaction was in agreement with hospital records in terms of the amount of expenditure and the time that it occurred.

To this end we investigated the effect of the recall period on: first, the mean and variability of the household to provider OOPs ratio; second, the risk of reporting higher or lower than amount of provider OOPs; third, the ability to report the exact month of the admission; and fourth, the ability to report the admission within the appropriate reference period.

We found that there was no evidence of an effect of the recall period on the mean ratio of household to provider OOP amounts, although that the confidence intervals did not rule out an effect. Similarly, there was no evidence of a difference in the risk for reporting higher or lower than the amounts of provider OOPs by recall period. Overall, 70% of transactions were recalled as occurring in the correct month. The 6-month recall period had a significant lower risk of backward telescoping or failing to remember compared to the 12-month one. This study highlights that both the longer and shorter recall periods are subject to recall issues. Although

this study did not produce strong evidence for one recall period over another, decisions may need to be made on imperfect evidence. Although not significant, the respondents for the 6 month period tended to report higher ratios between household and provider OOPs consistent with the higher OOPs for shorter recall periods reported in other studies (7-9, 14, 15), but remembered incident occurring significantly better. The 12-month recall period suffered less from forward telescoping but significantly more from failure to remember. Taken together, these results suggest that for studies on the amount of OOPs the 12 month recall period gave better agreement with the provider records. If the aim of the study is the recall or timing of events, then the 6-month recall period was better.

Both the average level of household OOPs in a country and the total level of household OOPs in a country are important statistics in health accounts. The most common approach to produce survey-based estimates of household annual OOPs consists of using a constant scaling factor that corresponds to the inverse of the recall period. Such an approach might not be an issue when the data collection is spread over a year and the statistic of interest is the average annual level of household OOPs in a country. For the purpose of measuring the total annual level of OOPs in a country, the effect of the shorter recall period in the high provider OOPs group suggest that the 12-month recall period is more appropriate.

This paper only partially contributes to inform the design of a survey for the purpose of accurate tracking of financial protection in health for two reasons. First, measures of financial protection compare at the household level, amounts spent on health out-of-pocket for all types of goods and services to household non-medical consumption. This paper focuses on household inpatient expenditures which are only one component of household OOPs. Second, even if the level of household OOPs compared to the provider record is accurate, the accuracy in the data collected is achieved by prompting memory. There is therefore a risk to distort the recall of non-medical consumption which in turns will lead to overestimate metrics of financial protection. The evidence in this paper comes from data collected as part of an individual module with a lot of detailed information about the admission being asked before asking about corresponding OOPs, including on the type of reasons leading to the admission spell. The effect of the recall period on household inpatient OOPs might differ without such prompting.

Yet, this study has several limitations. First, in our design, hospital records were considered as a gold standard. However, we managed to obtain the records from only the main provider for inpatient services within study area. Practically, patients could use inpatient services outside of the study hospital by going straight to or being referred to higher-level hospitals. In such cases,

we did not acquire data for validation. In addition, the hospital records may not include all OOPs incurred by inpatients for the illness episode that required the hospitalization. Another limitation of this approach is that the questions asked respondents to aggregate all expenses related to inpatient transactions. Consequently, for expenses related to one hospital admission episode that the households incurred at other health facilities or pharmacies were not captured by the hospital records. This factor may at least partially explain why households reported higher OOPs than provider. Our sample consisted of households having at least one inpatient sampled from hospital records. Households with higher OOPs per inpatient transaction may be more likely to remember illness events. Therefore the overall estimates for telescoping and failing to recall may be smaller than those among lower cost transactions in the general population. A potential bias is that 6- and 12-month recall periods may have extended into different seasons of the year. Another potential shortcoming of this study is the matching strategy. The recording system in Vietnam did not include a unique identification number of patients for linking household to hospital records. Thus the only strategy that was feasible for the setting was using demographic characteristics of the inpatient such as full name, gender, resident commune, age range and the date of service. We considered the matched pair with the minimum difference of reported service date between household and hospital as the right match. This practice might have impact on the result of telescoping in term of the actual month of the transaction. However, we think it is unlikely that it had a substantial impact on the recall period since the majority of transactions had a small number of days difference.

3.6 Conclusion

The study was designed to investigate the effect of 6- and 12-month recall periods on the estimated inpatient OOPs and explore the underlying mechanisms for any differences. Overall, households reported higher values of OOPs compared to the provider. There was no evidence of an effect of recall period on the mean ratio between household and provider OOPs, although the confidence intervals were not inconsistent with previous studies suggesting greater reported OOPs for shorter recall periods. Respondents tended to remember the timing of the inpatient stay well, recalling 70% of events in the correct month. The 12 month recall period had a higher risk of failing to recall an event compared to the 6 month recall period.

The results suggest the best recall period may depend on whether the purpose of a survey is for the recall of the timing of events, in which case the 6 month period may be better, or the amounts of OOPs, in which case there was no significant difference and the provider records are not a

gold standard but the 12 month period had a tendency to be in closer agreement with the provider OOPs.

3.7 Supporting information

S1 Fig. Mean square error of montly household and provider OOPs by categories of provider OOPs

S1 Table. Characteristics of respondents

S2 Table. Arithmetic mean if monthly OOPs separately for provider and households with/without medicine costs by two categories of provider OOPs

S3 Table. Contribution to total annual household and provider OOPs by version and level of provider OOPs

S4 Table. Mean bias and variability in measurement of OOPs with medicine costs by recall period (including medicine costs)

S5 Table. Effect of recall period on the risk of the reported OOP value for transactions being greater or less than the provider OOP amount (including medicine costs)

S6: Structure of health expenditures questionnaires at individual level for inpatient care

3.8 Acknowledgement

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4. CHAPTER FOUR: A comparison of face-to-face and mobile phone data collection for estimating out-of-pocket payments

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4.1 Abstract

Background: Household surveys have been the most common source of data for estimating household out-of-pocket payments (OOPs) in National Health Accounts, especially in developing countries. However, conducting those surveys are expensive to conduct every year resulting in the non-regularity of data. The use of mobile phone as a mean of data collection may cut costs and time. We compare and validate the reported OOPs generated from the face-to-face and mobile-phone surveys using provider data.

Method: A cross-sectional survey collected self-reported OOPs from 3531 households in Bavi district, Vietnam between June 2017 and April 2018. We applied both community and provider sampling approaches. Households were randomly assigned to the two data collection methods within two sampling groups. We compared the mean annual OOPs for different spending categories and estimated the ratio of expenditures between the two methods. For inpatient visits, we were able to link the inpatient transactions reported by households with the corresponding ones in hospital records for validation. The Bland-Altman method was used to estimate agreement between inpatient OOPs reported by households and the public hospital, and the level of agreement compared between the two data collection methods.

Results: The proportion of households reporting expenses in the mobile-phone survey was similar with the face-to-face survey for most spending categories in the provider sample but was fluctuated in the community sample due to different sample size. There was no consistent pattern of the ratio of mean household OOPs by spending categories in both sample groups. In the community sample, the ratio of the mean annual total OOPs between the mobile phone and the face-to-face survey of both households with utilization and all households were significantly at 1.3 (1.1- 1.5) and 1.5 (1.2 – 1.8). No significant evidence of the difference between two methods in estimating inpatient OOPs was found the in validation analysis for provider sample.

Conclusions: The study suggested that the mobile phone survey is an acceptable alternative method for estimating OOPs for inpatient care.

Keywords: data collection method, mobile phone interview, face-to-face interview, out-of-pocket expenditures, Bland-Altman, Vietnam

4.2 Introduction

Out-of-pocket payments (OOPs) are direct payments that patients or customers pay to health care providers when receiving health services. OOPs have been a dominant source of health financing due to the relative lack of prepayment mechanisms in many low-middle income countries (LMICs) [7-9]. Like other LMICs, Vietnam has been facing difficulties in offering affordable health care for citizens, especially the poor and vulnerable. With the initiation of user fees for services in 1989 [14], OOPs remains persistently high, ranging from 50% to 70% of total health expenditures [9, 14, 17-19]. These expenditures are a significant burden on household resources [13, 14, 22]. Therefore, measuring OOPs is important for tracking financial risk protection in health and monitoring the country progress of universal health coverage.

Household surveys are the dominant source of data for out-of-pocket health expenditures in many LMICs [28, 32, 73]. The surveys are carried out using face to face questionnaires and are expensive and time-consuming to conduct. In addition, the data collected by household surveys typically takes a long time to be processed and become available. There is a need for developing alternative tools that cut costs and time for collecting data for estimating OOPs.

The collection of data in surveys has undergone a transformation. Together with the growth of technology, access to inexpensive mobile phones and mobile network coverage has substantially increased in LMICs. This has raised interest in the potential use of the telephone as an alternative mode of data collection in household surveys. Several studies have compared telephone and face-to-face surveys in terms of the quality of data (response rate, completeness of questionnaire), the time and cost-effectiveness [37, 38, 74-80] and favored the use of telephone interview for data collection. To best of our knowledge, no study has conducted validation to assess the accuracy of the information collected between a face-to-face and a mobile phone survey for household health expenditures. To address this gap, this study reports a cross-sectional survey comparing the two modes of data collection for health expenditures. The OOPs estimates generated from two methods were compared to provider data for validation.

4.3 Methods

4.3.1 Study setting

The study was implemented in Bavi District, Hanoi, Vietnam. Bavi District is a northern rural district with 32 communes and an estimated population of 270,000. The district has a variety of health facilities including one public hospital, three poly-clinics, 32 commune health centers (CHC) and about 600 private providers and drugstores. CHCs are primary-level providers responsible for basic outpatient care, preventive care and medicines, health promotion and education. While the public hospital and three poly-clinics are authorized to service inpatient care, outpatient care, preventive care, most of the private health providers provide either outpatient care, medicines or both. The Filabavi Health and Demographic Surveillance System (HDSS) site was established in 1998 in Bavi district to conduct surveillance for basic health data and socio-economic status of household and to serve as sampling frame for community health research and training [59, 60].The population under HDSS, which accounts for 15% of Bavi population, is approximately 38,000 inhabitants with 8,000 households residing in 11 communes.

4.3.2 Study design

Study instruments

This research was part of a methodological project on household out-of-pocket health expenditures measurements (iHOPE project). The main objective of the iHOPE project was to develop alternative instruments based on the existing national survey instruments, with the aim at improving the measurement of OOPs.

In this study, we developed two survey instruments with two different modes of data collection named Household Health Survey (HHS) – the face-to-face survey and Survey of Wellbeing via Instant and Frequent Tracking (SWIFT) – the mobile phone survey by adapting from Vietnam Household Living Standard Survey 2014 (VHLSS 2014) and the revised Classification of Individual Consumption according to Purpose 2018 (COICOP 2018).VHLSS 2014 is a national cross-sectional survey that conducted since 1992 to present by General Statistics Office of Vietnam. In this study, VHLSS 2014 served as the platform to develop the two study instruments. COICOP 2018 is a classification developed by United Nations Statistics Division to classify and analyze individual consumption expenditures spent in households and general government according to their purpose. It is mainly used for consumer price indices and household budget survey. In household budget survey, COICOP consists of 12 divisions and health is sixth division that categorizes into three sub-division: (i) medical products, appliances and equipment; (ii) outpatient services; (iii) hospital services. A list of 11 health items drawn

from the health division of COICOP 2018 was integrated into the household health expenditures module of the two instruments and the data generated from this module of the two instruments were compared and validated in this study.

Household Health Survey (HHS) – The face-to-face survey

The HHS has two components: (i) household questionnaire and (ii) individual questionnaire. The structure of the HHS – Household level questionnaire partially follows the structure of VHLSS 2014. Because the study was a part of a larger project (iHOPE project), the household health surveys were developed as a multi-purpose survey to address other project objectives related to the choice of recall period and the specificity of non-medical items. Therefore, there were four alternative versions of each questionnaire. In the HHS, the health expenditures module were had two alternative recall periods and in the household non-medical expenditure module, there were two alternative sets non-medical items covering the same information but aggregated at two different levels. Thus, we had four versions of the household health survey questionnaire (S1 Fig).

SWIFT survey – the mobile phone survey

A set of questions on household health expenditures that were the same for the household-level health expenditures module of the face-to-face survey was also incorporated in the SWIFT survey (Appendix 4). Besides this main objective, similarly to the face-to-face survey, the household health expenditures module had two alternative recall periods. Thus, there are two versions of the SWIFT survey in total (S2 Fig).

In order to make it easier to follow, in the later part of this study, the terms "face-to-face survey" and "mobile phone survey" were used referring to the household health survey and the SWIFT survey, respectively.

Sampling approaches

Households were selected using two different sampling methods, community and provider sampling. For community sampling, households registered with the HDSS at the five communes were randomly selected for interview. The five communes cover all geographical characteristics of the district (low land, high land and mountainous).Provider sampling was used to ensure a sample with sufficient utilization for the rarer inpatient episodes. From the hospitalization records of the district public hospital, a list of individuals who had been

admitted to the hospital with information on full name, sex, age, resident commune, admission date was produced. Field surveyors with the help from village health workers identified the households having at least one person with a hospital admission in the list to recruit for interview. Households enrolled for the inpatient interviews could be from any of communes of Bavi district (except for the 5 communes selected for community sampling) and do not necessarily belong to the HDSS.

Within each sampling method, households were randomly assigned into either the face-to-face or the mobile phone survey (together with recall period and number of non-medical item).

Sample calculation

The sample sizes were calculated for the two sampling methods separately. We wished to estimate agreement between household and provider data for each questionnaire versions of both data collection methods. The sample size for each version was based on the suggestion of the Bland-Altman approach to analysis that 100 observations are sufficient when assessing agreement [63].

Sample calculation for community sampling group

The sample size needed to be large enough to capture 100 households with health care utilization.. From the census of Filabavi HDSS, 44% of households incurred out-of-pocket health expenditures for outpatient services over 4 weeks. We assumed that the proportion of household incurring outpatient spending within 4 weeks was similar.. We assumed that 10% of households would not respond, and for 20% we would be unable to link to the provider data. Each data collection method would need 295 households with the longer recall period (4 weeks) and 394 households with shorter recall period (2 weeks). This resulted in the target sample size of 689 households. However, besides the specific objective of this study, the larger project also tested the other objectives (the choice of recall periods, the specificity of non-medical items). Thus, in the end, we came up with the total project sample size of 2067 households (S2 Table).

Sample calculation for provider sampling group

The provider sampling recruited households for interview if they had at least one inpatient transaction in the hospital records. Using the suggestion for Bland-Altman approach to assess the agreement of 100 households per group, the target sample size at least 200 households.

Similar to the community-based sample, the iHOPE project had additional objectives and so the total project sample size was 1300 households (S2 Table).

4.3.3 Data collection

Household data collection:

The household data collection lasted for 6 months (from June to Nov 2017) for the community sampling group and for 8 months (Sept 2017 – April 2018) for the provider sampling group. For the face-to-face survey, interviewers conducted the whole survey in person at the household using electronic questionnaires in tablets.

For the mobile-phone survey, the data collection method followed the SWIFT approach and technical guidelines from World Bank [65]. First, field surveyors visited households to get their consent on participating in the mobile phone survey, their phone numbers and basic information on the household roster by tablets. The information was uploaded to the Commcare server for the mobile phone interviews that were scheduled for 2 weeks later. A call center was set up in the Filabavi HDSS office. A program was developed to automatically schedule the time for calling home-visited households. The mobile phone interviewers downloaded the household information from the server and received notifications when the time for calling the households came.

Provider data collection:

The provider data were generated from the recording system of the district hospital. We obtained all patient records for inpatient services. The information available in the hospital records included: patients name, gender, age, address, hospital admission and discharge date, duration of inpatient stay, diagnosis, health insurance status, expenses on medical fees, drugs, diagnostic tests, surgery, total expenditures, total expenses paid by patient to the hospital (i.e. out-of-pocket health expenditures), and total expenses covered by health insurance. At first, we obtained only the identifier information (name, age, gender, address, admission date) from hospital records to identify the inpatients for households' recruitment. After the household survey was completed and the work on linking household data with hospital data was done, the rest of information of the linked individuals was given to us by the hospital.

4.3.4 Matching procedures for the provider sampling

Matching was performed to link transactions reported by the households to those reported by the provider for the provider sampling group. Households were asked to report all inpatient services utilized and the out of pocket payments used by of all household members within the recall periods. Before matching, all out-of-pocket payments related to services that were not provided by the hospital included in this study were excluded. Matching was conducted based on demographic characteristics of inpatient which included full name, gender, resident commune and age. Thus, only households that reported at least one member with inpatient transaction were selected for matching. Therefore, if a household did not report any member with inpatient transaction within the recall period, it was excluded.

Matching was carried out for each person in a household who had a hospital admission. We used health expenditures at the household level, thus a household was included for assessing agreement if all inpatient transactions of that could be linked to provider records. Out-of-pocket expenditures from individual transactions from hospital records were aggregated for each household accordingly.

Then, the next step was narrowing down to the right match by applying restricting the age difference for the inpatient between the provider and household records (a window of seven-year difference in age between household and provider data was considered acceptable) and the interval between date of service reported by households and provider service (services had to be delivered before interview date and within 450 days for 12-month recall, 270 days for 6-month recall). The step was conducted to ensure the inpatient was recruited correctly given the possibility of recruiting the wrong inpatient with the same full name in the same commune.

Matching was only carried out for inpatient care because the abundant number of providers, mostly private ones for outpatient care and medicines in this district (>600) made it impossible to acquire the sufficient data from provider for conducting matching for community sampling group. In addition, it was also impossible to conduct validation approach for community sample because the sample was not sufficient enough for validation given that 10% of the community sample used inpatient care within the recall period and less than 30% of them were linked with hospital data, for validation.

4.3.5 Data analysis

We used two approaches. The first was a comparison of the reported OOPs for face-to-face and mobile phone surveys. We calculated the mean annual OOPs for all households and for households that utilized healthcare for each spending category and for the total. The ratio of the mean OOPs for mobile phone compared to face-to-face surveys was calculated and the confidence interval for the ratio was estimated using bootstrapping.

The agreement between the reported and provider OOPs could be assessed for the inpatient OOPs. We linked each inpatient transaction reported by the households with their corresponding hospital records. The OOPs were aggregated at the individual household level. Due to data constraints which made it impossible for linking outpatient care and inpatient care of community sample, we only conducted validation for inpatient data from the provider sampling groups.

We used a Bland-Altman approach to first describe the level of agreement between household-reported and provider-reported OOPs for each data collection method [63]. We calculated the mean ratio of household OOPs to provider OOPs to estimate the overall bias and quantified the variability using the 95% limits of agreement, the limits in which we expect 95% of individual ratios to lie.

We investigated whether the mean bias was not overly influenced by large ratios from very small OOPs caused by stochasticity by plotting the ratio against provider OOPs. We found that for very low provider OOPs, the ratios were very variable. To avoid the large variability in ratios for these transactions overly influencing the results, we carried out the analysis in two groups of provider OOPs (1) households with OOPs from provider less than or equal to 200 thousand VND (USD 8.8 – (the low OOPs group); (2) households with OOPs from provider greater than 200 thousand VND (USD 8.8 – the high OOPs group).

We compared the agreement of household and provider data for mobile phone and face-to-face surveys. The amounts of OOPs was annualized to remove the potential effect of recall period. We followed Bland-Altman [63] by fitting a regression model with the log-transformed ratios as the outcome variable and the data collection method as an explanatory variable, adjusting for recall period. This provides an estimate of the effect of the data collection method on the mean bias. We also estimated the effect of data collection method on variability. We fit a regression model with the residuals of the previous regression model as the outcome and

include data collection method as an explanatory variable, again adjusting for recall period [63]. We included a random effect in both models to account for the clustering of the households. Data were analyzed using Stata version 15.

4.4 Results

4.4.1 Description characteristics of two samples

In community sample, we interviewed 1375 households in person and 638 households via mobile phone. Among them, 1030 (75%) and 548 (85%) households reported using at least one type of health care services within the recall periods from the face-to-face and the mobile phone interview, respectively. In provider sample, we recruited and interviewed 1421 households in person and 97 households via mobile phone. The health care utilization rate was higher in this group with 1408 (99%) households in the face-to-face survey and 97 (100%) households in the mobile phone survey having at least one utilization of any health service (Table 4.1).

Table 4-1: Proportion of households using services

	Face-to-face interview		**Mobile phone interview**	
Community sampling				
	N	%	N	%
# of HHs interviewed	1375	100	638	100
# of HHs used services with expenses	959	69.7	519	81.4
Inpatient care	192	14.0	152	23.8
Preventive care	214	15.6	111	17.4
Outpatient care	365	26.5	401	63.0
Medicines	568	41.3	193	30.3
Medical products	3	0.2	3	0.5
Assistive products	8	0.6	13	0.2
# of HHs utilized services without expenses	71	5.2	29	4.5
# of HHs did not utilize	345	25.1	90	14.1
Provider sampling				
# of HHs interviewed	1421	100	97	100
# of HHs usedservices with expenses	1375	96.8	97	100
Inpatient care	1271	89.4	86	88.7
Preventive care	275	19.4	15	15.5
Outpatient care	449	31.6	66	68.0
Medicines	391	27.5	36	37.1
Medical products	2	0.1	0	0.0
Assistive products	20	1.4	0	0.0

# of HHs used services without expenses	33	2.3	0	0.0
# of HHs did not used	13	0.9	0	0.0

The demographic characteristics of households with utilization were similar in face-to-face and mobile phone surveys in all groups of households (Table 4.2). Characteristics of heads of households identified from inpatient provider records were also similar for most characteristics of those of all households.

Overall 75% of the heads of households were males and more than 80% of them were married. Approximately 60% of household heads were between 20 and 60 years old, and about 80% had finished secondary school or above. The heads of households recruited via inpatient hospital records had a higher proportion who finished high school or above and a lower proportion were farmers compared to those from community sampling (Table 4.2).

Table 4-2: Demographic characteristics of heads of households with health care utilization

	All households				Matched households	
	Community sampling		Provider sampling		Provider sampling	
	Face-to-face interview	Mobile phone interview	Face-to-face interview	Mobile phone interview	Face-to-face interview	Mobile phone interview
	n (%)	n (%)	n (%)	n(%)	n (%)	n (%)
Total number of households	1030	548	1408	97	896	79
Sex						
Male	788 (77)	436 (80)	1064 (76)	77 (79)	670 (76)	62 (79)
Marital status						
Married	820 (80)	461 (84)	1162 (83)	79 (82)	738 (83)	63 (81)
Age group						
20-59	690 (67)	402 (74)	883 (63)	58 (60)	558 (63)	48 (62)
60 – 69	178 (17)	94 (17)	291 (21)	22 (23)	188 (21)	16 (20)
70 – 79	94 (9)	34 (6)	148 (11)	12 (13)	92 (10)	10 (13)
80+	64 (6)	16 (3)	79 (6)	4 (4)	54 (6)	4 (5)
Education						
Illiterate or read/write	33 (3)	6 (1)	47 (3)	4 (4)	35 (4)	4 (5)
Primary school	167 (16)	68 (12)	162 (12)	7 (7)	103 (12)	6 (8)
Secondary school	603 (59)	329 (60)	744 (53)	47 (49)	447 (51)	37 (47)
Highschool and above	223 (22)	145 (26)	444 (32)	39 (40)	301 (34)	32 (40)
Occupation						
Farmer	510 (50)	287 (52)	362 (26)	26 (27)	231 (26)	25 (32)
Manual workers	196 (19)	109 (20)	423 (30)	25 (26)	269 (30)	20 (25)
Business	109 (10)	62 (11)	140 (10)	8 (8)	90 (10)	7 (9)
Retired/Elderly	117 (11)	47 (9)	233 (17)	23 (24)	152 (17)	17 (21)
Homework	41 (4)	18 (3)	88 (6)	7 (7)	53 (6)	4 (5)
Other	57 (5)	25 (5)	162 (11)	7 (7)	101 (11)	6 (8)
Religion						
None	999 (97)	535 (98)	1386 (99)	95 (99)	884 (99)	77 (99)
Catholic	28 (3)	11 (2)	10 (1)	1 (1)	7 (1)	1 (1)
Household size (n (%)						
1 person	47 (8)	12 (2)	108 (8)	6 (6)	82 (9)	5 (6)
2-5 persons	418 (72)	404 (74)	1031 (74)	69 (71)	650 (73)	55 (70)
>= 6 persons	115 (20)	132 (24)	262 (19)	22 (23)	160 (18)	19 (24)
# HH having children under 6	328 (32)	194 (36)	673 (48)	53 (55)	406 (45)	32 (40)
# HH having person above 65	332 (32)	161 (29)	508 (36)	33 (34)	329 (38)	27 (34)

4.4.2 Comparison of health care utilization and expenditures by spending categories across two methods

Distribution of household OOPs by spending categories

In general, the proportion of households reporting expenses in the mobile phone survey was similar for most spending categories to the face-to-face survey. The results fluctuated more for households recruited via community sampling compared to provider sampling due to sample size. Outpatient care witnessed a proportion of households reported to have incurred OOPs in mobile phone survey twice as high as that in the face-to-face survey with both sampling approaches. We investigated whether characteristics of the transactions differed by mobile phone or face-to-face survey. The mobile phone survey captured a higher proportion of transactions with a small value of OOPs and a lower proportion of transactions exempted partially or all compared to the face-to-face survey. The proportion of households reported services with expenses was naturally higher for the provider sampling than household sampling, regardless of to which data collection method they belong (Table 4.1).

Mean annualized OOPs reported by households

In general, the mean annual OOPs of all households were higher for the mobile-phone interview than the face-to-face interview for all spending categories and for total in both sampling approaches, except for preventive care which only had higher mean annual OOPs in the community sampling. For households with utilization, there was no consistent pattern of the ratio of mean household OOPs by spending categories. In the community sampling, the mean annual total OOPs of both households with utilization and all households were significantly higher at the ratio of 1.3 (1.1- 1.5) and 1.5 (1.2 – 1.8) respectively in the mobile-phone compared to the face-to-face survey (Table 4.3).

Table 4-3: Arithmetic mean annual OOPs by data collection methods (USD, 2017)

	All households					Households with utilization				
	Face-to-face		Mobile phone			Face-to-face		Mobile phone		
Spending category	No of HHs	Mean annual OOPs & CI SE	No of HHs	Mean annual OOPs & SE	Estimate ratio of mean annual OOPs & CI*	No of HHs	Average annual OOPs & SE	No of HHs	Average annual OOPs & CI	Estimate ratio of average annual OOPs & CI*
Community sampling										
Inpatient care	1375	65 (43-87)	638	102 (74-130)	1.6 (0.8 – 2.3)	229	391 (266-515)	175	372 (280 - 464)	0.95 (0.6 – 1.3)
Preventive care	1375	17 (12 -21)	638	29 (19 -39)	1.7 (0.96 – 2.5)	316	73 (55 - 92)	202	92 (63 - 121)	1.3 (0.8 – 1.8)
Outpatient care	1375	106 (82-129)	638	194.5 (162 – 227)	1.8 (1.3 – 2.4)	398	365 (288 - 442)	418	297 (250 - 344)	0.8 (0.6 – 1.03)
Medicines	1375	104 (87-120)	638	107 (76-137)	1.03 (0.7 – 1.4)	586	243 (207 - 279)	197	346 (255 - 436)	1.4 (0.99 – 1.9)
Total OOPs	1375	292 (255-328)	638	436 (378 -494)	1.5 (1.2 – 1.8)	1030	389 (341 - 437)	548	508 (442 - 574)	1.3 (1.1 – 1.5)
Provider sampling										
Inpatient care	1421	162 (139- 184)	97	250 (130 – 370))	1.5 (0.8 – 2.3)	1364	169 (145 - 192)	88	275 (144 - 407)	1.6 (0.8 – 2.4)
Preventive care	1421	31 (-6 – 68)	97	22 (3 -40)	0.7 (0 – 2.3)	560	78.5 (-14 – 172)	45	47.3 (7 - 87)	0.6 (0 – 1.9)
Outpatient care	1421	120 (96 - 145)	97	170 (100 - 240)	1.4 (0.7 – 2.1)	496	345 (277- 412)	67	246 (150 - 342)	0.7 (0.4 – 1.01)

Medicines	1421	107 (78 - 137)	97	143 (64 – 221)	1.3 (0.5 – 2.2)	406	376 (278 - 474)	37	378 (190 - 566)	1.0 (0.4 – 1.6)
Total OOPs	1421	421 (362 - 480)	97	586 (396 - 776)	1.4 (0.9 – 1.9)	1408	425 (365 - 485)	97	586 (396 - 776)	1.4 (0.9 – 1.9)

*The ratio of the mean OOPs for mobile phone compared to face-to-face surveys

4.4.3 Effect of data collection method on the agreement between household and provider OOPs

Table 4-4: Mean bias and variability in measurement of inpatient OOPs by data collection method

	Data collection method	**Number of households**	**Mean bias (ratio)**	**95% limits of agreement**	**Estimated ratio in bias (Mobilephone vs Face-to-face) & CI & p-value**	**Estimated ratio in SD (Mobilephone vs Face-to-face) & CI & p-value**
All matched households	Face-to-face	896	72.8	0.13 - 40033		
	Mobile phone	79	79.7	0.13 - 48834	1.2 (0.6 – 2.5) ; p = 0.59	1.04 (0.8 – 1.4) ; p = 0.82
Matched households with provider OOPs <= USD 8.8	Face-to-face	578	521	6.5 - 41835		
	Mobile phone	46	671	7.6 - 59045	1.45 (0.76 – 2.79); p =0.26	1.17 (0.75 – 1.82) ; p = 0.7
Matched households with provider OOPs > USD 8.8	Face-to-face	318	3.36	0.5 – 23.6		
	Mobile phone	33	4.08	0.2 - 92	1.28 (0.89 – 1.85) ; p = 0.18	1.68 (1.33 – 2.12); p < 0.01

The geometric mean ratios of the individual household to provider OOPs indicated that the reported OOPs were greater for the mobile phone survey than for face-to-face in general (Table 4.4). The comparison of the bias between face to face and mobile phone surveys found no evidence of a significant difference, however the estimates are consistent with the results of the previous analysis in that the direction is towards a slightly higher bias in the mobile phone group (Table 4.3). With the assumption that all recruited households were the correct households, we conducted sensitivity analysis which included all households that did not report any inpatient transaction and considered the household OOPs of those households were zero. We found the same results (S5 Table). Taken together, the analyses suggested that higher mean OOPs reported by mobile phone cannot be ruled out, but that the size of any increase is likely to be small.

4.5 Discussion

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes [81]. Mode of data collection referring to how the questionnaire is administered to the respondent (for example, mail, in person, or diary), is one of four primary sources of measurement error along with the questionnaire, the respondent and the interviewer [82]. Respondents may answer questions differently in the presence of an interviewer, by themselves, or by using a diary. The selection of the data collection mode is a complex decision related to a number of factors including the goals of the study, the expected quality of the data, funds available for the study, the questionnaire structure, the study population, and the administrative and staff resources.

In this study, we compared and validated the two modes of data collection for health expenditures to examine whether the mobile-phone survey could be an alternative tool for collecting data for estimating household OOPs. Overall, compared to the face-to-face survey, the mobile-phone survey tended to yield annual OOPs for all spending categories in the direction of being higher, but the differences were not significant Findings indicated that total annual OOPs estimate was significantly higher for mobile-phone survey in the community sampling, but no evidence of an impact was observed in the provider sampling. Results from Bland-Altman analysis demonstrated no evidence of a difference in the accuracy of the inpatient OOPs estimates from the two data collection methods. Taken together, this suggests that the mobile-phone survey could be an alternative tool that could be integrated into the VHLSS and

conducted in the interval between two national surveys to provide data for estimating OOPs for spending categories, particularly inpatient services in the regular basis.

Mobile phone interview can serve as real-time basis data collection method in the case of emergency such as disease outbreak, bushfire or disaster[37] where it is difficult and dangerous for surveyors to reach the households. Moreover, aside from the initial cost (baseline face-to-face survey, equipment, call center set-up, utilities), we think in a surveillance research site or cohort site where households are monitored every month or quarter, the application of mobile phone interview could be a cost-effective method for follow-up household interview of which the questionnaires are structures and focused on only one aspect. From practical insights, the mobile phone survey, which was combined with the face-to-face interview as the first encounter with the households, had very good response rate (93% of community sample and 100% provider sample.

There are some limitations of the study. Even though the study had data from two sampling approaches, due to practical constraint of recording system in Vietnam, we were only able to conduct matched analysis for validating inpatient OOPs of provider sampling. Thus, further studies on investigating the impact of data collection methods on OOPs estimate of other spending categories and total are recommended. The sample size of mobile phone survey in provider sampling was not inadequate enough which reduced the power of the Bland Altman method in assessing the agreement. Because this study was one of several questionnaire modules of a large cross-sectional study, it was impossible to estimate the time and cost of the survey, thus we could not evaluate cost-effectiveness of the method. However, given that the mobile phone survey required fewer surveyors as well as fewer tablets for collecting data than the face-to-face interview, we believe that it is cheaper in terms of cost on data collection and administration if being conducted on a regular basis.

4.6 Conclusion

Mobile phone survey tended to yield higher mean annual total OOPs than the face-to-face interview, but the magnitude was likely to be small. The study indicated that using either the face-to-face or the mobile phone survey did not have a substantial impact on the estimated inpatient OOPs. Findings suggested the mobile phone interview as an alternative method for collecting data for measuring OOPs that conducts in the interval between two rounds of national household surveys. Further studies on investigating the impact of data collection methods on estimates in other spending categories and total OOPs to precisely estimate the impact, and an

assessment of cost-effectiveness, time consuming, response rate and respondents perspective would be beneficial.

4.7 Supporting information

S1 Fig: Structure of household health survey (face-to-face survey)

S2 Fig: Structure of SWIFT survey (mobile phone survey)

S1 Table: Recall periods by spending categories

S2 Table: Sample calculation

S3 Table: Proportion of households with mobile phone

S4 Table: Proportion of transaction with payment characteristics

S5 Table: Sensitivity analysis for mean bias and variability in measurement of inpatient OOPs by data collection method

4.8 Acknowledgment

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4.9 Authors' contribution

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5. CHAPTER FIVE: Disease specific out-of-pocket payments are not be accurately measured in households surveys: a validation study in Vietnam

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This manuscript is in submission process

5.1 Abstract

Background: Out-of-pocket (OOP) is the dominant source of funding for health care in many low-middle income countries (LMICs) and are raised on a voluntary basi. Thus they are directly related to the underlying severity of health conditions in the delivery of health services. Therefore, an important question is therefore to what extent OOP health expenditures contribute to pay for the services that address diseases. The data sources currently used for estimation of OOPs are household surveys. However, in these surveys, information on utilization for health care is not linked to diseases or the list of diseases could be linked is limited. The study experimented a household survey with a module focusing on classification of diseases as the reasons for inpatient care. The study objective is to assess the validity of diseases and OOPs estimates by diseases related to hospital services using both data from the household survey and hospital records.

Methods: We compared the proportions of admissions by diseases reported by households with those of the hospital records to assess the agreement in prevalence of diseases between two data sources. The proportions of OOPs by diseases as a share of annual OOPs from the household survey were compared to those of hospital records. Median of disease-specific OOPs was estimated with and without costs for medications. Logistic regression was performed to predict relationship between some factors and the likelihood of reporting correct disease.

Results: Overall, households and provider shared the similar pattern of diseases. About 71% of admissions of the sample linked between household and provider had diseases agreed with those of in provider records. Reproductive health was the main driven of OOPs reported by both provider and households. We observed the similarity of the distribution of OOPs across diseases from households regardless of estimating OOPs with or without medicines expenses. Findings indicated the proportion of OOPs for diseases was mostly driven by some admissions with large amount of OOPs. Results from logistic regression reflected that the availability of discharge summaries, the respondent's recall of diseases, the respondent reporting himself/herself, gender and marital status of the respondent and the inpatient treatment period were associated with the probability of recalling the correct diseases.

Conclusions: Estimating disease-specific OOPs using information collected from household survey is challenging. The study provided evidence for household survey design improvement to obtain accurate information for measuring OOPs.

5.2 Introduction

Private payments in the form of out-of-pocket (OOP) have been the dominant source of funding for health care, particularly in the low-middle income countries (LMICs) due to the lack of both prepayment mechanisms and pooling resources [6-8, 14, 23, 45-48]. In Vietnam, the share of household out-of-pocket (OOP) payments for health , despite its decrease in recent years, is still very high and accounts for some 45-55% of total health expenditure [6-8, 14, 23, 45-48]. OOPs are inequitable, regressive and can be a source of financial hardship because they depend exclusively upon household's capacity to pay and payments required are directly related to the underlying severity of health conditions in the delivery of health services. As a financing scheme for the purpose of mobilising and locating money within the health system, OOPs have important limitations as funds are raised on a voluntary basis (depends on willingness to pay) and there can be no redistribution (inter-personal pooling of fund is not possible). From both an equity perspective as well as a resource allocation perspective, an important question is therefore to what extent OOP health expenditures contribute to pay for the services that address diseases [49, 50]?

Many studies on disease-specific health spending in LMICs have a good recording health system using linked administrative data from provider to estimate health accounts [32, 51]. However, similar linked data is not available in most LMICs due to the limited recording system. In Vietnam, the data sources currently used for estimation of OOPs for national health accounts is Vietnam Household Living Standard Surveys (VHLSS) [83]. In the VHLSS, there is a separate health care module asking about health seeking behaviour, health care utilization and related OOPs. There is some information on reasons to use services, but unlike other surveys these are linked to the type of care received (e.g. preventive, curative) rather than the type of disease. It is therefore not possible to estimate disease specific OOPs. In other countries, information on utilization of services is sometimes linked to diseases but the list is limited and does not cover the main categories of communicable and non-communicable diseases the population is exposed to. Realizing the challenges to map OOPs to diseases in household surveys and in Vietnam, a survey questionnaire was developed for household health surveys with a module on utilization of services linked to broad categories of diseases that could be mapped to the 2011 System of Health Account (SHA 2011) [49, 50]. Information on OOPs across diseases was collected from a sample of individuals who had been hospitalized over the

past 15 months and their answers compared to the hospital's records to assess the validity of diseases and OOPs estimates by diseases related to hospital services.

In addition to the primary objectives, we explored factors associated with the agreement in diseases between households and provider. The examined factors included the respondents report themselves; the recall period; the availability of discharge forms; the respondents 'recall of diseases; treatment period, gender and marital status of respondents. From existing literature review, respondent is one of the four primary measurement errors of household surveys along with the questionnaires, the data collection method and the interviewer [73, 82]. Thus, respondent selection is critical when conducting interview. In the study, we tested whether the likelihood of reporting a correct disease increase when the respondent reports his/her own inpatient admission. Another aspect related to respondent is recall period. When time period intervening between an event and the survey increases, respondents find more difficult to recall the event due to memory fades [84]. Different recall periods have different effect on the respondents' answers [27, 68, 69, 71, 85-87]. We examined whether the longer the recall period was, the less likely the respondents reported diseases correctly. Asking about subjects related to the events is a technique to reduce the recall errors [88]. Thus, the study investigated whether discharge summaries as the memory aid increased the likelihood of reporting a correct disease. Several studies indicated the people remember salient events more accurately [69, 73, 87, 88]. In the context of health care, generally, self-report accuracy increases for inpatient visits compared to outpatient visits. The severity of the sick episodes that contributes to the salience of admission tends to leas to accurate recall [87]. Treatment period, an indicator of the severity was investigated.

In summary, the study attempted to answer two research questions:

1. Can households accurately recall of disease?
2. Can households accurately recall of the amount of OOPs and attribute to diseases?
3. What are the factors of the likelihood of reporting a correct disease in household survey?

5.3 Method

5.3.1 Study design

This cross-sectional retrospective study was implemented in Bavi District, Vietnam. It was part of a methodological study on the measurement of household OOPs in household surveys (the

iHOPE project), which also aimed at testing and validating the choice of the recall period, the comprehensiveness and specificity of OOPs categories as well as the data collection method.

For this focus on distribution of OOPs by disease, an individual level questionnaire was developed linking utilization of inpatient and outpatient services to diseases. The broad categories of diseases were infectious and parasitic diseases; reproductive health; nutritional deficiencies; non-communicable diseases; injuries; non-disease specific; other and unspecified diseases/conditions. For this paper, only information about inpatient care was used as the survey was administered to a sample of individuals selected from the hospital records. Provider sampling was used to ensure the sample size would be sufficient to capture inpatient episodes that are a low probability and infrequent events for the general population. Individual's self-reported information on diseases and related OOPs during an inpatient care treatment was compared with hospital records with the assumption that their records could be used a "gold standard". Under that assumption, the reliability and accuracy of household survey data as source of information for measuring and tracking OOPs by disease for inpatient services can be assessed in Vietnam.

5.3.2 Study setting

The study was conducted in Bavi District, Hanoi, Vietnam. Bavi District is a northern rural district with 31 communes and an estimated population of 282,600 in 2018. There is one public hospital, three poly-clinics, 32 commune health centers (CHC) and about 600 private providers and drugstores. CHCs serve as medical hubs for outpatient care, preventive care and medicines. The public hospital and three poly-clinics provide all types of services including inpatient care, outpatient care, and preventive care. Most of the private health providers provide either outpatient care, medicines or both. This study uses provider records from the public hospital.

5.3.3 Study population and sampling

The study population comprised all households in Bavi district. The households, which were resident in 16 out of 32 communes of the district included in the study, were sampled from the hospitalization records of the Bavi district hospital, the main inpatient care provider. A list of individuals who had been admitted to the hospital with information on full name, sex, age, resident commune, admission date was produced. Field surveyors, with help from village health workers, identified the households that had at least one inpatient in the list to recruit for interview.

The study was nested in a larger project with several research objectives. The target sample size of 1200 households ensured that it could address the objective of this study and other project objectives.

5.4.4 Survey instrument

For this study, a questionnaire for health surveys was developed with two components: (i) Household questionnaire; (ii) Individual questionnaire. This study was based on OOPs collected from the individual level questionnaire. In the HHS, the health expenditures module were randomized by two recall periods, particularly 6-month and 12-month for inpatient services. Thus, in total, we had two versions of household health survey questionnaire.

The household questionnaire was partially adapted from the Vietnam Household Living Standard Survey 2014 (VHLSS 2014). VHLSS is a national cross-sectional survey that has been conducted since 1992 by General Statistics Office of Vietnam. At the household health expenditures module, household members who admitted to hospital were identified for the individual level questionnaires on inpatient services. Similar approach was applied for outpatient and medicines.

At the individual level, the instrument focused on gathering detailed information on all reported overnight stays of the identified household members over the past 6 or 12 months. A series of sequential questions was used to identify reasons leading to the overnight stay. A first screening question would group reasons into five first broad categories. For each broad category more specific questions were asked to map to more specific diseases (e.g. from physical symptoms or physical illness to cardiovascular disease) (Appendix 3).The grouping follows SHA 2011 recommendations and build on different classifications such as the global burden of disease classification**.**

5.3.5 Data collection

Household data collection:

The household data was collected between September 2017 and April 2018. Firstly, the list of inpatient with information on demographic characteristics (name, age, gender, address) and admission date from hospital records was distributed to surveyors to identify and recruit households having at least one inpatient episode within the recall periods. We applied convenient approach that meant the surveyors self-identified households with the help of the village health workers based on their knowledge and familiarity with the clusters. The following interview rules were applied: (1) Interviewers could not inform the households about the precise

inpatient admission that was used to identify the household; (2) The household respondent was first asked about all out-of-pocket health expenditures incurred by the household over the past year using different recall periods for inpatient; (3) For those households reporting OOPs for inpatient care, interviewers asked the household respondent about symptoms or diseases of each inpatient episode. If the households kept patient records or any documents that helped recall the disease, the interviewer would ask permission to consult it and report the diagnosis included in the discharge form, else the interviewer would ask about the diagnosis given by the provider. If not remembered a series of questions on diseases would be used to identify the main condition; (4) Questions about OOPs related to each inpatient episode were asked. First the total amount spent for that inpatient treatment and then disaggregated information to identify if possible amounts spent on medicines for consumption or use during the overnight stay, fees for services of doctors (general and specialized), emergency transportation etc…(Appendix 8). Out of pocket expenditures for inpatient care reported by the household could include payments related to the same episode but from different providers (e.g. medicine purchased outside the public hospital that was needed to receive the inpatient treatment but could not be provided by the hospital). The structure of the questionnaire did not allow to map providers for each specific component of OOPs but the one that is more likely to have been purchased from another provider is medicines and as such some sensitivity analysis to inclusion or exclusion of their OOPs is performed in this paper.

All household surveys were conducted face-to-face using tablets. Survey instruments were programmed into the tablets using the Commcare platform. Trained interviewers were authorized to download the questionnaires into tablets for interviews.

Provider data collection:

The provider data were generated from the recording system of the hospital. We applied retrospective approach and provider sampling, thus at first we obtained only the identifier information (name, age, gender, address, admission date) from hospital records to identify the inpatients for households recruitment. After the household survey was completed and the work on linking household data with hospital data was done, the rest of information of the linked individuals was given to us from the hospital.

The complete information available in the hospital records included: patient name, gender, age, address, hospital admission and discharge date, duration of inpatient stay, diagnosis, health insurance status, expenses on medical fees, drugs, diagnostic tests, surgery, total expenditures, total expenses paid by patient to the hospital (i.e. out-of-pocket health expenditures), and total

expenses covered by health insurance. The hospital used the 10th International Classification of Disease (ICD 10) to classify disease and diagnosis (Appendix 6).

5.3.6 Matching procedures

Households were asked to report all out-of-pocket payments made for inpatient services within the recall period. Before matching, all out of pocket payments related to inpatient admissions that were not provided by the hospital were excluded.

Matching was conducted based on demographic characteristics of inpatient that included full name, gender, resident commune and age. Some households did not report any admission for any household member; they were excluded from the matching analysis. This could have been due to a wrong recruitment or to households not remembering paying for the services they received. Given the design of the questionnaire, it was not possible to check the latter.

Matching was carried out for each person in a household who had at least one hospital admission.

First, we linked each inpatient admission to the hospital records using their last name, middle name, first name, gender and commune. With these criteria, a household inpatient admission could be matched with more than one records from hospital data. Then, we narrowed down to the best match by selecting the matched admissions having the minimum difference in days between household reported date of overnight stay and hospital admitted date. Thus, we had a dataset including linked admissions between households and hospital; and admissions reported by households that were not found in the provider records.

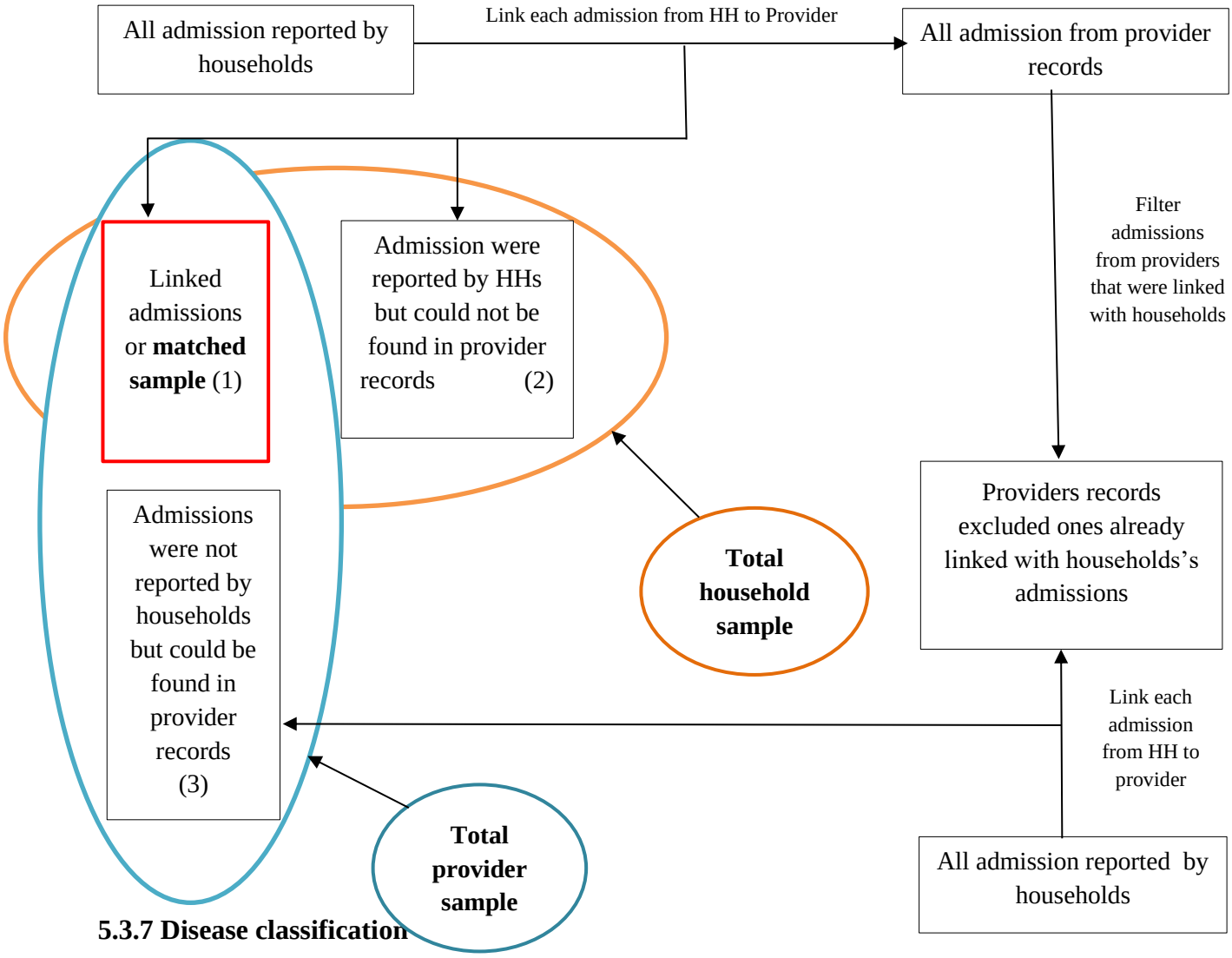
Secondly, we identified admissions recorded in the provider dataset but that the households did not report. We filtered hospital records that had not been previously matched and then, linked each inpatient admission from household data with these records using the same matching criteria.

Thirdly, a full matched inpatient admission data was created by merging the two above data files. The right match was narrowed down by applying restricting the age difference for the inpatient between the provider and household records (a window of seven-year difference in age between household and provider data was considered acceptable) and the interval between date of service reported by households and provider service (services had to be delivered before interview date and within the recall period). We applied these conditions in order to exclude all admissions that could be related to people with the same full name, same gender and lived in the same commune but in different households.

In the end, the final dataset consists of:

1. Linked admissions between households and provider that was named matched sample
2. Admissions that households reported but could not be found in provider records
3. Admissions that households did not reported but were found in provider records.

Figure 5-1: Matching procedures



5.3.7 Disease classification

At household level, information on diseases was gathered by asking about symptoms or referring to common disease's name while in hospital records, diseases were coded according to International Classification of Disease 10 (ICD-10) (Appendix 6). In order to assess the agreement by diseases between households and hospital records, diseases reported by both households and provider had to be converted into a same classification of diseases, i.e. the classification of diseases recommended in System of Heath Account 2011[50] (Annex 5). This

task was conducted by the senior medical doctor that had developed the algorithm included in the individual questionnaire on symptoms and illness.

5.3.8 Data analysis

The study primary objective was to assess the accuracy of diseases and OOPs related to diseases reported by households in a household survey. As a first step, we compared the distribution of survey characteristics and socio-demographic characteristics of the total household sample with the household matched sample in order to demonstrate the similarity between these two samples.

Then, in order to assess the agreement in the diseases driven the admissions, we compared the proportions of admissions by diseases reported by households with those of the hospital records. We plotted the proportion of admissions by diseases the total sample and the matched sample to identify whether the difference in prevalence of diseases was because of the unmatched admission or the admissions not concurred in diseases.

Next, to assess the agreement in amount of OOPs and OOPs attributed to diseases, the proportions of OOPs by diseases as a share of annual OOPs from the household survey were compared to those of hospital records. Out-of-pocket expenditures for inpatient care reported by the household could include payments related to the same episode but from different providers (e.g. medicine purchased outside the public hospital that were needed during the inpatient treatment but could not be provided by the hospital). Thus, we estimated OOPs for inpatient services with and without cost of medicines. We plotted the proportion of disease-specific OOPs of annual OOPs for the total sample, the matched sample and the sample with admissions agreed by diseases with provider in order to compare the distribution of OOPs across diseases. Diseases with proportion of OOPs accounted for at least 5% of the annual OOPs of either provider or households were presented in the graph. The rest were grouped in “Other diseases”. Median of disease-specific OOPs was estimated with and without costs for medications. Logistic regression was performed to predict relationship between some factors and the likelihood of reporting correct disease.

5.4 Results

5.4.1 Description analysis of sample

Matching household and provider records

We successfully recruited and interviewed 1421 households and among them, 1271 households (89%) reported at least one inpatient admission within the recall periods. There were 1593 inpatient admissions reported by households (S1 Table).

Among the 1593 admissions from 1271 households, 1331 admissions (84%) could be linked to the provider – the matched sample; 159 (10%) admissions were not found in the provider data and 103 admissions (6%) were dropped because they did not meet the conditions on the inpatient's age and date of inpatient service (not reported in the table). We found an additional 265 admissions reported by the provider but not recalled by the households (Table 5.1).

In total, we had 1755 admissions from 1229 households. Of these, 1490 admissions reported by 1223 households comprise the total household sample and 1331 admissions from 1106 households comprise the matched sample. (S1 Table)

Table 5-1: Status of matching outcome by admission level

Admission level	**# Admissions that provider reported**	**# Admissions not reported by provider**	**Subtotal**
# admissions that household reported	1331	159	1490
# admissions that household not reported	265	N/A	265
Subtotal	1596	159	1755

Characteristics of two samples

Table 5-2: Distribution of factors that might influence the memory

	Total household sample (N = 1490)	Matched household sample (N=1331)
Discharge form were kept and shown to interviewer	558 (37%)	507(38%)
Diagnosis were remembered by respondent (*asked if above question No/DK*)	803 (54%)	710 (53%)
Respondent is the inpatient	632 (42%)	560 (42%)
Treatment duration (mean)	6.4 (6.2 – 6.6)*	6.4 (6.2 – 6.6)
12-month recall	890 (60%)	798 (60%)
6-month recall	600 (40%)	533 (40%)

*159 admissions could not matched with provider so no information on treatment duration.

Overall, the household sample and the matched sample shared the same pattern of characteristics.

Socio-demographic characteristics

The demographic characteristics of the household respondent were similar between total household sample and the matched household sample. Overall 75% of the household respondents were female and over 80% of them were married. More than 60% of the respondents were between 20 and 60 years old, and about 85% had attended secondary school or above. About 30% of total households reported more than one inpatient admission within the recall period (Table 3).

Table 5-3: Characteristics of household respondents between household sample and matched sample

	Total household sample		**Matched household sample**	
	n	**%**	**n**	**%**
Total number of households	1223	100	1106	100
Gender				
Male	301	25	275	25
Female	921	75	830	75
Marital status				
Married	1007	84	916	84
Age group				
15-19	3	0.2	3	0.5
20-59	802	66.8	724	66.5
60 – 69	221	18	199	18
70 – 79	117	10	107	10
80+	59	5	55	5
Education				
Illiterature to read/write	43	3	41	4
Primary school	131	11	120	11
Secondary school	621	52	559	51
Highschool and above	405	34	367	34
Occupation				
Farmer	460	38	409	37
Office staff	87	7	81	7
Manual workers	194	16	173	16
Business	128	10	115	10
Retired/Elderly	169	14	159	14
Homework	115	9	106	10
Other	70	6	63	6
Religion				
None	1193	99.4	1080	99.4
Catholic	7	0.6	7	0.6

#HHs with more than 1 admission	345	28	331	30

Note: 2% of sample was missing information on household roster. The total household sample included 1223 households with 1490 transactions. Of these, 1106 households had at least one transaction linked to the hospital records forming the matched household sample.

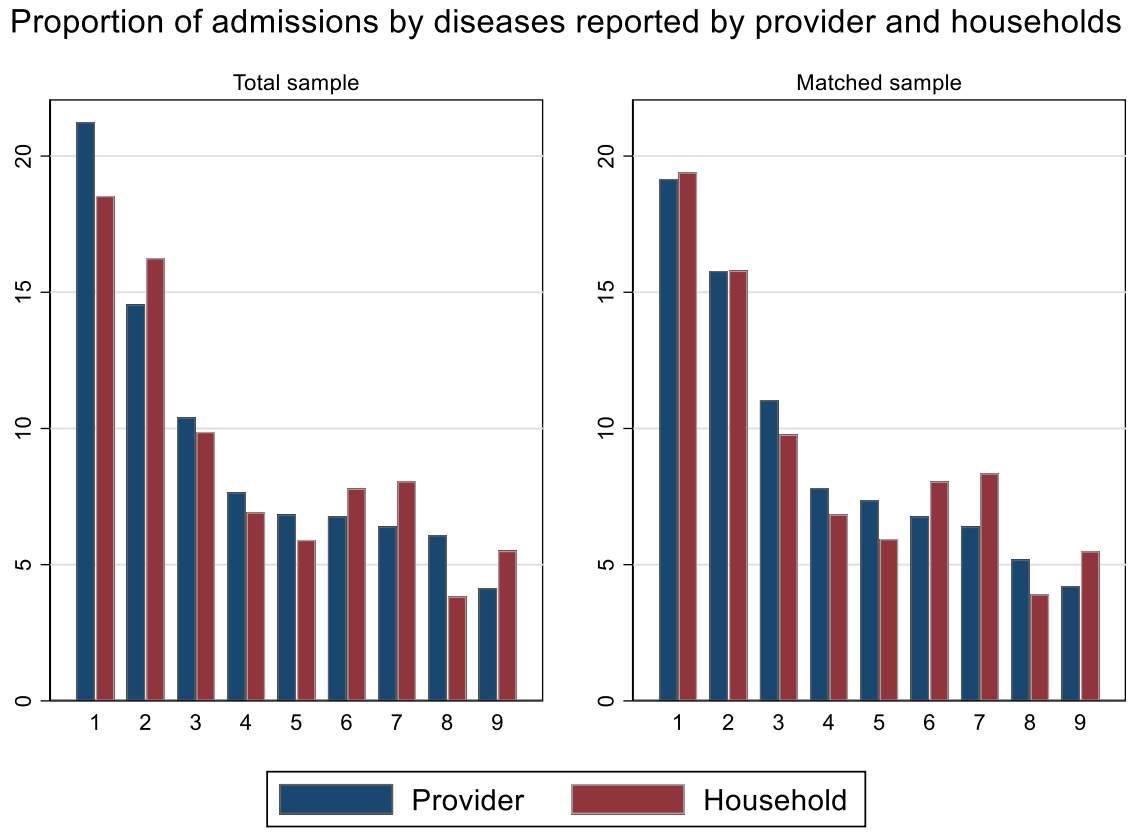
5.4.2 Agreement in diseases and amount between provider and households

Agreement in prevalence of diseases

Of 1106 households in the matched household sample (1331 admissions), there were 817 households (945 admissions) which had at least one admission with the disease classification agreeing with the provider and 289 households (386 admissions) having all transactions disagreeing with the provider.

In general, households and provider shared the same pattern of diseases in both the total and the matched sample. Both provider and households reported respiratory infections, reproductive health and digestive diseases as the top three classification of diseases across two samples. (Figure 2).

Figure 5-2: Proportion of admissions by diseases reported by provider and households



1 – Respiratory infections; 2 – Reproductive health; 3 – Diseases of the digestive; 4 – Other and unspecified non-communicable diseases; 5 – Sense organ disorders; 6 – Other and unspecified infectious and parasitic diseases; 7 – Cardiovascular diseases; 8 – Respiratory diseases; 9 – Injuries

Note: Diseases presented in the figure accounted for at least 5% of admissions reported by either provider or households each sample.

Agreements in amounts of OOPs and OOPs attributed to diseases

Overall, the proportions of admissions by most of diseases reported by provider and households were similar when comparing between the two samples. We observed that the proportions of admissions for respiratory infections, reproductive health from provider and households were different in the total sample, but were similar in the matched sample. It implied the difference in prevalence of the two classifications of diseases between provider and households was driven from the unmatched admissions. For other diseases, no difference in distribution of admissions was observed, which meant the difference in prevalence of these diseases might be driven from the disagreement in diseases between households and provider.

Agreement in amounts of OOPs and OOPs attribute to diseases

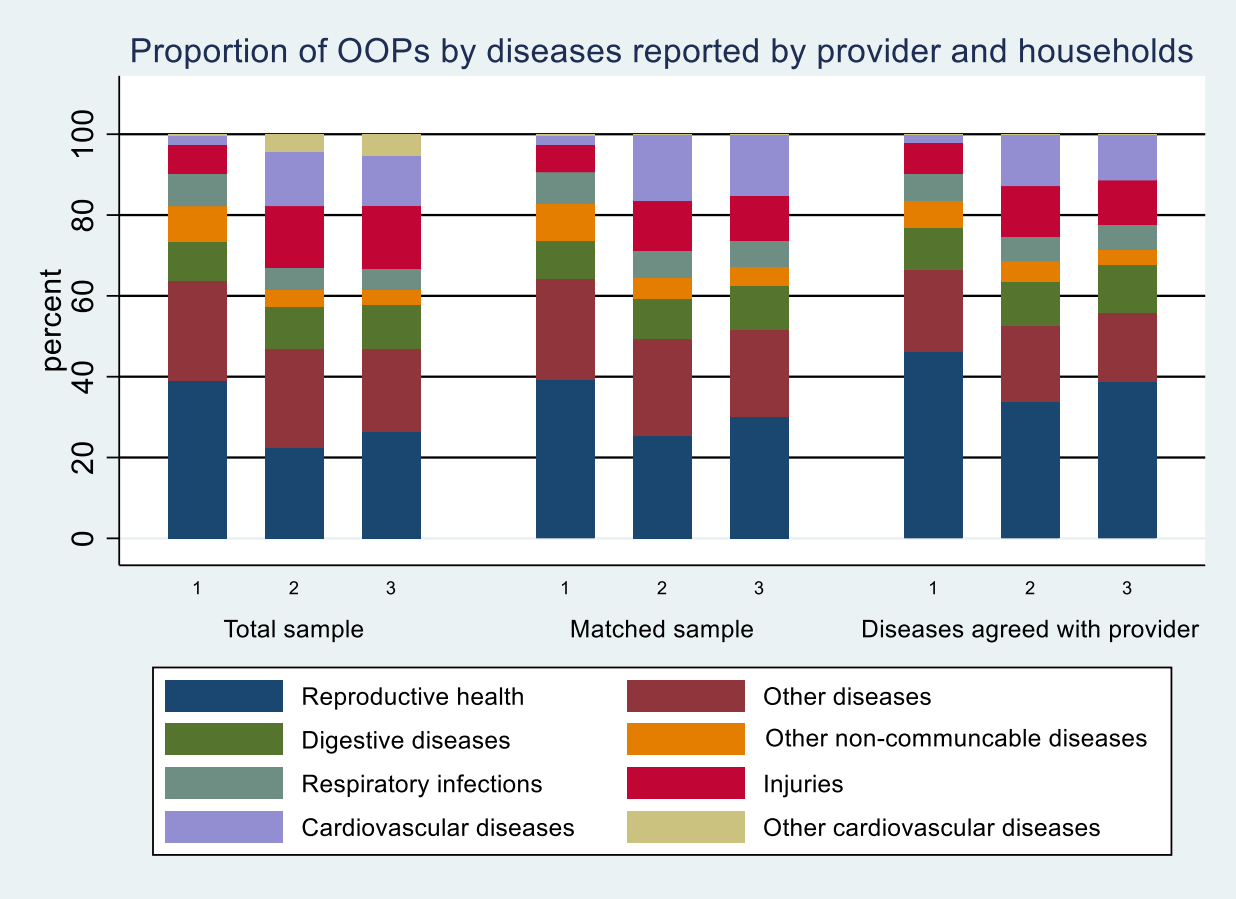
Before assessing the agreement in distribution of annual OOPs across diseases between provider and households, we looked at the proportion of admissions reported incurring OOPs by provider and households in the total and matched sample. Households had the same share of admissions incurring OOPs with 996 (67%) and 880 (66%) admissions in the total household sample and the matched sample, respectively. The similarity in the proportions of admissions with OOPs reported from provider was also observed in the total provider sample and the matched samples. There was 43% (683 admissions) and 46% (607 admissions) reported incurring OOPs for inpatient care from provider in these two samples, respectively. In the end, there were 577 admissions (43%) of the matched sample that households and provider agreed in reporting admissions with OOPs. Findings implied that households tended to report higher OOPs than provider did.

Given the possibility of households including OOPs incurred outside hospital when reporting amounts of OOPs, we conducted the same analysis but excluded costs for medications. There were 591 admissions (44%) reported with cost for medicines related to the corresponding inpatient episodes in the matched sample. Of those admissions, respondents could recall the amount of OOPs for medicines in 267 admissions (20%). We observed the decreased in the proportion of admissions incurring OOPs of households by more than 10% in both samples. In the matched sample, there were 482 (36%) admissions that households and provider agreed in

reporting admissions with OOPs. It indicated that OOPs of some admissions were paid fully for medications.

Overall, we found the similar pattern of disease-specific OOP as the share of annual OOPs across different samples. Reproductive health was the main driven of OOPs reported by both provider and households. Other diseases accounted for about 20% of annual OOPs of both provider and households was the second highest proportion in most samples. The proportion of OOPs for digestive diseases and respiratory infections were similar between provider and household annual OOPs in all samples. While the proportions of OOPs for injuries and cardiovascular diseases as the share of annual household OOPs were 2 times and 5 times higher than those of provider annual OOPs.

We observed the similarity of the distribution of OOPs across diseases from households regardless of estimating OOPs with or without medicines expenses in the matched sample and the admissions with diseases agreed with providers. (Figure 3).



1 - OOPs by diseases from provider; 2 - OOPs with medicines by diseases from households; 3 - OOPs without medicines by diseases from households

Figure 5-3: Proportion of disease-specific OOPs reported from provider and households

Median and proportion of OOPs by diseases reported by provider and household in the sample agreed by diseases

Overall, disease-specific OOPs reported by households had higher median than those of provider regardless of estimating with or without cost for medications. The range of min-max was large in comparison with the median implied the skewed distribution of OOPs and the Findings indicated the proportion of OOPs for diseases was mostly driven by some admissions with large amount of OOPs.

Table 5-4: Mean disease-specific OOPs and its proportion of annual provider and household OOPs of the sample agreed by diseases (USD,2017)

	Provider OOPs		Household OOPs with medicines		Household OOPs without medicines	
Disease (provider order)*	Median (min max)	% of annual OOPs	Median (min max)	% of annual OOPs	Median (min max)	% of annual OOPs
Reproductive health	23.2 (0 – 178.7)	46.25	44.05 (0 – 881.1)	33.84	44.05 (0 – 881.1)	38.81
Other diseases*	0 (0 – 88)	20.20	13.2 (0 – 573)	18.79	4.4 (0 – 573)	17.16
Digestive diseases	2.2 (0 – 107.4)	10.47	13.2 (0 – 660.8)	10.91	7.9 (0 – 660.8)	11.67
Injuries	13.2 (0 – 126)	7.72	22 (0 – 793)	12.49	44 (0 – 617)	11.02
Other non-communicable diseases	0 (0 – 105.9)	6.64	9 (0 – 440.5)	5.02	0 (0 – 440.5)	3.81
Respiratory infections	0 (0 – 102.8)	6.60	0 (0 – 440.5)	6.12	0 (0 – 440.5)	6.10
Cardiovascular diseases	0 (0 – 97)	1.88	7.7 (0 – 1762.1)	12.76	0 (0 – 1762.1)	11.35

Note: Only diseases with proportion of OOPs accounted for >=5% of either provider or household annual OOPs included in the table. Other diseases consisted of all diseases with less than 5% of the annual OOPs of either provider or households.

5.4.3 Factors associated with the agreement in diseases between provider and households

Findings from logistic regression reflected that the availability of discharge summaries, the respondent's recall of diseases, the respondent reporting himself/herself, gender and marital status of the respondent and the inpatient treatment period were associated with the probability of recalling the correct diseases. The results indicated that the likelihood of reporting accurately a disease increased 3.3 times for the admission having the discharge summaries kept and shown to interviewer during the survey and increased 1.8 times if the respondent could recall the diagnosis given by provider. Findings revealed that diseases were more likely to be correctly reported if the respondents were interviewed their own inpatient admissions and the respondents were female and married. The odds ratio indicated that for treatment period longer than one week, the likelihood that reporting the right diseases decreased by approximately 0.6 times.

Table 5-5: Factors predicting an admission with diseases agreed with provider

Variables	**Adjusted Odd ratio (CI)**	**p-value**
Discharge form kept and shown to interviewer	3.3 (2.1 – 5.1)	<0.01
Respondent recalled diseases	1.8 (1.2 – 2.8)	<0.01
Respondent is the inpatient	1.5 (1.2 – 1.9)	<0.01
Respondent is male	0.6 (0.5 – 0.8)	<0.01
Respondent is married	2.1 (1.5 – 2.9)	<0.01
Treatment period is longer than 1 week	0.7 (0.5 – 0.9)	<0.01
6-month recall period	1.2 (0.9 – 1.6)	0.16

5.5 Discussion

This study assessed the validity of diseases specific OOPs estimates related to hospital services obtained from a households' survey in Vietnam comparing them to those reported by health care providers. Findings from our cross-sectional survey indicated that 71% of admissions could be linked between households and provider got the right diagnosis. The pattern of prevalence of diseases as the reasons for inpatient care were similar between households and

provider. Both provider and households reported respiratory infections, reproductive health and digestive diseases as the top three classification. Overall, households reported higher proportion of admission incurring OOPs than provider did. Findings implied that reproductive health had the most admissions and was the main drives of OOPs for both household and provider. We observed the discrepancy in the median OOPs of diseases and the disease-specific OOPs proportion of the annual OOPs between provider and households, particularly when estimating OOPs with and without cost for medications. Overall, the medians of household-reported OOPs attributed by diseases were higher than those of provider regardless of excluding or including expenses on drugs. It implied that the disease-specific OOPs proportions of annual OOPs of both households and provider were mostly driven from some admissions with large amount of OOPs. Findings from regression demonstrated that the availability of discharge form, the respondents' recall of diagnoses, respondents' characteristics and treatment period were the predictors for reporting correct diseases.

The study provided evidence for the validation of household-reported disease-specific OOPs with hospital records. The results from this study were not favorable for estimating OOPs by diseases using data from national household surveys given that only 71% of diseases of the matched sample were correct reported. In fact, we did not use detailed diagnosis categories to maximize matching and we were hoping for higher proportion. More than 90% diagnoses were reported relying on the discharge forms or the respondents' recall and only about 8% of them were reported through the sequential questions on diseases made our effort on integrating this module in the household survey somehow useless.

However, we obtained evidence for recommendations on improving household surveys in collection information on diseases. Discharge forms were proven essential when interviewing inpatient services given that more than 90% of those admissions with discharge form were reported diseases correctly. Respondents 'recall on diagnosis was more accurate if the diagnosis were given and explained by the health workers. Thus, our recommendation is encouraging doctors and nurses to explain diagnoses/diseases to households and provide discharge documents, particularly in countries where there are no centralized e-records like Vietnam. We also should encourage households to ask for diagnoses and discharge summaries; and create habit of keeping medical records in a safe accessible place in the house. The study also indicates that selecting the respondents who are the actual patient is recommended.

Yet the study had some limitations. This study only focused on inpatient care provided at the district hospital. Thus, the results on pattern of diseases and the disease-specific OOPs cannot

generalize. Other services such as outpatient care and medicines might need further studies for validation. The study was nested in a larger project thus the household survey had several modules addressed different objectives. It might affect the quality of household responses.

5.6 Conclusion

Estimating disease-specific OOPs using information collected from household survey is challenging. The study provided evidence for household survey design improvement to obtain accurate information for measuring OOPs.

5.7 Supporting information

S1 Table. Status of matching outcome at household level

5.8 Acknowledgment

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5.9 Authors' contribution

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6. CHAPTER SIX: General discussion, recommendations and conclusions

6.1 Outline of the discussion

The overall goal of this thesis was to test and validate the effect of household survey designs on the accuracy of household response for measuring household out-of-pocket payment with the aim of improving the existing household surveys. The thesis was nested in a methodological study on the measurement of household OOPs in household surveys (the iHOPE project).The study entailed three specific objectives. The first objective was "to investigate the effect of recall period for estimating out-of-pocket health expenditures for inpatient services" (Chapter 3). The second objective was "to compare and validate the out-of-pocket estimates for inpatient services by face-to-face and mobile phone survey" (Chapter 4). The third objective was "to assess the validity of diseases specific OOPs estimates related to hospital services from a household survey (Chapter 5). The study gave an opportunity, of experimenting the implementation of various tailored household survey designs in Vietnam, from which a number of helpful lessons can be drawn for similar projects in other parts of the world, particularly in the setting of low-middle income countries in the future. This discussion chapter will now highlight the key findings and contributions of each objective. Finally, a set of conclusions, research needs and recommendations, for further improving alternative methods for OOPs measurements are put forward.

6.2 Summary of the research findings

The PhD study developed new study instruments by repurposing existing instruments to be sensitive to the problems identified (Chapter 2 section 2.4). In the second stage, we experimented the new instruments by using them for interviewing in a cross-sectional study. The final stage included validation strategy to assess the accuracy of data generated from the new study instruments using the provider data as gold standard (Chapters 3, 4, 5). The inclusion of the provider data as a gold standard to validate the methods gives this research some added value in relation to all other past studies. Most importantly, this study identified and quantified the amount of bias introduced into OOPs estimates when different survey instruments are used. In this PhD study, the assessment and validation of household survey designs was undertaken for three aspects: (i) the choice of recall period (Chapter 3); (ii) the mode of data collection (Chapter 4); and (iii) the validity of disease-specific OOP estimate from a household survey (Chapter 5).

6.2.1 The choice of recall periods

This study quantified the bias introduced into OOPs if a shorter recall period (6-month) was used relative to using a longer recall (12-month), and further assessed how the bias behaved. Findings from this study provide some experimental evidence that explains how different recall periods affects the measurement of OOPs in household surveys by comparing such estimates with a 'gold standard'. The results from the first component favored the 12-month recall period for the infrequent health services such as hospitalization. The results of this study were consistent with previous researches on the recall period for health services [24, 25, 29, 33]. Moreover, our research revealed the underlying drivers of the recall bias on reported OOPs expenditures that were telescoping. Telescoping effects are defined as temporal displacement of an event. There are two directions of telescoping: forward and backward. The former is reporting or dating distant events as being more recent. The latter refers to perceiving recent events as being more remote. Telescoping can lead to under-reporting as well as over-reporting of expenditure in the recall period [89]. Several literature reviews on survey response behavior and its association with memory factors in social surveys found memory errors arise in retrospective questions due to telescoping [31, 33-35, 68, 69, 71, 73, 86, 88, 90-92]. Findings from the thesis was consistent with those of previous studies and revealed that both longer and shorter recall period suffered from telescoping. While forward telescoping was the larger problem for the 6-month recall period and was the underlying driver for the higher risk of over-reported OOPs in the 6-month recall period, backward telescoping/failing to recall had larger impact on the 12-month recall one and resulted in higher risk of under-reported OOPs. It is inevitable that retrospective surveys are subject for memory errors and selecting a recall period, which minimizes the recall errors, is a classic issue in designing a survey. This study provided evidence of the mechanisms by which recall bias affects the reported amounts of OOPs and timing of transactions. The findings could contribute to the decision on the length of recall for health expenditures.

A literature review described different techniques that have been experimented to reduce possible recall errors that are associated with telescoping [88]. One suggestion is to use varying recall lengths for different interested events/activity. In the context of health expenditures, we can apply different recall periods for different health services depending on the frequent level of the health events. In a study investigating the optimal recall period for medicines and inpatient services in Ghana, results revealed a survey combined of shorter recall period for medicines and longer recall period for infrequent services as hospitalization gave better OOPs

estimation [27]. Another strategy is called “bounded recall” involving completing an initial interview that is unbounded solely used as a means for reminding respondents in subsequent interviews about the behaviors that have already been reported. They demonstrated that this strategy decreased the forward telescoping and increased the accuracy of report between the first and the second interviews [92]. However, multiple interviews in a survey are costly and are not always feasible to conduct. To reduce costs, Sudman, et al. (1984) conducted an experiment on using bounded recall within a single interview by asking respondents to recall health events in a previous month and then to recall events for the current month. Giving a clear landmark to prompt respondents ‘memory when interviewing is another technique. In the second component of the thesis, we applied this technique and required the interviewer to give the exact time period when asking questions on health expenditures. For instance, the question asked for inpatient care in the last 12 months in June 2017, and then the question should be “In the last 12 months, from June 2016 to June 2017, did your household incur expenses for inpatient services?”

6.2.2 Mode of data collection

The second study compared OOPs estimates between the mobile phone interview and the face-to-face interview. The findings showed that the mobile phone survey could be an alternative method for collecting information on OOPs for inpatient services. Although the OOPs for other spending categories estimated by the mobile phone survey were higher than those estimated by the face-to-face survey, no statistically significant difference was observed. As this study was part of a broader study with several questionnaire modules, it was impossible to calculate the time and cost of the survey, it was not possible to evaluate cost-effectiveness of the method. However, given that the mobile phone survey required fewer surveyors as well as fewer tablets for collecting data than the face-to-face survey, it the costs of data collection and administration should be limited if conducted at regular basis. Moreover, the mobile phone survey, which was combined with the face-to-face interview as the first encounter with the households, had very good response rate. In the study, 93% of the community sample and 100% of the provider sample were successfully contacted and interviewed via phone. Findings encouraged the incorporation of the mobile phone interview as an alternative method conducting in the interval between national household surveys. The study is the first of its kind conducted in Vietnam. It addressed the issues of lack experimental evidence on the feasibility of using mobile phone survey for household interview and opened the opportunity for application in reality.

6.2.3 Validity of disease-specific OOPs

The third component of the thesis attempted to test a questionnaire module on classification of diseases recommend by System Health Accounts 2011 in order to map OOPs to diseases. About 70% of inpatient admissions could be linked between households and provider had diseases agreed with provider. Overall, the pattern of prevalence of diseases as the reasons for inpatient care were similar between households and provider. Reproductive health had the most admissions and was the main drives of OOPs for both household and provider. Findings implied that the disease-specific OOPs proportions of annual OOPs of both households and provider were mostly driven from some admissions with large amount of OOPs. The availability of discharge form, the respondents' recall of diagnoses, respondents' characteristics and treatment period were the predictors for the likelihood of reporting correct diseases.

The study provided evidence for the improvement of conducting questionnaire module on classification of diseases in a household survey. With more than 90% of diseases was captured by discharge summaries or respondents' recall of the diseases, the study pointed out the importance of asking for memory aids (in this context it was discharge summaries) when interview households on past events. Respondent selection was also proved important when interviewing households. The study reflected that when interviewing individual module of questionnaire such as health care utilization, we should select the respondents who used or experienced the services/events to get more accurate information. Household members who are female and married are also encouraged to be recruited as the respondents. In this study, the longer of treatment period was, the less likely the disease as reason for admission was correctly recalled. This results was opposite with our hypothesis at the beginning. Normally, the admission with long duration than one week is too severe to be treated at the district hospital. Then, the patient might be referred to a higher-level hospital for treatment which resulted in the diseases at discharge the higher-level provider is different with the diseases from records of the district hospital. Further studies engaging more providers at different level of delivery care are recommended to give deeper insights about the hypothesis.

In general, the study indicated that using information from household survey to estimate disease-specific OOP was challenging.

6.3 Challenges and limitations

Even though findings are plausible and comparable to results of other studies, there are several challenges and methodological limitations. In this section, the limitations will be discussed for two main parts of data collection process: provider and household.

Provider data collection

The study was designed to use provider data as gold standard, which made it very important on data collection at provider level. However, we faced many challenges when conducting the process.

Given that, there are abundant number of private providers in the study area (> 600), it was very challenging to recruit all of them for participating in order to capture all possible health care transactions in the study area. With this big number of providers, it was impossible to send a data collector to each of them to collect data. Moreover, data collectors could only document transactions provided in daytime and missed all transactions, most likely emergencies in nighttime. Thus, we came up with the diary strategy in which a standardized template was distributed to all participated providers. The providers was given incentive for every participated month for noting down all information on patients/purchasers for tracking back them at the household level. We also realized it is impossible to recruit all providers in the district. Thus the five communes, which cover all geographic characteristics of the district and have natural barrier (river) between other communes to avoid patient seek care in different communes, were selected with 103 identified providers.

Then, the next challenges was provider recruitment. Among 103 providers, we successful recruited 79 providers, then 4 of them were dropped out before the data collection completed. When recruiting providers, it was very difficult to persuade private ones to participate. As discussed before, findings from a study in rural district revealed that less than 20% of private providers registered and documented in authority records. The situation was similar in Bavi. Thus, those providers were very reluctant to participate which in the end we could only recruit 76% of them.

Another challenge on provider data collection was the completeness and quality of data generated from the standardized template. Both patient/purchasers and provider perspectives could explain this problem. From patient/purchaser perspective, providing information on fullname, age, and address was uncomfortable to them, particularly in the case of seeking health care for sensitive disease/symptoms. Another challenge from client perspective happened mostly at drug stores was that the purchaser was not the patient, which made the effort on tracking patient useless. From provider perspective, particularly unlicensed private ones, the

information on the services expenses was very sensitive to them, because the fear of being tracking on revenue for taxation by the local authority. Thus, we doubted the information on number of patient/purchasers and the expenses on services/drugs that they provided to us.

Due to above challenges and limitations, the study used only data retrieved from hospital that were reliable enough for conducting validation. Therefore, the study only provided evidence on the effect of study designs for measuring OOPs for inpatient services. Other services might need further studies with improved study design for validation.

Household data collection

The first challenge due to the design was sample size calculation. In order to meet the objective of validating household-reported data with provider records for each version, sample size had to be big enough to capture all health services. Because the proportion of incurring health spending on outpatient services were 4 times higher than inpatient services, the sample size that could capture all types of health spending was too big in the context of feasibility and budget constraints. Thus, two sampling methods were introduced targeting differently on inpatient care and outpatient care. Due to this manner, the iHIOPE project in Vietnam experimented total 13 different versions of household survey.

Implementing such a large validation study with 13 different versions of household survey came with many challenges. The first challenges was how to collect data efficient for both surveyors and supervisors. Given the study requirements on collecting data using electronic questionnaires on tablets and the complicated structure of module, computer-assisted persons interview (CAPI) method was indeed better mean for household data collection and supervision. We also realized that it was a great opportunity for capacity enhancement for staff of Filabavi HDSS. However, having been implemented interviews in paper format since its establishment, it was a big challenge to change.

Another potential limitation was the quality of data. Due to the long nature of the consumption module (health and non-health items) in the survey instruments, it took long time to administer a single questionnaire to a household by a field worker (average 2 hours/interview). This affected both the concentration and willingness to answer of the respondents due to tiredness.

In summary, designing and implementing successfully a complex validation study required a careful understanding of the limitations and gaps in the existing tools and the preparedness of all stakeholders, particularly the supervisors and field workers. The iHOPE project in Vietnam received consultations from international stakeholders and technical experts from a variety of disciplines in order to adapt the multi-country study design into the setting of Vietnam. It was a great challenge managing diverse technical views and gaining a consensus on a final product for the study.

6.4 Recommendations

This study is the first exploration of the effect of study design on the accuracy of household response for estimating OOPs using validation approach in Vietnam. The following are proposed recommendations for Vietnam and other LMICs.

This study was a very complex study in which provider data was an important component for validation. In LMICs where the health systems are under-developed, using provider data as gold standard need many preparations. In the absence of a proper recording and reporting system on health, it is challenging to acquire adequate data for validation, particularly from private providers. It is therefore important to improve the information system at provider level, particularly in the private sector. To this end, it is necessary to work closely with the local authorities monitoring and supervising the performance of providers on reporting information on their clients and their sales.

To have a comprehensive assessment of the effect of recall period on estimating OOPs, future studies should include other health spending categories such as outpatient and medicines.

Regarding the mode of data collection, studies investigate the effectiveness in terms of cost and time, respondents' perspective when conducting mobile phone survey would give more information on the feasibility of using it as alternative method for collecting health expenditures data.

In term of estimating disease-specific OOPs, the most accessible data tends to be the inpatient care thanks to the systematic recording of diagnostic information is used for reimbursement and administrative purposes at hospitals [93]. In the outpatient care and pharmacies setting, it is more difficult because each patient or purchase of drugs may not be necessarily linked to disease groups. Thus, most of study on disease attribution to OOPs focused on hospitalization. This results in an incomplete picture of the drivers of health spending. Therefore, further research

works are recommended to address this issue in order to contribute to the availability of current health spending by disease for these providers.

6.4 Conclusions

Measuring OOPs is important given that it constitutes the largest source of health care financing in LMICs and an important indicator for tracking financial risk protection in health and monitoring the country progress of universal health coverage. This thesis provides actionable evidence and recommendations for directions in the current discussions about the need to improve the measurement of out-of-pocket health expenditure in household surveys. In this thesis, three important aspects related to the accuracy of data for estimating OOPs were identified: the choice of recall period, the mode of data collection and the validity of disease-specific OOPs estimated from a household survey. We confirmed that retrospective surveys are subject to recall errors, which were telescoping despite what recall period used. The results were consistent with previous studies and favored the 12-month recall period for estimating OOPS for inpatient care. In the light of the need of data in regular manner, the mobile phone survey can be an alternative method integrated into the Vietnam Household Living Standard Survey to collecting information on OOPs in the intervals of two national surveys. Findings on the validity of disease-specific OOPs demonstrated that the pattern of diseases were similar between households and provider. However, it captured the discrepancy in the median OOPs of diseases and the proportion of disease-specific OOPs to total OOPs that raised the issues of misattribution of spending on diseases from the population. The study reflected that estimating OOPs across diseases using data from household surveys is challenging. Despite the challenges in setting up and implementing this ambitious study, this study successfully developed, tested and validated new health expenditures modules that have provided important evidence that will guide policy discussions. The study provided insights into several challenges of a validation study using provider data as gold standard, lesson learnt and recommendations that will serve as a guide for future similar studies.

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Appendices

Appendix 1: List of non-medical items of Household Health Survey

Item ID	Non-medical items	Type of expenditures	Recall period
Level 1 - 31 items			
1	Bread, rice, mais, millets and all other forms of cereals	Food	7 days
2	Sweet potato, yam, cassava and all other roots, tubers & plantains	Food	7 days
3	Tawatawa, ground nuts, all kind of other nuts and seeds and all kind of beans	Food	7 days
4	All vegetables	Food	7 days
5	All fruits	Food	7 days
6	Meat, poultry, and offal	Food	7 days
7	Fish and sea food	Food	7 days
8a	Milk and other liquid milk products (e.g. cream, yoghourt, liquid fats and oils) from animal, vegetables and nuts	Food	7 days
8b	Other solid milk product (e.g. butter, cheese, solid fats and oils) from animal, vegetable and nuts	Food	7 days
9	Eggs	Food	7 days
10a	Liquid Oils and fats(excluding those derived from milk)	Food	7 days
10b	Solid oils and fats (excluding those derived from milk)	Food	7 days
11	Sugar, jam, honey, cholate & sweets	Food	7 days
12	Ginger, pepper, yeast, baking powder and all other condiments, spices & baking agents.	Food	7 days
13	Other food items not mentioned elsewhere	Food	7 days
14	Non-alcoholic beverages	Food	7 days
15	Alcoholic beverages (spirits; wine; beer) consumed at home	Food	7 days
16	Food, non-alcoholic and alcoholic beverages consumed away from home by all the different members of your household at street stalls; mobile vendors; restaurants; cafes; bars; take-away; canteens etc	Food	7 days
17	Cigarettes, cigars, other tobacco products, marijuana, opium and other vegetable-based, chemicals and man-made narcotics for consumption at home or away from home	Food	7 days

18	Personal items (non-electric) for both personal hygiene and beauty and personal care services (e.g. toothpaste, make-up, hairdressing salons…)	Regular	30 days
19	Fares for transportation services and fuels for personal vehicles	Regular	30 days
20	Communication services, such as mobile phone and telephony/internet/television service packages	Regular	30 days
21	Housing, water, electricity, gas and other fuels	Regular	30 days
22	Electric appliances for personal care and personal effects such as electric razors, hairdryers and jewelry, watches and hand-bags. Please include acquisition, repair and rental.	Annual	12 months
23	Clothing and footwear including their cleaning, repair and hire.	Annual	12 months
24	Furnishings, household equipment and routine household maintenance	Annual	12 months
25	Acquisition of personal vehicles and deposit fees, maintenance, repair and rentals of personal vehicles. Also include spares parts and accessories for personal vehicles as well as driving lessons.	Annual	12 months
26	Audiovisual equipment such as fixed and mobile phones, computers and TV including acquisition, repair and rental	Annual	12 months
27	Recreation and culture such as religious activities, sporting services and goods games, garden products and stationary	Annual	12 months
28	Education and tutoring for children	Annual	12 months
29	Expenditures on non-medical child care services; non-medical retirement home; non-health related insurances; taxes (property tax, vehicle tax, income tax…); charges by banks/post offices; remittance fees and other financial services	Annual	12 months
30	Accommodation services such as hotels, camping sites and boarding schools (when accommodation priced separately)	Annual	12 months
31	All other goods and services not elsewhere specified excluding health expenditures	Annual	12 months
Level 2 - 42 items			
1	Bread, rice, mais, millets and all other forms of cereals	Food	7 days
2	Sweet potato, yam, cassava and all other roots, tubers & plantains	Food	7 days
3	Tawatawa, ground nuts, all kind of other nuts and seeds and all kind of beans	Food	7 days
4	All vegetables	Food	7 days
5	All fruits	Food	7 days
6	Meat, poultry, and offal	Food	7 days
7	Fish and sea food	Food	7 days

8a	Milk and other liquid milk products (e.g. cream, yoghourt, liquid fats and oils) from animal, vegetables and nuts	Food	7 days
8b	Other solid milk product (e.g. butter, cheese, solid fats and oils) from animal, vegetable and nuts	Food	7 days
9	Eggs	Food	7 days
10a	Liquid Oils and fats(excluding those derived from milk)	Food	7 days
10b	Solid oils and fats (excluding those derived from milk)	Food	7 days
11	Sugar, jam, honey, cholate & sweets	Food	7 days
12	Ginger, pepper, yeast, baking powder and all other condiments, spices & baking agents.	Food	7 days
13	Other food items not mentioned elsewhere	Food	7 days
14	Non-alcoholic beverages	Food	7 days
15	Alcoholic beverages (spirits; wine; beer) consumed at home	Food	7 days
16	Food, non-alcoholic and alcoholic beverages consumed away from home by all the different members of your household at street stalls; mobile vendors; restaurants; cafes; bars; take-away; canteens etc	Food	7 days
17	Cigarettes, cigars, other tobacco products, marijuana, opium and other vegetable-based, chemicals and man-made narcotics for consumption at home or away from home	Food	7 days
18	Toilet paper, personal soaps, toothpaste, sanitary towels/tampons, diapers and all other personal hygiene items	Regular	30 days
19	Make-up/make-up removal products, hair products, shave products, razors and all other beauty products and personal non-electronic appliances	Regular	30 days
20	Services of hairdressing salons and other personal grooming establishments (e.g. barbers, beauty shops, manicure/pedicure); cosmetic surgery for other purposes than reconstructive surgery.	Regular	30 days
21	Diesel, petrol and other fuels and lubricants for personal vehicles (cars, motor cycles etc…)	Regular	30 days
22	Fares for buses/taxi and other transportation services for passengers; driving lessons; postal services; removal and storage services of furniture; service delivery of goods; hire of garages	Regular	30 days
23	Telephony/internet/television service packages; TV and radio licenses, fees and subscriptions; internet access provision services; net storage services and other streaming and communication services	Regular	30 days
24	Fixed and mobile phone communication services including installation and subscription costs of fixed phones; national and international voice/video calls; pre-paid/post-paid phone packages	Regular	30 days
25	Electricity, heating and cooking fuel; gas; water supply/sewage collection and other housing utilities	Regular	30 days
26	Rent/mortgages for primary and secondary residences and garages	Regular	30 days
27	Electric razors, hairdryers and all other electric appliances for personal care. Jewelry, watches and other personal effects n.e.c. such as umbrellas; hand-bags; articles for babies etc… Please include acquisition, repair and rental	Annual	12 months

28	Clothing and footwear including their cleaning, repair and hire.	Annual	12 months
29	Services and/or materials for the regular maintenance and repair of the dwelling.	Annual	12 months
30	Lighting equipment, household textile and all household and garden furniture, including repair and rental	Annual	12 months
31	Household appliances whether electric or not; glassware, tableware and household utensils; and all other tools and equipment for house and garden; including repair and maintenance.	Annual	12 months
32	Domestic services by paid staff, services and goods for routine household maintenance	Annual	12 months
33	Purchase, deposit fees, maintenance, repair and rentals of personal vehicles (cars, motor cycles, bicycles, animal drawn vehicles). Also include spares parts and accessories for personal vehicles as well as driving lessons.	Annual	12 months
34	Telephone equipment (fixed and mobile phones); tablets, computers and laptops; TV, video/DVD players; radio; other equipment for reception, recording and reproduction of sound and vision including acquisition, repair and rental	Annual	12 months
35	Sporting services and goods; music instruments; audio-visual media; services provided by cinemas, and other leisure services, religious and cultural goods and services	Annual	12 months
36	Games, toys and hobbies including games console and game software	Annual	12 months
37	Plants and flowers and other garden products; pets and related products; Veterinary and other services for pets	Annual	12 months
38	Newspapers, books, educational material, drawing material and other stationery)	Annual	12 months
39	Early childhood, primary, secondary and post-secondary educational services, tutoring and other educational services not defined by level (e.g. for adults or language courses).	Annual	12 months
40	Expenditures on non-medical child care services; non-medical retirement home; non-health related insurances; taxes (property tax, vehicle tax, income tax…); charges by banks/post offices; remittance fees and other financial services	Annual	12 months
41	Accommodation services(hotels, motels, inns and similar accommodation services; holiday centres, camping sites, youth hotels; boarding schools when accommodation priced separately).	Annual	12 months
42	All other goods and services not elsewhere specified excluding health expenditures	Annual	12 months

Appendix 2: List of health items of Household Health Survey

ID	D2 (11 items)	Recall period
1.1	1.1 treatment received in a nursing home; medical convalescent homes; mental health care facility for patients with severe mental illnesses or severe substance abuse patients (those who require surveillance or constant help due to limited functional capacity) or any other long term care facility Please include payments for all services, medicines and medical products needed during the overnight stay, except non-emergency transportation and non-medical costs for patient's relative.	6/12 months
1.2	1.2 medical or dental treatment that required an overnight stay, from any type of facility excluding long term care facilities. Please include payments for all services, medicines and medical products needed during the overnight stay, except non-emergency transportation and non-medical costs for patient's relative.	
2.1	2.1. Immunization/vaccination services for maternal and child care; travel and tourism vaccination as well as any other compulsory or voluntary immunization/vaccination service. Exclude payments for the vaccine itself when separately invoiced	3/6 months
2.2	2.2 other preventive services such as prenatal/postnatal care, family planning, screening, tests, medical examinations to detect communicable or non-communicable diseases before symptoms appear (e.g. diabetes, heart problems, high blood pressure) Include diagnostic and laboratory tests needed to provide preventive services.	
3.1	3.1 Emergency patient transportation services not related to an overnight stay	
4.1	4.1 Dental services that did not require an overnight stay, inside or outside a hospital setting Please include diagnostic and laboratory tests needed to provide dental services (e.g. x-rays, scans, blood tests).	15 days/30 days
4.2	4.2 other medical services than dental and preventive that did not require an overnight stay Please include diagnostic and laboratory tests needed to provide medical services	
5.2	5.2. Herbal medicines and homeopathic products for consumption outside a health facility or institution.	
5.2	5.1 Medicines (branded, generic, homeopathic), vaccines, oral contraceptives, vitamins and minerals for consumption outside a health facility or institution	15 days/30 days
6.1	6.1 Pregnancy tests, blood pressure devices, inhalers, mechanical contraceptives; incontinence products, absorbent including diapers for the aging population insecticide treated mosquito nets and other medical health products for personal use including repair, rental and maintenance	15 days/30 days
7.1	7.1 Glasses for vision; hearing aids; crutches & wheelchairs; walkers; pressure relief mattresses other assistive health products including repair, rental and maintenance	6/12 months

Appendix 3: Questionnaires on mapping diseases for inpatient services

Question ID	Questions
Opening	I would now like to know about your household recent experiences in using health services. I want to know first about utilization of services as an inpatient, i.e. for which an overnight stay of at least one night was needed.
1	Number of inpatient episodes of all members in your household over the last period
2a	Does the inpatient member live in the household?
	1.Yes
	2.No
2b	Why did the member not live in the house?
	1.Moving out
	2.Death
2c	Enter name of inpatient member who is no longer living in the household
3	Is it true that the member had inpatient episode over the last period?
	1.Yes
	2.No
4	Admission date of the member?
5a	Name of health facilities where the member came for inpatient treatment over the last period?
5b	What is other health facilities?
6a	Do you have a copy of the discharge form of <output value="#form/q/q2a" /> <output value="#form/q/q2" />?
	1.Yes => Q6b
	2.No
	3.Lost or don't know where
6b	May I see it? I am only interested in the reason for overnight stay indicated in the form. Remember that whatever information you give me is confidential and will only be used for research purposes.
	1.Yes => Q6c
	2.No
6c	Diagnosis of the admission of the member in discharge form
7a	Was the member given a diagnosis?
	1.Yes => Q7b
	2.No
	8.Don't know
7b	Do you know diagnosis of of the admission of the member?
	1.Yes => Q7c
	2.No
	8.Don't know/Don't remember
7c	Diagnosis of the admission of the member as your recall
8a	Which of the following best describes the reason for the member receiving inpatient care? (Pls select the main reason)
	1.Physical symptom or physical Illness
	2.Psychological illness or symptom => Q35
	3.Injuries => Q36
	4.Pregnancy, childbearing, childbirth, obstetric => Q37

	9.Don't know => Q38a
8b	Which of the following best describes the main type of physical illness/symptoms/problems of the member?
	1.Symptoms specific to some part of the body or body organs => Q9
	2.General symptoms, not specific to any part of the body or body organ => Q38a
	8.Don't know
	9.Others (specify) => Q8c
8c	What is other symptom?
9a	Can you state or point to the specific part of the body?
	1.Cardiovascular
	2.Neurological
	3.Respiratory
	4.Digestive
	5.Muscular or skeletal
	6.Genital/Urinary (not related to pregnancy, childbearing, child birth)
	7.Eye
	8.Ear
	9.Skin
	10.Oral/Mouth/Teeth
	99.Other (specific)
	88.Don't know OR cannot tell
9c	What is other organ/part of body?
10	Did the member experience any fever or did you/name receive antibiotics or similar medicines (main reason for the consultation)
	1.Yes
	2.No
	3.Don't know
11a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 1 and Q10 select 1)
	1.Rheumatic heart
	2.Acute myocardial infarction (due to virus)
	3.congenital heart disease
	8.Don't know
	9.Others (specify) => Q11b
11b	What is other cardiovascular disease?
12a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 2 and Q10 select 1)
	1.Meningitis
	2.Encephalitis
	3.Tetanus
	8.Don't know
	9.Others (specify) => Q12b
12b	What is other neurogolical disease?
13a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 3 and Q10 select 1)
	1.pneumonia
	2.bronchitis
	3.Upper respiratory infection (not pneumonia)
	4.Acute tonsillitis

	5.primary complex (TB)
	6.Asthma
	8.Don't know
	9.Others (specify) => Q13b
13b	What is other respiratory disease?
14a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 4 and Q10 select 1)
	1.diarrhea
	2.Digestive disorder
	3.Gastric ulcer
	4.Food poisoning
	8.Don't know
	9.Others (specify) => Q14b
14b	What is other digestive disease?
15a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 5 and Q10 select 1)
	1.joint infection
	2.bone infection
	3.muscular infection
	8.Don't know
	9.Others (specify) => Q15b
15b	What is other muscular or skeletal disease?
16a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 6 and Q10 select 1)
	1.genitourinary infection
	2.phimosis
	8.Don't know
	9.Others (specify) => Q16b
16b	What is other genitourinary disease?
17a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 7 and Q10 select 1)
	1.conjunctivitis
	2.Lacrimal gland inflammation
	3.Corneal infection
	8.Don't know
	9.Others (specify) => Q17b
17b	What is other eyes disease?
18a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 8 and Q10 select 1)
	1.Middle ear inflammation
	3.Outside ear inflammation
	8.Don't know
	9.Others (specify) => Q18b
18b	What is other ear disease? (if Q9a select 9 and Q10 select 1)
19a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 9 and Q10 select 1)
	1.Skin infection by sebaceous glands
	2.Skin infection
	8.Don't know

	9.Others (specify) => Q19b
19b	What is other skin disease?
20a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 10 and Q10 select 1)
	1.Mouth infection
	2.Tongue tua
	3.gingivitis
	4.Tooth decay
	8.Don't know
	9.Others (specify) => Q20b
20b	What is other oral disease?
21a	If yes, did the member have fever because of any of the following diagnosis? (if Q9a select 99 and Q10 select 1)
	1.measles
	2.Chicken pox
	3.Malaria
	4.Mumps
	5.Dengue fever
	6.Hand,foot, mouth
	7.Other viral fever
	8.Don't know
	9.Others (specify)
21b	What is other disease?
22	Did the member admit to hospital due to a chronic or degenerative condition, i.e. due to the process of growing older?
	1.Yes
	2.No
	3.Don't know
23a	Was it any of the following diagnosis? (if Q9a select 1 and Q22 select 1)
	1.Rheumatic heart
	3.congenital heart disease
	8.Don't know
	9.Others (specify) => Q23b
23b	What is other cardiovascular disease?
24a	Was it any of the following diagnosis? (if Q9a select 2 and Q22 select 1)
	1.epilepsy
	2.mental retardation
	3.loss of consciousness
	4.disorientation/confusion
	5.Headache
	8.Don't know
	9.Other (specify) => Q24b
24b	What is other neurological disease?
25a	Was it any of the following diagnosis? (if Q9a select 3 and Q22 select 1)
	1.Asthma
	2.Chronic cough
	8.Don't know
	9.Other (specify) => Q25b
25b	What is other respiratory disease?

26a	Was it any of the following diagnosis? (if Q9a select 4 and Q22 select 1)
	1.Malnutrition
	2.Anemia
	3.Lose appetite
	4.Chronic diarrhea, chronic digestive disorder
	8.Don't know
	9.Other (specify) => Q26b
26b	What is other digestive disease?
27a	Was it any of the following diagnosis? (if Q9a select 5 and Q22 select 1)
	1.weakness
	2.Deformity
	8.Don't know
	9.Other (specify) => Q27b
27b	What is other muscular or skeletal disease?
28a	Was it any of the following diagnosis? (if Q9a select 6 and Q22 select 1)
	1.Nephrotic syndrome
	2.Chronic renal failure
	8.Don't know
	9.Other (specify) => Q28b
28b	What is other genitourinary disease?
29a	Was it any of the following diagnosis? (if Q9a select 7 and Q22 select 1)
	1.Decreased vision
	2.Blind
	3.Natural congenital crystals
	8.Don't know
	9.Other (specify) => Q29b
29b	What is other eyes disease? (if Q9a select 8 and Q22 select 1)
30a	Was it any of the following diagnosis?
	1.Decreased hearing
	2.Deaf
	8.Don't know
	9.Other (specify) => Q30b
30b	What is other ear disease?
31a	12b9.Was it any of the following diagnosis? (if Q9a select 9 and Q22 select 1)
	1.Skin disease due to degeneration
	2.Eczema
	8.Don't know
	9.Other (specify) => Q31b
31b	What is other skin disease?
32a	Was it any of the following diagnosis?
	1.Lose teeth
	2.Harelip, cleft palate
	8.Don't know
	9.Other (specify) => Q32b
32b	What is other oral disease?
33a	Was it any of the following diagnosis? (if Q9a select 10 and Q22 select 1)
	1.Allergy
	2.Other congenital diseases
	8.Don't know

	9.Other (specify) => Q33b
33b	What is other disease?
34a	Was it a new growth or tumor? (main reason for the consultation)?
	1.Yes
	2.No
	8.Don't know/Don't remember
34b	Please specify which organ?
	1.Cardiovascular
	2.Neurological
	3.Respiratory
	4.Digestive
	5.Muscular or skeletal
	6.Genital/Urinary (not related to pregnancy, childbearing, child birth)
	7.Eye
	8.Ear
	9.Skin
	10.Oral/Mouth/Teeth
	99.Other (specific) => Q34c
	88.Don't know OR cannot tell
34c	Please specify other organ
34d	Was cancer mentioned?
	1.Yes
	2.No
	8.Don't know/Don't remember
35	Which of the following best describes the main type of psychological problem?
	1.Anxiety/nervosity/stress/Depression
	2.Depression
	3.Addiction alcohol, tobacco, medication, drug
	4.Dementia
	5.Schizophrenia
	8.Don't know
	9.Other psychological problem (specify)
	Please specify
36	Which of the following best describes the main type of injury?
	1.Accidental injury, road traffic accidents and falls
	2.Accidental drowning and submersion
	3.Burns and corrosions
	4.Poisoning
	5.Intentional self-harm
	6.Assault
	8.Don't know
	9.Other (specify)
	Specify other injury
37	Which of the following best describes the main type of pregnancy, childbearing, childbirth, obstetric problems?
	1.Pregnancy with complications before childbirth (abortion, ectopic pregnancy, abortion, hypertension)
	2.Childbirth without complication – Caesarean/normal
	3.Complications during labor

	4.Complications after birth of child/Illness in the newborn/ sick newborn
	8.Don't know
	9.Other (specify)
	Other (specify)
38a	What type of reason if it is not a physical illness/symptom; neither a psychological reason nor an injury, nor either related to a pregnancy, childbearing, childbirth, obstetric?
	1.Could not state the main symptom/main diagnosis
	2.Other diseases/other symptoms
38b	Please specify other diseases/other symptoms

Appendix 4: Household health expenditures questionnaire at household level of Household Health Survey and SWIFT survey

Question ID	Questions (asking for 11 health items)
1	Over the last *recall period* , did you or any member of your household make any payment for *health item*
	1.Yes => Q2
	2.No
2	If yes what was the total amount paid for *health item*? (1000 đ)
3	Which of the following sources did you use to pay for such amount for *health item* over the last **recall period**?
	1.household's imcone
	2.money gift
	3.cash savings
	4.selling of any household's assets or goods (housing, land, animals, jewelry, appliances or machines)
	5.barter of household assets or goods
	6.loan => Q3c
	9.other (specify) => Q3a
	8.Don't remember/Don't know
3a	Khoản khác là khoản gì?
3b	Please state the amount from each mentioned source (x1000 đ) for *health item** over the last **recall period**?
	2.money gift (x1000đ)
	3.cash savings (x1000đ)
	4.selling of any household's assets or goods (housing, land, animals, jewelry, appliances or machines) (x1000đ)
	5.barter of household assets or goods (x1000đ)
	6.loan(x1000đ)
	9.other (x1000đ)
3c	What was the type of loan?
	1.no interest rate, no collateral
	2.with both interest rate and collateral
	3.with either interest rate or collateral
	4.Don't know
3d	Did your household have to give informal payment to health workers to get service?
	1.Yes => Q3e
	2.No
3e	If yes,how much? (x1000 đ)
4	Was there any member of your family being exempted for *health item** over the last **recall period**?
	1.Yes => Q4a
	2.No
4a	If need to pay, how much did your householdhave to pay?
5	Number of episodes using **health item** over the last **recall period**?

5a	Was**the member** exempted for **health item** over the last**recall period**?
	1.Paid all expensed
	2.Exempted partially => Q5b
	3.Exempted all => Q5c
5b	Which is the reason for**the member** being exempted partially?
	1.Health insurance covered partially
	2.Government program covered partially
	3.Other (specify) => Q5bx
	4.Don't remember/Don't know
5bx	What is the other reason?
5c	Which is the reason for**the member** being exempted all?
	1.Health insurance covered all
	2.Government program covered all
	3.Other (specify) => Q5cx
	4.Don't remember/Don't know
5cx	What is the other reason?
6	Could you please recall the date *the member* recevied services for *health item*?
7	Please let me know name of provider where *the member* came for *health item* over the last *recall period*?
8a	Can you tell me when admitted time of *the member* for *health item* over the last *recall period*? (only for inpatient and long-term care)
	1.From 15 days to 30 days ago
	2.From 1 month to 3 months ago
	3.From 3 months to 6 months ago
	4.From 6 months to 9 months ago
	5.From 9 months to 12 months ago
8b	Can you tell me when discharged time of *the member* for *health item* over the last *recall period*? (only for inpatient and long-term care)
	1.From 15 days to 30 days ago
	2.From 1 month to 3 months ago
	3.From 3 months to 6 months ago
	4.From 6 months to 9 months ago
	5.From 9 months to 12 months ago
9	Did you or any member of your household require *health item* over the last **recall period** but could not get it?
	1.Yes
	2.No
10	Do you want to end interview?
	1.End now
	0.Not end now
	Note of interviewer

Appendix 5: Data collection template for private clinics/providers

List of outpatients at private clinics/providers

1	2	3		4	5	6	7					8
No	Full name	Gender		Age	Address (village, commune)	Symptoms/Diagnoses	Expenditures (if applicable) (x1000đ)					Total expenditures (x1000d)
		M	F				Medical fee, small operation	Lab test	Injections, infusion and medicines	Medical products	Preventive services	
	Date …….month …….year 2017											

Appendix 6: International statistical classification of diseases and related health problems (ICD-10)

ICD Chapter	Blocks	Description
I	A00-B99	Certain infectious and parasitic diseases
II	C00-D48	Neoplasms
III	D50-D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism
IV	E00-E90	Endocrine, nutritional and metabolic diseases
V	F00-F99	Mental and behavioural disorders
VI	G00-G99	Diseases of the nervous system
VII	H00-H59	Diseases of the eye and adnexa
VIII	H60-H95	Diseases of the ear and mastoid process
IX	I00-I99	Diseases of the circulatory system
X	J00-J99	Diseases of the respiratory system
XI	K00-K93	Diseases of the digestive system
XII	L00-L99	Diseases of the skin and subcutaneous tissue
XIII	M00-M99	Diseases of the musculoskeletal system and connective tissue
XIV	N00-N99	Diseases of the genitourinary system
XV	O00-O99	Pregnancy, childbirth and the puerperium
XVI	P00-P96	Certain conditions originating in the perinatal period
XVII	Q00-Q99	Congenital malformations, deformations and chromosomal abnormalities
XVIII	R00-R99	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified
XIX	S00-T98	Injury, poisoning and certain other consequences of external causes
XX	V01-Y98	External causes of morbidity and mortality
XXI	Z00-Z99	Factors influencing health status and contact with health services
XXII	U00-U99	Codes for special purposes

Source: SHA 2011, chapter 10 table 10.2.

Appendix 7: Data collection template for drug stores

LIST OF MEDICINES AND MEDICAL PRODUCT BUYERS

Name: …….. Address: ……. Date:…….

1	2	3		4	5	6		7	8	9	10
No	Full name	Gender (mark X)		Age	Address (village, commune)	Buying for		Symptoms/Diagnoses of user/patient	Medicines	Medical products	Total amount (x1000)
		M	F			6a.Own household (mark X)	6b.Other households (specify name and address)*				
1	*Nguyen Van A*	*X*		*37*	*Village 3, Thuan My*		*Tran Thi B, Village 5, Thuan My*	*Running nose, cough*	*Amoxiciliin, Paracetamol*		50

Appendix 8: Structure of health expenditures questionnaires at individual level for inpatient care

Question no	Questions
1	What was total expenditures for inpatient within recall period?
1a	On which of the following type of services or products did the member or your household spend for the overnight stay within recall period?
	1a.Fees for Services of doctors (general and specialized)
	1b.Fees for services of nurses/midwifes and other health practitioners and auxiliaries that are not doctors
	2a.Medicines for consumption or use during the overnight stay
	2b.Other medical products, assistive (e.g products for vision, hearing, mobility, Chairs for bath/toilet Hand rails/grab bars; mattresses and special beds; Portable ramps etc..) health products required for the overnight stay
	3.Laboratory services; imagining services and services
	4.Patient emergency transportation services and emergency rescue
	5.Operation or major procedure
	6.Cost for sick beds (including costs for meals if provided by hospital)
	0.Non-medical goods and services, includes the cost of cooking, cleaning, accommodation, but also the hosting of patients' relatives (if it is indispensable) – associated with the overnight stay
	8.Informal payment to doctors, nurses and health workers
	9.Other (specify)=> Q1c
1c	Please specify
2	Please specify the amount for each used services
	1a.Fees for Services of doctors (general and specialized)
	1b.Fees for services of nurses/midwifes and other health practitioners and auxiliaries that are not doctors

	2a.Medicines for consumption or use during the overnight stay
	2b.Other medical products, assistive (e.g products for vision, hearing, mobility, Chairs for bath/toilet Hand rails/grab bars; mattresses and special beds; Portable ramps etc..) health products required for the overnight stay
	3.Laboratory services; imagining services and services
	4.Patient emergency transportation services and emergency rescue
	5.Operation or major procedure
	6.Cost for sick beds (including costs for meals if provided by hospital)
	0.Non-medical goods and services, includes the cost of cooking, cleaning, accommodation, but also the hosting of patients' relatives (if it is indispensable) – associated with the overnight stay
	8.Informal payment to doctors, nurses and health workers
	9.Other (specify)
3	Did the member or your household spend on transport to get to the health provider and back (return) for the member overnight stay?
	Yes => Q3a
	No => Q3b
3a	If yes, please specify
3b	Did the member walk?
	Yes => Q3c
	No
3c	Why did the member walk?
	1.Facility is nearby
	2.No money to spend on transportation
	3.Other (specify)

	Specify
3d	Estimate how much it would have cost with the cheapest public transportation?

Appendix 9: Supporting information of chapter 3

S1 Table: Characteristics of household respondents

	12 - month recall		6 - month recall	
	n	(%)	n	(%)
Number of households				
Sex of Household respondent				
Male	187	26	117	25
Female	539	74	355	75
Marital status				
Married	603	83	399	85
Age group of HH respondent				
15-19	0	0	3	0.5
20-59	477	66	315	67
60 – 69	141	19	81	17
70 – 79	72	10	51	11
80+	36	5	22	4.5
Education of HH respondent				
Illiterature or read/write	32	4.5	13	3
Primary school	81	11	53	11
Secondary school	356	49	257	55
Highschool & above	257	35.5	147	31
Occupation of HH respondent				
Farmer	270	37	181	38
Office staff	58	8	24	5
Manual workers	109	15	80	17
Business	83	11	51	11
Retired/Elderly	112	15	63	13
Homework	72	10	53	11
Other	32	4	22	5
Religion of HH respondent				
None	720	99	469	99.8
Catholic	6	1	1	0.2

S2 Table: Arithmetic mean of monthly OOPs separately for provider and households with/without medicine costs by two categories of provider OOPs (USD, 2017)

Items	No of HH	All households	No of HH	Households with provider OOPs <= USD 0.4	No of HH	Households with provider OOPs > USD 0.4
		Mean (SD)		Mean (SD)		Mean (SD)
12-month						
Provider OOPs	736	0.8 (1.5)	488	0.02 (0.07)	248	2.2 (1.8)
Household OOPs with medicine costs	736	2.5 (8.2)	488	2.1 (9.5)	248	3.1 (4.5)
Provider OOPs without medicine costs	736	0.7 (1.3)	494	0.02 (0.08)	242	2.0 (1.5)
Household OOPs without medicine costs	736	1.0 (2.5)	494	0.6 (2.0)	242	1.6 (3.0)
6-month						
Provider OOPs	474	1.3 (2.7)	319	0.003 (0.03)	155	3.9 (3.4)
Household OOPs with medicine costs	474	4.7 (11.5)	319	3.2 (10.1)	155	7.9 (13.3)
Provider OOPs wihtout medicine costs	474	1.1 (2.3)	323	0.007 (0.05)	151	3.5 (2.9)
Household OOPs without medicine costs	474	2.0 (6.8)	323	1.4 (7.5)	151	3.2 (5.1)

Note: OOPs was in thousand Vietnam dong. 1 USD was equivalent to 22700 VND in 2017.

S3 Table: Mean bias and variability in measurement of OOPs with medicine costs by recall period (including medicine costs)

Provider OOPs Group	Recall period	Number of households	Geometric mean ratio	95% limits of agreement	Estimated effect of recall period on the mean ratio: the ratio of the mean ratios(95% CI)	Estimated effct of recall period on variabilty: the ratio of the standard deviations(95% CI)
Expenses with medicine cost						
All sample	12-month	736	3.0	0.003 – 3085		
	6-month	474	4.6	0.007 - 2829	1.6 (1.1 – 2.4) P =0.01	0.9 (0.7 – 1.2) P = 0.4
Lower Provider OOPs[1]	12-month	481	9.5	0.02 – 5173		
	6-month	333	10.6	0.02 – 5798	1.3 (0.8 – 2.0) P = 0.2	1.2 (0.9 – 1.3) P = 0.2
Higher Provider OOPs[2]	12-month	149	0.3	0.001 – 110.6		
	6-month	141	0.6	0.005 – 71.5	1.9 (1.1 – 3.4) P = 0.02	0.7 (0.5 – 1.0) P = 0.07

1 Households with provider-reported OOPs less than or equal to USD 4.4

2 Households with provider-reported OOPs greater than USD 4.4

Note: Limits of agreement refer to the range in which 95% of the individual matched pair ratios are expected to lie. Low/higher provider OOPs and interaction term were significant at p-value <0.01 in the likelihood ratio test.

S4 Table: Contribution to total annual household and provider OOPs by version and level of provider OOPs

All sample		
	% of annual inpatient provider OOPs (%)	% of annual inpatient households OOPs (%)
Lower provider OOPs	1.5	31
Higher provider OOPs	98.5	69

S5 Table: Effect of recall period on the risk of the reported OOP value for transactions being greater or less than the provider OOP amount (including medicine costs)

Variables	**Relative risk for greater than provider[6] versus small or no difference[5]**	**Relative risk for smaller than provider[6] versus small or no difference[5]**
With medicine costs	RR (CI)	RR (CI)
Effect of recall period overall[1]		
6-month compared to 12 month recall period	1.1 (0.9 – 1.4)	0.6 (0.5 – 0.9)
Effect of recall period by provider OOPs categories[2]		
6-month compared to 12 month recall period for the low provider OOPs group[3]	1.1 (0.9 -1.5)	-[7]
6-month compared to 12 month recall period for the higher provider OOPs group[4]	1.1 (0.7 – 1.7)	0.6 (0.4 – 0.9)

[1] Other variables in adjusted model: respondent role, gender of respondent

[2] Other variables in adjusted model: respondent role, gender of respondent, lower/higher provider OOPs group, interaction term of recall period and lower/higher provider OOPs group. Lower/higher provider OOPs and interaction term were significant at p-value <0.01 .

[3] Transactions with provider-reported OOPs less than or equal to USD 2.2

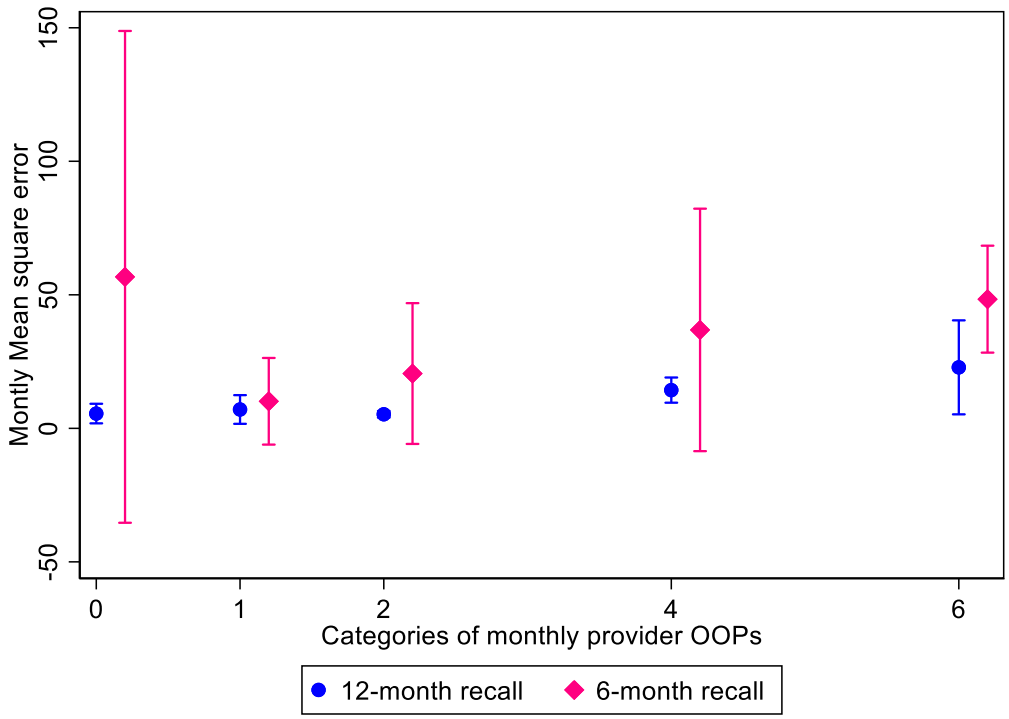
[4] Transactions with provider-reported OOPs greater than USD 2.2

[5] Small difference was defined as the absolute difference between household and provider OOPs being less than or equal to 20% of the provider OOPs of the corresponding transaction.

[6]Greater or less than provider OOPs was defined as the absolute difference of OOPs being greater or less than 20% of the provider OOPs

[7]Very few observations with lower than provider in the lower provider OOPs category

S1 Fig: Mean square error plot by categories of provider OOPs (monthly)



S6: Structure of health expenditures questionnaires at individual level for inpatient care

Question no	Questions
1	What was total expenditures for inpatient within recall period?
1a	On which of the following type of services or products did the member or your household spend for the overnight stay within recall period?
	1a.Fees for Services of doctors (general and specialized)
	1b.Fees for services of nurses/midwifes and other health practitioners and auxiliaries that are not doctors
	2a.Medicines for consumption or use during the overnight stay
	2b.Other medical products, assistive (e.g products for vision, hearing, mobility, Chairs for bath/toilet Hand rails/grab bars; mattresses and special beds; Portable ramps etc..) health products required for the overnight stay
	3.Laboratory services; imagining services and services
	4.Patient emergency transportation services and emergency rescue
	5.Operation or major procedure
	6.Cost for sick beds (including costs for meals if provided by hospital)
	0.Non-medical goods and services, includes the cost of cooking, cleaning, accommodation, but also the hosting of patients' relatives (if it is indispensable) – associated with the overnight stay
	8.Informal payment to doctors, nurses and health workers
	9.Other (specify)=> Q1c
1c	Please specify
2	Please specify the amount for each used services
	1a.Fees for Services of doctors (general and specialized)
	1b.Fees for services of nurses/midwifes and other health practitioners and auxiliaries that are not doctors

	2a.Medicines for consumption or use during the overnight stay
	2b.Other medical products, assistive (e.g products for vision, hearing, mobility, Chairs for bath/toilet Hand rails/grab bars; mattresses and special beds; Portable ramps etc..) health products required for the overnight stay
	3.Laboratory services; imagining services and services
	4.Patient emergency transportation services and emergency rescue
	5.Operation or major procedure
	6.Cost for sick beds (including costs for meals if provided by hospital)
	0.Non-medical goods and services, includes the cost of cooking, cleaning, accommodation, but also the hosting of patients' relatives (if it is indispensable) – associated with the overnight stay
	8.Informal payment to doctors, nurses and health workers
	9.Other (specify)
3	Did the member or your household spend on transport to get to the health provider and back (return) for the member overnight stay?
	Yes => Q3a
	No => Q3b
3a	If yes, please specify
3b	Did the member walk?
	Yes => Q3c
	No
3c	Why did the member walk?
	1.Facility is nearby
	2.No money to spend on transportation
	3.Other (specify)

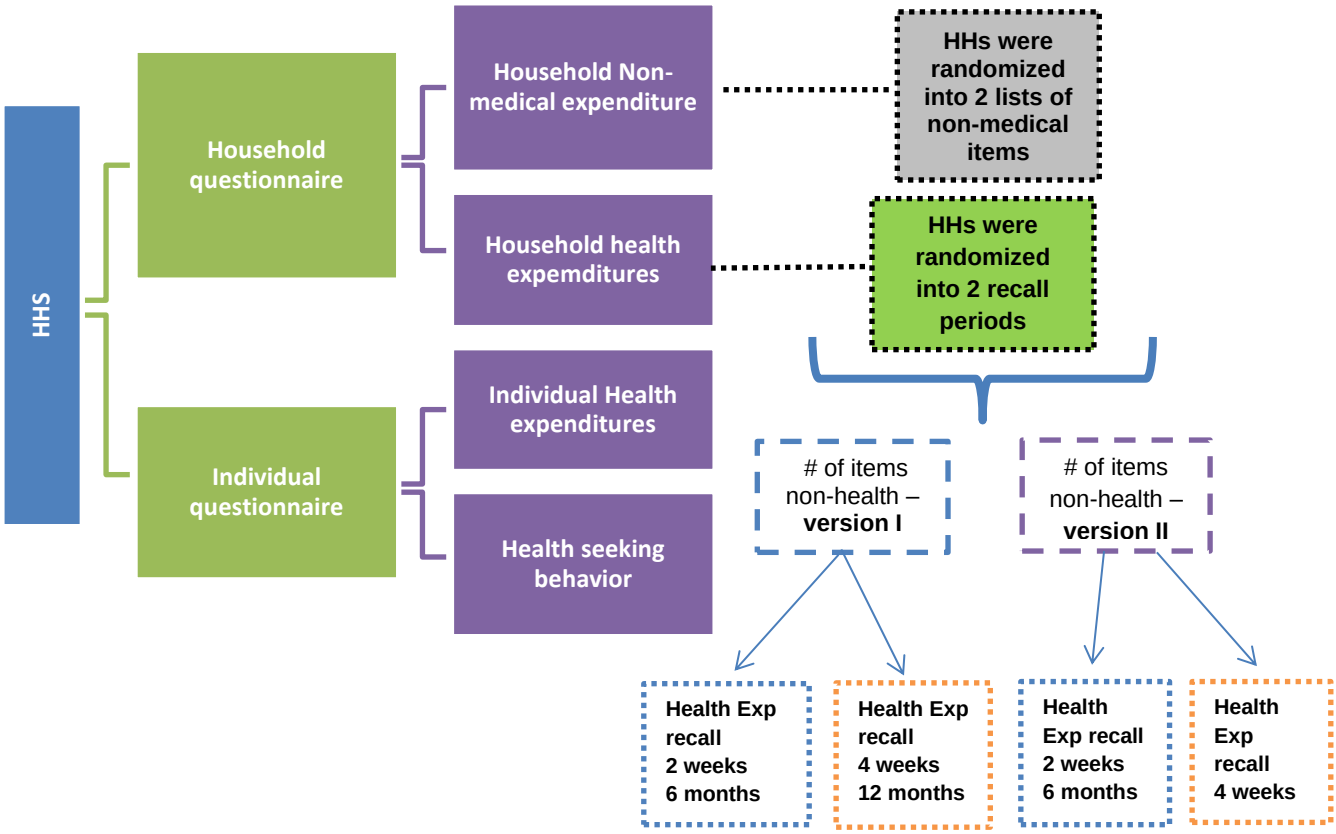
	Specify
3d	Estimate how much it would have cost with the cheapest public transportation?

Appendix 10: Supporting information of chapter 4

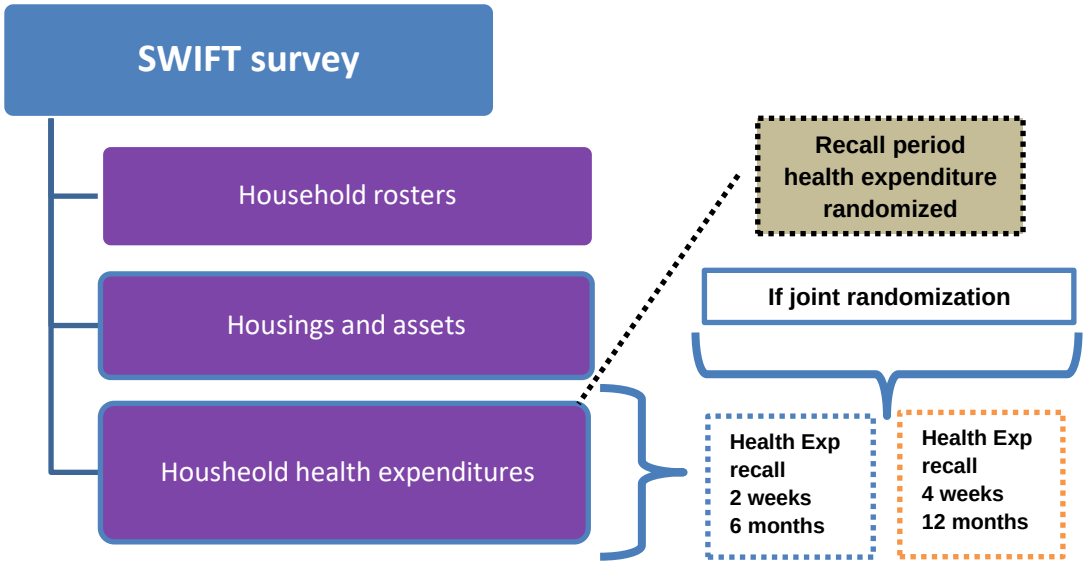
S2.1 Table: Annex 1Recall periods by spending categories

	Shorter recall period	Longer recall period
Inpatient care	6 month	12 month
Preventive care	3 month	6 month
Outpatient	2 weeks	4 weeks
Medicines	2 weeks	4 weeks
Medical products	2 weeks	4 weeks
Assistive products	6 month	12 month

S2.1 Fig: Annex 2 Structure of household health survey (face-to-face survey)



S2.2 Fig: Annex 3 Structure of SWIFT survey (mobile phone survey)



S2.2 Table Annex 4: Sample calculation

Parameter	Calculation
Community sampling group	
Proportion of household incurring outpatient spending (4 weeks)	44%
Expected number per 100 who have outpatient spending with recall periods	2 weeks: 22 – 44 4 weeks: 44
Number needed to estimate bias and variability for one questionnaire version to get approx. 100 who have outpatient spending (assuming mid-point of intervals in row above)	2 weeks: 100*100/33 = 303 4 weeks: 100*100/44 = 227
Number needed to estimate bias and variability for one questionnaire version to get approx. 100 who have outpatient spending (assuming 10% of non-response and 20% of unmatching)	2 weeks: 303 + 10% non- response + 20% unmatching = 394 4 weeks: 227 + 10% non-response + 20% unmatching = 295
The objective sample of each method	394 + 295 = 689
The project sample	Face-to-face: 689 * 2 = 1378 Mobile phone: 689
Total sample	1378 + 689 = 2067
Provider sampling group	
The objective sample of each method	100
The project sample	Face-to-face: 1200 Mobile phone: 100
Total sample	1200 + 100 = 1300

S2.3 Table Annex 5: Proportion of households with mobile phone

	Household sampling		**Provider sampling**	
	F2F (n = 1375)	MP (n = 638)	F2F (n= 1421)	MP (n = 97)
% of household with mobile phone	1277 (92.9%)	522 (99.2%)	1311 (92.3%)	94 (97%)
# mobile phone/household	2.6	2.7	2.5	2.5

S2.4 Table 6: Proportion of transaction with payment characteristics

Community sampling	**Face-to-face**	**Mobile phone**	**Face-to-face**	**Mobile phone**
	Transactions paid all		Transactions got exempted partially or all	
Inpatient care	48 (17.4%)	61 (25.3%)	228 (82.6%)	180 (74.7%)
Preventive care	133 (27%)	79 (17%)	366 (73%)	386 (83%)
Outpatient care	336 (69%)	674 (89.3%)	152 (31%)	81 (10.7%)
Medicines	706 (94%)	240 (97%)	45 (6%)	8 (3%)
Total	1223 (60.7%)	1054 (61.7%)	791 (39.3%)	655 (38.3%)
Provider sampling	Face-to-face	Mobile phone	Face-to-face	Mobile phone
	Transactions paid all		Transactions got exempted partially or all	
Inpatient care	47 (2.5%)	6 (5.2%)	1850 (97.5%)	109 (94.8%)
Preventive care	164 (11.6%)	8 (6.4%)	1249 (88.7%)	117 (93.6%)
Outpatient care	562 (75.8%)	85 (85%)	179 (24.2%)	15 (15%)
Medicines	546 (93.7%)	44 (97.8%)	37 (6.3%)	242 (2.2%)
Total	1319 (28.5%)	143 (37.1%)	3115 (71.5%)	242 (62.9%)

S2.4 Table Annex 7: Sensitivity analysis for mean bias and variability in measurement of inpatient OOPs by data collection method (1222 HHs including 148 HHs did not report)

	Data collection method	Number of households	Mean bias (ratio)	95% limits of agreement	Estimated ratio in bias (Mobilephone vs Face-to-face) & CI & p-value	Estimated ratio in SD (Mobilephone vs Face-to-face) & CI & p-value
All matched households	Face-to-face	1037	84.5	0.2 - 37542		
	Mobile phone	85	79.6	0.13 - 48834	1.08 (0.5 – 2.2) , p = 0.83	1.1 (0.8 – 1.4) , p = 0.5
Matched households with provider OOPs <= USD 8.8	Face-to-face	683	524.7	6.6 - 41763		
	Mobile phone	52	671	7.6 - 59045	1.4 (0.7 – 2.7) , p = 0.28	1.18 (0.8 – 1.8) , p = 0.47
Matched households with provider OOPs > USD 8.8	Face-to-face	354	3.36	0.5 – 23.6		
	Mobile phone	33	4.1	0.2 – 91.9	1.3 (0.9 – 1.9) , p = 0.2	1.7 (1.3 – 2.1) , p < 0.01

Appendix 11: Supporting information of chapter 5

S1 Table: Status of matching outcome at household level

Household level	No of households
# HHs interviewed	1421
# HHs reported at least 1 inpatient transaction	1271 (89%)
# HHs* having at least 1 matching outcome	1229 (86%)
# HHs having at least 1 transaction linked with provider	1106 (78%)
#HHs having no transaction linked with provider	123 (8.6%)

Appendix 12: Curriculum Vitae

My Lan Le

I am a researcher with 10 years of experience in doing research in the field of public health. I have excellent global experience, having lived, and worked in Vietnam, Thailand and Switzerland. I am open to opportunities that involve public health, health economics, outcome research or implementation research.

PERSONAL DETAILS

Qualifications	PhD, MSc, BA
Nationality	Vietnamese
Languages	Vietnamese (mother tongue), English (level C2)
Computer skills	Microsoft Office, STATA, ODK, Commcare
Email address	lan.lemy@gmail.com
LinkedIn	https://www.linkedin.com/in/lan-le-my-11740970/

PROFESSIONAL EXPERIENCE

Local Consultant (project-based contract) July 2021 — present
The Task Force for Global Health, USA

Responsibilities:
Worked as a local consultant with U.S CDC Hanoi team and General Department of Preventive Medicine to develop a protocol for evaluation an application on monitoring adverse events following COVID-19 immunization and a protocol on cohort event monitoring of adverse events of special interest and medical attended events.
Acted as a focal person with stakeholders to provide technical support for the implementation of the protocols.
Performed quantitative analysis.
Led in report writing.
Deliverables:
A protocol of evaluation a mobile application on monitoring adverse events following COVID-19 immunization.
A protocol on cohort event monitoring of adverse events of special interest and medical attended events following COVID-19 immunization.
A full report on evaluation of the mobile application on adverse events following COVID-19 immunization.

Research Consultant (project-based contract) Sept 2021 — present
Pharmacotherapy Outcome Research Center, University of Utah, USA

Responsibilities:
Worked as a research consultant for a research project funded through CDC'SEPHeRD program.
Supervised PharmD and Ph.D students in several projects.
Collaborated with international colleagues in data handling and analysis of research projects.
Led in report writing for funder and manuscript writing.

Consultant June 2021— Nov 2021
AstraZeneca

Responsibilities:

Worked as a research consultant in a team of pharmacists and health economists to prepare a health technology assessment application for a lung cancer maintenance therapy approval of social insurance.

Deliverables:
A complete health technology assessment application addressed all technical aspects (clinical and economic) of the therapy.

Research Fellow January 2021 — June 2021
Pharmacotherapy Outcome Research Center, University of Utah, USA

Project 1: Economic evaluation of seasonal influenza vaccinations in high-risk population: a systematic review and meta-analysis
Link: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=246746

Project 2: The impact of pharmacist involvement on immunization uptake and other outcomes : An updated systematic review and meta-analysis
Link: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=251119
Responsibilities:
Worked as a postdoctoral fellow and co-investigator for research projects in the field of evidence synthesis and equity in health.
Supervised PharmD and Ph.D students in several projects.
Collaborated with international colleagues in data handling and analysis of research projects.
Led in report writing for funder and manuscript writing.

Key achievements:
Submitted two manuscripts, one as first author to the JAPhA and one as second author to the eClinicalMedicine.
Developed several concept notes. One of them became an objective of a proposal submitted to SHEPHeRD program of US CDC.

Research Fellow August 2016 — June 2020
Swiss Tropical and Public Health Institute, Basel, Switzerland

PhD thesis title: “Assessing the effect of household survey designs on the accuracy of out-of-pocket health expenditures measurement in Vietnam”.
Synopsis: Developed 13 study instruments for household survey according to Vietnam Living Standard Household survey and Classification of Individual consumption according to purpose. Validated them with health provider data to explore what study designs give more accurate out-of-pocket estimates.

Responsibilities:
Developed the study proposal, literature review, methodology, and implementation plan.
Designed survey instruments and programmed in electronic format.
Led and supervised data collection fieldwork.
Handled data cleaning, data management and data analysis.
Presented the findings at conference and published journal paper.

Research Officer March 2015 — Dec 2018
Hanoi Medical University, Hanoi, Vietnam

Project 1: Household OOPs tracking for Disease-specific health account and universal health coverage measure: Developing household OOP Measurement Methodology (Ph.D project)
Link: http://www.indepth-network.org/projects/ihope

Project 2: Vietnam Health and Aging Study
Link: https://grantome.com/grant/NIH/R01-AG052537-01A1

Responsibilities:
Worked as research officer for 2 main research projects and supported other projects.
Prepared the project proposals for IRB and Ministry of Health approval.
Developed study designs and methodologies.
Developed survey questionnaires and manual handbook.
Programmed survey tools for tablet data collection (Commcare).
Provided training for field surveyors. Supervised data collection fieldwork.
Handled data management and qualify control

Health Financing Assistant September 2014 — January 2015
Luxembourg Agency for Development Cooperation, Hanoi, Vietnam

Project: Supporting Policy on Health Care for the Poor in the Provinces of Cao Bang and Bac Kan (VIE/027)
Link: https://luxdev.lu/en/activities/project/VIE/027.

Responsibilities:
Worked as research assistant for a performance-based finance (PBF) project in at mountainous provinces in the North Vietnam.
Consulted the PBF implementation for the provincial authority and health officers.
Developed capacity enhancement program and training for CHCs 'health staffs.
Participated in writing manual handbook of PBF implementation for provincial and district authorities in the health sector.
Analyzed and reported the PBF implementation.

Deliverables:
Manual handbook of PBF implementation
Verification tools for implementation evaluation
Technical report.

Research Assistant May 2012 — May 2013
Hanoi Medical University, Hanoi, Vietnam

Project: A randomized Controlled Trial to Assess Antiretroviral Treatment Strategies in Relation to Adherence, Resistance and Virological Treatment Failure – (DOTARV project)
Link: https://ichgcp.net/clinical-trials-registry/NCT01433601

Responsibilities:
Worked as research assistant for several projects.
Conducted administrative and financial procedures for research projects.
Supported in data collection of research projects of Vietnamese and foreign researchers.
Participated in report writing.
Translated documents.
Facilitated workshop and training courses.

EDUCATION

Doctor of Philosophy (Ph.D) in Epidemiology
University of Basel, Basel 2016 — 2020

Master of Sciences (MSc.) in Health Economics and Health Care Management Chulalongkorn University, Bangkok 2013 — 2014

Bachelor of English
Academy of Finance, Hanoi 2008 — 2012

HONORS AND AWARDS

Speaker scholarship August 2020
6th Global symposium on Health system research 2020

PhD Scholarship March 2019 — July 2020
Kanton of Basel

PhD Fellowship February 2016 — January 2019
INDEPTH Network

Scholarship for ASEAN student June 2013 — May 2014
Chulalongkorn University

CONFERENCES AND WORKSHOPS

ISPOR 2022 May 2022
Washington DC, United Stated

6th Global symposium on Health system research 2020 November 2020
Dubai, United Arab Emirates
Conference presentation: "A comparison of face-to-face and mobile phone data collection for estimating out-of-pocket payments"

Canadian Institutes of Health Research Planning Meeting August 2019
Halifax, Canada

2019 iHEA World Congress July 2019
Basel, Switzerland
Conference presentation: "Effect of the recall period for estimating inpatient out-of-pocket expenditures: validation study in Vietnam"

iHOPE workshop on Data analysis October 2018 — November 2018
Basel, Switzerland

INDEPTH-Network household out-of-pocket payment project workshop September 2017
Hanoi, Vietnam

INDEPTH-Network household out-of-pocket payment project workshop March 2017
Hanoi, Vietnam

INDEPTH-Network household out-of-pocket payment project workshop October 2016
Navrongo, Ghana

4th National Graduate Conference May 2014
Nonthaburi, Thailand

Conference presentation: “Factors affecting the enrolment in Voluntary Health Insurance of people in Bavi district, Hanoi, Vietnam"

PUBLICATIONS (published, submitted and on progress)

Le ML, Flores G, Tan-Torres T, Tran KT, Nguyen CTK, Tran DT, Dang HP, Agorinya I,Tediosi F, Ross A, Investigating the effect of recall period on estimates of inpatient out-of-pocket expenditure from household surveys in Vietnam. PLOS ONE. 2020;15(11): e0242734. DOI: http://dx.doi.org/10.1371/journal.pone.0242734

Agorinya I, Ross A, Flores G, Tan-torres T, Wilgenburg K, Akazili J, Dalaba M, Mensah N, **Le ML**, Bacha YD, Sumboh J, Oduro AR, Tediosi FEffect of specificity of health expenditure questions in the measurement of out-of-pocket health expenditure: evidence from field experimental study in Ghana. BMJ Open. 2021;11(5): e042562. DOI: https://bmjopen.bmj.com/content/11/5/e042562

Le ML, Chaiyakunapruk N, Urgent need to take action on reducing postoperative respiratory complications. The Lancet Regional Health - Western Pacific. 2021; 10:100136. DOI: https://doi.org/10.1016/j.lanwpc.2021.100136

Dilokthornsakul P, **Le ML**, Thakkinstian A, Hutubessy R, Lambach P, Chaiyakunapruk N, Economic evaluation of seasonal influenza vaccination in elderly and healthcare workers: a systematic review and meta-analysis. eClinicalMedicine 2022;47: 101410. DOI: https://doi.org/10.1016/j.eclinm.2022.101410

Le ML, Veettil S, Donaldson D, Kategaew W, Hutubessy R, Lambach P, Chaiyakunapruk N, The impact of pharmacist involvement on immunization uptake and other outcomes : An updated systematic review and meta-analysis. JAPhA (2022) (accepted).

Agorinya I, Ross A, Flores G, Tan-torres T, Wilgenburg K, Akazili J, Dalaba M, Mensah N, **Le ML**, Bacha YD, Sumboh J, Oduro AR, Tediosi F, The effect of recall period on reported out-of-pocket health expenditure in Ghana. This manuscript is submitted to PLOS ONE.

Syeed S, Ghule P, **Le ML**, Veettil S, Horn E, Wasserman M, Perdrizet J, Thakkinstian A, Chaiyakunapruk N, Pneumoccocal Vaccination in children: a systematic review and me-ta analysis of cost-effectiveness studies. *Abstract is accepted for poster presentation at ISPOR 2022.*

Trerayapiwat K, Jinatongthai P, Vathesatogkit P, Sritara P, Paengsai N, Dilokthornsakul P, Nathisuwan S, **Le ML**, Chaiyakunapruk N, Using real world evidence to generate cost-effective analysis of Fibrinolytic Therapy in Patients with St-Segment Elevation Myocardial Infarction in A resource-limited country. First rebvision is submitted to The Lancet Regional Health – Western Pacific. *Abstract is accepted for poster presentation at ISPOR 2022.*

Le ML, Ross A, Flores G, Tan-Torres T, Tran KT, Nguyen CTK, Tran DT, Dang HP, Agorinya I,Tediosi F, A comparison of face-to-face and mobile phone data collection for estimating out-of-pocket payments. Manuscript is submitted to BMJ Open. *Abstract was accepted for podium presentation at HSR2020.*

Le ML, Tan-Torres T, Flores G, Ross A, Tran KT, Nguyen CTK, Tran DT, Dang HP, Agorinya I,Tediosi F, Disease specific out-of-pocket payments are not be accurately measured in households surveys: a validation study in Vietnam. This manuscript is in submission process.