Evaluating alternative approaches for improving the measurement of household Out-of-pocket health expenditure: The Indepth-Network household out-of-pocket health expenditure (iHOPE) experimental study in Ghana

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Dekan

Dedicated to my parents Mr. Daniel Agorinya and Victoria Ayampoka Aduah

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List of abbreviations

BMC	Budget Management Centres
BMGF	Bill and Melinda Gates Foundation
CAPI	Computer Assisted Personal Interview
CE	Catastrophic Health Expenditure
CHAG	Christian Health Association of Ghana
CHESS	Comprehensive Health and Epidemiological Surveillance System
CHPS	Community based Family Planning Systems
COICOP	Classification of Individual Consumption according to purpose.
DHA	District Health Administration
DHMT	District Health Management Team
DHS	Demographic and Health Survey
GDP	Gross Domestic Product
GHS	Ghana Health Service
GLSS 6	Ghana Living Standards Survey sixth edition
GSS	Ghana Statistical Service
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
ICPC-2	International Classification of Primary Care second edition
iHOPE	INDEPTH-Network Household Out-of-pocket Expenditure
LEAP	Livelihood Empowerment Against Poverty
LMIC	Low and Middle-income Countries
LSMS	Living Standards Measurement Survey
MOH	Ministry of Health
NH	Non-health Consumption
NHA	National Health Accounts
NHIA	the National Health Insurance Authority
NHIS	National Health Insurance Scheme
NHRC	Navrongo Health Research Centre
OOPs	Out-of-Pocket Health Spending
OPD	Out-patient Department
SAGE	Study on Global Ageing and Adult Health
SDG	Sustainable Development Goal
SES	Socio-economic Status
SHA	System of Health Accounts
STI	Sexually Transmitted Infection
UHC	Universal Health Coverage
WHO	World Health Organization
WHS	World Health Survey

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Summary

Out-of-pocket health payments (OOPs) defined as direct payments for services from the household's primary income or savings with no third-party payer is involved, has been identified by System of Health Accounts (SHA) as the largest source of health care financing in most low and middle-income countries. The world spent nearly US$7 trillion on health care in 2011 and US$7.3 trillion by 2015 on health. Low and middle-income countries rely on out-of-pocket payments to finance health care. Recent data shows a global decline in the reliance on OOPs, declining from 56% in 2000 to 44% in 2016. Out-of-pocket payments as a share of total current health expenditure has also seen some decline in all regions. In the African region for instance, data from 47 countries showed a decline in the share by 9% (from 46% to 37%). The decline in the share of OOPs relative to total current health spend was found to be driven by increases in other source and not a decline in OOPs spending and therefore the levels and burden of OOPs to households still remain high. More and more people globally are pushed in to catastrophic health payments or impoverishment due to out-of-pocket health payments. 808 million people globally incurred catastrophic health expenditure in 2010 as a result of out-of-pocket health spending. This has pushed for the inclusion of financial risk protection in the sustainable development goals, specifically in goal 3.8 (SDG 3.8) that talks about universal health coverage (UHC). In this regard, UHC was recently adopted an SDG target with the aim of proving quality and accessible health care and at the same time protecting people against financial shocks that come with accessing such health care. The concept of financial risk protection has put the spot light on the measurement of out-of-pocket health payments particularly in LMIC. Catastrophic health expenditure and impoverishment due to OOPs are two important indicators for measuring financial risk protection in health and therefore the accurate measurement of OOPs payments is critical in monitoring progress towards achieving SDG 3.8. As result, many countries, as well as development partners are now requesting WHO to estimate the Out-of-Pocket (OOP) health expenditures in WHO National Health Account (NHA) disease specific account in order to track the investments and the financial burdens on key healthcare priority interventions.

National household surveys are the primary sources of data for estimating household Out-Of-Pocket payments in most low and middle income countries due to the absence of routine and transactional medical records. National Health Accounts (NHA) which is the most commonly used tool to track health care expenditure across countries requires breakdown of information on out-of-pocket payments by providers, diseases, age, gender and functions. However, such

information is usually not well captured in the current surveys. The way data in current surveys is collected raises accuracy, reliability and comparability concerns due to the heterogeneity in the way out-of-pocket payments variables are collected in these survey.

In these surveys, there are substantial variations in recall periods in the tools across countries, some surveys use one week others one month and others a one year recall. There are also variations in the number of OOPs expenditure items included in surveys and the overall structure of the health expenditure questions differ. Also, the interval between national surveys is usually long (5 years in the case of the LSMS and DHS). It is also very difficult to validate out-of-pocket data collected through these national surveys as there is no agreed gold standard approach and therefore very difficult to know which survey type offers the best OOPs estimates. This raises the need to develop new methods that are tested and validated to improve the measurement of OOPs in household surveys.

The aim of this thesis is therefore to test and validate a standardize set of questions to improve the measurement of OOPs by specifically answering questions on; the structure of the instrument (Type of instrument and overall structure of health expenditure questions), the optimal recall period, the optimal number of items/specificity and to also share some key lessons, challenges and recommendations in implementing a large validation study in a resource poor setting. This study was implemented in three stages; the first stage involved literature review to identify the gaps and limitations in current methods of measuring OOPs, in the second stage, findings from the first stage was used to develop new instruments by repurposing existing instruments to be sensitive to the gaps and limitations identified in stage 1, and in the final stage, a validation strategy was developed to test the new instruments. The validation strategy included a cross-sectional survey and provide data collection. Data from the cross-sectional study was validated using the provider data which was considered as a gold standard.

Given that this is a validation of quantitative methods in an experimental context, an approach proposed by Bland-Altman for assessing agreement between two quantitative measurements was adopted. This analytical approach was adopted to quantify biases by validating the new approaches using provider data as ‘gold standard’.

The findings demonstrates varying levels of bias of out-of-pocket health expenditure across different health expenditure modules. The results provides important evidence of the independent effect of the number of health items/specificity, recall period and the structure of the expenditure module on OOPs estimates. These survey characteristics impact on OOPs estimates differently depending on the type of spending class one is confronted with. Inpatient

care and medicines are the main drivers of OOPs expenditure among households and this can be attribute to the existence of a national health insurance scheme that provides insurance coverage for 95% of diseases in Ghana. In all spending categories, households consistently report estimates that are higher than provider records. In terms of the specificity of health expenditure items, we found that contrary to evidence from existing nationally representative surveys, increasing specificity underestimates OOPs in some spending categories (Outpatient care, medicines and preventive care) and at the same time decreases the accuracy of the estimates in inpatient care and medicines. This implies that, less detailed health expenditure list tend to produce relatively accurate and reliable OOPs estimates than more detailed list.

In terms of the effect of recall period, OOPs estimates for inpatient care are relatively more accurate and reliable in longer recall (12months), whilst OOPs estimates for medicines are relatively accurate in shorter recall period (2weeks). A household expenditure module that combines longer recall for inpatient care and a short recall for medicines will produces more accurate and reliable OOPs estimates as suggested by our findings. In terms of the structure and the level at which the expenditure questions are asked in the health expenditure module. Two modules (household-level and individual-level) were tested in this project, we found no substantial difference in OOPs between the two modules even though OOPs were slightly higher in household-level module. This implies that, additional effort, time and money that is required to field an individual-level health expenditure module does not yield additional benefits if the intent is for household level aggregates. This research has produced evidence to suggest an improved health expenditure tool using existing instruments. Our evidence suggests that, a health expenditure module that is less detailed and less specific in health expenditure items, uses a long recall for inpatient care and a short recall period for medicines will produce more accurate and reliable OOPs in household surveys.

Experimental studies have the advantage of allowing researchers to appropriately control the experimental environment, however, our study was limited by the quality, availability and accuracy of health provider records. One most important lessons that is worth explicitly noting is that, future studies of this nature must invest time and money in improving the health provider records by first engaging the providers within the study area to understand the factors that influence and drive data quality. This approach will help contextualize the challenges so that appropriate approaches can be designed to improve the quality of the provider if such records are to be considered as ‘gold standard’. This study has provided evidence that supports the current conversation about improving measurement of OOPs and further suggests a direction for this agenda.

Chapter 1

Thesis outline

This doctoral thesis is put together in seven chapters. Each chapter describe in detail the main activities undertaken in this research work. Chapter 1 gives a detailed description of the background to the research. The chapter contains a review of literature that directly or indirectly relate to this research work. The chapter concludes by identifying the knowledge gap and elaborating the rationale for this research work. Chapter 2 of this thesis is dedicated to the research methodology. This study is generally a methodological study and therefore the steps taken to execute the project are chronologically outline in this chapter. Three steps in the methods were taken to successfully implement this study, the first step involved the development of the research tools, the second step involved the implementation of a cross-sectional survey with the developed tools and the final step was the validation of the tool using the cross-sectional data from step two. Each chapter in Chapter 3 to Chapter 5 presents results of the key research questions in this study. The Bland-Altman analytical approach of comparing two quantitative measurement was employed to test and validate the research questions in these chapters. Chapter 3 specifically tests and validates the optimal number of health items/specificity to be included in a household budget survey. Chapter 4 also tests and validates the optimal recall period for health expenditure items in a health focused household survey. Chapter 5 is a working paper that focuses on the effects of the structure of health expenditure module in the estimation of out-of-pocket health expenditure.

Chapter 6, analyses the lessons learnt and the challenges in implementing a large validation study in a resource poor settings. Adopting a mixed-method approach, this chapter shed lights on particularly the challenges in this study. The quantitative part presented results on demographic characteristics of household members, health care utilization rates, proportion of household expenditures that successfully linked with provider records or otherwise. The qualitative part of this chapter focused on documenting and understanding the challenges in recording and extracting health expenditure data from both private and public health providers and linking such data to households members in the community who incurred such expenditures.

The general discussions and conclusions of this thesis in contained in Chapter 7. This chapter summarizes all the key points and findings from chapter 1 to chapter 6 and also include discussions about the policy implications of the findings in the research work.

1. Introduction

1.1 Out-of-pocket payments

The cost of health care is increasing across all WHO regions. Globally, US$7 trillion was spent on health care in 2011 and by 2015 the amount rose to US$7.3 trillion (WHO, 2014, 2017). It is estimated that, more than 80% of the world's population live in low and middle income countries (LMIC) but account for only 20% of world health care spending in 2016 (Xu, Soucat & Kutzin, 2018). Total health spending is growing faster in low and middle income countries, growing faster that gross domestic product (GDP) by about 6% compared to 4% in high income countries (HIC). Recent data show that, countries are now relying on domestic sources to finance health care. In African region for instance, domestic resource account for about 76% of total spending and about 69% in the least developed countries (WHO, 2016). Recent data shows a global decline in the reliance on out-of-pocket payments (OOPs), declining from 56% in 2000 to 44% in 2016 (Xu, Soucat & Kutzin, 2018). Household out-of-pocket health payments (OOPs) is the direct payments for services from the household's primary income or savings when accessing health care and this usually include cost-sharing and informal payments which also includes in-cash and in-kind payments (SHA, 2011).

Out-of-pocket payments as a share of total current health expenditure has also seen some decline in all regions. In the African region for instance, data from 47 countries showed a decline in the share by 9% (from 46% to 37%). The decline in the share of OOPs relative to total current health spend was found to be driven by increases in other source and not a decline in OOPs spending (Xu, Soucat & Kutzin, 2018) and therefore the levels and burden of OOPs to households still remain high. However, out-of-pocket spending still remains the largest health financing scheme in most low and middle income countries (LMIC). Globally, the distribution of OOP health payments varies greatly between HICs and LMICs. WHO estimated that about 33% of all health care financing is by OOP payments globally with about 41% in low-middle income countries, 32% in upper-middle income countries and about 21% in high-income countries (WHO, 2016).

More and more people globally are pushed in to catastrophic health payments or impoverishment due to out-of-pocket health payments. 808 million people globally incurred catastrophic health expenditure in 2010 as a result of out-of-pocket health spending (Wagstaff et al., 2018). This evidence pushed for the inclusion of financial risk protection in the sustainable development goals, specifically in goal 3.8 (SDG 3.8) that talks about universal health coverage (UHC). OOPs as financial scheme represents a major financial burden for

households (O'Donnell, 2019). Households exposed to OOPs are at risk of catastrophic health expenditure (CHE) or impoverishment; two key indicators for measuring financial protection in health (WHO, 2017). Catastrophic health expenditure (CHE) and impoverishment are both measured by OOPs (Organisation mondiale de la santé & Groupe de la Banque mondiale, 2015; WHO, 2017) and therefore have an indirect link with SDG1 which is the elimination of poverty (WHO, 2017). This has opened up the discussions about financial shocks to households when accessing health care and how to protect households against such shocks. The concept of financial protection in health is often defined in relation to the objectives health systems should have, that is to protect people from the financial consequences associated with the use of medical care (O'Donnell, 2019). This definition focuses on the burden of health care cost due to the utilization of heath care services. The recent adoption of universal health coverage (UHC) as a sustainable development goal (SDG) target (UN, 2015) has questioned a focus on financial hardship exclusively. The SDG target 3.8 seeks to achieve universal health coverage, 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 (WHO, 2017; The World Bank). Indeed, financial protection in health can legitimately be defined in relation to a concern for reducing, if not eliminating, any risk of financial loss which is the ultimate goal of universal health coverage in SDG 3. OOPs undoubtedly plays an important role in tracking UHC in SDG era and therefore it is important to accurately measure its levels among households.

Out-of-pocket health expenditure measure 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. As a financing scheme, household out-of-pocket payments have serious limitations for the purpose of mobilising and locating money within the health system. In particular, pooling of funds is not possible since services are provided only if the individual pays and individuals pay only if a decision is made to seek care and therefore funds are raised within this scheme solely on a contributory and voluntary basis(SHA, 2011).

Since it is not possible to pool resources, OOPs as a health system-financing scheme 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. There is growing demand to have accurate and reliable OOPs estimates due to its importance within and without the health system.

As a result, countries and development partners globally are now demanding the World Health Organization (WHO) to estimate Out-of-Pocket (OOP) health expenditures in WHOs National Health Accounts (NHA) in order to track the investments and the financial burdens on the key healthcare priority interventions (including SDG 3.8). National Health Accounts (NHA) is the most commonly used tool to track health care expenditure across countries. System of Health Accounts (SHA) aims at providing guidelines for (SHA 2011) to systematically describe financial flows in the context of NHA and beyond. SHA 2011 recommends ideally disaggregating total OOPs according to the financing regime. Ideally it should be disaggregated as i). OOPs excluding cost-sharing; OOPs including cost-sharing with, ii). government scheme and compulsory contributory health insurance schemes and, iii) with voluntary insurance schemes. The share of each of these sub-categories over time and across countries depicts the financial burden households are exposed to and in particular can enable to monitor the effect of interventions trying to mitigate such burdens (SHA, 2011)**.** 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) (Lorenz, 2009). Accurate measurement of OOPs is therefore critical for NHA since incorrect measurement of OOP can undermine the credibility of total current health spending estimates and thus NHA statistics; an otherwise important indicator for policy makers.

1.2 Measurement and estimation of Out-of-pocket health expenditures

The accurate measurement of OOPs is undoubtedly important as we have learnt from the previous section, however, the existing approaches for measuring OOPs differ across countries and territories. The needs of Development partners mostly drive the choice of the approach. However, most measurement approaches try to follow the guidelines of SHA.
In a more general sense in the measurement of OOPs, different approaches are needed to estimate i) the extent to which OOPs contribute to support the demand for health care goods and services in a country (SHA, 2011); ii) attributing OOPs to diseases and linking this to health care financing schemes and; iii) estimating the extent to which OOPs represents a financial burden for households and the health system as a whole. The methodology for iii) has been published in peer-reviewed journals(Wagstaff & Doorslaer, 2003) and WHO and the World Bank are currently recommending its adoption to monitor financial protection in health(United Nations, 2015; WHO, 2017). Guidelines for i) and ii) are also embedded in the system of health accounts framework(Directorate for Employment, Labour and Social

Affairs, 2013; SHA, 2011). This framework is developed for National Health Accounts (NHA) and is commonly used to track health care expenditure across countries and territories. In high-income countries, data for measuring and estimating OOPs in mostly obtained from routine transactional or administrative medical records and registries (Gliklich, Dreyer & Leavy, 2014) whilst in most low and middle income countries, the methods heavily rely on household surveys as primary source. Household surveys have been found to vary from country to country and by territory (Lu et al., 2009; Grosh & Glewwe, 2000; Rannan-Eliya & Lorenzoni, 2010a; Rannan-Eliya, 2010; SHA, 2011). There is evidence to suggest that the current national surveys used to estimate out-of-pocket health payments do not give reliable data for preparing National Health Accounts and measuring financial protection (Lu et al., 2009; Xu et al., 2009; Lavado, Brooks & Hanlon, 2013a; Heijink et al., 2011; Neter, 1970; SHA, 2011). This has been attributed to the fact that, most of the existing national representative surveys are limited in that they are not health specific as they collect a broad range of information hence do not go into details to collect a more disaggregated out-of-pocket payments (Lu et al., 2009; Heijink et al., 2011). A review and compilation of source of data for preparing health expenditures in different countries revealed a very heterogeneous picture, where even given the same country, different surveys, which are different in their design and purposed are used to prepare health expenditure estimates (see Table 1.1).

Table 1.1: Data sources for estimating OOPs in different countries

Income level	Number of countries	Survey type	Number of surveys
HIC	10	WHS	8
		HBS	4
		IES	1
UMIC	23	WHS	16
		HBS	2
		IES	1
		HLSS	2
		QHS	1
		LMS	1
		HSPS	1
		NIDS	1
LMIC	24	WHS	17
		IES	7
		HLSS	6
		LCMS	1
		NBHS	1
		APIS	1
LIC	21	WHS	12
		HBS	4
		HLSS	1
		NHS	2
		CWIQ	1

Source: http://www.who.int/bulletin/volumes/91/7/12-115535/en/

*WHS-world health survey, * HLSS- Household living standards survey, *HBS- Household Budget Survey, *IES- Income and Expenditure Survey, * QHS- Quarterly Household Survey, *HSPS- House Survey panel Series, *LMS- Longitudinal Monitoring Survey, *NIDS- National Income and Dynamic Survey, *NBHS- National Baseline and Household Survey, *LCMS- Living Conditions Monitoring Survey, *APIS- Annual Poverty Indicator Survey, *NHS- national Household Survey, *CWIQ- Core Welfare Indicator Questionnaire.

The principal source of problem in the measurement and estimation of OOPs expenditures is the reliance on household surveys as primary source of data despites available evidence that demonstrate the limitations in using such data sources. Therefore, the production of reliable estimates thus requires considerable care in selection of appropriate methods, in the assessment of the available data, and in combining information from multiple data source. These enforced data challenges in the existing surveys do not give a platform to compare resource tracking and financial protection across countries due to the different methods used in different surveys by different countries. Evidence exist to show that, even with the same type of survey, questions regarding health expenditure still vary (Lu et al., 2009).

1.3 Description of existing household surveys for measuring OOPs in LMIC

From Table 1.1, there are potentially four data sources that are used to gather information on household out-of-pocket health expenditures in most LMIC. The first three are all household consumption and expenditure surveys but differ in their design because they have different major purposes. While Household budget surveys (HBS) and household income and expenditure surveys (HIES) are primarily designed to collect data that enables the calculation of consumer price indices or the compilation of national accounts (Grosh & Glewwe, 2000; Smith, Dupriez & Troubat, 2014), socio-economic or living standard surveys conducted in developing countries is to measure and monitor poverty or track progress in its eradication which is the first SDG Goal (United Nations, 2015). Hereafter we refer to all first three data sources as Household Consumption and Expenditure Survey (HCES) following the terminology adopted by Smith et al (Smith, Dupriez & Troubat, 2014). While HCES can be grouped according to their main objective, they are nationally designed and as such there are important non-sampling difference undermining ex-post harmonization efforts.

The fourth data source which we will refer to as Health Surveys hereafter are sometimes also designed to collect data on health spending but here again depending on the focus of the survey, different instruments are used to collect such information. Most frequently used health surveys include but not limited to; World Health Survey (WHS), Demographic and Health Survey (DHS) and Study on global AGEing and adult health (SAGE). This project focuses on these four main household surveys.

Across most household surveys, information on health is captured in either a health module or in a utilization module depending on the purpose of the survey. Calculations by WHO on World

Bank's non-food assessment survey demonstrate a rather interesting distribution in current household surveys how health information is captured. The structure and design of health information questions in survey also vary between HCES and Health surveys.

Household consumption and expenditure surveys (HCES)

Tables S6 and S7 in Appendix VI show detailed summary of how information on health is captured in most HCES. In tablet S6 (*summary of HCES surveys with health module*), we see that, out of 100 HCES reviewed, 81% have a health module, 74% collect information on general health status, 46% on maternal health and 42% on immunization. Only 18.5% of HCES collect information on only one health domain out of 81 HCES surveys reviewed. In table S7 (*summary of HCES surveys with health care utilization*), 80% of the surveys collect data on health care utilization and this information is only conditional on some characteristic (mainly being sick or injured). About 44% of the surveys had such utilization module. Information on utilization by type of health care facility is available in 89% of the utilization module and on type of provider in 60%. Information on service received and type of treatment, medication and exams received on the other hand is only collected in 20% of the utilization modules. Half of the utilization modules include information on frequency of visits whilst details about hospitalization are less often collected in utilization modules (44%). Based on these findings we presume 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. The living standards measurement survey (LSMS) is the most widely implemented HCES in most LMIC and therefore we adapt its structure in this study as follows.

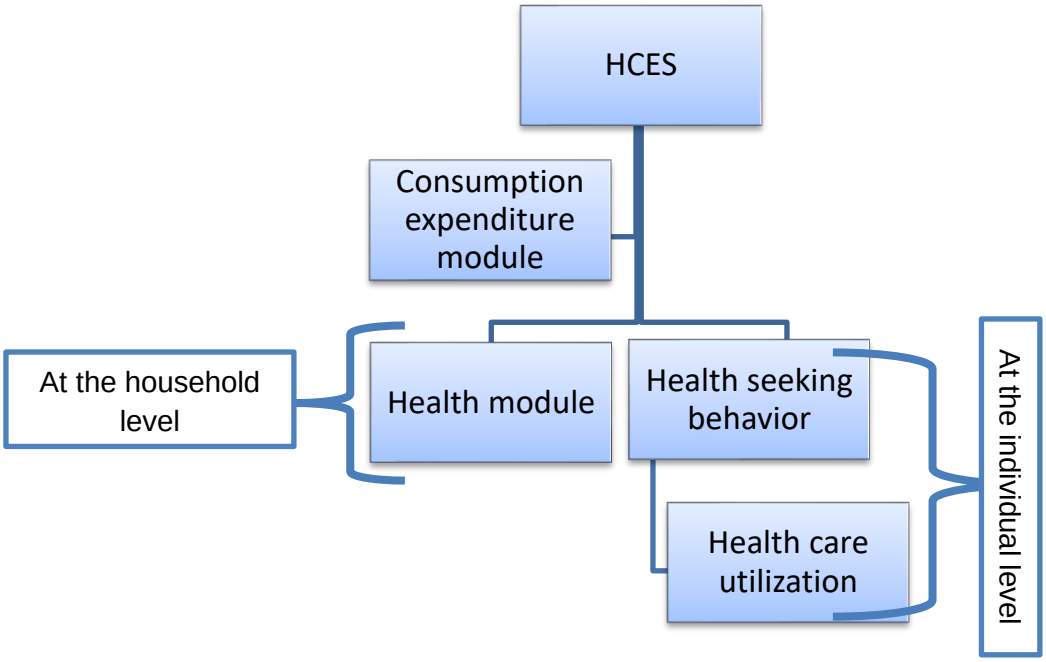


Figure 1.1: Generic structure of Household Consumption and Expenditure Survey (HCES)

This generic structure is consistent with the methodology used in system of health accounts (SHA 2011) which mostly relies on the ratio of household health spending to total expenditure to estimate the level of health expenditures. The LSMS takes the structure of figure 1.1 and is widely implemented in most LMIC by the World Bank to collect general household data including information on health care in a health module and a utilization module. The LSMS project was initiated in 1980 by the Policy Research Division of the World Bank. The LSMS project is multi-topic in structure and seeks to make available relevant data for policy and decision-makers to measure socio-economic indicators and their determinants and to provide valuable understandings into living conditions of developing countries. The program primarily seeks to improve the quality of household survey data, increase the capacity of statistical institutes to perform household surveys, improve the ability of statistical institutes to analyze household survey data for policy needs, provide policy makers with data that can be used to understand the determinants of observed social and economic outcomes. The LSMS typically has a frequency of 5 years.

Health surveys (DHS, SAGE, WHS)

Overall, the health surveys examined here do have several features in common with half of the HCES surveys reviewed in this study. Figure 1.2 outlines those of interest. Based on this, we focused on two type of surveys: “pure” household consumption expenditure surveys *à la*

Household Budget Survey (HBS) type versus household surveys collecting data on health expenditures in both a household module (referred to as "the envelope") and within a health care utilization module. For the sake of simplicity, we refer to this as a "household health survey" type but as shown in the previous section, this structure is also observed in HCES surveys. The purpose of the "envelop" should be the estimation of the level of OOPs consistent with the prevailing practice in HCES surveys. The purpose of the information in the health care utilization module is to measure the level of OOPs at the individual level and includes data on diseases and type of provider. Figure 1.2 below gives a generic structure of most health surveys particularly the DHS, WHS and SAGE. These surveys individually have structural difference and their limitations on collecting health expenditure information but generally they all have the design similar to figure 1.2.

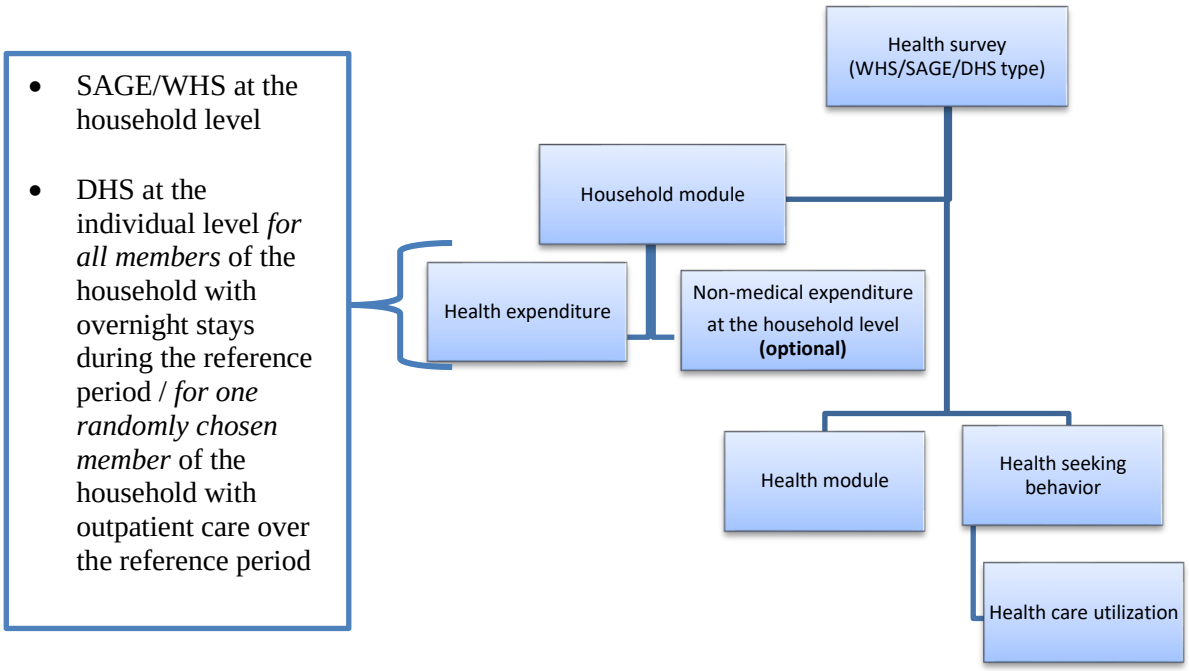


Figure 1.2: Feature of the Health Survey instrument

Demographic and Health Survey (DHS)

For instance, the DHS is nationally representative household survey with primary objective of providing up-to-date estimates for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. There are two main types of DHS Surveys: Standard DHS Surveys and Interim DHS Surveys. The Standard DHS survey mostly has a sample size range between 5,000 and 30,000 households and conducted about every 5 years, to allow comparisons over time whilst the Interim DHS Surveys focus on the

collection of information on key performance monitoring indicators and usually does not include data for all impact evaluation measures. Interim DHS Surveys are conducted between rounds of standard DHS surveys and have shorter questionnaires and smaller sample size than standard DHS surveys(USAID, 2013, 2014)

Specifically, the DHS collected information on fertility levels, marriage, sexual activity, fertility preferences, awareness and use of family planning methods, breastfeeding practices, nutrition, childhood mortality, maternal and child health, awareness and behavior regarding HIV/AIDS and other sexually transmitted infections (STIs), and other health issues such as smoking, tuberculosis, and blood pressure (USAID, 2013)

The Demographic and Health Surveys (DHS) program has a developed module with information on health expenditures included in the household questionnaire. The current design of the module makes it similar to a health care utilization module rather than to a health expenditure module. The module starts gathering information on expenses at the individual level conditional on utilization, for all inpatient members of the households but just one randomly selected outpatient. The recall period used is last six months for inpatient care (hospitalization) and last month for outpatient care. Household level information on spending is only collected for some specific health-related items and never on non-health household expenditures.

Based on the previous discussion about the type of information on health expenditure needed to inform SHA and/or the measurement of financial protection in health, it is not clear how the current structure of the DHS can be used to estimate health expenditure aggregates of interest for NHA. By collecting data for all members hospitalized versus one randomly chosen individual with outpatient care *ceteris paribus* the relative cost weight of overnight stay will be overestimated. This can also potentially lead to overestimate utilization rates by type of provider, let alone the disease attribution. Since DHS is a multi-topic survey, for the sake of the shortness of the health expenditure module, one alternative could be to collect data on overnight stays for one randomly chosen member of the household. This could be used to inform SHA focus on spending by beneficiary characteristics. The other alternative, that would serve the purpose of both SHA and the measurement of financial protection, would be to gather information on health spending at the household level and then list all members of the household that have received inpatient and outpatient care (as well as preventive care). One of them could be randomly chosen to gather details on utilization. This configuration is explored in this study.

World Health Survey (WHS)

On the other hand, the World Health Survey (WHS) is conducted by the WHO in 2002–2004 in partnership with 70 countries to collect data on the health of adult populations and health systems. Its design is a cross-sectional study with a total sample size of more than 300 000 individuals. The survey is broadly in two types, one for developing countries and the other for developed countries. The health expenditure questions are under the household expenditure section and has recall period for overnight stay (inpatient care/hospitalization\) is 4 weeks and 12 months. The 12 months is for the number of times household members obtained inpatient care and payments for all the costs associated with the inpatient care except for the past 4 weeks which have already been reported. At the individual levels people 12 years and above are also asked for inpatient expenditure. with a recall period of 5 years. Outpatient recall period is 4 weeks for health care related to care given by doctors and nurses, dentist and even traditional and other alternative health care givers. Non-health expenditure questions (food and non-food non-medical) are also found under the household expenditure section and the recall period is 4 weeks.

Study on global AGEing and adult health (SAGE)

Similarly, SAGE is a US National Institute on Aging, Division of Behavioral and Social Research and national governments supported WHO study. It is primarily a longitudinal study collecting data on adults aged 50 years and older, and includes a smaller comparison sample of adults aged 18-49 years. The study forms nationally representative samples from Ghana, India, Mexico, China, South Africa and Russian Federation. It has a module on health expenditure included in the household questions, Non-medical expenditure at the household level also included in household questionnaire. The study uses recall periods last 7 days for food; last 30 days for other non-food, non-medical expenditure items except education and rituals/ceremonies; last 30 days is also used for health expenditures not-related to overnight stay; last 12 months is used for health expenditures related to an overnight stay. SAGE also gathers qualitative information on sources of funding for all health expenditures over the last 12 months. Details on type of provider, treatment received, expenditures gross and net of any reimbursement and sources of funding collected for one randomly chosen member of the household but the last three spells over the last 12 months.

1.4. Limitations in measurement of OOPs: Heterogeneity in existing surveys

The structure, design and purpose of both the HCES and household health surveys discuss above are specifically different even though they are appear to follow Figure 1.1 and 1,2. There is considerable amount of evidence show this heterogeneity of information on OOPs in these surveys. The evidence particularly sheds lights on how the variations across the surveys influence the reliability and accuracy of health expenditure data. These variations have been attributed to both sampling and non-sampling errors which are common to almost every survey (Rannan-Eliya, 2010). Sampling errors are relatively well understood and can be easily quantified but non-sampling errors tend to affect the reliability and comparability of health accounts estimates (Rannan-Eliya & Lorenzoni, 2010) and are very difficult to quantify. Non-sampling errors may be broadly classified into three categories; (a) Specification errors: occur at planning stage due to various reasons, for instance; inadequate and inconsistent specification of data with respect to the objectives of surveys; omission or duplication of units due to imprecise definitions; faulty method of enumeration/interview/ambiguous schedules. (b) Ascertainment errors: occur at field stage due to various reasons for instance; lack of trained and experienced investigations, recall errors and other type of errors in data collection, lack of adequate inspection and lack of supervision of primary staff. (c) Tabulation errors: occur at tabulation stage due to various reasons, for instance; inadequate scrutiny of data, errors in processing the data, errors in publishing the tabulated results, and graphs. Most common non-sampling errors that have been reported to influence reliability and comparability of OOP estimates across these household survey instruments include: type of instrument, the structure of the instrument, the choice of the recall period, the completeness of enumeration of the health payments made when seeking health care or of the health expenditure faced by a household, the comprehensiveness and specificity of the health expenditure list (Rannan-Eliya, 2010). The nature of these errors have been discussed and documented by several studies (SHA, 2011; Xu et al., 2009; Lavado, Brooks & Hanlon, 2013; Lu et al., 2009a; Neter, 1970; Clarke, Fiebig & Gerdtham, 2008; Wagstaff et al., 2018b; Heijink et al., 2011) with the aim of providing evidence that will contribute to minimizing or eliminating them. In this doctoral thesis, the focus is on investigation three of these important sources of measurement errors.

1. *The structure of the instrument (Type of instrument and overall structure of health expenditure questions)*
2. *The choice of the recall period*
3. *Number of items/specificity (number of questions asked to respondent on health or on house consumption).*

Structure of the instrument

The structure of the instrument in terms of the overall purpose of the survey and the structure of the health expenditure questions poses limitations in comparing health expenditure estimates across different surveys as previously discussed. Table 1.2 is a calculation by WHO on the World Bank's non-food assessment survey. It presents data on where health expenditure data is obtained across different survey designs. From table 1.2, quite clearly, all surveys collect information on health expenditures, the respondent is seldom identified, the information on health expenditures is mostly gathered in an expenditure module (51% of the 91 that has been reviewed up to 2016) and about a third of the surveys include such information in both an expenditure module and a health module. However, there is no enough information on mode of payment, informal insurance arrangements, insurance status, co-payments or amounts reimbursed by any insurance scheme to enable calculation of OOPs. When there is data on insurance coverage, the individual is the unit of analysis. Information on coping strategies is related to health shocks not health expenditures. There is considerable variability across different surveys and as previously discussed, this variability potentially introduces some level of bias in the OOPs estimates and consequently limit how estimates are compared.

Table 1.2: Health care expenditure and health insurance

Health care expenditure and health insurance	Number of surveys	Percentage of total	Total number of surveys
Data collected on health expenditures	100	100	100
Health expenditure information included in*			
Expenditure module	46	50.5	91
Health module	19	20.9	91
Both, expenditure and health module	26	28.6	91
Respondents to the health expenditure questions identified	27	27.0	100
Information on who contributes to health care utilization cost	16	16.0	100
Clearly stated whether the expenditure should include/exclude insurance reimbursement	4	4.0	100
Information related to health insurance coverage			
Health insurance affiliation	36	36.0	100
Insurance status			
at household level	7	19.4	36
at individual level	29	80.6	36
Co-payment of insurance	2	5.6	36
Amount reimbursed by insurance	2	5.6	36
Informal insurance and health shocks			
Information collected on informal insurance	2	2.0	100
Strategies employed by households to cope with health shocks	23	23.0	100

Source: World Bank non-food assessment survey, WHO calculations

Choice of recall period

The variation in use of recall across different in current surveys is depicted in Table 1.3a and 1.3b.the evidence suggests there is considerable heterogeneity in the recall period used to collect data on health expenditure items with "last 30 days or last month" and "last 12 months" more often used when the information is collected in both an expenditure and health module; "last 3 months" and "last 12 months" is also predominantly used when the only source of information is the expenditure module (e.g. pharmaceutical products, medical services and paramedical service); "last 30 days or last month" and "last 4 weeks" are the primary recall period in health modules except for hospital services (is still last 12 months). Last 6 months is only used but seldom in expenditure modules. The observed heterogeneity in the use of recall has been identified to be of concern when reliability and comparability of health expenditure estimates across different recall periods is of interest.

Table 1.3a Recall period of health expenditure items by location of the Health Expenditure information

	last illness/ use	last 7 days or last week	last 14 days or last 2 weeks	last 4 weeks	last 30 days or last month	last 3 months	last 6 months	last 12 months or last year	other	not specified
Household expenditure module										
Pharmaceutical products	0	2.22	2.2	4.4	26.7	31.1	6.7	33.3	17.8	4.4
Other medical products	0	0	0	0	26.9	19.2	7.7	11.54%	30.78	11.5
Therapeutic appliances and equipment	0	2.9	0	0	20.6	14.7	8.8	41.12	22.9	5.9
Medical services	0	2.4	0	0	24.4	31.7	9.8	29.3	14.6	2.4
Dental services	0	3.3	0	0	23.3	26.7	13.3	20	20	6.7
Paramedical services	0	2.4	0	2.4	26.2	28.6	9.5	38.1	16.7	2.4
Hospital services	0	2.4	0	0	19.1	14.3	7.1	50	16.7	2.4
Health module										
Pharmaceutical products	5.3	0	15.8	26.3	31.6	21.1	0	15.8	10.5	5.3
Other medical products	0	0	30	10	40	10	0	20	10	10
Therapeutic appliances and equipment	0	0	8.3	8.3	25	25	0	33.3	8.3	0
Medical services	8.3	0	8.3	25	25	33.3	0	8.3	16.7	0
Dental services	0	0	14.3	0	14.3	42.9	0	14.3	14.3	14.3
Paramedical services	7.1	0	14.3	14.3	21.4	21.4	0	21.4	14.3	0
Hospital services	5.9	0	17.7	5.9	11.8	11.8	0	58.8	11.8	0

Source: World Bank non-food assessment survey, WHO calculations

Table 1.3b Recall period of health expenditure items by location of the Health Expenditure information

	last illness /use	last 7 days or last week	last 14 days or last 2 weeks	last 4 weeks	last 30 days or last month	last 3 months	last 6 months	last 12 months or last year	other	not specified
Both household expenditure module and health module										
Pharmaceutical products	3.9	0.0	19.2	7.7	61.5	15.4	0.0	42.3	19.2	3.9
Other medical products	0.0	0.0	16.7	0.0	50.0	16.7	0.0	33.3	16.7	8.3
Therapeutic appliances and equipment	0.0	0.0	11.8	0.0	29.4	17.7	0.0	29.4	17.7	5.9
Medical services	4.6	0.0	18.2	0.0	72.7	18.2	0.00	27.3	22.7	4.6
Dental services	0.0	0.0	0.0	0.0	43.8	18.7	0.0	31.3	18.8	6.3
Paramedical services	4.5	0.0	8.7	4.4	69.6	13.0	0.0	26.1	13.0	4.4
Hospital services	0.0	0.0	17.4	0.0	47.8	13.0	0.0	34.8	17.4	4.4

Source: World Bank non-food assessment survey, WHO calculations

Number of health expenditure items

Table 1.4 also shows the distribution of the type of health expenditure items in current surveys. More than 80% of the surveys regardless of the structure to get information on health expenditure collect data on pharmaceutical products; hospital services; medical services and paramedical services; Except for transportation and gifts/gratuities/unofficial payments the level of reporting is mostly the household but this result is driven by the fact that most HCES survey collect data on health expenditure in either an expenditure module or *in addition* to a health module.

Table 1.4: Health expenditure items

					level of reporting (% of the surveys not merging info with other items, N= _nm)		
Health expenditure items	Number of surveys, Nc	(% of total with a health expenditure module, N=100)	Not merged with other items (nb, N_nm)	(% of surveys with info not merged with other items, N=Nc)	Household	Individual	Both
Pharmaceutical products	99	99.0	81	81.8	56.8	27.2	16.0
Other medical products	53	53.0	37	69.8	94.6	5.4	0.0
Therapeutic appliances and equipment	70	70.0	58	82.9	84.5	13.8	1.7
Medical services	83	83.0	66	79.5	62.1	21.2	16.7
Dental services	59	59.0	50	84.7	82.0	16.0	2.0
Paramedical services	85	85.0	69	81.2	60.9	24.6	14.5
Hospital services	90	90.0	79	87.8	60.8	30.4	8.9
Transportation	35	35.0	30	85.7	16.7	66.7	16.7
Gifts/gratuities/unofficial payment	8	8.0	5	62.5	20.0	60.0	20.0
Other	28	28.0	28	100.0	57.1	35.7	7.1
Other items	63	63.0	61	96.8	49.2	34.4	16.4

Source: World Bank non-food assessment survey, WHO calculations

Comprehensiveness and Specificity of health expenditure list

Table 1.5 shows a summary of the comprehensiveness and specificity of health expenditure list across different surveys. The table establish that, the median number of health expenditure major items collected in HCES is four. However, 52.2% of surveys gathering data on health expenditure in an expenditure module list items that cannot be mapped to any of the classification of individual consumption according to purpose (COICOP) major group for health, let alone any COICOP class for health. This rate increases to 69% when the information comes from both an expenditure module and health module. Exceptions to the ambiguity of the spending area include pharmaceutical products; paramedical services and

hospital services. COICOP is the classification of individual consumption according to purpose (United Nations, 2018). In this framework, health consumption is coded 06. Within this division there are four major groups – medicines and health products (06.1); outpatient care services that do not require an overnight stay (06.2); inpatient care services provided during an overnight stay (06.3); and diagnostic imaging services, medical laboratory services, patient emergency transportation and emergency rescue services (06.4). Details about the COICOP division 06 are discussed in the methods sections of this thesis.

Table 1.5: Comprehensiveness and specificity of the health expenditure list

Comprehensiveness of the health expenditure list (includes major spending groups - pharma, medical, dental, paramedical, hospital)				mean	Coefficient of variation	median		
				3.45	47.6%	4		
Specificity of the health expenditure list	**in expenditure module**				**in both expenditure and health module**			
	# of surveys	% of all surveys	mean # of items	median # of items	# of surveys	% of all surveys	mean # of items	median # of items
COICOP-code 06 Health	24	52.2	2.4	1.5	18	69.2	2.3	2
COICOP-code 061 Medical products, appliances and equipment	8	17.4	1.4	1	6	23.1	1.5	1.5
0611-Pharmaceutical products	43	93.5	8.2	3	26	100.0	4.7	4
0612-Other medical products	24	52.2	3.3	2	10	38.5	2.3	1
0613-Therapeutic appliances and equipment	31	67.4	2.5	1	18	69.2	3.2	2
COICOP-code 062 Outpatient services	25	54.3	1.5	1	16	61.5	2.4	2
0621-Medical services	28	60.9	2.6	2	18	69.2	2.2	1
0622-Dental services	25	54.3	2.0	1	13	50.0	2.1	1
0623-Paramedical services	37	80.4%	4.7	3	21	80.8%	4.1	2
COICOP-code 063 Hospital services	40	87.0%	2.4	2	21	80.8%	2.3	1

Source: World Bank non-food assessment survey, WHO calculations

1.4 Knowledge gap

Haven documented the variations across different surveys, there is evidence to show that surveys that are health focused tend to get higher estimates of health expenditure relative to non-health expenditure (Bernard et al., 2012; Raban, Dandona & Dandona, 2013). It has also been found that the fewer the number of items, the lower the average health spending, on the other hand, the shorter the recall period, the larger the average estimate(Lu et al., 2009). Different types of measurement instruments (e.g. interviews, self-administered questionnaires) have also been documented to give different results in some cases.
A peculiarity in obtaining OOPs from household surveys is the potential difference in level of information that can be provided by primary respondents in health surveys (e.g. mothers in DHS) versus general consumption surveys (head of household who controls the spending). Another major concern with household surveys is their periodicity. The interval or time period between national surveys is usually long regardless of their focus. Health surveys such as the DHS are conducted every 5 year, SAGE every 3 to 4 years. Many HCES surveys have either sporadic schedule or a five-year interval between surveys (HCES) and even among higher income countries with an annual Household Budget Survey (HBS) (EUROSTAT Report, 2015), several countries have decided to reduce their frequency (in the future). The infrequency of households surveys in addition to the non-sampling errors of current survey instruments are a major concern for the purpose of tracking health care expenditure across countries and by beneficiary characteristics (Rannan-Eliya, 2010); to measure financial protection in health or country's performance towards any national or international target. There is a knowledge in gap in identifying which surveys designs gives relatively better health expenditure estimates for the purpose of national health accounting and for tracking and monitoring progress towards UHC. Studies (SHA, 2011; Xu et al., 2009; Lavado, Brooks & Hanlon, 2013; Rannan-Eliya, 2010; Rannan-Eliya & Lorenzoni, 2010a; Xu et al., 2003; Lu et al., 2009; Heijink et al., 2011) that have attempted to identify the best instrument for measuring health expenditures in household surveys either had inconsistent or inconclusive results due to the lack of a better gold standard for comparison. There is vast literature on the implication of non-sampling measurement error for the measurement of household consumption or expenditure in general (United Nations, 1982; Neter, 1970; Grosh & Glewwe, 2000; Lu et al., 2009; EUROSTAT Report, 2015; Rannan-Eliya & Lorenzoni, 2010) but for OOPs there is still no strong consensus on the actual questions that should be asked. (Heijink et al., 2011).

The primary purpose of this thesis is to provide experimental evidence that will support the improvement in the measurement of household out-of-pocket health expenditure on health. The INDEPTH Network platform provides a unique opportunity to implement a validation research designs that is able to test and validate results and assess which survey designs are best suited for measuring out-of-pocket health expenditures in household surveys. This study was achieved through the INDEPTH-Network Household Out-of-Pocket Expenditure (iHOPE) project.

1.5 The INDEPTH-Network Household out-of-pocket expenditure (iHOPE) project

INDEPTH-Network

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.

Since they collect data from whole communities over extended time periods, they more accurately reflect health and population problems in low- and middle-income countries (LMICs). The HDSSs increasingly link population and health facility data to implement the new Comprehensive Health and Epidemiological Surveillance System (CHESS). Since its inception in 1998, the Network has gathered a treasure trove of robust data, and is uniquely positioned both to answer the most pressing questions on health, population dynamics and development, and to provide policy-makers and donors with evidence on the impact of interventions. In a world seeking answers to poverty and underdevelopment, INDEPTH produces the data necessary to study and solve our greatest social problems.

iHOPE Ghana Project

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 Budget Survey 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 leverage on 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 Ghana.
The iHOPE project was implemented in Ghana by the Navrongo Health Research center health and demographic surveillance site (NHDSS). The project leveraged on the structure of the sixth edition of the existing living standards measurement survey (GLSS 6) instrument implemented by the Ghana government through the Ghana statistical service (GSS). The NHDSS 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 Ghana 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. We expect the prevailing Ghana health system and health care financing to affect the distribution and levels of out-of-pocket payments due to the existence of the national health insurance scheme.

Health financing in Ghana

Ghana has a well-developed, integrated, multilevel health system distributed throughout the country. The health system is made up of the Public Sector Organization of the Ministry of Health and the Nongovernment and Private Sectors.

The Ministry of Health is the steward of the system, which consists of public (the Ghana Health Service), nongovernmental organization (the Christian Health Association of Ghana [CHAG]), and private providers, as well as the National Health Insurance Authority (NHIA) and numerous governmental and regulatory entities at various levels of Ghana's highly decentralized health system. Budget Management Centres (BMCs) have been created to promote financial decentralization to and within districts and to improve both access to health services and community involvement in planning and delivery of services. Management Committees have been established in almost all peripheral health facilities. At the base of the health system, the MOH through its agency the Ghana Health Service (GHS), runs a system of "close to client" health services based on a strategy dubbed Community-based Health Planning and Services (CHPS). There are also health centres manned by auxiliary and professional health staff. The CHPS centres and health centres are meant to be the points of first contact for the sick. Complicated cases are referred to district hospitals initially, then to regional, teaching and specialized hospitals as the complexity of the treatment required

increases. Health service delivery in Ghana follows a three-tier arrangement: primary, secondary and tertiary levels. Correspondingly, there are three levels of management in the Ghanaian health sector: central or national headquarters; regional; and district. At the regional level, curative services are delivered at the regional hospitals and public health services are delivered by the District Health Management Team (DHMT), as well as the public health division of the regional hospital. The Regional Health Administration (RHA) provides supervision and management support to the districts and subdistricts within each region. At the district level, curative services are provided by district hospitals, many of which are mission based. Public health services are delivered by the DHMT and the public health unit of the district hospitals. The District Health Administration (DHA) provides supervision and management support to the subdistricts.

At the subdistrict level, both preventive and curative services are provided by the health centres, as well as outreach services to the communities within their catchment areas. Basic preventive and curative services for minor ailments are being addressed at the community and household level with the introduction of the Community-based Health Planning and Services (CHPS). The role played by the traditional birth attendants (TBAs) and the traditional healers is also receiving national recognition.

Ghana is one of very few countries to have enacted a legislation (National Health Insurance Act 2003 (Act 650) and begun the transition to universal health insurance coverage (National Health Insurance Scheme, NHIS) to replace the OOPs previously referred to as “Cash and Carry” system. The financing scheme is generally progressive and is largely financed through tax (Akazili, Gyapong & McIntyre, 2011) and a small proportion from client contributions and donations. One of the principles underlying the design of the NHIS is equity which implies that everybody has access to the minimum benefit package irrespective of people’s socio-economic background. It also means that health insurance should be available all the time so that subscribers are not denied access to health care when they need it. In this regard, the NHIS strives at all times to achieve horizontal equity (equal treatment of individuals or groups in the same circumstances) and vertical equity (individuals who are unequal are treated differently according to their level of need) in its operations where applicable; enrolment, contribution (premium rate), access to healthcare services, and financial protection. In 2014, the scheme covered about 40% of Ghana’s population (10.5 million active subscribers) with about 69% of these exempted (Wang, Otoo & Dsane-Selby, 2017) from any form of payment to the scheme, the rest of the 60% of the population will be

required to pay out-of-pocket to be able to access health care. The exempt group include; Indigent people, pregnant women and Livelihood Empowerment Against Poverty (LEAP) beneficiaries. Though the scheme covers 95% of disease conditions reported in Ghana with services including primary curative care to care at tertiary facilities, challenges (Addae-korankye, 2013) within the operationalization of the scheme expose subscribers to out-of-pocket payments within the health system. All subscribers accessing health care from NHIS accredited health facility are assured of free services but maybe exposed to spending out-of-pocket for medicines, laboratory tests and other consumables which may not be available at the provider due to stock-outs or some of the challenges discussed by Addae-korankye (2013). In terms of the levels and impact of the NHIS on catastrophic expenditure and poverty, Aryeetey et al found that 7-18% of insured households incurred catastrophic health expenditure compared to 29-36% in the uninsured group whilst 3-5% in both groups fell into poverty due to out-of-pocket expenditure. The NHIS was also found to be protective against out-of-pocket expenditure in households by about 86% and reduced the incidence of catastrophic expenditure 3% and poverty by 7.5% (Aryeetey et al., 2016). Therefore, even in a seemingly functioning health insurances scheme in Ghana, some level of OOPs in is still observed within the health system.

1.6 Aims and Objectives of study

General aim

In the context of the iHOPE project, the main aim is to develop alternative instruments and approaches to collecting household data that will enhance ex-post harmonization efforts and attribute OOP to specific diseases. This project is a methodological study that will make use of existing national survey instruments (i.e. Household Budget Survey and Household Health Survey) from Ghana with the aim of repurposing them to be sensitive to the non-sampling errors that cause biases in the current household surveys.

Specific objectives

Given the above aim, this doctoral study focus on answering four important questions of the iHOPE project implemented in Ghana. Specifically, this doctoral research work aims to:

- Investigate and validate the minimum number of health expenditure items to be included in household expenditure surveys so to adequately track OOP

- Investigate and validate the optimal recall period for health expenditure items to be included in household expenditure surveys so to adequately track OOP
- Investigate and validate the appropriate health expenditure module to be included in household expenditure surveys so to adequately track OOP
- Document lessons learnt, experiences and challenges associated with implementing and validating community level (household) and health provider expenditures.

1.7 Research questions

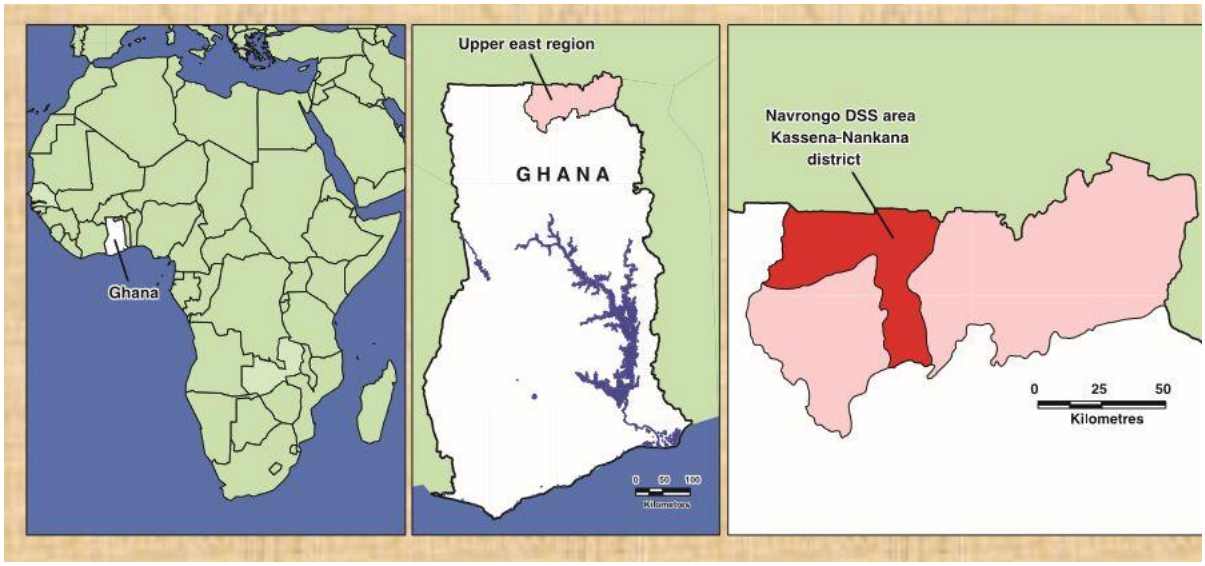
1. What is the relative importance of the structure of the instrument (household module versus individual module) on the measurement of the level of OOPs, by spending category?
2. What is the relative importance of the choice of the recall period (last 30 days/ last 6 months versus last 14 days/last 12 months) on the level of OOPs, by spending category?
3. What is the relative importance of the comprehensiveness of the health expenditure list on the measurement of the level of OOPs, by spending category? Comprehensiveness is defined in relation to minimum number of items on health expenditure using COICOP 2018 second level so that any spending can unambiguously be mapped to only one of these categories.
4. To assess the relative importance of the specificity of the health expenditure list, i.e. the number of items within each COICOP 2018 second level, on the measurement of the level of OOPs, by spending category.
5. What factors drive and limit the completeness and accuracy of health provider data when such data is required as a gold standard for a validation study

Chapter 2

Research methodology

2.1 Study setting

This study was implemented in a Health and Demographic Surveillance System (HDSS) site located in Navrongo, Ghana. The Navrongo HDSS was established in 1988 as a field station and subsequently upgraded to a research centre in 1992. The site has two administrative districts with an estimated total population of 160,000 covering a total area of about 1,685 km^2. The Navrongo Health Research Centre (NHRC) operates the Navrongo Health and Demographic surveillance system (NHDSS) that continuously monitor the health and demographic dynamics of the area. Operationally, the surveillance area has been divided into five zones and these have been further divided into 247 clusters with each cluster having an average of seventy compounds. Individual compounds are mapped by geographic positioning system (GPS coordinates) (Oduro et al., 2012). The Navrongo HDSS vital statistics and registration data, and Geographical Information System (GPS) data collection are conducted every four months while household characteristics and assets are collected every two years. The site has some expertise in collecting data on total health expenditures and disease specific spending (e.g. Malaria). The health care financing system in Ghana is a national health insurance scheme (NHIS), with about 50% of the population in Navrongo HDSS enrolled onto the Scheme. The site has one hospital, one health research centre, one private clinic, seven health centres, and 27 community-based health compounds (CHPS). A number of pharmacy shops, chemical and drug shops, petty traders and peddlers, herbalists, faith-based and traditional healers. The average travel distance to the nearest health facility in Navrongo HDSS is 5km. about 93% of the individuals attend public health facilities for in-patient care and 100% attend private health facilities for out-patient care (Oduro et al., 2012). Figure 2.1 shows the geographic location of the study site whilst table 2.1 gives a summary of the characteristics of the study site.



Source: (Oduro et al., 2012a)

Figure 2.1 Geographic location of study area

Table 2.1: Summary of Health provider characteristics in the study site

	Ghana
Average travel time to nearest health facility	5km
Proportion of households with access to cell phones	72%
Number of rounds of DSS data collection	3 per year
Number of Health facilities at the HDSS site	1-Hosp, 1-research centre, 1-private clinic, 7-health centres, 27-community-based health compounds
Types of Health insurance available at HDSS site	National
Health insurance coverage at the HDSS site	50%
Proportion of individuals attending Public health facilities for In-patient cases	93%
Proportion of individuals attending Private health facilities for out-patient cases	100%
Co-payments for the insured	No
Disease classification type in hospital setting (district hospital)	ICD-10
Disease classification type in community health center	**
Disease classification type in other outpatient care settings	**
Recording system in hospital setting (district hospital)	Paper
Recording system in community health center	Paper
Recording system in other outpatient care settings	Paper

***** No conventional disease classification method adopted***

2.2 Research design

The main aim of this study is to try to improve the measurement OOPs in both HCES surveys and health surveys. In pursuance to this, different instruments are proposed to collect data on household out-of-pocket payments depending on the purpose of the survey (consumption expenditure focus versus health focus). We propose new instruments by repurposing existing household instruments. For HCES surveys, we adopted the structure of LSMS; specifically, the sixth edition of the Ghana Living standards survey (GLSS 6) to propose different instruments. We also utilized the structure of the DHS, WHS and SAGE to propose a health focused household survey instrument. Data collected from the proposed new data collection tools were validated using health provider records, which we considered 'gold standard'/benchmark. The provider records were considered the most accurate data even though we acknowledge the limitations in using such data. The design of this study is in three forms; instrument development, field-testing of the instruments in a cross-sectional survey and provider data collections.

Section 2.4 and 2.5 clarifies which modules are new and which ones are going to be randomized and also indicates which type of information is going to be confronted to the provider information considered as "a gold standard". These sections also presents an "overarching questionnaire design" to collect self-reported retrospective information on OOPs in household surveys and how the designs are further refined to accommodate different purposes (measure OOPs; by type of beneficiary characteristics).

As a preamble, the following section clarifies at the onset, the choices that have been made before developing the instruments.

- Information on household total health expenditure incurred during a given reference period will be secured from totaling major components of expenditures

•The minimum number of household health expenditure components to be included in cross-section survey corresponds to COICOP 2018 third level, which has one more component than the most detailed level of disaggregation in COICOP 1999. The difference is due to splitting hospital services into curative and rehabilitative care services and long-term care services.

- Information on health expenditure components is frame in relation to expenses net of any reimbursement and any transport cost to transport to get to the health provider and back
- Persons covered by any insurance scheme are not excluded from this study. Instead there will be a question on mode of payment including any prepayment scheme. Upon

positive response, a subsequent question will gather information on amounts covered by the scheme

- The basic unit for recording health expenditures is the household; the basic unit for recording expenditures by type of provider or beneficiary is the individual member of the household.
- Information on health expenditures is reported by the best informed individual member in the household who should be the most knowledgeable person about household members and characteristics, transfers and financial status, in particular expenditures.
- The household informant may be different from the individual informant reporting payments by type of provider or beneficiary. In particular, all household members will provide information on health seeking behavior and utilization except children under the age of 15 years for whom the information will be provided by the household head or spouse.
- In order to validate information on health expenditures at the household level with the provider information, the household informant will be asked to identify the members of the households for whom such payment was made.
- The household was defined following the current practice in the GLSS 6 surveys conducted in Ghana, even if such definition is different from the INDEPTH network one.
- Data collected on household's ownership of selected assets; materials used for housing construction; and types of water access and sanitation facilities will also follow the current practice in the GLSS 6 surveys conducted in Ghana. Another alternative would have been to draw on the list identified by the DHS program but consistency with HCES is needed for imputing household expenditures.

2.3 "Gold standard"- Provider information

The provider level patient data records will be taken as the most accurate data in that efforts will be made to ensure information on reasons for seeking care, insurance status and cost of service paid by an individual are available on a timely and consistent manner that minimizes measurement error. To this end, there was a brief intervention to improve the recording of such data at the provider level in private facilities where routine transactional data are most often not recorded.

A generic template was developed for the different types of Health providers in *primary care settings without any recording system* (see Appendix I). This contains basic information and identifiers (name, address, phone number, referral status, reason for consultation and cost of treatment/service) that will 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 it can be accepted by the health care providers. Prior to the field work, during a pre-testing face, the capacity of providers to understand the list of symptoms, diagnostic and processes included in ICPC-2 was assessed. By understanding, it is meant here that they are familiar with most of the items included in the list and the classification is perceived to be relevant given the epidemiological setting of the area. We did not attempt to assess their capacity to accurately recognize each of these symptoms. For instance, we did not attempt to determine whether providers classify high fever as fever or malaria as long as the diagnostic recorded is the one communicated to the patient. So the focus is on the diagnostic given to patients.

Pharmacy/Chemical shops and other non-traditional health care providers were given the standardized template for improving data collection at these facilities. Due to the complex nature of patient flow in the traditional hospitals (mostly public or government hospitals), it was extremely difficult to introduce a standardized template to collect the provider information, for this reason, patient folders were reviewed and a standardized survey template used to extract the desired information for the Projects' purpose (see Figure 2.2). All information from the different types of providers were extracted from a standardized health provider survey template to obtain a benchmark for the level of health expenditure by type of health provider and disease. Figure 2.2 below shows the entire process of obtaining the health provider level data.

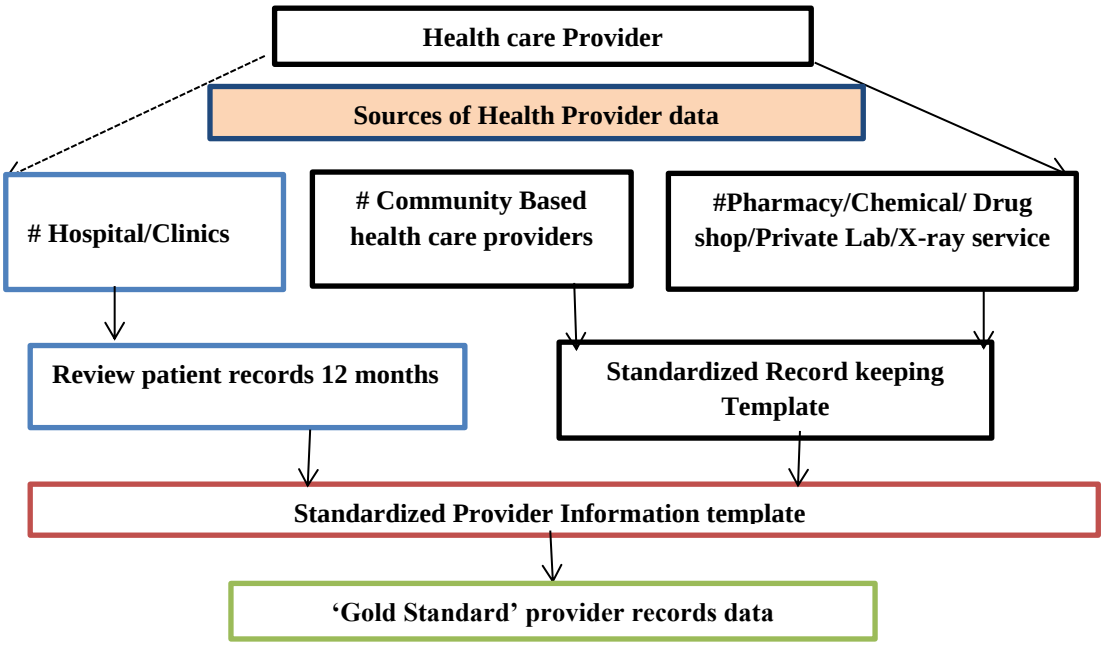


Figure 2.2: Structure of Health provider data collection process

2.4 Overarching household questionnaire design (HBS & HHS)

Figure 2.3 outlines the structure of the cross-sectional questionnaires that have been designed to address the objectives of this study. In order to be able to assess the relative importance of the comprehensiveness of the health expenditure list on the measurement of the level of OOPs, by spending category and beneficiary characteristics (research question 3), comprehensiveness is defined in relation to minimum number of items on health expenditure using COICOP 2018 levels. In the budget survey type, to assess the relative importance of the specificity of the health expenditure list on the measurement of the level of OOPs, the number of items within each COICOP 2018 third level is randomized. To assess the relative importance of the choice of the recall period (research questions 2) on the level of OOPs, by spending category and beneficiary characteristics, recall periods will be randomized in the health survey. The following combinations will be explored: last 14 days/ last 30 days for frequent items versus last 6 months/last 12 months for less frequent ones.

To assess the relative importance of the structure of the instrument on the measurement of the level of OOPs (research question 1), information on health expenditure will be collected in both the envelop module (in both type of surveys – budget and health surveys) and the health seeking behavior module. Details of the designs are discussed in the next section (section 2.5)

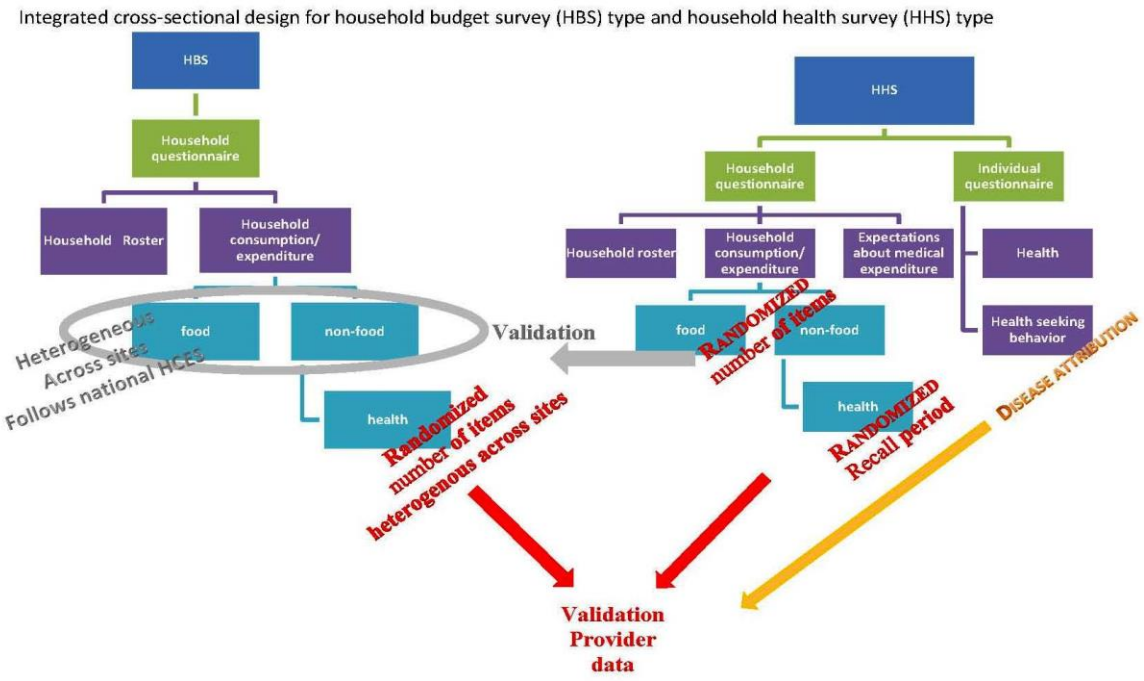


Figure 2.3: Proposed integrated cross-sectional design for HBS and HHS type

2.5 Cross-sectional survey design with retrospective data collection

2.5.1 Household budget survey (HBS) type

The focus is on a typical budget survey with a large module on household expenditures reported by a single respondent and structured around food versus non-food expenditures, using similar recall periods for all food and non-food divisions regardless of whether or not these are the relevant ones to gather information on health. In most cases also, HBS follow or attempt to follow the COICOP 2018 classification. Hence is to be expected that in budget surveys drawing on the COICOP classification, the health component will be drowning in information on non-health consumption. To improve the measurement of health expenditure in budget surveys, the specificity of the health component will be randomized but the informant and the choice of the recall period will be held constant (see Figure 2.3**)**

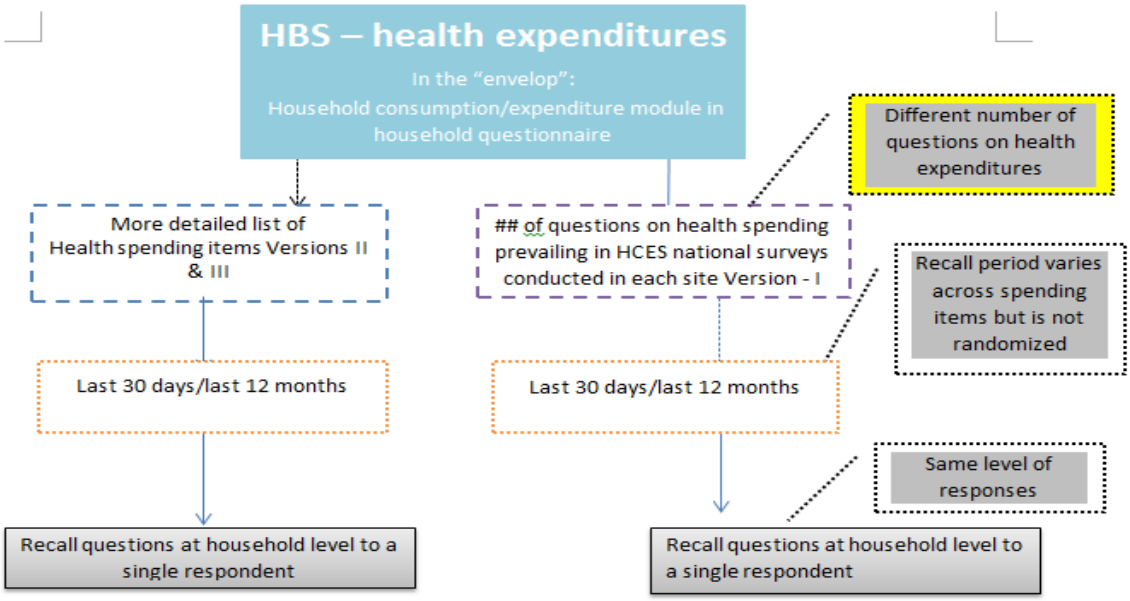


Figure 2.3: Household Budget survey type proposed by iHOPE project

The intention is to compare the COICOP 2018 classification at different levels of disaggregation. We denote the third level of COICOP 2018 as D3 which comprises 11 sub-classes; the fourth level as D4 with 44 items and the fifth as D5 with 54 items (see Appendix III). At present the only difference between D4 and D5 is the information on prescribed pharmaceutical products which is decomposed by type of disease following the ICPC-2 major grouping. The recall period will be allowed to vary for across D3 level of disaggregation but will be held constant within such classes.

The GLSS 6 consumption module has a slightly greater number of health items (23) than COICOP D3 level. Some of these items however such as expenses on hospital services group

related to gym and health clubs shouldn't be included in this section at all. If we ignore the focus on public/private in the GLSS 6, we are almost back to COICOP-D3. The ownership of the facility is relevant for SHA (SHA2011) as the perceived status of a facility might be different from the financing schemes supporting the provision of care in each facility. For this reason, the current suggestion is to start with COICOP-D3 hierarchy and then move to D4 and D5. The ratio of health to non-health questions will increase then from 4.4% in D3 to 9% in D4 and 12% in D5.

In order to be able to validate the information in the HBS survey with the provider information, for each health spending category in COICOP-D3/D4/D5 level, the survey concluded by asking the respondent to enumerate the members on whom health expenditures were made and such members interviewed to identify the respective providers.

2.5.2 Household health survey (HHS) type

Recall period for OOPs

The health surveys reviewed for this research work have a household questionnaire that include a module on health expenditures; some of them even have an individual questionnaire with similar information included in a health seeking behavior module (see Figure 1.2). This study already established that some HCES surveys also share a similar structure (See Figure 1.1). Hence, there is scope to increase harmonized HCES and household health surveys. Besides the structure of the questionnaire and level of respondent, other key factors need to be taken into account such as the recall period for the health expenditure items. In the HBS type previously discussed (**section 2.5.1**), 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. And yet, some of the evidence reviewed suggests that last 30 days is too long for services that do not require overnight stay. Also some HBS survey do use a 6 month recall period which is also adopted in DHS surveys. Hence recall periods for a given level of COICOP-disaggregation as specified in "the envelop" 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

Comprehensiveness and specificity of the non-health expenditure list

The estimation of the level of OOPs can also be affected by the number of questions on non-health expenditure items. While this has already been addressed in the HBS instrument while keeping the number of such items constant and varying the number of health spending items, variation in health surveys will most likely be driven by variation in the non-medical expenditure list. Since the focus of health surveys is health; information on health spending will be prioritize. Assuming that COICOP-D3 level is the relevant level of disaggregation for most type of health surveys and keeping in mind that this includes 22 spending items, in order to preserve the ratios of health to non-health questions observed in HBS type surveys which vary between 5% and 15%, health surveys would need to collect data in between 440 and 147 non-health expenditure items. If COICOP-D2 with 8 health expenditure items is the relevant one to be included in the household module of a health survey, the number of non-health expenditure items should range between 160 for a 5% ratio and 53 for a 15% ratio which seems unreasonable. For ratios above 20%, the number of non-health expenditure items decreases from 40 to 16, i.e. from twice as much to five times more.

It is decided in this study to focus on COICOP-D3 level for "the envelope" under the assumption that a greater level of detail can be gathered from the health seeking behavior module. Starting with 11 items listed on health expenditures, we further consider adding to the consumption module four times as many numbers of items on non-health consumption (NH) which is characterized by 40 NH items. COICOP has over 110 classes for non-health consumption(United Nations, 2018) but we focus on the 40 accounting on average for 80% of household total spending on non-health.

The recall period for food items is last 7 days; the recall period for frequent non-food and non-medical items is last 14 days and for non-frequent ones either last months (e.g. COICOP- code 4 on housing, water, electricity, gas and other fuels) or last 6/12 months (e.g. clothing) as upon current practice in the GLSS 6. Ultimately, the recall period for the food items will also be aligned with LSMS conducted as the HBS instrument develop for this project and used as benchmark for the randomization of the number of NH items.

The characteristics and features of the expenditure modules in both survey designs are shown in table 2.2 below.

Table 2.2: Characteristics of proposed health expenditure modules

Type of survey	Randomization	Number survey instrument versions	Number of Health items	Number of non-health items	Recall period for health expenditure items	Version specification	Type of health expenditure module	Validation benchmark
Houshole Budget Survey (HBS)	Number of health items	3	11 items, 44 items and 56 items	231	4w/12m	V1- 11 health items V2- 44 health items V3- 56 health items	Household level (envelope)	Provider (Gold standard)
Household Health Survey (HBS)	Recall period	2	11 items	42 items	4w/12m 2w/6m	V1- 11 health items, 42 non-health items, 2w/6m V2- 11 health items m, 42 non-health items, 4w/12m	Household level (envelope) and Health care utilization module (individual)	Provider (Gold standard)

2.6 Sample size calculation and justification for household retrospective survey

Sample size calculations for estimating agreement are based on the precision of the estimates, which is quantified as the desired width of the confidence interval. 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 (Bland, 2004). Since agreement may depend on factors such as Socio-Economic Status (SES) and distance from the health facility, we have considered 100 observations as a minimum sample size (who utilized health care) per each spending category within each questionnaire version and by type of survey.

The data collection started from the community level survey to link with provider level data so that it will not be possible to identify those who get sick and utilized the health care in the respective recall period before the community data is collected. We also included those who had costs on the questionnaire but no provider-level costs. We need to survey sufficient households to get 100 who utilized health care.

We applied the probability of outpatient spending in the study (estimated as 15.5%) for a 2 week recall period while the probability of inpatient spending over a 12 month recall period is 10%. Details of the sample size estimations are included in each chapter depending on the research question.

2.7 Analytical approach

In this study, both quantitative and qualitative analytical methods were adopted to achieve the study objectives. The Quantitative analytical methods were used in Chapter 3 to chapter 5, whist a mix-method approach was used in Chapter 6.

The primary objectives of this study (chapter 3-5) addresses the validation of the out-of-pocket spending with various levels of questionnaire item details (identified as versions) taken from the COICOP expenditure of the health sub-category. The questionnaires (versions) are not nested and it is not possible to ask the same individuals more than one set of questions. Households within the communities were randomly assigned to one of the questionnaire versions within each survey type (budget survey or health survey). At the household level, data from each questionnaire version was compared with the provider data which was considered the ‘gold standard’ to assess the degree of agreement between the two data source. When assessing the agreement between two quantitative methods, the correct statistical approach is seldom obvious (Giavarina, 2015). Most often, correlation and regression statistical techniques are used in assessing the relationship between two measurements. The correlation coefficient and regression technique are sometimes insufficient when assessing agreement because they evaluate only the linear association

between the two measurements and not the degree of agreement (Giavarina, 2015). The Bland-Altman method provides an alternative for assessing the degree of agreement between two quantitative measurements (Altman & Bland, 1983; Bland, 2004; Giavarina, 2015). 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).

The overall bias is given by the mean ratio (log of the difference) between the two measurements and the 95% limits of agreement (95% LoA). The 95% limits of agreement are given by the mean raio ± 2*SD. To summarize the overall bias and variability for the agreement between one questionnaire version and the provider data the ratio of the estimates from one questionnaire version and provider data is plotted against the gold standard (provider).

To compare the agreement between questionnaire version and provider for two different versions, Bland and Altman (1999) propose using regression models. For the overall bias: the ratio is the outcome variable. The questionnaire version is an explanatory variable with 0 for version 1 and 1 for version 2, so that

Ratio = b_0+ b_1 qu2

where b_0 represents the mean ratio for version 1 and b_1 is the difference in mean ratio for version 2 compared to version 1. The estimates will have 95% confidence intervals.

Data were collected in clusters defined by the Navrongo demographic surveillance site, we include a random effect to account for this. The model becomes

ratio= b_0+ b_1 qu2+ ∅_i ……eqn1

where ∅_i is the random effect for cluster i.

To get a direct estimate of the effect of questionnaire version on variability, first the residuals from the previous model are calculated. The residuals are the differences between the observed ratios and predicted ratios. Then,

residual= c_0+ c_1 qu2. ……..eqn2

A random effect for cluster is also included. The effect of cluster on the overall bias should already have been taken care of in the first regression (eqn1) model but cluster may have an impact on variability. Following Bland and Altman (1999), the overall bias comes from the first regression (eqn1) and the limits of agreement from the second (eqn2).

Chapter 6 addresses a secondary objective using a mixed-method approach. Descriptive analysis was employed to understand the distribution of demographic characteristics, utilization rates of households by type of health provider and how provider and household

data successfully linked. For the qualitative part, indepth interviews (IDIs) were conducted in English, audio- recorded using digital audio recorders and transcribed verbatim into Microsoft Word. Transcripts were reviewed, and key themes were identified for discussion. A coding list was prepared for data analysis. NVIVO 11 software was used for coding the transcripts and data was analyzed following a deductive content analysis to identify key the issues influencing completeness and accuracy of provider health records.

2.8 Planning and conducting survey

2.8.1 Data collection method and tools

The data collection approach was face-to-face tablet based interview, self-administered recording system for the providers, record review, and paper diary depending upon whether we were collecting household information or provider information. The questionnaires were pre-tested in the field before a broader application. The questionnaires were formatted and framed in a manner avoid errors and biases.

Household surveys

The cross-sectional household budget survey followed the data collection methods of the LSMS surveys that is implemented in Ghana. We used the manual from national statistical office in Ghana (Ghana Statistics Service-GSS). For the expenditure survey, interviewer's manuals of LSMS in Ghana was strictly followed to collect data on expenditures. The consumption expenditure was collected via a recall face-to-face interview, except for food items for which a self-administered paper diary was distributed and collected every 3 days, 6 times.

For the health survey, face to face interview was conducted based on the recall instruments described in the previous sections. These instruments do differ from the ones currently used in HCES in Ghana, there is a lot of heterogeneity in the type of information collected on health and health care utilization. While we will use a standardized set of modules, the method of data collection and the respondent are the same as in the surveys currently implemented in the country. In addition to the choice of the recall period that is going to be randomized for this project, the main differences will be the number of questions to be included in our questionnaires. All household cross-sectional surveys were conducted with

tablets. The survey instruments were programmed into the tablets using CSPro 7.1 platform. Each instrument was programmed and uploaded into a local server at the Navrongo HDSS site and downloaded onto the tablets (client) via internet connectivity for data collection. The household roster and the modules on housing conditions and assets were similar to those currently used in GLSS 6 consumption and expenditure survey. The final survey tools for the cross-sectional field data collections had the following structures (see figure 2.4).

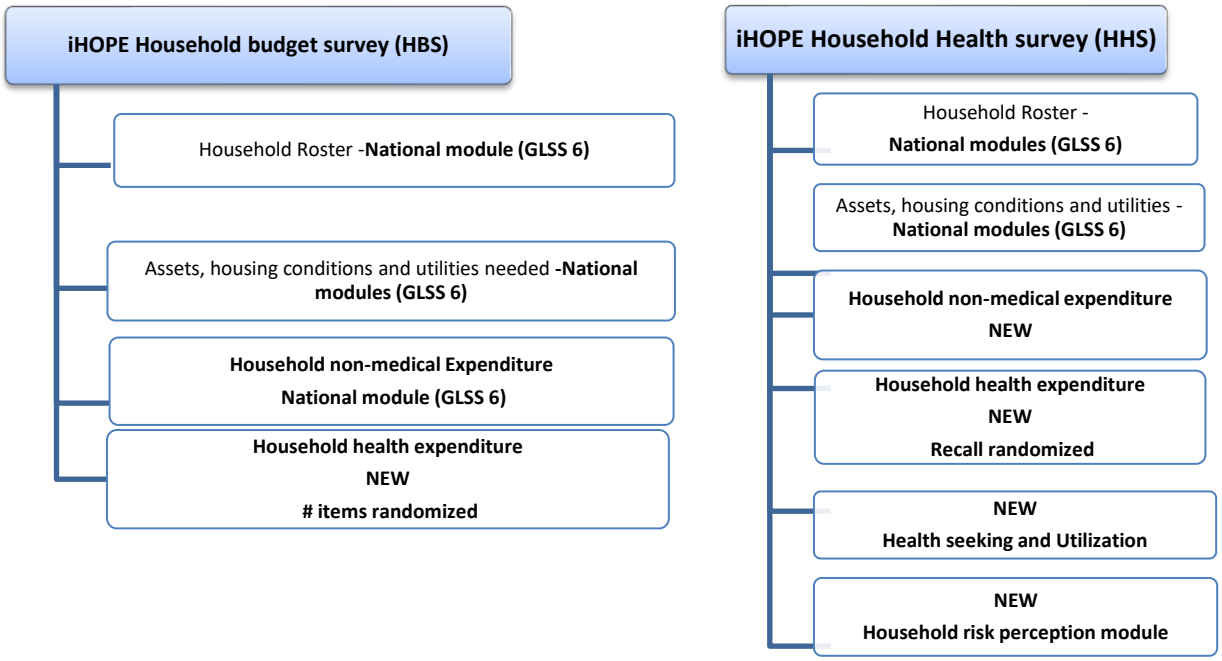


Figure 2.4: Summary of final survey instruments developed for household survey

Provider information

A paper diary as described in section 2.4 was used to improve the recording system of the following providers. As already mentioned, for inpatient care, there was no attempt to improve the recording system. Health provider owners were contacted and trained on the improved recording system. Regular monitoring visits were carried out (once every week) to ensure the improved recording system is being adopted by the health providers and if otherwise, they were encouraged to use the system and possibly organize a retraining. The record review from the health facilities were collected after the respondents' consents was obtained during the household cross-sectional interview. There were two data sources for the provider data collection; the respondents' report which would be obtained through household survey and the record reviews of the health facilities will be compared

Field work

Trained field workers were deployed with tablets preloaded with the study instruments to collect the data. These field workers were given a sample list of the households to be visited in the community to collect the data. There were two data collection approached used: the health provider data retrieval, and the household interviews at the community level. Two different field teams between June-September, 2016, conducted data collection for the household expenditure (HCES pure expenditure type) and health survey (HHS) simultaneously.

Data collectors

For face-to-face interviews, there is chance that interviewers can influence responses through their personal attributes and their behaviors and so interviewers were carefully recruited. We recruited interviewers from the same community as the respondents ('insider-interviewers') or from a different community called 'stranger-interviewers'. Insider-interviewers usually help generate good data in studies like this since they have better knowledge of the setting and so the social distance between themselves and respondents will be reduced. To be included, the interviewers were required to have at least a high school certificate and be able to speak or communicate in the local language of the respondent. He or she must possess good interviewing skills and computer or technical skills to qualify for recruitment. In a situation where the conditions allow, interviewers who have previously worked on similar studies and have good recommendations based on their performance were given preference. Data collectors were thoroughly trained on how to create rapport with the respondents during the face-to-face interview. Among these field workers recruited, we selected and retrain some of them as field supervisor.

2.8.2 Data quality control

To ensure reliable and valid measurement and to generate comparable data, multiple standard measures were implemented. Data collection tools' designing and formatting were undertaken taking into consideration of the validation blocks of the surveys. Once the final version of the questionnaire was prepared, it was pretested within the study area. Appropriate customization and modifications were made through pretesting for cultural appropriateness and clarity. As the study consists of different levels of data collection approaches, a field manual and a supervisor manual were prepared and applied to standardize all procedures. The data collection processes was closely supervised on a daily basis through trained supervisors and field coordinators. Data editor were assigned to periodically check for missing data and inconsistencies.

2.8.3 Data management

Data was stored at the iHOPE project office in Navrongo HDSS Ghana. Trained data managers and clerks at the data center were responsible for data storage and confidentiality of both electronic and paper forms. Only authorized data managers had password to the database at all levels. Paper data were also transferred to the central data management unit for verification. Data were electronically transferred to a central data management unit at the INDEPTH Secretariat in Accra, Ghana. Final data were collated, standardized and integrated into common formats (e.g., STATA Version 13, Stata Corp) before analysis. The databases that contain expenditures were linked to databases from the health facility. Interim analysis were conducted every six month.

2.9 Ethical considerations

The Ethical Review Board of the Navrongo Health Research Centre, Ghana (NHRCIRB217) approved for the conduct of the study. Informed consent was also obtained from all study participants before interviews were conducted.

Chapter 3

Testing and validating appropriate specificity of health expenditure items in the measurement of out-of-pocket health expenditure: Evidence from an experimental study in northern Ghana

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Abstract

Background: The effect of number of health items on OOPs has been identified as a source of bias in measuring OOPs. The evidence comes mostly from cross-sectional comparison of different survey instruments to collect data on OOPs. Very few studies have attempted to validate these questionnaires. This study estimates the effect of the number of health items on reported OOPs by confronting provider and household's information. **Methods**: A generic questionnaire to collect data on household's out-of-pocket health expenditure was developed following the nomenclature proposed in division 6 of the 2018 statistical classification of individual consumption according to purpose (COICOP). There are four major groups in such division, the specificity within each group was tailored to the design of the nationally representative living standard survey in Ghana where a field experiment was conducted to test the validity of different versions. Households were randomized to 11, 44 or 56 health items. We used data from provider records as the gold standard. We compared the mean positive OOPs in the three groups, and estimated the mean bias and variability in the ratio of household expenditures to provider data for the individual households using the Bland-Altman method of assessing agreement. We also compared unmatched samples. **Findings**: We found evidence of a difference in the overall bias by levels of disaggregation for OOPs in inpatient care and medications. More detail levels of disaggregation yielded lower OOPs estimates than aggregated levels of health expenditure items and the level of agreement decrease with increasing specificity of health items. **Conclusion:** Our findings suggest that**,** systematically decomposing health expenditure items into finer sub-classes tend to produce lower OOPs estimates which also tend to have lower agreement when compared to provider estimates. Our experiment demonstrates that less number of health items produce more accurate and reliable OOPs estimates.

Keywords :

Health expenditure items, out-of-pocket, universal health coverage, household survey, specificity, validation, Ghana

3.1 Introduction

Household out-of-pocket health payments (OOPs) are direct payments for services from households' primary income or savings with no third-party payer involved (SHA, 2011). OOPs are an important measure of performance of the health financing system, particularly to monitor to what extent such payments impact on household's living standard and ability to spend on other basic needs (O'Donnell et al., 2007; O'Donnell, 2019). The system of health accounts (SHA2011) is the methodology that enables tracking household private expenditures flows through the health system. Within the framework of the health system, there is a concern for the protection against the negative economic consequences against the cost of health services good health systems should provide. This dimension is at the core of Universal Health Coverage, one of the health targets all countries are committed to achieve by 2030 within the sustainable development goals (Thomson et al., 2019; Wagstaff et al., 2018; Xu et al., 2003; Wagstaff et al., 2018).

An important source of information to track OOPs for SHA are household surveys, especially in countries where much private health care financing occurs without the generation of linked, reliable and comprehensive routine data. Household consumption and expenditure surveys, household utilization and expenditure surveys, health surveys with information on health expenditures can be used to inform SHA. The last one cannot be used to monitor financial protection. This is because in addition to the information on OOPs, data on a measure of household welfare is also needed. None of these surveys are standardized as they differ, among other things, in the level of details (specificity) of the information collected on out-of-pocket payments (Rannan-Eliya & Lorenzoni, 2010; Lu et al., 2009; Neter & Waksberg, 1964; Neter, 1970; Lavado, Brooks & Hanlon, 2013; Heijink et al., 2011; Xu et al., 2009). For instance, Lu (2009) comparing estimates from 50 countries using WHS data reported that, the fewer the number of health items (1 item versus 8 items), the lower the average health spending. The comprehensiveness and specificity of health expenditure items has been found to vary greatly across different surveys in different countries. Heijink (2011) found from 114 country-survey type combinations that the number of health items used ranged between 1 and 25, with some outliers falling over this range (Heijink et al., 2011). Lavado et al, also found the number of questions on health expenditure to range from 1 to 274 in 214 surveys and that an additional question on OOPs increases health expenditure share by 1% (Lavado, Brooks & Hanlon, 2013). There is paucity of literature that investigates accuracy and reliability of OOPs in these individuals surveys, to the best of our knowledge no

validation study has so far been conducted to assess the effect of the specificity of the OOPs expenditure list on the accuracy and reliability of OOPs statistics in the context of low-middle income countries. This paper aims at filling this gap. In particular, we will show that the specificity of the OOP list leads to lower OOPs estimates than aggregated levels of health expenditure items and that the accuracy and reliability of OOPs estimates decrease with increasing specificity of health items.

Our findings come from an experimental study specially designed to validate household self-reported information with provider's records. The experiment had two purposes: validate the number of health expenditures items and the choice of the recall period. This paper presents results for the former only by testing the effect of the specificity of health expenditure items on reported OOPs in Ghana at the Navrongo health and demographic surveillance site of the INDEPTH-Network. To this end, three versions of health expenditure modules with different level of specificity of health expenditure items were developed and adapted to the structure of the Ghana living standards survey 6 (GLSS6) instrument (GLSS6 Report, 2014). These three versions were all comprehensive in that they all captured the major health care consumption groups that constitute the main categories of health care expenditures individuals are confronted with as identified by the classification of household final consumption (COICOP), 2018 version (United Nations, 2018). They differed in the level of detailed within each class. Average positive health expenditures were first compared across versions without any gold standard. This is what most studies to date have been able to analyze. The value added of this study is the possibility to have been able to use provider records to identify the level of agreement between provider and household records using the Bland-Altman method of method comparison.

3.2 Methods

Study setting

This study was implemented at the Navrongo HDSS site located in the Northern region of Ghana. The site has two administrative districts with an estimated total population of 160,000. The site has one public hospital, one health research centre, one private clinic, seven health centers, and 27 community-based health compounds. A number of pharmacy shops, chemical and drug shops, petty traders and peddlers, herbalists, faith-based and traditional healers also operate in the area. The research centre collects vital socio-demographic data every four

months while household characteristics and assets are collected every two years (Oduro et al., 2012).

Study design

This study is a field experiment designed to test and validate positive health expenditures reported by household using health provider records as the 'gold standard' for comparison. Two sets of data was collected in this study. The first set of data was captured from households in a cross-sectional field survey and the second set of data was obtained from health provider records. To collect data from households, new household survey questionnaires were developed and fielded in an experimental context using a cross-sectional survey design. Households were randomized into three versions of a general household questionnaire for face-to-face interview. Each version of the questionnaire was unique in the specificity of the health expenditure items in the health expenditure module of the questionnaire. The versions were labeled; version-1 for the questionnaire with 11 health expenditure items in the health expenditure module, version-2 for questionnaire with 44 health expenditure items and version-3 for questionnaire with 56 health expenditure items in a health expenditure. All three versions of the instrument used similar recall periods of 4 weeks for frequently purchased items and 12 months for less frequently purchased items in the household consumption module (including health expenditure). Details of how the health expenditure items were constructed is discussed in the next sections of the manuscript. Both private and public health care providers within the study area were engage by the project team to improve the recording and extraction of provider records. This was done to create a database of provider records to be able to validate household reported expenditures. For each questionnaire version administered to a household, positive health expenditures reported by any member of the household was tracked and a corresponding health provider record obtained to create a matched data set for validation. Household heads were the main respondents for the household survey but in some cases, other persons within the household were nominated by the household head to provide responses. This study is part of larger project implemented in three demographic and health surveillance sites in Ghana (Navrongo health and demographic surveillance site), Burkina Faso (Ouagadougou demographic surveillance site) and Vietnam (FilaBavi demographic surveillance site) supported by the World Health Organization (WHO) and Swiss tropical and public health institute (STPH) called the INDEPTH-Network Household out-of-pocket (iHOPE) project. The INDEPTH platform provides the project the opportunity to identify and track households and link them

to health provider records. The GLSS6 instrument was used because it's the current primary source of information for information on OOPs for national health accounts (NHA) estimates. All field activities were carried out using GLSS6 field guidelines (GLSS6 Report, 2014).

Study population and Sampling

All households registered under the Navrongo demographic surveillance site database constituted our study population. The sample size for the household cross-sectional survey was based on estimating the agreement between two quantitative measurements. We followed the Bland and Altman approach of sample size estimation for measuring quantitative agreements. Bland-Altman suggests a rule of thumb that 100-200 observations is adequate for sufficient precision when assessing agreement (Bland, 2004).We therefore calculated the expected proportion of households who would have utilized health care based on the probabilities of spending on inpatient and outpatient care within the study area. Based on unpublished district health management report in the study, the probability of spending on outpatient for a 2-week recall period is 15.5% and lower at 10% for a 12-month recall for inpatient care. To achieve a minimum of 100 households with reported inpatient care (outpatient spending is included in this sample), the sample size required would be 1000 households plus 10% non-response rate which gives a total of 1100 households per questionnaire version, and 3300 households for all three versions.

Health financing system in Ghana

Ghana is one of very few countries to have enacted a legislation (National Health Insurance Act 2003 (Act 650) and begun the transition to universal health insurance coverage (National Health Insurance Scheme, NHIS) to replace the OOPs previously referred to as "Cash and Carry" system. The scheme is largely financed through tax and a small proportion from client contributions and donations. In 2014, the scheme covered about 40% of Ghana's population (10.5 million active subscribers) with about 69% of these exempted from any form of payment to the scheme, the rest of the 60% of the population will be required to pay out-of-pocket to be able to access health care (Wang, Otoo & Dsane-Selby, 2017). The exempt group include; Indigent people, pregnant women and Livelihood Empowerment Against Poverty (LEAP) beneficiaries. Though the scheme covers 95% of disease conditions reported in Ghana with services including primary curative care to care at tertiary facilities, challenges (Addae-korankye, 2013) within the operationalization of the scheme expose subscribers to OOPs. All subscribers accessing health care from NHIS accredited health facility are assured

of free services but maybe exposed to spending out-of-pocket for medicines, laboratory tests and other consumables which may not be available at the provider due to stock-outs or some of the challenges discussed by Addae-korankye (2013). Therefore, even in a seemingly functioning health insurances scheme in Ghana, we expect some level of OOPs especially when accessing care for medicines and hospitalization.

Data collection instruments

Ghana Living Standards Survey 6 (GLSS6)

The Ghana Living Standards survey (GLSS) is a multi-purpose household survey instituted by the World Bank to collects information on many different dimensions of living conditions, including education, health, employment and household expenditure on food and non-food items. The GLSS 6 is the sixth edition of the survey conducted in 2012/2013 (GLSS6 Report, 2014). The survey instrument has one large module on household consumption reported by a single respondent and structured around food versus non-food expenditures (health expenditure included) using similar recall periods for all food and non-food divisions regardless of their relevance in gathering information on health. The consumption module in the survey is comprehensive in covering household consumption items. The structure of the consumption module follows the Classification of individual Consumption According to Purpose (COICOP 1999) classifications. COICOP is the international reference classification of household expenditure which aims at providing a framework of homogeneous categories of goods and services considered a function or purpose of household consumption expenditure. Following this classification, the GLSS6 has 251 items in the consumption module, of these, about 7% (17 items) are questions asking about health expenditure. The GLSS6 adopted the second level of disaggregation of COICOP for collecting information on Health expenditure in the consumption module but COICOP is of little guidance when there is an interest in refining the information on health expenditure beyond the second level of disaggregation. The GLSS is deficient in the level of items on health expenditure and this is largely attributed to its focus, which is collecting data for household economic analysis (Lavado, Brooks & Hanlon, 2013). The GLSS has been the primary source of data for estimating OOPs in Ghana.

iHOPE Ghana household survey instrument

The shorter version of the health expenditure module aims at capturing all major health groups included in division 6 at the class level. COICOP has four main classes of health

expenditure list namely medicines and health products, Outpatient care services, inpatient care services and other health services. The first questionnaire version expanded these four main COICOP classes to collect information at a sub-class level to obtain a total of 11 health items for this version. The second questionnaire was further expanded to collect more detailed information on inpatient care services and medicines at the sub-class level to arrive at a total of 44 health items for this version. At the sub-class level, COICOP 2018 (United Nations, 2018) only consider two categories for medicines: herbal medicines versus medicines, to further disaggregate this sub-class in the third questionnaire version, the third questionnaire version further expanded the information on medicines and health products from questionnaire version two to better capture expenditures on prescribed, non-prescribed and health products for personal use outside health facility to arrive at a total of 56 health items for version three (see Supplementary material 1 for details on disaggregation). The total number of items within each questionnaire version was decided taking into account the 2012/2013 GLSS6 version which has 5 main classes of health expenditure. The final three modules differ from the GLSS in that the module in the first version of our questionnaire uses the second level of disaggregation of COICOP 2018 with a total of 11 health items whilst the GLSS6 used same second level of disaggregation but with a total of 17 health items fielded in the consumption module of the survey. The remaining two versions differ from the GLSS6 in that they are systematically decomposed to be more detailed and specific in collecting the health expenditure information.

The new developed versions on health care expenditure were then included into the consumption module of the GLSS6 survey tool as a new section called “health care expenditure” to replace 17 health items in the consumption module of the GLSS6 instrument. The GLSS6 uses 4 week recall for frequently purchased non-food items and 12 month recall period for less frequently purchased non-food items including health expenditure items. We adopted the 12month recall period for inpatient care and medical products since they both fall under less frequently purchased items, and adopted 4week recall for outpatient/medicines, 6 months for preventive care to capture health expenditure in these sub-classes. The recall periods were consistent across the three versions of the questionnaire. The final instruments developed had 6 sections all drawn from the GLSS 6 instruments; household roster, housing characteristics, household assets, frequently purchase items (non-food items), health expenditure and health provider details. Food items were collected using a diary approach

with a total of 6 household visits at an interval of three days. Figure 3.1 shows the generic structure of the developed instrument.

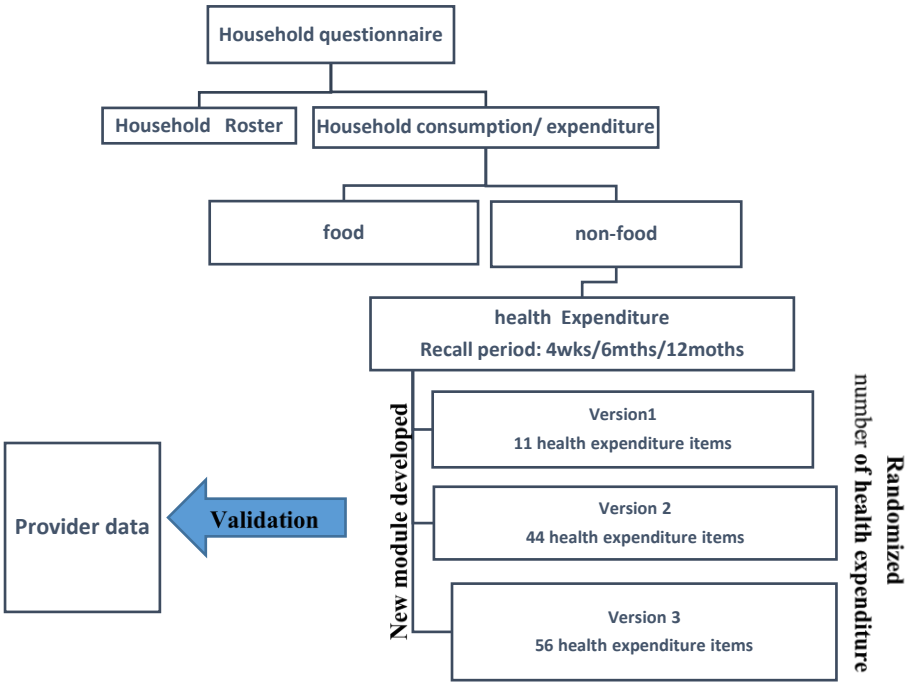

Figure 3.1: Structure of survey instruments

Provider data collections

Within the Ghana health care system, public health providers who are managed by the government keep patient records as part of routine activities while most private providers either kept minimal transactional records or no records at all. To generate accurate data for comparison, we developed a template (Appendix I) and trained private provider owners on how to use it to collect patient information. The main fields in the template included name, address, phone number, referral status, reason for consultation and cost of treatment/service. For public providers where patient data was already recorded, trained field workers completed the template by review and extracting relevant information from the provider records. We therefore purposely selected major health care providers within the demographic surveillance site to obtain the provider data. The criteria for selecting the providers was based on the availability of transactional data or a care-taker who could record details of the transactions from clients in the case of private providers. The public health providers selected

include; one hospital, one clinic and seven public health centres. For the private health care providers, ten high volume pharmacy and license chemical shops met our selection criteria and where selected.

Matching

Matched samples in this study refer to households that were accurately linked to their provider records. For any households that reported positive expenditure on any of the health expenditure items, corresponding health provider data was obtained from the provider records using details about the provider obtained from the respondents. The linked household-provider data formed a matched sample used in our validation analysis. The matching of household and provider data was done at the individual household member level and by spending category (Figure 3.2). Due to challenges about the accuracy and reliability of provider details provided by respondents and possible errors in recording patient details at the provider, some households could not be matched to provider data and were therefore excluded from the validation analysis. These challenges are being discussed in detail in another paper title "Challenges in linking household health expenditure records to provider records".

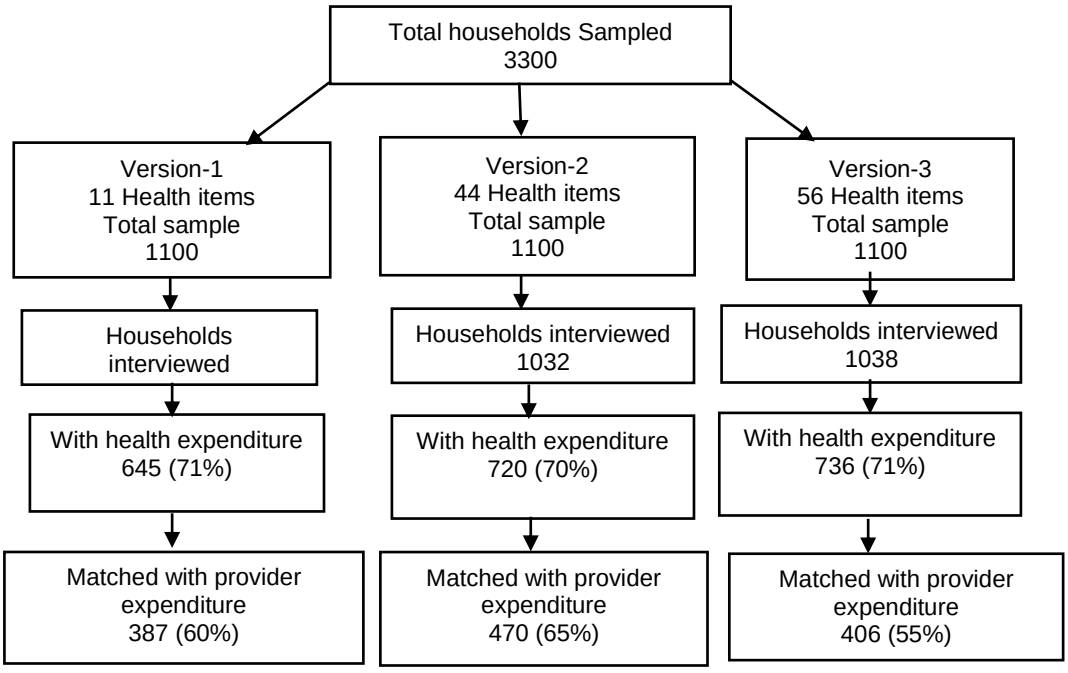

Figure 3.2: flow chart of sample and matching

Data analysis

We did separate analysis according to matched and unmatched samples to give clarity to our findings. For the unmatched samples, we summarized the OOPs and household characteristics

by questionnaire version using mean and standard deviation or median and 90% central range for continuous variables and proportions for categorical variables. We summarized the overall OOPs by group using the ratio of each group to the reference version (11 items).

For the matched samples, we adopted the Bland-Altman approach (Giavarina, 2015a; Bland & Altman, 1999) to assess the level of agreement between household reported health expenditures and corresponding provider records for each questionnaire version separately. We calculated the ratio of the household to provider OOPs. The ratio was straightforward to summarize since it had a reasonably constant distribution over the range of the provider OOPs, whereas the difference between household and provider OOPs was dependent on the provider OOPs. We also log-transform the ratio before analysis as recommended when the distribution is skewed (Giavarina, 2015a; Bland & Altman, 1999). For each questionnaire version, we estimated the overall mean bias using the geometric mean of the ratios and the variability using the 95% limits of agreement (limits within which 95% of the ratios are expected to lie). To assess the effect of number of health items on OOPs, we compared the overall mean bias and variability between the three versions of the questionnaire using regression models proposed by Bland-Altman (Bland & Altman, 1999). To investigate the effect of the questionnaire version on the mean bias, we fitted a regression model with the log ratio of household expenditures to provider expenditure as the outcome variable and questionnaire version as an explanatory variable. This provides an estimate of the effect of the questionnaire version on the mean log ratio of the bias with corresponding confidence interval and p-value. We included a random effect parameter to account for the clustering of the households within clusters defined by the Navrongo DSS. We estimated the effect of the questionnaire version on the variability by regressing the questionnaire version on the absolute values on the residuals of the previous model. The regression models were fit on the log ratio scale, but transformed to obtain results on the ratio scale for ease of interpretation and communication in terms of mean under the assumption of log-normality of the distribution of the ratio. Questionnaire version 1 which has the least number of health items (11 items) was used as the reference group for the regressions. Questionnaire version one was selected because it covers all COICOP-2018 classes and it has number of health items closer to that used in the GLSS6 survey. Data was analyzed using STATA Version 14, Stata Corp.

3.3 Results

Socio-demographic characteristics of households

Table 3.2: Demographic Characteristics of household head

	Questionnaire version 1		Questionnaire version 2		Questionnaire version 3		All Questionnaire versions combined	Households with any expenditure		Households without any expenditure		Matched Households		Unmatched Households	
Total number of households	N=925		N=1062		N=1036		N=3023	N=2093		N=914		N=1300		N=1698	
	n	%	n	%	n	%	n (%)	n	%	n	%	n	%	n	%
Sex															
Male	582	63	705	66	647	62	1934 (64)	1332	64	589	64	841	65	1074	63
Marital status															
Married	566	61	687	65	606	59	1859 (62)	1326	63	519	57	827	64	1013	60
Level of Education															
No education	451	49	574	54	572	55**	1597 (53)	1116	53	474	52	656	50	931	55
Primary	200	22	214	20	202	20	616 (20)	420	20	196	21	262	20	349	21
Junior high school	144	16	141	13	136	13	421 (14)	292	14	128	14	195	15	223	13
Senior high school	44	5	51	5	49	5	144 (5)	97	5	43	5	71	5	70	4
Vocational/Technical/College/ Graduate	86	9	82	8	77	7	245 (8)	167	8	73	8	116	9	125	7
Religion															
Christians	519	56	501	47*	571	55	1591 (53)	1114	53	460	50	730	56	841	50
Islam	54	6	148	14*	41	4**	243 (8)	162	8	81	9	107	8	136	8
Traditional	314	34	355	33	362	35	1031 (34)	708	34	326	34	387	30	638	38
No religion	38	4	58	6	62	6	158 (5)	110	5	47	5	76	6	83	5
Age group															
15 - 19	40	4	56	5	43	4	139 (5)	96	5	37	4	60	5	74	4
20-34	51	6	77	7	67	7	195 (6)	138	7	58	6	91	7	102	6
35 - 64	572	62	621	59	589	57**	1782 (59)	1228	59	543	59	781	60	989	58
65 +	262	28	308	29	337	33	907 (30)	630	30	276	30	368	28	533	31
Mean age (SD)	55	17	54	17	56	17	55 (17)	55	17	55	17	54	17	55	17
Household size															
1 person	67	7	82	8	64	6	213 (7)	108	5	103	11	70	5	141	8
2-5 persons	418	45	549	52	566	55**	1533 (51)	1010	48	516	56	616	47	906	53
6 and above	441	48	432	41*	403	39**	1276 (42)	975	47	295	32	614	47 **	652	38

* Significant difference between version 1 and 2. ** Significant difference between version 1 and 3. *** Significant difference between all versions and matched households

A total of 3023 households were interviewed. Of these, 64% of the household heads were males, the majority (89%) of the household heads were above 34 years of age, 62% of the household heads were married, more than half (53%) of household heads did not have any formal education, more than half (53%) were Christians and the mean age was 55 year (17 SD) . The majority of households had more than one member with 51% having 2-5, and 42% with 6 or more. The distribution of demographic characteristics was similar between households with the three questionnaire versions, with households with health expenditure versus those without and households with matched provider records versus households

without successful matched provider records except for a few cases where the proportions differed significantly by version (Table 3.2).

Distribution of household OOPs by spending categories

Overall 19% of households had reported to have incurred OOPs for inpatient care within a 12 month recall period. The proportion of households reporting OOPs for inpatient care was similar (19%, 17% and 19%) across all three versions of questionnaire. The proportion of households reporting OOPs on preventive care decreased with increasing specificity of health of items (15% for 2 items, 9% for 5 items and 4% for 6 items) within a 6 month recall period. Overall, 12% of households incurred OOPs on outpatient care within a 4 week recall period. The specificity of health items for outpatient care (from 2 items to 12 items) did not show a clear trend in the proportion with expenditure (9% for 2 times, 18% for 12 items and 10% for 12 items). More than half (56%) of the households also reported to have incurred OOPs on medications, and the proportions were similar for all three versions. In all spending categories, the observed differences were not statistically significant across the versions (Table 3.3).

Table 3.3: Health expenditures – Proportion of households reporting positive OOPs by spending category

	Questionnaire version-1			**Questionnaire version -2**			**Questionnaire version -3**		
	N=901			N=1032			N=1036		
number of households with positive health by category: COICOP 2018	Number of health items	n	Percent	Number of health items	n	Percent	Number of health items	n	Percent
inpatient care services	2	170	19	14	177	17	14	193	19
preventive services	2	137	15	5	92	9	5	46	4
Other health services	1	9	1	2	5	0.5	2	2	0.2
outpatient	2	81	9	12	181	18	12	105	10
medicines	2	487	54	9	560	54	16	609	59
health products	2	36	4	2	25	2	7	18	2
number of households with any health expenditure	11	645	71	44	720	70	56	736	71

****Version-1=11 health items, version-2=46 health items, version-3=56 health times**

Mean OOPs reported by households by questionnaire version

The mean household OOPs were larger for higher levels of aggregation of health expenditure items than at lower levels (increasing specificity) for all spending categories except health products where we see the ratio of the means to be greater than 1 with increasing specificity and, inpatient care where there was no consistent pattern with increasing specificity. The observed mean ratios were significant for only preventive care and medicines (Table 3.4). appendix V1 Tables S1 and S2 also shows the summary of mean for matched and unmatched households versus provider estimates across the three versions and by spending categories.

Table 3.4: Arithmetic mean OOPs by questionnaire version

	Questionnaire Version-1 11 disaggregated health items				**Questionnaire Version-2** 44 disaggregated health items					**Questionnaire Version-3** 56 disaggregated health items				
Spending category	Number of health items aggregated	N	HH average OOPs (Ghc)	sd	Number of health items aggregated	N	HH average OOPs (Ghc)	sd	Estimated ratio of the means (Version-2/version-1) (95%CI)	Number of health items aggregated	N	HH average OOPs (Ghc)	sd	Estimated ratio of the means (Version-3/version-1) (95%CI)
outpatient	2	81	64	135	12	181	43	130	0.70 (0.20 – 1.21)	12	105	44	78	0.75 (0.27 – 1.22)
inpatient	2	171	319	527	14	177	398	809	1.25 (0.75 – 1.74)	14	193	287	716	0.92 (0.51 – 1.34)
medicines	2	487	41	140	9	560	29	78	0.71 (0.44 – 0.98)	16	609	29	76	0.66 (0.44 – 0.88)
Preventive care	2	137	59	95	5	92	34	53	0.60 (0.33 – 0.87)	5	46	31	44	0.57 (0.27 – 0.88)
Other medical services	1	8	203	201	2	5	113	217	0.56 (-)	2	2	12	4	0.06 (-)
Health products	2	36	71	133	2	25	160	250	2.38 (-)	7	18	165	232	2.32 (-)

Note: HH-households, sd-Standard deviation

Quantifying the mean bias and variability between household and provider OOPs

We assessed the agreement between the household and provider OOPs by estimating the overall bias and variability for each type of health expenditure class. The mean bias was estimated as the geometric mean ratio for household divided by provider OOPs. The geometric mean ratio increase with increasing specificity for OOPs in inpatient care, outpatient care and medicines. We did not find evidence of a consistent increase or decrease in mean bias with increasing specificity in preventive care spending. The magnitude of the mean bias is observed to be directly proportional to the amount of OOPs incurred across all spending categories. Out-of-pocket expenditure from 2 items on inpatient care and 11 items on total health expenditure yielded a mean bias of 3.88 (0.17 – 86.2 95% LoA), decomposing 2 inpatient items to 14 inpatient items and increasing the number of items on medicines from 2 to 9 increased the mean bias in inpatient care by about 70% (from 3.88 to 6.61). Further increasing specificity of medicines from 9 items to 16 items increased the mean by on inpatient care by an additional 39% (from 6.61 to 9.19). These evidence suggests that, disaggregating health expenditure items into finer specific items tended to decrease the level of agreement between household expenditures and corresponding provider records and thereby making OOPs estimates less accurate and reliable. However, the differences in the observed biases across the versions was only significant in inpatient care and medicines. The implication is that, even though increasing the specificity of health items tend to lead to higher biases, it only significantly affect inpatient care and medicines OOPs (Table 3.5).

Table 3.5 Mean bias and variability in measurement of OOPs by number of health expenditure items by spending category

Number of Health items	Number of households	Mean bias (Log difference)	95% limits of agreement of mean bias	Estimated difference in bias between questionnaire versions & CI & p-value	Estimated difference in SD questionnaire versions & CI & p-value
	Outpatient care			**p = 0.49**	**p = 0.50**
2 health items	44	1.02	0.05 – 21.2	-	-
12 health items	126	1.21	0.05 – 26.7	1.29 (0.74 – 2.23) 0.37	1.02 (0.73 – 1.42) 0.90
12 health items	47	1.56	0.12 – 19.6	1.47 (0.77 – 2.80) 0.24	0.84 (0.57 – 1.25) 0.39
	Inpatient care			**p = 0.003**	**p = 0.01**
2 health items	91	3.88	0.17 – 86.2	-	-
14 health items	99	6.61	0.16 – 270.7	1.63 (0.99 – 2.69) 0.06	1.35 (1.03 – 1.76) 0.03
14 health items	100	9.19	0.51 – 161.2	2.34 (1.44 – 3.83) 0.001	0.93 (0.71 - 1.21) 0.58
	Medicines			**p = 0.023**	**p = 0.33**
2 health items	302	1.26	0.10 – 16.0	-	-
9 health items	381	1.35	0.09 – 19.5	1.14 (0.91 – 1.42) 0.25	1.04 (0.91 – 1.19) 0.56
16 health items	354	1.62	0.18 – 15.0	1.36 (1.01 – 1.70) 0.01	0.95 (0.83 – 1.08) 0.41
	Preventive care			**p = 0.290**	**p = 0.51**
2 health items	86	1.21	0.09 – 15.15	-	-
5 health items	67	0.89	0.04 – 18.9	0.74 (0.46 – 1.14) 0.16	1.19 (0.88 – 1.62) 0.26
5 health items	22	1.33	0.08 – 22.4	1.07 (0.55 – 2.05) 0.85	1.04 (0.68 – 1.60) 0.85

Note: The unit of the estimated difference is the actual ratio

3.4 Discussion

We present experimental evidence of the influence of the specificity of health items on the bias and variability of reported household positive OOPs. Our study focused on quantifying the bias and variability of OOPs with increasing specificity and by spending category by comparing household and provider data.

A number of studies have investigated and documented the potential effect and consequence of varying number of health items on the estimation of OOPs using nationally representative survey data (Lu et al., 2009; Lavado, Brooks & Hanlon, 2013; Xu et al., 2009; Grosh & Glewwe). All these studies focused their investigations on the effect of number of health items on total household health expenditure without examining the dynamics of the effect by spending categories. For instance, Lu (2009) using WHS data involving 43 countries looked at average annual OOPs from a single-item measure to an 8 item measure and found that in 37 of the countries, the average annual OOPs was higher in the 8 item measure (Lu et al., 2009). Similarly, Heijink (2011) also using WHS data from 50 countries found aggregated health expenditures to be greater than reported total health expenditure but however, found no significant difference between reported household total expenditure and aggregated total household expenditure from 6 items (Heijink et al., 2011). In another similar study, Lavado (2013) found a unit increase in the number of health items to result in one percent increase in health expenditure share whilst a unit increase in the total expenditure questions resulted in less than one percent decrease in health expenditure share when the number of health questions remain unchanged (Lavado, Brooks & Hanlon, 2013). Xu (2009) investigated and found similar results in most countries where single item yielded less OOPs estimates than aggregated items. Other studies have also looked at levels of disaggregation in non-health consumption and expenditure in households and found in most surveys that more aggregated items tend to produce higher estimates than less aggregated or single item (Grosh & Glewwe, 2000). These evidences suggests' more items results in higher total household OOPs. In the pool of such evidences, Lu (2009) acknowledged that these findings may not be universally true across countries and that the degree of bias using a single-item is highly variable. They also admitted their constraint in drawing conclusions on the true effect of number of health items on OOPs estimates because of the additional influence of recall period which we have controlled for in our study.

However evidence from our experimental study focusing on the specificity within COICOP main spending classes suggests otherwise. Analysing the effect of specificity of health items

on OOPs by spending category suggests that being more specific and detail on health expenditure items for some spending categories yielded less mean OOPs compared to aggregated levels. Outpatient care, medicines and preventive care showed a consistent trend of decreasing mean OOPs with increasing specificity. This suggests that being more detailed as a consequence of increasing the number of health items within these categories leads to under estimation of mean OOPs in these spending groups. And of course, the observed difference in the direction of mean OOPs ratio between our study and previous studies could be driven by a number of factors including; the analytical approach, study design and choice of health expenditure category groupings. While previous studies adopted paired analytical approach to analyse aggregated versus disaggregated health expenditures within the same survey to estimate total OOPs (Heijink et al., 2011; Lavado, Brooks & Hanlon, 2013; Xu et al., 2009), our study employed a validation approach where the main spending classes where decomposed into versions and the resulting OOPs estimates compared across different survey versions and then validated with a 'gold standard'.

Most significantly, the validation approach helped us identify the most accurate and reliable level of detail of health items for collecting OOPs information which has previously not been done by any study. Using matched household-provider data, and considering the provider data as a gold standard, we validated household reported health expenditures. The validation analysis throws more light on the accuracy and reliability of OOPs estimates at different levels of specificity and by main spending categories. Our findings suggests that the level of agreement between provider and household OOPs decreased with increasing specificity for outpatient care, medicines and inpatient care. This may be due to the fact that, detailed decomposition of the health items tend to be more specific and therefore households are not able to identify and separate such expenditures from other related expenditures that were incurred within the same episode of care and as a result may leave some expenditures out.

Experimental studies have the added advantage of giving us a fair platform to be able to assess and measure the independent effect of measurement errors such as the specificity of health items. This experimental study attempts to validate a standard structure to collect data on OOPs that is further refined to reflect national practise in gathering such information. More and less details versions are tested, and we find that the less disaggregated version provides the more accurate information in particular for inpatient care and medicines. The questionnaire is implemented in the context of rural Northern Ghana where people are covered for their direct inpatient expenditures by insurance but non-the-less, challenges

(Addae-korankye, 2013) within the insurance system still exposes care seekers to OOPs. Findings may be different in other context and experimental studies are being conducted in urban Burkina Faso and urban/rural areas of Vietnam in an attempt to generalize results to be able to appropriately identify valid, reliable and comparable methods for estimating OOPs in household surveys.

3.5 Key message

- *Increasing specificity under estimates means OOPs in Outpatient care, medicines and preventive care*
- *Increasing specificity of health items significantly decreases level of agreement between household data and provider records for only inpatient care and medicines*
- *Having less detailed health expenditure items produces relatively more accurate and reliable OOPs estimates in household surveys.*

3.6 Limitations

As the study relied on health provider data as a 'gold standard' for the validation of household expenditures, the total sample size for the estimation of bias and variability was influenced by number of household that could be successfully matched to their corresponding provider data. Most of the providers had challenges recording and extracting health expenditure records of clients since this was not routinely done. This affected the completeness of the provider data and therefore households with zero expenditures could not be validated and consequently influenced the final sample size for the analysis. Details of these challenges are discussed in another yet to be published paper looking at challenges in linking household expenditures to provider records in a validations study in rural northern Ghana.

3.7 Conclusion

This study has demonstrated the feasibility of conduction a large validation study in rural setting the operates a demographic surveillance system. The evidence from this study gives some level clarity to development partners and national health accountants on how different surveys tools estimate health expenditures and how much variation to expect when an alternate tool is used for the estimation. This study also provide evidence for policy dialogue towards improving the measurement of household health expenditures particularly OOPS. We found that systematically decomposing health expenditure items into more specific and finer sub-classes by main spending categories saw a consistent under estimation of OOPs in households in outpatient care, medicines and preventive care. There is also decreasing levels of agreement between positive OOPs from households and provider records with increasing

specificity of health expenditure items across the main spending categories, this consequently imply that OOPs are more accurate and reliable when collected in a module where the health expenditure items are less specific.

We further recommend for more validation studies to be able to generate more evidence to guide policy dialogue towards improving the measurement of out-of-pocket expenditures in households.

Chapter 4

Testing and validating the optimal recall period in the measurement of household out-of-pocket health expenditure. Evidence from an experimental study northern Ghana

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Abstract

Background: Financial risk protection is a key component of universal health coverage. Measuring out of pocket payments (OOPs) through household surveys is challenging and recall bias has been identified as one of the main sources of bias in previous studies. This study investigates the effect of two different recall periods on reported OOPs. **Methods**: We used data on OOPs from health providers and community surveys using two versions of a health expenditure module developed for this study drawing on the World Health Survey and adapted to the Ghana living standards measurement survey. We compare estimates of households OOPs health expenditures using recall of 2weeks for medicines and outpatient care, 3months for preventive care and 6months inpatient care and medical products for one questionnaire version and 4weeks, 6months and 12months respectively in the other questionnaire version. We adopted a matched and unmatched analytical approach. Matched analysis was done using the Bland-Altman method of quantitative measurement to compare bias and variability between household OOPs and provider data whilst unmatched analysis was done to compare mean household OOPs across spending categories and recall periods. **Findings**: We surveyed 800 and 480 households in the two recall periods respectively, of which 48% and 58% respectively had incurred OOPs, of these, 73% and 81% of the households that had at least one spending category that could be successfully matched to provider records.. OOPs reported by the households in the matched sample were between 2 – 4 times higher than provider in the both short and long recall periods for inpatient care, and between 1 -3 times higher than those of the provider in the longer recall period group. There was no evidence of a difference in the mean bias between the two recall periods in both inpatient care and medicines and provider data, however, there was substantial variability in the ratios of individual household to provider OOPs for medicines but not for inpatient care. **Conclusion**: This study suggests that a recall period of 6 months and 12 months for asking about inpatient care expenditure and, 2 weeks recall period and 4 weeks recall period for asking about OOPs on medicines do not yield substantially different estimates when sample sizes of the surveys are calculated to obtain a sample of spenders.

Keywords: Recall period, out-of-pocket, universal health coverage, household survey, comparability, validation, Ghana

4.1 Introduction

Universal health coverage (UHC) means access to needed health services without incurring financial hardship (Boerma et al., 2014; WHO, 2017). Out of pocket payments (OOPs) made by individuals when they use health services are a not only a barrier to accessing care but also a source of financial hardship when they exceed ability to pay (O'Donnell, 2019). OOPs are part of the health financing mix in all countries, at global level they accounted for between 15-40% of current health spending in 2015 (WHO, 2017). The share of health spending financed through OOPs has been decreasing globally, however, the share of OOPs relative to household consumption has been increasing (World Bank, 2012). The main distinction between Low- and lower Middle Income Countries, upper-middle income and High Income Countries (HICs) is the extent to which they depends on OOPs to finance health care; 40% in low and middle-income countries, 30% upper-middle income countries and 15-20% in high-income countries (WHO 2018 report). So all countries must track OOPs on the path to UHC.

Most countries do not depend on one method of estimating household health expenditure and OOP payments, but a combination of methods which are largely dependent on the availability of data and the individual country context (Lu et al., 2009). The most common data source for measuring OOP health payments are household surveys (Heijink et al., 2011; Lavado, Brooks & Hanlon, 2013; Neter, 1970; SHA, 2011). These include the World Health Survey (WHS), Living Standards and Measurement Surveys (LSMS), Household Budget Survey (HBS), Socio-Economic Surveys (SES) and Income and Expenditure Surveys (IES) (WHO, 2010; Heijink et al., 2011; O'Donnell et al., 2007).

The validity and reliability of OOP estimates depend on the survey instrument used (Lu et al., 2009; Heijink et al., 2011; Neter, 1970; Neter & Waksberg, 1964; Rannan-Eliya, 2010). Recognizing biases in household surveys is important for both interpreting results and improving data quality in future surveys (Lu et al., 2009; Heijink et al., 2011). Many factors, such as the number of questions on health expenditure, whether the data is collected using a diary or an interview, and whether the OOP data is collected in a health module or in an expenditure module (Lu et al., 2009; Heijink et al., 2011; Rannan-Eliya, 2010), affect OOPs measurements (Lu et al., 2009c; Lavado, Brooks & Hanlon, 2013b; Heijink et al., 2011). Recall period has been identified as an important measurement error affecting comparability of OOPs estimates across household surveys (Lu et al., 2009; Lavado, Brooks & Hanlon, 2013; Neter, 1970; Pravin & Pal, 1980; Anand & Harris, 1994). According to some studies that used nationally representative survey data, a short recall period results in a significantly

larger estimate of OOP than a long recall period in most countries (SHA, 2011; Heijink et al., 2011; Lu et al., 2009). Sample sizes in those surveys where not computed with the objective to capture a sample of spenders but rather to capture utilization. Very few experimental studies exist that test the impact of recall period on OOPs measurement in household health expenditure and utilization surveys (Lu et al., 2009; Heijink et al., 2011; Scott & Amenuvegbe, 1990). Stull et al., 2009 found that, a standard recall period is not appropriate for measuring and understanding all phenomena and that different phenomena should be dealt with different recall periods (Stull et al., 2009). The effect of recall period on consumption and expenditure estimates have been well documented in literature, however, identifying the optimal recall period for different phenomena has always been the challenge. In respect to recall period for health expenditure or utilization surveys, the preference is to rely on shorter recall periods for more frequent and smaller expenditure items (e.g. those for outpatient services and medicines) while capturing infrequent larger expenditures (e.g. those for hospital admissions) in a longer recall period (Kjellsson, Clarke & Gerdtham, 2014; Heijink et al., 2011; Bhandari & Wagner, 2006). Due to frequent use of different recall periods in health expenditure and utilization modules in current modules, it is important to identify the most optimal recall period that will give accurate and reliable estimates for the measurement of out-of-pocket health expenditure in surveys. Past studies (Heijink et al., 2011) have recommended for experiment studies to quantify and identify the most optimal recall period for health expenditures in surveys.

The INDEPTH-network household out of pocket expenditure (iHOPE) project, supported by BMGF in collaboration with SPTH and WHO set out to develop, compare and validate alternative survey instruments for collecting valid and reliable out-of-pocket health expenditure data. As part of the iHOPE project, the present study test's different recall period in health expenditure module to identify the most optimal recall period for different spending categories. This study was implemented in an experimental context in Northern Ghana.

4.2 Methods

Study setting

This study was implemented at the Navrongo Health and Demographic Surveillance System (NHDSS) site located in northern part of Ghana. The site includes two administrative districts with an estimated total population of 160,000. Within this site, there is one hospital, a health research institution, one private clinic, seven health centers, and 27 community-based health compounds. A number of pharmacies and licensed chemical shops, petty traders, drug

peddlers, herbalists, faith-based and traditional healers also operate in the area. The NHDSS maintains a demographic surveillance system that routinely collects vital health, socio-demographic and economic data (Oduro et al., 2012)

Study design

This the iHOPE project is generally a methodological experimental study where we applied cross-sectional survey design to generate data to in other to evaluate and validate new methods using provider data as 'gold standard' for comparison. There were in three steps involved in this methodological study. The first step involved designing new modules of health expenditure questions and integrating them into existing survey tools (GLSS6 questionnaire), the second step involved data collection (cross-sections survey and provider data collection) in the field using the new questionnaires and the third step involved matching the cross-sectional data with provider data for validation analysis. Since the main object is to test and validate recall period, the developed instruments where assigned two different recall period groups for asking health expenditure questions in the cross-sectional survey. Households were then randomized into the questionnaire with different recall period for the data collection in the cross-sectional survey. The first group of households received a questionnaire with recall periods of 2 weeks for medicines and outpatient care, including dental care, 3 months for preventive care and 6 months for inpatient health care and assistive products. The second group of households received a questionnaire with recall periods of 4 weeks, 6 months and 12 months respectively. Reported household OOPs were then validated using information obtained from health care providers. We attempted validating OOPs for all spending categories if the numbers report by households met the sample size requirement for the validation analysis. To identify the optimal recall period, we assessed the agreement between household data and provider data for each household recall period group by spending category, we linked every household reported health expenditure with their corresponding health provider data to produce a matched dataset for analysis. The matching was done at the spending category level. Provider data was obtained from all public and private health care providers operating within the NHDSS area. (see Figure 4.1)

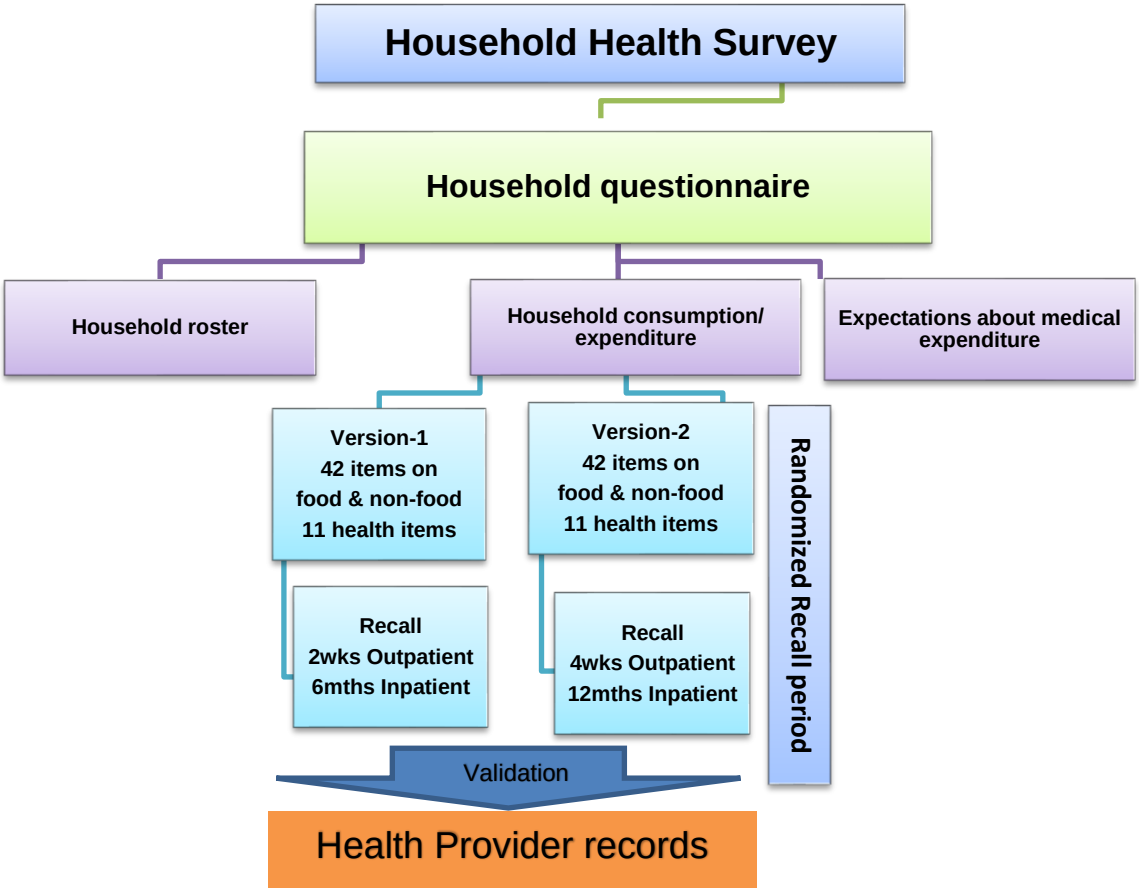

Figure 4.1 Design of Household Health Survey Instrument

Study population and Sampling

The study population constituted all households registered in the Navrongo Health Research Demographic Surveillance System (NHDSS) register. The household survey sample size was based on the precision of estimating the agreement between household and provider records. As a rule of thumb for the Bland-Altman method of assessing agreement, between 100-200 observations would provide a sample size with sufficient precision of the estimates when assessing agreement (Bland, 2004). We accepted 50 observations for each spending category per questionnaire version as adequate in this study due to evidence on probability of spending in each category and in order to obtain a manageable sample of households to implement the project. We adopted separate sampling strategies for separate spending categories: we adopted a household sampling for outpatient, medicines and preventive care, and provider-based sampling for inpatient care.

Outpatient/medicines/preventive care sampling

The probability of spending was16% for outpatient care within a two week period [*unpublished Navrongo DHMT, 2015 data*]. In order to obtain a sample size of 50 households who had utilized outpatient care for the 2 week recall period the sample size required would be 300. We added 10% to account for non-response to arrive at a total sample of 330 households for this questionnaire version. For the 4 week recall period, the sample size required to get a minimum of 50 households who utilized health care would be 200, adding 10% to account for non-response gives a total of 220 households.

Inpatient sampling

The probability of spending on inpatient care in the study area was 10% within 12 months (unpublished Navrongo DHMT, 2015 data). The number of households needed to be interviewed to obtain a sufficient number accessing inpatient care and successfully linking them with provider data was too high to be feasible. Therefore we relied on provider based sampling for inpatient care. We randomly selected 220 households with positive expenditure on hospitalization from the hospital database to form the sample for inpatient care. Each recall period group was randomly assigned 110 households.

Therefore, the total sample size for questionnaire version with shorter recall was 660 plus 110 households to obtain a total of 770 minimum households whilst the number required for the version with longer recall was be 440 plus 110 to obtain a total of 550 households. Due to challenges in identifying and locating households sampled from the provider sampling, only 17% and 41% of the provider sample was achieved in the 6month and 12month recall period respectively. This implies that, version-2 will have more households reporting OOPs on inpatient than version-1. We do not however, expect this to influence the average OOPs, bias and variability of the estimates. Table 1a gives a summary of the sample size composition.

Provider sample and provider records

Health providers sample included all public and private health care providers operating within the study area. They include; 1 hospital, 1 clinic, 7 health centers and 10 high volume pharmacy shops and about 50 chemical shops. This allows us to attempt validate of all spending categories reported by households. In order to obtain data from the providers, we identified and selected only providers that kept transactional records or were capable of recording such information.

Data collection instruments

Household data collection instrument

A health expenditure and utilization household survey was developed by WHO drawing on the structure of the World Health Survey (WHO, 2002) and adapted to the Ghana Living Standards Survey 6 (GLSS6) (GLSS6 Report, 2014). The survey instrument had two components, a household level questionnaire with questions about household OOPs asked to a single respondent within the household, and an individual level questionnaire with information on utilization and health expenditures. The focus on this study is on the household level questionnaire and therefore the descriptive of the questionnaire here is with respect to the household level questionnaire. Within this household questionnaire, 11 questions on OOPs were included in the survey. The questions were drawn from the UN statistical classification of individual consumption according to purpose COICOP-2018 (United Nations, 2018). These questions are included at the end of a household food and non-medical expenditure module in the survey instrument which takes the general structure of the GLSS6 instrument. The final structure of this household questionnaire is illustrated Figure S3 in supplementary material 3. Table S1 in supplementary material 1 also shows how the health expenditure questions were frame and instructions on how the questions were administered. The final household survey questionnaire was divided into two versions (see Table 1a). A questionnaire version was identified by the recall period used within the health expenditure module. The respondent to the expenditure module was identified as the head of the household or any other knowledgeable person assigned by the household head to provide such information. Trained field workers conducted face-to-face interviews using CAPI.

Table 1a: Spending categories and their recall periods

	Questionnaire Version 1	**Questionnaire Version 2**
Health spending category	**Recall period**	**Recall period**
Inpatient care	6 months	12 months
Preventive care	3 months	6 months
Other health servicves	2 weeks	4 weeks
Outpatient	2 weerks	4 weeks
Medicines	2 weeks	4 weeks
Health products	6 months	12 months

Provider data collection and matching

A template (Appendix I) was developed to collect patient data from different types of health care providers (all pharmacy and licensed chemical shops) who did not have experience collecting patient data prior to the start of our study. The template was used to collect patient data such as name, address, phone number, referral status, reason for consultation and cost of treatment/service. This information was requested from patients at the point of paying for the services. Two of the high volume pharmacy shops requested for and received additional staff to assist in recording patient data. For providers who already had experience collecting patient data (public providers), OOPs records were extracted from the provider records database or books by the project field team. All provider records were collected for a total of 12 months to cover the different recall periods. Hospital records covering a period of 12 months were extracted to capture inpatient expenditures over the past 12 and 6 months. Every household that incurred OOPs within a given recall period for any of the spending categories was asked additional details about the transaction(s) and the provider(s). The details allowed for the matching process. Matching of household OOPs to provider records were done at the individual level for every transaction. **Figure 4.2** gives a summary how of sample allocations and the proportion of OOPs that matched within each spending category.

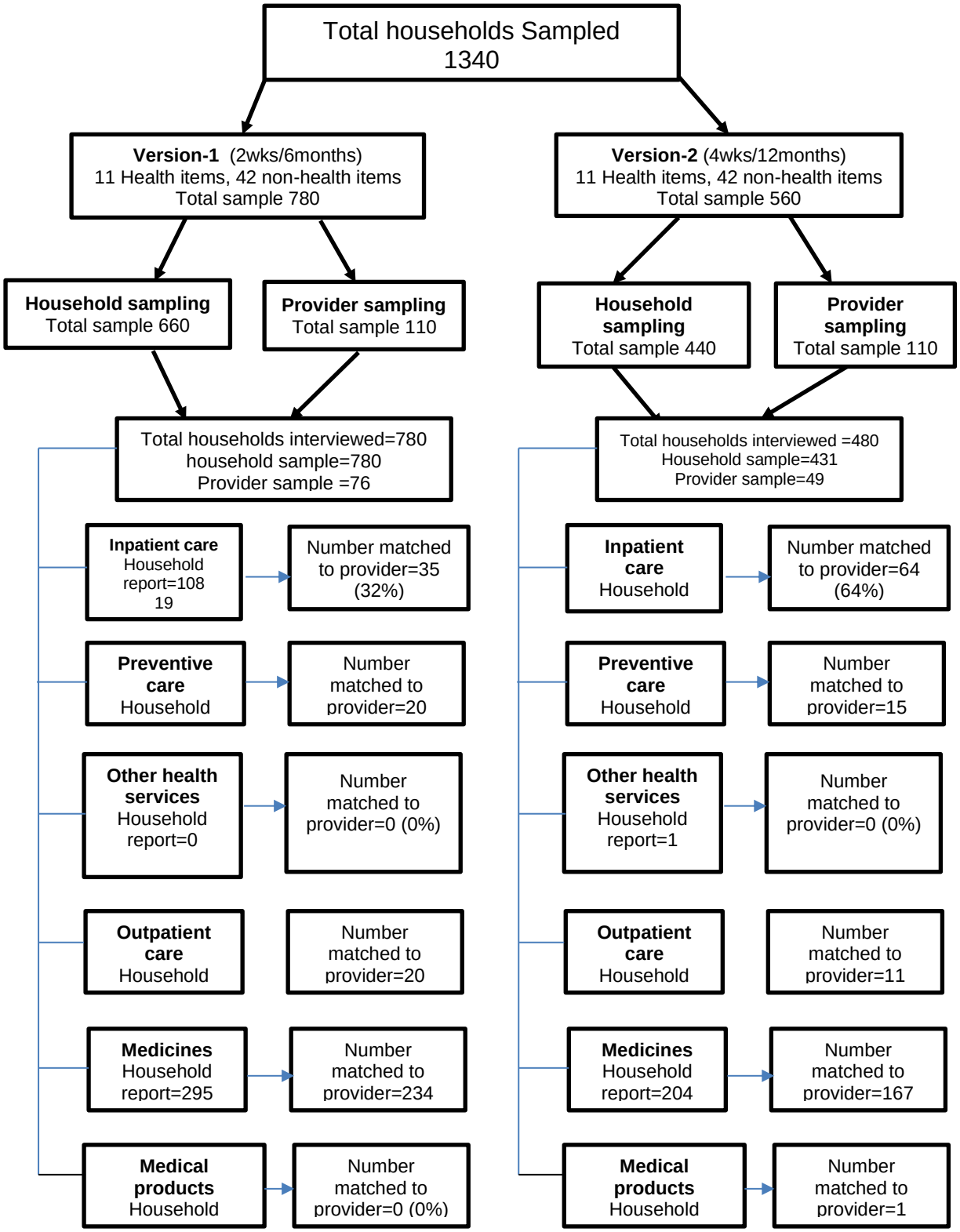

Figure 4.2 Sample size allocation by questionnaire version, spending category and matching

Data analysis

Two analytical approaches were developed. The first one consist on comparison of means, standard deviations and ratio of means across different recall periods without matching. This is what is typical investigated in published studies. The limitation of this approach is the lack of benchmark. If one of the recall period is identifying as leading to higher estimates it is not possible to know if that is more reliable than the other one. This study has the advantage to count on provider data for medicines and inpatient to compare to the household's self-reported information. The second approach consisted therefore in estimating the level of agreement between each questionnaire version and the provider data, we applied the Bland-Altman approach for method comparison (Bland & Altman, 1999; Giavarina, 2015b). For each type of component, we estimated the overall bias between the household and provider OOPs and the variability in the bias between records. We calculated the ratio of household OOP to provider OOP since the difference was heavily dependent on the provider amount. We also log-transform the ratio before analysis as recommended when the distribution is skewed (Bland & Altman, 1999; Giavarina, 2015). This transformation has implication for the interpretation of results. We investigated whether recall period affected the agreement between household and provider OOPS by following the method of Bland and Altman (Bland & Altman, 1999). To investigate the effect of the questionnaire version on the mean bias, we fitted a regression model with the log of the difference (ratio) between household and provider expenditures as the outcome variable (Giavarina, 2015) and questionnaire version as an explanatory variable. This provides an estimate of the effect of the questionnaire version on the mean ratio of the bias and variability as well as their corresponding confidence interval and p-value. This allow us to interpret the results in term of their real value of the difference between the two quantitative measurements. We included a random effect parameter to account for the clustering of the households within clusters defined by the Navrongo DSS (Oduro et al., 2012). We estimated the effect of the questionnaire version on the variability by regressing the questionnaire version on the absolute values on the residuals of the previous model. Data was analyzed using STATA Version 14, Stata Corp.

4.4 Results

The results presented here included sample from both household sample and provider based inpatient sampling as discussed under the sampling section. We used the combined sample for the final analysis because the number of households interviewed from provider based inpatient sampling was very small relative to the entire sample size. Including the provider

sample in the analysis did not bias the validation results even though there was disproportionate contribution of provider sample into the two versions. (Table 4.1b). **Appendix VI** shows tables of results from the sample that did not include the provider inpatient sample. The outcome of the results in the two analysis were similar so we present in this paper results from the combined sample.

Table 1b: Final household sample composition by questionnaire version

Spending category	**Version-1 Short recall period**				**Version-2 Long recall period**			
	Recall period	Household sampling	Provider sampling	Total households	Recall period	Household sampling	Provider sampling	Total households
inpatient care services	6 months	89	19	108	12 months	55	45	100
preventive services	3 months	18	10	28	6 months	19	2	21
Other health services	2 weeks	0	0	0	4 weeks	1	0	1
Outpatient	2 weeks	25	8	33	4 weeks	10	5	15
Medicines	2 weeks	278	17	295	4 weeks	185	19	204
health products	6 months	5	4	9	12 months	1	1	2

Demographic Characteristics in all households and matched households only

A total of 1,280 households from the combined sample were surveyed of which 665 (52%) reported OOPs expenditure and 513 (77%) of these were successfully matched with their respective provider data at both individual and transaction levels (supplementary material 2). The demographic characteristics of the household heads were similar across the two questionnaire versions for the both unmatched and matched samples (Table 4.2). Roughly 65% of the households are headed by males. Only 10% of heads were under 35 years and 58% were married.

Table 4.2: General household characteristics by questionnaire version

	All household characteristics			Matched household characteristics		
	Questionnaire Version 1 (2wks/6months)	**Questionnaire Version 2 (4wks/12months)**	**Total**	**Questionnaire Version 1 (2wks/6months)**	**Questionnaire Version 2 (4wks/12months)**	**Total**
Total number of households	N=800 n (%)	N=480 n (%)	N=1280 n (%)	N=278 n (%)	N=235 n (%)	N=513 n (%)
Sex						
Female	492 (61)	287 (60)	779 (61)	172 (62)	164 (70)	336 (65)
Marital status						
Married	446 (56)	272 (57)	718 (56)	161 (58)	141 (60)	303 (59)
Level of Education						
No education	538 (67)	289 (60)	827 (65)	187 (67)	140 (60)	326 (64)
Primary	111 (14)	104 (22)	215 (17)	46 (17)	53 (23)	99 (19)
Junior high school	70 (9)	43 (9)	113 (9)	23 (8)	25 (11)	48 (9)
Senior high school	22 (3)	25 (5)	47 (4)	4 (1)	9 (4)	13 (3)
Vocational/Technical/College/Graduate	59 (7)	19 (4)	78 (6)	18 (7)	7 (3)	27 (5)
Religion						
Christians	349 (44)	236 (49)	585 (46)	110 (40)	118 (50)	228 (44)
Islam	19 (2)	35 (7)	54 (4)	6 (2)	10 (4)	16 (3)
Traditional	332 (42)	181 (38)	513 (40)	125 (45)	91 (39)	216 (42)
No religion	100 (13)	28 (6)	126 (10)	37 (13)	16 (7)	53 (10)
Age group						
15 - 19	33 (4)	16 (3)	49 (4)	11 (4)	12 (5)	23 (4)
20-34	47 (6)	34 (7)	81 (6)	17 (6)	18 (8)	35 (7)
35 - 64	420 (53)	282 (59)	702 (55)	150 (54)	138 (58)	288 (56)
65 +	300 (38)	148 (31)	448 (35)	100 (36)	67 (29)	167 (33)
Mean age (SD)	59 (17)	55 (17)	114 (17)			
Household size						
1 person	57 (7)	38 (8)	95 (7)	17 (7)	9 (4)	26 (5)
2-5 persons	421 (53)	301 (63)	722 (56)	127 (46)	143 (61)	270 (53)
6 and above	322 (40)	141 (29)	463 (36)	134 (48)	83 (35)	217 (42)

Proportion of households with health care utilization and expenditure

The proportion of household reporting OOPs in medicines and inpatient care is observed to be higher in the longer recall period than in the shorter recall period in the unmatched combined sample (household and provider inpatient samples). The higher proportion observed for inpatient care in the longer recall period is largely attributed to the disproportionate contribution of samples (Table 4.1a) from the provider inpatient sample into the two recall period groups. With exception of inpatient care, the addition of the provider sample did not influence the distribution of reported expenditures by recall period. **Table S3** in **Appendix VI** also shows details of the distribution of OOPs in households for the household-only sample. In the household-only sample, the proportion of households reporting inpatient care is 12% in both 6 months and 12 month recall period.

Table 4.3: Households with out-of-pocket payments by spending category for matched household on reported expenditures

	Questionnaire Version 1 (Short recall period)			Questionnaire Version 2 (Long recall period)		
	Unmatched combined sample		Number matched		Unmatched combine sample	Number matched
Spending category	Recall period	N=780 n (%)	N=278 n (%)	Recall period	N=480 n (%)	N=235 n (%)
inpatient care services	6 months	108 (14)	35 (12)	12 months	100 (21)	64 (27)
preventive services	3 months	28 (3)	20 (7)	6 months	21 (4)	18 (8)
Other health services	2 weeks	0 (0.0)	0 (0.0)	4 weeks	1 (0.2)	0 (0.0)
Outpatient	2 weeks	33 (4)	20 (7)	4 weeks	15 (3)	11 (5)
Medicines	2 weeks	295 (38)	234 (85)	4 weeks	204 (43)	167 (72)
health products	6 months	9 (1)	0 (0.0)	12 months	2 (0.4)	1 (0.43)

Comparison of mean OOPs in household samples by spending category

Table 4.4 shows the summary of mean household OOPs by recall period for the unmatched combined sample. Annual mean household OOPs expenditures which are obatined by annualizing each spending category are observed to be about 79% higher in shorter recall periods compared to longer recall periods. From spending category perspective, OOPs estimates are higher in shorter recall period compared to longer recall period in inpatient care, outpatient care and health products whilst the opposite is observed in medicines and preventive care. A rank-sum test to assess the difference in the distribution in the levels of annual household OOPs across recall period groups show that, only the OOPs estimates in medicines are significantly influenced by recall period (p=0.007) whilst the rest of the spending categories showed no statistical significance in the observed differences in the mean OOPs between shorter and longer recall periods. In the case of medicines where statistical significance was observed in annualized mean OOPs estimates, annual OOPs was about 59% higher in shorter recall period than in longer recall period. However, for the non-annualized estimates, mean OOPs was seen to be lower in the shorter recall period than in the longer recall period (ratio=0.79, 0.44-1.13 95% CI).

Table 4.4 Comparison of mean OOPs in household samples by spending category

	Questionnaire Version 1 (short recall period)			Questionnaire Version 2 (long recall period)			Non-annualized ratios	Annualized ratios	
Spending category	N	Household (HH) Mean(SD)	Annualized total Estimates Mean(SD)	N	Household (HH) Mean (SD)	Annualized total Estimates Mean(SD)	Estimated ratio (HH-v1/HH-v2 95% CI	Estimated ratio (HH-v1/HH-v2 95% CI	Rank sum test p-value
Inpatient	108	462 (1573)	923 (3145)	100	419 (675)	419 (675)	1.10 (0.29, 1.89)	2.20 (0.53, 3.87)	0.12
Medicines	295	15 (43)	358 (1040)	204	19 (38)	226 (460)	0.79 (0.44, 1.13)	1.59 (0.88, 2.29)	0.01
Outpatient	28	43 (79)	1027 (1894)	11	27 (23)	327 (273)	1.59 (0, 3.22)	3.14 (0, 6.78)	0.95
Preventive care	22	25 (29)	99 (115)	21	93 (241)	187 (482)	0.26 (0, 0.82)	0.53 (0, 1.66)	0.23
Other medical services	0	0 (0)	0 (-)	1	200 (-)	2400 (-)	-	-	-
Health products	5	21 (21)	21 (21)	2	7 (4)	7 (4)	3 (0, 6.77)	3 (0, 6.77)	0.43
Annualized total household OOPs		-	627 (2095)		-	355 (681)		1.79 (1.10, 2.49)	-

Note: the currency used is the Ghana cedi (GHc). US$1 was equivalent to Ghc4.2 at the time of collecting data. **Short recall period**: 2 weeks outpatient/medicines/other health services, 3 months for preventive care and 6 months for inpatient/medical products. **Longer recall period**: 4 weeks outpatient/medicines/other health services, 6 months for preventive care and 12 months for inpatient/medical products

Similarity of mean OOPs in households with matched provider data

Household reported health expenditures are on average higher than provider recorded expenditures and this was observed in both shorter and longer recall period groups and in all spending categories. However, only difference in mean OOPs on inpatient care and medicines were statistically significant and these difference were similar in both recall period groups. The implication of this results is that, expenditure records from health care providers are underestimated on average by about 3 times the amount households would report to incur for inpatient care and about 2 times the amount in medicines regards of the recall period used (Table 4.5).

Table 4.5: Mean OOPs in households with matched provider data

	Questionnaire Version 1				**Questionnaire Version 2**			
	(short recall period)				**(Long recall period)**			
Spending category	N	Provider OOPs Mean (SD)	Household OOPs Mean (SD)	Estimated ratio (HH/provider) of the means (95% CI)	N	Provider OOPs Mean (SD)	Household OOPs Mean (SD)	Estimated ratio (HH/provider) of the means (95% CI)
Inpatient	35	94 (114)	298 (322	3.17 (1.70, 4.65)	64	144 (167.)	427 (539)	2.94 (1.82, 4.10)
Medicines	234	5 (5)	10 (15)	2.1 (1.66, 2.46)	167	7 (7)	15 (31)	2.26 (1.60, 2.91)
Outpatient	11	3 (5)	46 (88)	14 (0, 38.16)	11	9 (9)	23 (20)	2.72 (0.58, 4.87)
Preventive care	9	6 (13)	18 (16)	2.98 (0, 7.78)	15	21 (60)	42 (76)	1.62 (0.56, 2.68)
Other medical services	0	0 (0)	0 (0)	-	0	0(0)	0 (0)	-
Health products	0	0 (0)	0 (0)	-	3	3 (0.5)	6 (4)	-

Note: the currency used is the Ghana cedi (GHc). US$1 was equivalent to GHc4.2 at the time of collecting data. **Short recall period**: 2 weeks outpatient/medicines/other health services, 3 months for preventive care and 6 months for inpatient/medical products. **Longer recall period**: 4 weeks outpatient/medicines/other health services, 6 months for preventive care and 12 months for inpatient/medical products

Comparing variability and agreement between household and provider data

This part of the analysis focuses on matched OOPs estimates from only inpatient care and medicine as only a few households reported expenditures on the other spending categories and therefore the sample size did not allow for the Bland-Altman analytical approach. We estimated the overall mean bias and variability within each recall period separately to estimate the level of agreement between household and provider data. We found relatively larger mean bias in shorter recall period for inpatient care and relatively large mean bias in longer recall period for medicines. This means that, household and provider data agree better in longer recall period for inpatient care whilst the agreement is better for medicines in shorter recall period. However, the estimated difference in the observed biases did not show statistical significance in both spending categories but the estimated variability in the OOPs

estimates were found to be statistically significant between estimates from shorter recall period to those from longer recall period for medicines with about 26% high variability in the longer recall period. The 95% limits of agreement represent the range in which we expect 95% of the observed individual ratios lie. The wide limits for inpatient care may have been influence by the small nature of the sample size in the shorter recall period group. This might explain with the wide limits of agreement but no statistical significance in the estimated difference in variability of the individual ratios (Table 4.6).

Table 4.6. Mean bias and variability in measurement of OOPs by recall period

Spending category	Number of observations	Mean bias	95% limits of agreement	Estimated difference in bias (qu2 vs qu1) & CI & p-value	Estimated difference in SD (qu2 vs qu1 (& CI & p-value
Inpatients					
6 month recall (qu1)	31	2.48	0.35 – 18.2	-	-
12 month recall (qu2)	63	1.77	0.19 – 16.5	0.74 (0.45 - 1.19) 0.22	1.02 (0.77 – 1.37) 0.87
Medicines					
2 weeks recall (qu1)	235	1.37	0.40 – 4.64	-	-
4 weeks recall (qu2)	169	1.42	0.38 – 5.47	1.26 (0.93 – 1.39) 0.09	1.24 (1.03 – 1.49) 0.02

Note: Limits of agreement refer to the range in which 95% of the ratio values are expected to lie. Mean bias is the log difference between household OOPs and provider OOPs

4.5 Discussions

We developed, tested and validated optimal recall periods using household expenditure modules by assessing the agreement with a gold standard within each recall period version. Evidence from our study suggests that the two major sources of household OOPs is inpatient care and medicines. This may be due to the existence of a compulsory national health insurance scheme that has a generous benefit package that covers most health care services (Akazili, Gyapong & McIntyre, 2011; Aryeetey et al., 2016). The average household out-pocket expenditure is found to be overestimated by households respondents relative to provider transactional records regardless of the recall period. This has serious implications in resource poor settings especially in LMIC where there is no complete and consistent structure for tracking health expenditures and therefore have to rely on periodic household surveys or transactional and administrative provider data to track OOPs. This evidence throws some light on how much variations to expect when interpreting the levels of OOPs using household surveys to when using health provider data. Another paper in this series of papers on the iHOPE project has explained some of the challenges in recording transactional data in health

providers that may account for the observed differences between the household and provider OOPs.

Most importantly, annual household reported OOPs from shorter recall period was found to exceed annual OOPs from longer recall period up to about 79%. This difference was largely driven by large expenditures on less frequent utilized health items which include outpatient care, preventive care and medical products. Mean OOPs on Medicines at the household levels where observed to be slightly higher in 4 weeks recall than 2 weeks, but the annualization of these estimates cause the OOPs in the 2 week recall period to exceed the 4 weeks estimates by about 24% and consequently driving the total household mean OOPs in the shorter recall period higher than the longer recall period. This evidence exposes the limitation of annualization of health expenditures and further identifies the spending components that contributes to this limitation. In assessing how well provider and household agree within each recall period group, we found agreements to be better in long recall periods for inpatient care and for medicines in short recall periods with some substantial variability in the individual difference in OOPs for medicines in longer recall period. The implies that, it is relatively better to have a survey that combines a long recall period for inpatient care and short recall period for medicines. However, most existing surveys especially the LSMS uses a combination of 12 months and 4 weeks in the health expenditure questions.

Findings from our study are consistent with the literature on recall periods in health spending. Lu et al, 2009, found similar outcome when they analyzed nationally representative data from 43 countries. Using world health survey data, they found that, 39 of the 43 countries had average OOPs ratios greater than 1 after comparing recall period of 1-month against 11-months for hospitalization cost. They also investigated the effect of recall using data from Nepal LSMS which asked questions on health expenditure using 1-month and 12 months recall period (Lu et al., 2009). Their results from Nepal LSMS were consistent with evidence from our study. Another similar study by Lavado (2013) on estimating health expenditure shares from household surveys quantified the effect of household expenditure survey characteristics on the estimated health expenditure share and found that, one-month increase in recall period resulted in a 6% reduction in the share households devoted to health care. Their results suggested that, recall period was not the only characteristic that influenced household expenditure, the number of health and non-health items also played a significant role in determining the share of household expenditures on health (Lavado, Brooks & Hanlon, 2013). Taking this additional effect into consideration, we controlled for the effect of both health and non-health items but still found higher OOPs estimates in shorter recall

period. Heijink and his colleagues (Heijink et al., 2011) found from 90 surveys in 64 countries using International Household Survey Network (IHSN), that most surveys preferred longer recall (12 months) periods in hospital spending and short recall periods (2 weeks) for outpatient and medicine spending in half of the surveys they evaluated. Several other studies have also confirmed the preference of longer recall period for infrequent events and shorter recall period for frequent events (Bhandari & Wagner, 2006; Heijink et al., 2011; Kjellsson, Clarke & Gerdtham, 2014).

Evidence from our study quantifying the bias and variability in OOPs supports this preference for longer recall period. Our study found relatively larger bias in shorter recall period for inpatient spending than in longer recall period and vice-versa for spending in medicines even though the observed biases where not statistically significant. Our evidence supports the preference for longer recall period for inpatient care and shorter recall period for medicines. Even though some studies, for instance, vital and health statistics report (NCHS, 1977), have argued that reporting accuracy for inpatient care decreased significantly after eight months, however, Nester and colleagues (Neter & Waksberg, 1964) found no evidence such in their study using bounded and unbounded interviews. This phenomenon which is referred to as telescoping was not investigated in this paper due to data limitations.

Our study adopted an experimental approach to assess the independent effect of recall period on OOPs estimates while controlling for the number of health and non-health items using COICOP-2018 levels of health care expenditure disaggregation structure. Our findings generate some level of evidence for guidance on the comparability of health expenditures across different surveys using different recall periods. Our evidence also raises some questions about the annualization method of some spending groups especially for OOPs on medicines. Our study is but one experimental study whose results may not be generalizable. The household survey tool developed by the iHOPE project from where data for the paper was drawn, potentially provides a baseline evidence for more experimental studies geared at generating more evidence to strengthen decision making for the generation of reliable and comparable health expenditure data in household health surveys to enhance the compilation of NHA for System of Health Accounts (SHA).

4.6 Key messages

1. *Inpatient care and medicines are the main sources of out-of-pocket health payments in households.*
2. *Recall period does not significantly affect OOPs estimates by spending category but significantly influence annual estimates.*
3. *Household OOPs estimates are overestimated relative to health provider estimates*
4. *OOPs estimates for inpatient care are relatively more accurate and reliable in longer recall period and relative more accurate and reliable in shorter recall for medicines though no statistical significance was established relative to the other recall groups.*
5. *Household survey combining long recall period for inpatient care and short recall period for medicines is more preferred to obtain relatively more reliable and accurate household OOPs estimates.*

4.7 Limitations

As the study relied on provider data as a 'gold standard' for the validation of household expenditures, the total sample size for the estimation of bias and variability was affected by number of household that could be successfully matched to their corresponding provider data. Most of the providers had challenges recording and extracting health expenditure records of clients since this was not routinely done. This affected the completeness of the provider data and therefore households with zero expenditures could not be validated and consequently affected the final sample size for the analysis.

We acknowledge that using the provider data as 'gold standard' may not yield the best results since some levels bias might have been introduced into the results due to the incompleteness of the provider data. We however expect the bias to be uniform across our analysis groups.

4.8 Conclusion

Optimal recall period for health expenditure questions is very important for gathering information within households surveys. In current methods of collecting information od health expenditures, a variety of recall periods are used in different survey instruments depending on the focus or purpose of the survey. There is data to show how different recall periods are used and in which survey designs. Despite these differences in recall periods in current surveys, national health accountants and development partners still rely on health expenditure estimates to compare the burden on household out-of-pocket expenditures across countries and territories. This has paper provided some level of evidence for comparing OOPs estimates across different recall periods in household surveys. This study did not find any consistent effect of recall period on the bias and variability of OOPs estimates from

household survey by recall period. Even though no statistical significance was observed, the wide limits or agreement observed for the mean bias shows evidence of some level of variability in the individual OOPs estimates. Our results general confirms what most researcher have identified as the most preferred recall period for health care related questions. Our study supports longer recall for infrequent expenditures and a short recall period for frequent expenditures. This evidence is intended to provide directions for current discussions about improving the measurement of household OOPs. However, more validation studies conducted to provide more evidence to buttress the discussions

Chapter 5

Estimating the effect of level of health expenditure questionnaire (Household-level versus Individual-level) on the measurement of out-of-pocket health expenditure: Evidence from an experimental study northern Ghana

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Abstract

Background: Most low and middle-income countries currently rely on data from household surveys for estimating out-of-pocket payments. Two survey design strategies are frequently adopted for use: questions focusing on household expenditure or on the individual depending on the purpose and focus of the survey. However, existing evidence is inconsistent about the true effect that questions aimed at different levels of aggregation have on health expenditure measurement. This study therefore set out to investigate the effect of the differences between the two survey designs on the estimated expenditure. **Methods:** Household-level expenditure and utilization (individual-level) modules were developed drawing on the structure of existing household health household surveys. Households from the Navrongo health and demographic surveillance site were sampled and randomized into four groups: the two questionnaire versions, and also two different sets of recall periods The measured health expenditures were validated by spending category using health provider data as the 'gold standard'. We estimated the mean expenditure, overall bias and variability for each questionnaire version separately using the Bland-Altman method for assessing agreement. We then compared them directly between questionnaire versions. **Results:** Inpatient care and medicines were the main spending categories driving out of pocket payment in the study area**.** Mean OOPs spending agreed well between the "household and individual expenditure modules, regardless of the recall period. In both cases, the reported expenditure was higher than from the provider. There was no evidence of a difference in the agreement with provider data between the household and individual modules. **Conclusions;** Our findings suggest that there is no substantial difference in household out-of-pocket payments estimates between a household-level survey module and an individual-level module when both designs are fielded together. The extra time and cost of the individual modules is not justified in terms of the accuracy of results.

Key words: Survey design, household module, individual module, out-of-pocket, health expenditures, accuracy, Ghana, Navrongo, INDEPTH-Network

5.1 Background

Most low and middle-income countries (LMIC) currently rely on data from household surveys for estimating out-of-pocket payments (OOPs) to track financial risk protection due to the lack of routine transactional and administrative data (SHA 2011). Out-of-pocket payment is defined as payments made by patients to both private and public health care providers at the point of seeking health services (SHA2011). Two survey strategies are frequently adopted for use: the household- and the individual-level (utilization) household surveys depending on the purpose of the survey. The most frequently used household-level surveys for estimating OOPs in most low and middle-income countries include the World Bank's Living Standards Measurement Survey (LSMS), Income and Expenditure Surveys (IES), the Household Budget Survey (HBS), Socio-economic Surveys (SES) (Habicht et al., 2006; van Doorslaer et al., 2006; Wagstaff et al., 2018a; Xu et al., 2003a) and WHO's World Health Survey (WHS). Surveys that also collect relevant data for estimating health expenditures including data at the individual-level include the Study on global AGEing and adult health (SAGE) and the Demographic and Health Survey (DHS).

The overall structure (design), purpose and frequency of these surveys limit their comparability. The variations result from how the health expenditure questions are framed (wording), the characteristics of respondents, the recall period, the number of health expenditure items (specificity) and whether the health questions are captured in an expenditure module or a consumption module. These survey design characteristics are identified as sources of non-sampling errors that potentially influence OOPs estimates and limit comparability across different surveys, countries and even zones zones (Biemer, 2001; Rannan-Eliya & Lorenzoni, 2010b; Heijink et al., 2011)

The distinction between a household- and individual-level design is in the level of details in the questions, the number of items/questions and type of respondent. The detailed nature of individual-level survey makes them more time consuming and expensive relative to household-level surveys. A major problem in survey design is how best to obtain information without compromising the quality of the information or lengthening the survey time (Grosh, 2000). There is a debate in literature about whether shorter consumption questionnaires can save time and money and still offer quality estimates (Grosh & Glewwe, 1998). With regard to health expenditures, there is a general consensus that, higher number of health items/questions yield larger OOPs estimates (Heijink et al., 2011; Lavado, Brooks & Hanlon, 2013b). For the effect of respondents alone on estimates, investigators either found

conflicting or inclusive results with regard to their role, (Heijink et al., 2011; Hess et al., 2002)

Little work has been done to assess and quantify the differences in estimates from the health expenditure modules in terms of the level (individual or household) (Heijink et al., 2011). There have been calls for more robust validation studies to establish the best approaches for improving the estimation of out-of-pocket health payments (Heijink et al., 2011). To the best of our knowledge at the time of setting up this study, no large experimental study on improving the measurement of OOPs has been conducted in recent times. In the knowledge of this, the Indepth-Network Household Out-of-pocket health payment study (iHOPE) in collaboration with WHO set out to experimentally test alternative approaches for improving the estimation and comparability of OOPs in household surveys. This paper is part of a series of papers that seek to provide experimental evidence for the improvement of OOPs estimates. In this paper, we focus on experimentally assessing and validating OOPs from household-level and individual-level module using health provider data as 'gold standard' for comparison.

5.2 Methods

Study setting

The study was implemented in one of the INDEPTH-Network demographic surveillance sites located in the Northern part of Ghana and operated by the Navrongo Health research Centre (NHRC). The geographic area under surveillance is about 1675 square kilometers. The area has a population of about 160, 000 individuals from 33,000 number of households under surveillance. The study area has one government-operated hospital, a health research institution, one private operated clinic, seven government operated health centers, and 27 community-based health compounds operated and maintained by the government. The area is also dotted with some informal health care providers, which include, pharmacies and licensed chemical shops, petty drug traders, drug peddlers, herbalists, faith-based and traditional healers (Oduro et al. 2012).

Study design

This study is a validation study. The reported expenditure is measured using a cross-sectional survey and is then validated using health provider records as a 'gold standard'. We developed one health focused household survey instrument with two separate household questionnaire that include different health expenditure modules for estimating household

OOPs. The first questionnaire is the household questionnaire which has three section: household roster, household consumption /expenditure and household expectation about medical expenditure. The second questionnaire is the individual questionnaire which also has two sections: health and health seeking behavior. (see Figure 5.1)

We refer to the health expenditure module in the household questionnaire as “household expenditure module” and it was purposed to collect health expenditure data at the household level from a single respondent (household head or person assigned by household head) whilst the health expenditure module in the individual questionnaire is referred to as the “individual expenditure module” which is also purposed to collect more detailed health expenditures from individuals who incurred health expenditure in the household expenditure module but this time at the individual level from multiple respondents. We adopted two recall period groups for asking about health expenditures within each expenditure module. The effect of recall period is investigated in Chapter 4. The focus of recall period in this study is to assess if recall period has an influence on the level of agreement between estimates from the two health expenditure modules. Therefore, within each expenditure module, households were randomized into these two recall period called questionnaire versions and face-to-face household interviews conducted in a cross-sectional survey using trained field workers. We identified short recall period as version-1 and long recall period as version-2.

Version-1 uses the following recall period for the health expenditure questions: 2weeks for medicines/outpatient care, 3 months for preventive care and 6 months for inpatient care/medical products, whilst version-2 used 4weeks for medicines/outpatient care, 6 months for preventive care and 12 months for inpatient care/medical products To validate the health expenditures within each module and recall period version, reported expenditures were compared to the expenditures from provider records. To achieve this, reported expenditures were linked to the provider records to create a linked pair of household-provider data to assess the extent of the agreement between the two data sources. The provider data were considered the most accurate data and was therefore used as the benchmark for establishing which expenditure module produced more accurate estimates In this study, two outcomes are of interest, the level of agreement in OOPs estimates between the two modules and the level of agreement between OOPs reported within each module and provider records.

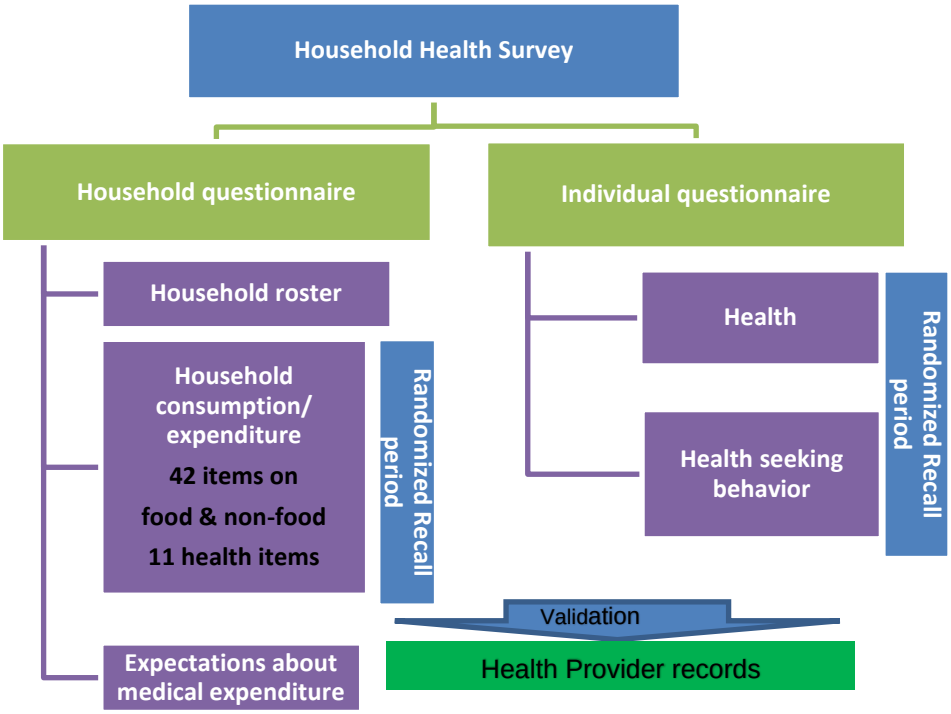

Figure 5.1 Survey Instrument design

Type of respondents

Respondents here refer to individuals who directly answered questions about health expenditures during the face-to-face interview. In the "household expenditure module", a single individual with knowledge about household health expenditures' answered on behalf of the entire household. In this individual questionnaire, the respondents could be multiple individuals. These in household head or any other capable person answering for a household member or the household member answering for himself.

Study population and sampling

We sampled households from the Navrongo Health Research Centre demographic surveillance system (NHDSS) database. Since the same households are from the household module are followed up and asked the individual level questionnaire, the sample size is only computed for the household questionnaire. The sample size is computed separately for the two questionnaire versions using the probability of incurring OOPs within each recall period. We calculated the sample size using the probability of households incurring OOPs within area. To be able to determine the required sample size to estimate the agreement between two quantitative measurements precisely, Bland-Altman suggested a rule of thumb of between 100-200 paired observations (Bland, 2004). We accepted a minimum of 50 observations for

each health-spending category per questionnaire version for our analysis on the basis of feasibility. The probability of inpatient care in a 12-month recall period is 10% for an individual in the study area (unpublished Navrongo DHMT, 2015 data). The expected number of households with OOPs per 100 households sampled will be 10. To get a minimum of 50 households per each spending category in each version who would have incurred OOPs, a minimum of 500 households will be required for the 12-month recall period (version-1) whilst a minimum of 650 will be required in the 6-month recall period (version-2). Adding 10% of the sample to each version to account for non-response gives a total sample of 550 and 715 households for version-1 and version-2 respectively for the cross-sectional survey.

Health provider sampling

All public and private health care providers operating within the study area that had existing transactional records or were capable of recording such information were included in the study. The providers include one hospital, one clinic, 7 health centers, 27 community health and family planning compounds (CHPS), 10 pharmacy shops and about 50 small licensed chemical shops.

Health provider data collection instrument

We developed a simple template to gather basic patient transactional information from sampled health providers. The template collected transactional data such as: name of patient, address, phone number, reason for consultation and cost of treatment/service. For public providers where patient information among other records are routinely collected, we extract the required information form the provider record books or database using the template as guide. For private providers where data is not mostly routinely collected, the template was the main recording system implemented in such providers to record the required patient information.

Matching household reported expenditures with provider records

We matched the reported expenditures to the provider data. For every reported health expenditure by a household member in the household survey, details of the transactions (name of household member, sex, date, insurance number if available and name of provider) were obtained from the household to enable tracking of such expenditures to the health provider. Matching was done at the individual level for every household member who incurred health expenditure. In the case where transactions were incurred in multiple health provider for any

household member, we aggregated the cost from all the individual providers to obtain total expenditure for that individual.

Constructing OOPs aggregates

In the "household expenditure module", total amount spent by household for medicines was aggregated from two expenditure items; for inpatient care, the amounts was aggregated from two expenditure items (Appendix III). The amounts where asked as the total expenditures incurred by all members of the household. The "individual expenditure module' had the structure of a utilization module and therefore aggregates where constructed from individual reported expenditures. For every individual with an episode of health expenditure, details of such expenditures were obtained from the individual. Questions in this module where framed within each main COICOP 2018 spending class (inpatient care, outpatient care, preventive care, other health services, medicines and health products). Total OOPs for household was obtain by aggregating the individual cost from the various spending categories for all individuals

Analytical strategy

We adopted two analytical approaches: unmatched and matched analysis. In the unmatched analysis, we employed descriptive statistics to estimated arithmetic means, standard deviations, frequencies and proportions for household/respondent characteristics and household out-of-pocket health expenditure by type of recall and expenditure module. We also compared the estimated mean OOPs between version-1(short recall period) and version-2 (long recall period) estimates to obtain mean ratios and 95% confidence interval. We employed Bland-Altman's method (Giavarina, 2015; Bland & Altman, 1999) of comparison of the agreement between two quantitative measurements to assess the extent of the agreement between OOPs reported in a "household module" against those reported in an "individual module" and by questionnaire version (recall period). We achieved this by estimating the overall mean bias between the OOPs reported in the "household module" against those reported in the "individual module". We also estimated and compared the variability in the estimated mean bias. The mean bias was estimated in terms of the ratio or the log-difference of the OOPs between the survey modules. We performed the log-transformation of the difference to obtain the ratios as recommended by Bland-Altman for cases where the distribution of data is skewed (Giavarina, 2015; Bland & Altman, 1999). Linear regression model was used to assess the difference in the estimated mean bias between

the two survey questionnaire versions in the unmatched analysis and between household reported and OOPs and provider records in the matched analysis.

In the matched analysis, we estimated the mean bias and variability between household OOPs and provider OOPs. This was done to identify the most accurate and reliable expenditure module using provider records as the 'gold standard'.

5.3 Results

The results are presented here are from the unmatched and matched analysis. In the unmatched analysis, we compared average OOPs by type of expenditure and spending category within each recall period. In the matched analysis, we also compared the bias and variability the distribution of OOPs between the two expenditure modules by recall period for medicines only. The matched analysis was performed for only OOPs on medicines because inpatient care did not have sufficient household-provider matched records to perform the Bland-Altman method (see table 5.1)

Mean OOPs between the two modules by spending category and recall period

We computed and compared the arithmetric mean OOPs incurred by households within a "household expenditure module" and an "individual expenditure module" by spending category and recall period. The mean inpatient OOPs in the "household expenditure module" was estimated to be slightly higher than that of the individual module for all recall periods and spending categories, but not significantly so (Table 5.1).

Table 5.1 Mean OOPs between the two modules by spending category and recall period

	Questionnaire Version 1 (short recall period)				**Questionnaire Version 2 (long recall period)**			
Spending category	N	Household expenditure module (HH) Mean(SD)	Individual expenditure module (IND) Mean(SD)	Estimated ratio (HH/IND	N	Household expenditure module (HH) Mean(SD)	Individual expenditure module (IND) Mean(SD)	Estimated ratio (HH/IND 95% CI
Inpatient	82	449 (1770)	439 (1769)	1.02(0.96–1.09)	43	409 (850)	382 (852)	1.07 (0.97-1.16)
Medicines	249	15 (46)	11 (24)	1.34 (0.89-1.78)	161	18 (40)	15 (18)	1.25 (0.90-1.60)

Mean bias and 95% LoA between the health expenditure modules by recall period

There was little bias observed in the household compared to the individual module OOPs (Table 5.5) for both recall periods and spending categories. This means that the two expenditure modules produce similar OOPs estimates. The mean ratio also tells which expenditure module has higher estimates. In both spending categories and recall period, a mean bias ratio greater than 1 indicates that household module has higher estimates.

Table 5.2: Mean bias and 95% LOA in measurement of OOPs

	Number of households incurring OOPs	Mean bias (ratio) household/individual	95% limits of agreement (95% LOA)
Spending category/ recall period			
Inpatient care			
6 months recall period	82	1.06	0.43 – 2.60
12 months recall period	43	1.12	0.41 – 3.1
Medicines			
2 weeks recall period	249	1.04	0.53 – 2.04
4 weeks recall period	161	1.0	0.41 – 2.43

Mean bias and 95% LoA between health expenditure modules and provider records

Table 5.3 shows the level of agreement in terms of the estimated bias between OOPs reported by households and their corresponding provider records. We observe that in both recall periods, reported OOPs in both expenditure modules are higher than provider recorded expenditures. Our results also show that, "household expenditure module" has a relatively better degree of agreement with provider records than the "individual expenditure module". We observed that in a 2 week recall period, OOPs estimates on medicines from a "household expenditure module" is 44% higher than corresponding providers OOPs estimates whilst it is about 49% higher in the "individual expenditure module". Similarly, it is 27% and 53% higher in "household expenditure module" and "individual expenditure module" respectively in the 4 weeks recall period.

Table 5.3. Mean bias and 95% LoA between health expenditure modules and provider records

Recall period	Survey design type version provider	Matched households	Mean bias	95% limits of agreement
	Medicines			
2weeks	Household expenditure module **vs** Provider records	196	1.44	0.39 – 5.26
	Individual expenditure module **vs** Provider records	196	1.49	0.37 – 6.06
4weeks	Household expenditure module **vs** Provider records	139	1.27	0.47 – 3.41
	Individual expenditure module **vs** Provider records	139	1.53	0.32 – 7.36

Estimated difference in mean bias and variability in measurement of OOPs between expenditure modules and provider data by recall period

For each recall period, we assessed how the structure of the module and the type of respondent influenced the observed bias and variability in the OOPs estimates. In the 2 weeks recall period, we found no statistical significance in the difference for the observed bias and variability. in the type of health expenditure module and type of respondent even after

including an interaction between type of module and type of respondent. However in the 4 weeks recall period, we found that, the bias in the "individual expenditure module" was significantly higher than the bias in the "household expenditure module" (1.21, 1.04- 1.41 95% CI p=0.0116). The variability was also significantly higher in "individual expenditure module" (1.27, 1.14 – 1.41 95%, p<0.001). However, the difference in bias by type of respondent and the interaction term did not show any statistical significance (Table 5.4)

Table 5.4. Estimated difference in mean bias between health expenditure modules versus provider records by recall period

Recall period	Survey design type versus provider	Estimated difference in mean bias 95% CI & p-value	Estimated difference in SD & 95% CI & p-value
2weeks	Household expenditure module vs Provider records	1	
	Individual expenditure module vs Provider records	1.04 (0.91 - 1.17) 0.59	1.05 (0.97 - 1.15) 0.24
4weeks	Household expenditure module vs Provider records	1	1
	Individual expenditure module vs Provider records	1.21 (1.04 – 1.41) 0.016	1.27 (1.14 - 1.41) <0.001

5.4 Discussions

This study found that the mean OOPs spending in both inpatient care and medicines agreed well for the household and individual expenditure modules. There was a tendency for very slightly greater reported OOPs in the household module. The implication of this finding is that, the extra time and cost involved in collecting health expenditure data at the individual level does not yield further benefits. Of course, different user of health expenditure data will require different levels of such data, however, when the interest is in total household expenditures, household modules tend to offer cost-effective benefits and reliable data than individual/utilization modules.

In terms of agreement with provider data, there was no evidence of any difference in agreement between provider data and household data in expenditure modules within the shorter recall period. However, there was evidence that agreement in the household-level module was significantly better than in the individual-level module in medicines.

Similar findings have been found in past studies that investigated the effect difference in questionnaire design have on research outcomes particularly in health care use. In most of such studies, conclusions were not consistent and in some cases inconclusive. For instance, (Hess et al., 2002) presenting results from Census Bureau's 1999 Questionnaire Design Experimental Research Survey (QDERS) found conflicting and inclusive results on person-level and

household level questions. They found evidence of an increased risk of under-reporting in household-level relative to person-level in some summary measures (3 out of 5 indicators). Despite their conflicting results, their conclusion suggested a preference for household-level question. Other studies (Heijink et al., 2011; Schaeffer & Dykema, 2011) also studied some key distinguishing features (respondent characteristics and mode of reporting in survey designs) that are characteristic of the two designs, and their effects on survey outcomes. They focused on examining the influence of respondent characteristic because of its association with measurement errors especially among studies that estimate health expenditure (Odierna & Schmidt, 2009)

There is generally paucity of literature investigating this area that focuses on health expenditures. Some studies have investigated this in the context of households surveys and have provided some level of evidence to guide policy dialogue. However, the evidence available is not sufficient to inform critical policy directions. In the context of health expenditure, WHO calculations of World Banks non-food assessment survey show that, data for household-level expenditures are mostly either in a health module (21%), expenditure module (51%) or both (29%) and the respondent is seldom known; only 27% of 100 surveys identified respondent to expenditure questions. Data for individual-level expenditures are also gathered from a health care utilization module in household consumption and expenditure surveys. 81% of all household consumption and expenditure surveys have a health module whilst 80% have a health care utilization module and this information is only conditional on some characteristics in 44% of the utilization surveys. This assessment reveals how diverse expenditure data are collected. “Health expenditure and utilization surveys” which are generally individual-level based surveys are funded by donors (e.g. WHO, USAID, The World Bank) to bridge an information gap in some countries where no other survey can be used to inform health policy dialogue. Household surveys are nationally representative surveys that are mostly multi-topic and therefore gather a broad range of data including information on health. In the context of national health accounting, it is important to have health data that are comparable across countries and zones. When the focus is on preparing such national accounts, household surveys are recommended according to our evidence.

Comparison of mean OOPs was possible for all the spending categories but we were only able to validate expenditures medicines because we did not have adequate matched cases for the other categories to assess the agreement with provider data as suggested by Bland-Altman, 1999. Households generally reported OOPs for only two spending categories with medicines receiving the highest reports by households. Due to insufficient numbers in the other spending

categories, we focused our analysis on inpatient care and medicines for unmatched analysis and focus on medicines for the matched analysis.

5.5 Conclusions

Surveys can vary in whether they focus on the household or individual expenditure. We developed and tested two different versions of a questionnaire collection information; household module and individual level module or utilization module as commonly referred to in most surveys.

Our findings suggest that there is no substantial difference in household out-of-pocket payments estimates between a household-level survey module and an individual-level module when both designs are fielded together within the same survey and at the same time . Even though we did not detect substantial difference between the two instrument designs, household-level estimates were slightly higher.

Chapter 6

Experience and challenges in linking household reported health expenditures to provider records: Evidence from an experimental study northern Ghana

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Abstract

Out of pocket health payment (OOPs) has been identified by System of Health Accounts (SHA) as the largest source of health care financing in most low and middle-income countries. This means that, most low and middle-income countries will rely on user fees and co-payments to generate revenue, rationalize the use of services, contain health systems costs or improve health system efficiency and service quality. However, the accurate measurement of OOPs has been challenged by several limitations which are attributed to both sampling and non-sampling errors when OOPs are estimated from household surveys, the primary source of information in LICs and LMICs. The incorrect measurement of OOP health payments can undermine the credibility of current health spending estimates, an otherwise important indicator for tracking UHC, hence there is the need to address these limitations and improve the measurement of OOPs. In an attempt to improve the measurement of OOPs in surveys, the INDEPTH-Network Household out-of-pocket expenditure project (iHOPE) developed new modules on household health utilization and expenditure by repurposing the existing Ghana Living Standards Survey instrument and validating these new tools with a 'gold standard' (provider data) with the aim of proposing alternative approaches capable of producing reliable data for estimating OOPs in the context of National Health Accounts and for the purpose of monitoring financial protection in health. This paper reports on the challenges and opportunities in using and linking household reported out-of-pocket health expenditures to their corresponding provider records for the purpose of validating household reported out-of-pocket health expenditure in the iHOPE project.

Keywords: Health provider, challenges, out-of-pocket, limitations, households, validation, Ghana

6.1 Introduction

Out of pocket health payment has been identified by System of Health Accounts (SHA) as the largest source of health care financing in low- and middle-income countries (Organisation for Economic Co-operation and Development, World Health Organization & Statistical Office of the European Communities, 2011). Household out-of-pocket health payments (OOPs) as defined by system of health accounts 2011 (Organisation for Economic Co-operation and Development, World Health Organization & Statistical Office of the European Communities, 2011) are direct payments for services from household primary income or savings without the involvement of a third-party payer. These payments are usually made by the user at the time of accessing services and includes cost-sharing and informal payments (Organisation for Economic Co-operation and Development, World Health Organization & Statistical Office of the European Communities, 2011). The over dependence of health systems on OOPs to finance health care is severe in most low and middle-income countries and implies that health system in these countries will rely on revenue mobilized from households at the time of seeking care. OOPs can have negative consequences on households' ability to spend on other basic needs in which case they lead to catastrophic health expenditures and, living standards which case they lead to impoverishing health expenditures (Wagstaff et al., 2018). The incidence of catastrophic and impoverishing health expenditures are two strong indicators used to monitor how well a health system is performing in terms of financial protection (WHO & The World Bank). These two indicators are solely determined by the extent to which OOPs absorb household's financial resources (Boerma et al., 2014). One of the Sustainable Development Goals approved by the United Nations in 2015 (SDG3.8) focuses on health targets including moving towards universal health coverage (UHC). Undoubtedly, OOPs and its negative consequence on households is an important but not exhaustive (Anon) indicator for tracking progress towards UHC and financial risk protection in low and middle-income countries so an accurate estimate of OOPs in households is critical to the aim of UHC. OOPs incurred by households account for an average of 40% of current health expenditure (CHE) in low-income countries and 30% of current health expenditure in lower middle-income countries compared 15-20% in high-income countries (WHO, 2017). However, the accurate measurement of OOPs has been challenged by several limitations in the sources of data for their estimation (Lu, 2009).. The principal source of these measurement challenges is the tendency for private health care financing to occur without the generation of linked, reliable and comprehensive routine data for national registries, in particular in low and low-middle income countries (Lorenzoni & Rannan-Eliya, 2010). In the

absence of routine data, these countries rely on national surveys as the main source of data for estimating OOPs (Gliklich, Dreyer & Leavy, 2014). However, these surveys are household based and have been found to have several limitations due to their design and focus thereby affecting ex ante post harmonization efforts. Household surveys such as the Living Standard Measurement Surveys (LSMS) have been used extensively in collecting data for estimating current health expenditures and OOPs for most LMIC (Gliklich, Dreyer & Leavy, 2014; Rannan-Eliya). Some studies (Lu, 2009; Rannan-Eliya & Lorenzoni, 2010) have attributed the sources of heterogeneity in these surveys to both sampling and non-sampling errors. Unlike sampling errors that are well understood and quantifiable, non-sampling errors result from; survey design, recall period used, number of questions asked, the choice of respondent, lack of adequate supervision of primary field staff, tabulations errors among many others (Organisation for Economic Co-operation and Development, World Health Organization & Statistical Office of the European Communities, 2011; Lu, 2009; Rannan-Eliya & Lorenzoni, 2010) and these errors tend to affect the reliability and comparability of health accounts estimates (Rannan-Eliya).

To address these limitations and improve the measurement of OOPs in LMIC, there is a need to improve the questionnaires used in these surveys. Establishing a method to generate valid, reliable and comparable information on national and international resource inputs for health is critical for developing policies, managing program implementation and evaluating efficiency and performance of health systems in developing countries. In the context of improving the measurement of OOPs, the INDEPTH-Network Household out-of-pocket expenditure (iHOPE) project aimed at developing alternative approaches to collect valid and reliable data for the measurement of OOPs in surveys. The iHOPE project developed new modules on household out-of-pocket expenditure from the existing Ghana LSMS (GLSS6) (GLSS6 Report, 2014) and cross-validated the data generated by these tools with provider data (‘gold standard’) to propose alternative modules which are sensitive to collecting accurate and reliable health expenditure data for estimating OOPs in LMIC. This paper is part of a series of papers chronicled to share the results of the iHOPE project. In this first paper, we present the challenges and opportunities in linking household reported data to their respective provider for the purpose of validating household reported out-of-pocket health expenditure data in Ghana using mixed method approach.

6.2 Methods

Study design

The study uses data from iHOPE project's Household Budget Survey conducted in Ghana between June 2017 and December 2017. The study was conducted in Navrongo Health and Demographic Surveillance Site (NHDSS) using a cross-sectional design. The iHOPE project aimed at developing alternative tools for estimating OOPs in LMIC. This involved collecting household out-of-pocket health expenditure from sampled households in the study area and cross-validating these expenditures with corresponding provider. In this paper, we employed a mixed method approach where both quantitative and qualitative data were used for the analyses. We obtained quantitative data from the iHOPE cross-sectional Household Budget Survey (HBS) and Household Health Survey (HHS) and qualitative data from In Depth Interviews (IDIs) conducted with the healthcare providers within the study area.

Study site

The study was conducted in the Kassena-Nankana East and West Districts of Ghana by the Navrongo Health Research Centre (NHRC). The NHRC operates the Navrongo Health and Demographic Surveillance System (NHDSS) in the two districts. The estimated population of the districts under continuous demographic surveillance is 152,000. The districts cover an area of 1,675 square kilometres (Oduro et al., 2012). The districts have one district referral hospital located in the capital town of the Kassena-Nankana East district (Navrongo) that serves as a referral point for all the health facilities in the districts. The study site has different types of health providers operated and managed by the government and private individuals as seen in Table 6.1.

Table 6.1: Characteristics of study area

Average km to nearest health facility [1]	5km
Proportion of households with access to cell phones[1]	72%
Number of Health facilities at the HDSS site	1-Hospital, 1-Health Research Centre, 3-private clinic, 8-health centres, 28-community-based health compounds. 3 Pharmacy shops, 7 high volume chemical shops and Over 50 small chemical/drug sellers, drug peddlers and provision shops
Types of Health insurance available at HDSS site	National
Health insurance coverage at the HDSS site[1]	50%
Proportion of individuals attending Public health facilities for In-patient cases[1]	93%
Proportion of individuals attending Private health facilities for out-patient cases[1]	6%
Disease classification type in hospital setting (district hospital)	ICD-10
Recording system in hospital setting (district hospital)	Paper
Recording system In Pharmacy and chemical shops*	Paper
In community health centre	Paper
In other outpatient care settings	Paper

Source: Computed from unpublished data from the Kassena-Nankana District Health and Management Team (DHMT)
*** Data recorded is daily sales**

Training of data collectors

University graduates with experience in collecting household survey data and conducting qualitative interviews in demographic surveillance sites were recruited and trained for this study. They were trained on the iHOPE project protocol & survey tools, health provider patient flow dynamics and how to engage with key persons responsible for running the activities for the providers. A pre-test was conducted at the end of the training session to assess the appropriateness of the data collectors for the work.

Data source

A total of 2990 households were sampled from the study site using stratified random sampling for the iHOPE Household Budget Survey. Information such as socio-demographic characteristics, general household consumption, and health care utilization & expenditures were collected from all households. Data obtained from the providers include; name of the patient, date the health expenditure was incurred, the reason for visit to the provider and the expenditure incurred by the household for the service/medicine accessed.

For the qualitative part of this study, 10 high volume private providers were identified from the study area for the study. They included 3 pharmacy shops and 7 licensed \chemical shops. In-Depth Interviews (IDIs) were conducted with all the sales representatives of these 10 providers. They answered questions on challenges in recording patient data and also provided suggestions to improve the recording process. For the public providers, 8 health centers, 3 clinics and one hospital were included in the study. Each of these types of public/formal providers had a different structure for collecting routine patient information. Patient information such as name, contact address, reason for visiting the health facility/diagnosis as well as related cost of treatment and/or medicines are routine information kept by these providers for all patients. Data collectors documented all the challenges involved in recording and extracting patient data from these public health care providers for our qualitative analyses. Public providers in this study refer to providers operated by the government of Ghana through the Ghana Health service and private providers are those operated managed by private individuals in the community.

Data processing and analysis

In Depth Interviews analysis

Qualitative interviews (IDIs) were conducted in English, audio- recorded using digital audio recorders and transcribed verbatim into Microsoft Word. Transcripts were reviewed, and key themes were identified for discussion. A coding list was prepared for data analysis. NVIVO 11 software was used for coding the transcripts and data was analyzed following a deductive content analysis to identify key issues (Figure 6.1).

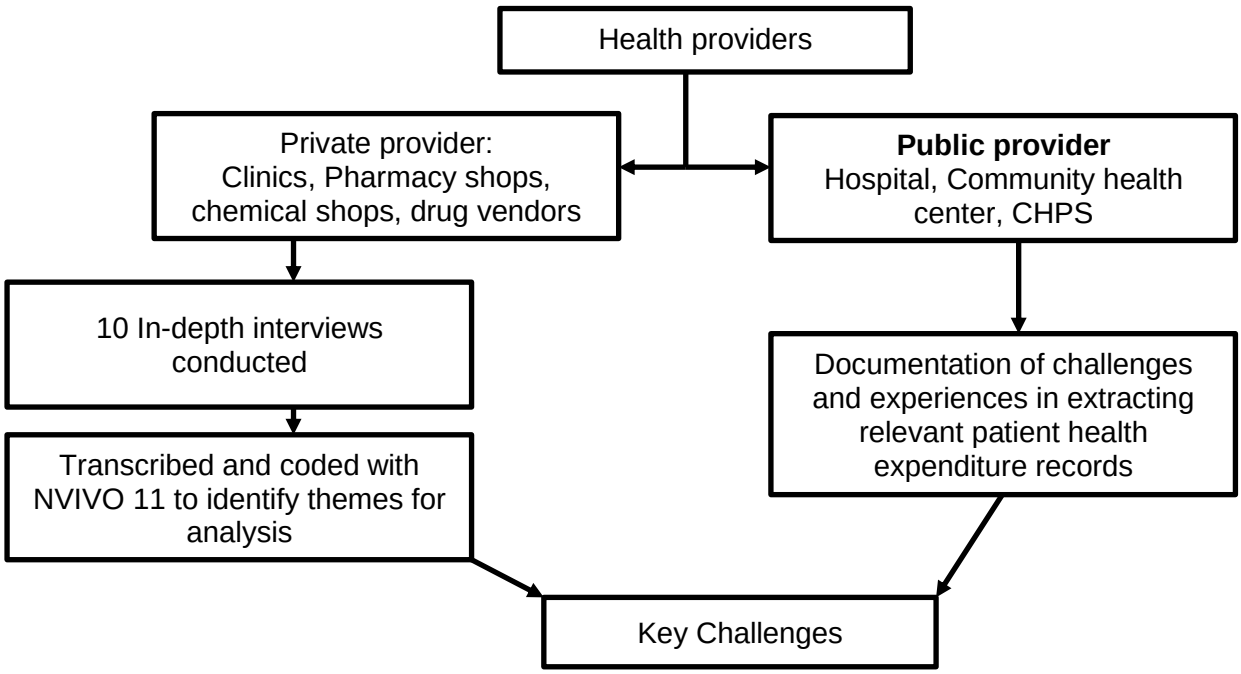

Figure 6.1: Structure of data processing for qualitative analysis

Households survey analysis

CSPro 7 was used to capture data for processing and cleaning and then imported into Stata 14 for analysis. Descriptive statistics was used to describe socio-demographic characteristics of households, the distribution of types of health providers and the distribution of OOPs spending categories by households. Matching rate was defined in this study as the proportion of individuals from our sampled households whose reported patient details were successfully identified in the records of the corresponding provider where health expenditures were incurred.

6.3 Results

Generally, our results highlighted very important issues influencing how well community reported data on health expenditure link with corresponding records at health providers in a rural setting. Our results are grouped in 3 parts; 1. Descriptive statistics, 2. challenges and 3. proposed solutions. First, we present quantitative results of household characteristics, distribution of providers and health care utilization, and their corresponding proportions linked with households. Second, we analyze the challenges from patients and providers influencing the quality of health care utilization and expenditure data. Lastly, we present

suggested solutions by the provider owners on how to improve and enhance recording and quality of health care utilization and expenditure data.

Socio-demographic characteristics of households and matching rates

A total of 1402 individuals from 868 (29%) households accessed care from different kind of health care providers in this study. Table 6.1 summarizes socio-demographic characteristics of the households in our study area. Most households (66.6%) were headed by men and were married (66.4%). Majority of the households (61.3%) were headed my adults between the ages of 35-64 years. More than half of the household heads (53.3%) did not have any formal education and about 52% were Christians. The average household size was 6 (3 SD) with about 49.3% of the households having more than six household members.

Table 6.1: Demographic characteristics of household heads

Household characteristics	**n**	**%**
Sex of HH head		
Male	578	66.6
Household size		
1 person	43	4.9
2-5 persons	397	45.7
6 and above	428	49.3
Marital Status of household head		
Not married	292	33.6
Married	576	66.4
Educational level of HH head		
No education	463	53.3
Primary	166	19.1
Junior High School	137	15.8
Senior High School	45	5.2
Tertiary	57	6.6
Religion HH head		
Christians	452	52.1
Islam	85	9.8
Traditional	281	32.4
No religion	50	5.8
Age group of HH head		
15- 19	39	4.5
20 - 34	63	7.3
35 - 64	532	61.3
65 +	234	27.9

Note: HH-Household

Healthcare utilization and matching rates of provider and household information

Table 6.2 summarizes the distribution of first visit by household members to different type of health providers. About 32% of all participants visited the hospital first to seek care, 28% sought first care in community health centers/ CHPS, 25% sought first care from licensed

Chemical/Pharmacy shops whilst about 8% sought care from unlicensed drug sellers in the community. For each type of provider, the proportion of household that we correctly linked with the provider records varied considerably. For hospital settings, 47% of clients where correctly identified and matched, CHPS recorded 90%, Chemical shops recorded 71%, Diagnostic laboratories recorded 83% and Pharmacy shops 74% (Table 6.2).

Table 6.2: Distribution of type of providers visited by individuals

Type of provider	Total number of clients attending provider	proportion of clients attending provider	proportion of clients with linked records to household
Public health providers			
Hospital	453	32.3	46.8
Community Health Centre	195	13.9	55.4
CHPS	196	14.0	90.3
Private health providers			
Clinic	58	4.1	27.6
Chemical Shop	194	13.8	71.1
Diagnostic laboratory	29	2.1	82.8
Hawker/Vendor/ Mobile Van	25	1.8	0.0
General local shop	81	5.8	33.3
Other	16	1.1	12.5
Pharmacy	155	11.1	73.6
Total	1402		59

As shown in Table 6.3, less than half (47%) of clients visiting a provider for inpatient care could be linked to their respective household records. About 63% of patients seeking out-patient care at the health provider could be linked to their respective household records, and about 62% of those who visited the provider to purchase medicines could be linked to their household records. This proportion was about 69% for clients seeking preventive care and about 38% for medical products. (Table 6.3).

Table 6.3: Proportion of clients at provider correctly linked with household information before and after intervention and by type of service provided.

	Before interventions			After interventions		
Spending category	**Total number of cases**	**Number of cases matched**	**Proportion of cases matched**	**Total number of cases**	**Number of cases matched**	**Proportion of cases matched**
Inpatient care	339	159	47	221	139	63
Out-patient	551	351	63	53	34	64
Medicines	468	286	62	579	482	83
Preventive care	32	22	69	60	44	73
Medical products	7	1	14	7	5	71
Total	1397	820	59	921	705	77

Challenges influencing quality and completeness of data recorded by health care providers

The section presents results from interactions with health providers about the factors that potentially influence the quality and completeness of patient data at health care providers in the context of collecting out-of-pocket health expenditure data. The results from the IDIs are structured in three parts. The first part focuses on challenges that relate to patients, the second part presents challenges relating to providers in both public and private settings and the third part of this section presents some suggested solutions by health care providers on how to improve patient data quality and completeness.

Patient challenges

Willingness of clients to provide information on "stigmatized" conditions

It came out strongly across all respondents that some clients were unwilling to provide their details especially when buying medicines for "stigmatized" or confidential conditions. For example, respondents mentioned that conditions such as diabetes, sexually transmitted diseases (HIV/AIDS, and Gonorrhea), and medicines such as contraceptive pills and aphrodisiacs are stigmatized conditions/medications in the district and for that matter clients are usually not comfortable to answer questions when they are buying such medicines. They reported that clients usually want to buy the medicine and quickly leave the counter**.** Respondents mentioned that such clients either refuses to provide the information, provide wrong contact information or lie that they were sent to buy the medicine.

*"Yeah, there are some types of medicines and cases that people want to keep secret, so when they come here, they don't want to disclose their diseases and they don't want you to even know why they are buying the drug. sometimes they will even tell you they are buying the medicines for someone because they don't want you to know they have such an illness (IDI-*In charge, *Pharmacy shop)*

…for *some clients, their problem is related to the medicines especially the girls, when they come to buy pregnancy test kits and you ask them to write their names, they do not agree for you to record their names because they think that maybe when someone else come to buy, you will show the name that he/she came to buy pregnancy test kits here (IDI-In charge, Chemical shop).*

It came out from the interviews that sometimes people self-prescribe and consume medicines that may not be needed. In these cases, they are usually uncomfortable when they are being

asked questions about what they are using the drugs for. They see the providers to be inquisitive when they are asked about the medicines and contact information. For instance, the youth in the district abuse the use of tramadol tablets (a narcotic pain reliever) with the assertion that tramadol makes them "high" or hyper. Because of this they are usually not willing to respond appropriately to the providers. For example, a respondent said:

"...for others, the medicines that they are buying they don't want you to kwon what they are using it for. The youth these days abuse tramadol a lot and are usually skeptical when you start asking them questions about the medicines. They will simply tell you they are in hurry and leave (IDI-In charge, Chemical shop)

Willingness of clients to provide information when buying medicine on credit

Another issue that came out in the interviews relates to confidentiality when buying medicine on credit. Sometimes, people do not have money when they are sick but would still want to seek treatment. In the light of this, some people purchase medicines and pay back when they have the money at a later time. Respondents mentioned that some of the clients were not comfortable having their details recorded when they are buying the medicines on credit. These clients perceive this would indicate a lack of trust that they will repay the money owed. On the other hand, some clients perceived that it is only when someone is buying medicine on credit that records are taken. In either case, respondents mentioned that some clients are usually reluctant to give out information.

A responded for instance said:

"like those who will come to buy on credit, when they come and you ask them to give you their names they will think that you want to write their names because they are buying on credit and you are taking all this information to be able to trace them when they do not come back to pay. So, they are usually not comfortable to give the information. You need to explain several times. Some will agree but others will still refuse" (IDI-In charge, Chemical shop)

Similarly, another provider said:

"Last time one guy came and I asked him to give me his name and he refused. He said that he is not buying the medicine on credit so why do I need his contact information. That I do not have to record his name in my credit record book. I explained that the information was only for record keeping, but he still said no" (IDI-In charge, Chemical Shop)

Limited information about patient from buyer

It came out of the interviews that sometimes providers cannot obtain the needed information

of the patient because some of the buyers do not know the details (Name of patient, home address, phone number) of the patient who requires the medication. Thus, provider operators reported than, sometimes, patients send other persons to buy the medicines on their behalf as such some of these persons are unable to provide full details of the patient to the providers.

"sometimes it will just be a small child that will come or just a person sent by a patient. When you ask such as person to provide any information he/she will tell you that they were sent by someone and as such do not know the details.

"But if the person has a prescription from the hospital, we are able to record the details from the prescription note. Some will say they were at the hospital premises and they prescribe medicine for someone and the person says he cannot get to the pharmacy because he/she is ill or does not have means of transport that is why I offered to bring the prescription here to assist him/her buy the medicines. So, in these cases, they are unable to provide the needed information about the patient" (IDI-In charge, Pharmacy shop)

Clients perceived the process as waste of time and unnecessary

In times of ill health, patients are usually in hurry to buy medicines to treat their conditions. It was mentioned across the respondents that some clients complained that they were busy or are not well and for that matter have no time to answer questions. Some clients refused outright while some provided incomplete information and moved away.

"…Others too say it is waste of their time (IDI-In charge, Chemical Shop)

"You are wasting his time, for he is in hurry to go and you are asking all sorts of questions … (IDI-In charge, Pharmacy shop)

In addition, given that the patient data recording is not a routine activity and also because patients do not directly benefit from providing their data to providers, they see the process as unnecessary and therefore are not motivated to provide any information to the providers.

… some of the people are difficult, they will ask you whether you are going to give them discount or reimburse them. The say it is unnecessary and waste of time (IDI-In charge, Chemical Shop).

Clients have no trust in the use of their details

Respondents mentioned that despite the explanations they provide to clients on the reasons for collecting the information, some clients were not still sure what the data was going to be used for and therefore refuse to provide the information.

"Some understand, but some do not know why you need to know details about them, I need my medicines, am in a hurry to go (IDI-In charge, Pharmacy shop).

"for some clients, when you ask them of their Names, they reply by asking, why do you want to know my name, I'm buying medicines from you and you are asking for my name. they don't know why you want to record their names… (IDI-In charge, Chemical Shop).

Provider challenges

Quality of information provided by patients

Every client/patient visiting a health facility is required to provide personal information for recording. Information such as; name, home address, phone numbers, address & contact information and insurance status are obtained from patients. But most of these patients sometimes provide inaccurate information, partly due to memory challenges which makes it a challenge to identify them at a later time.

Providers fear of loss of clients

Given that providers do not collect patient information such as names and contact address, providers feared that they will lose customers when they continue to ask these questions. They felt collecting the data was more of intrusion and waste of customer time and are likely to lose these clients if they kept asking for details on their purchases.

"Sometimes the clients do not see it necessary to provide contact information particularly on sensitive illness or contraceptives. So, they will try to avoid your shop" (IDI-In charge, Pharmacy shop)

Provider forget to record data

Respondents mentioned that they sometimes forget to record patient information in the record books particularly the early days of our study. This is because recording was not part of the routine activity as well as workload, so they sometimes forget to collect patient information when they come to the shop to buy medicine.

"sometimes we do forget, the patients will leave before we will realize that we have to take the details of the client (IDI-In charge, Pharmacy shop)

Lack of motivation for provider

Lack of motivation for the sales persons of the chemical shop was cited as a reason for non–recording of patient information. Given that the NHRC has been working with some of these providers and has established that rapport, some respondents were shy to mention that they needed compensation to motivate them to collect patient information. That notwithstanding,

few respondents mentioned that motivation to them in the form of money or anything will somehow motivate them to work hard to collect the needed information. Some respondents also explained that sometimes they needed additional person to help in recording the information and that person needs to be paid for work done.

"Of course, financial motivation will compel us to try hard to collect the information" (IDI-In charge, Chemical Shop)

"It means I have to add more staff and if I am to record this data it means I must pay another person to record the details" (IDI-In charge, Pharmacy shop)

Workload to provider

Most respondents mentioned that they sometimes do not record patient information due to workload, especially busy days such as market days. They stated that sometimes, it is only one person serving at the shop and will not be able to record information of all the customers.

"*Difficulties in recording is because of time. we are few staff here (IDI-In charge, Pharmacy shop)*

"For my side, non-market days are always better but when it comes to market days where we receive a lot of clients, the clients are always too many that it is difficult to sell and record patient information at the same time. This causes delays in the queue and some clients do get annoyed and go away… (IDI-In charge, Chemical Shop)

Also, some of the workload relates to double entry. Respondents reported that they had to record in their daily sales book as well as the recording template developed for the iHOPE study. It was easier for providers to record daily sales because, only the name of medicine sold and the corresponding amount is recorded.

"Because i work alone in the shop, i can't record into my daily sales book and on another patient record book at the same time. (IDI-In charge, Chemical Shop)"

"it is the pressure. I have to complete my sales books and also your book. It is double work. (IDI-In charge, Chemical Shop).

Suggested solutions by providers to mitigate challenges

General education

Given that recording patient details is not the norm, continues education on the importance of collecting patient records will improve compliance. They also suggested that the education can be in the form of posters at the chemical shops for clients to read.

"…people should be aware that when they come to the provider, they will be asked questions before medicines are dispensed … (IDI-In charge, Pharmacy shop)

"…I think it will be better you get a poster and paste on the wall for those who can read, so that when they come, we can show them the poster to read. for those who cannot read we need to continuously educate them verbally… (IDI-In charge, Chemical Shop)

"I think health education should be carried out on air to let people understand that normally when you get into a health facility, and the person is taking your information, you need to have patience and provide the information that is needed. This is going to help the country as whole since in the future, they can be able to look at the information and tells us the problems or top disease encountered and help us address them" (IDI-In charge, Chemical Shop)

Client compensation or immediate benefits for clients

Respondents mentioned that if clients are being compensated for the time, it will motivate them to have time to provide the needed information.

"If we are compensated, it will certainly improve recording and if the clients know that they will get something, money or any product or package that will help with their health issues, they will be willing to provide information to us" (IDI-In charge, Pharmacy shop)

Client follow-up

Respondents mentioned that if providers make follow up calls or visits to clients to ask about their conditions or the safety of the medicine bought it will go a long way to improve willingness to provide details.

"some people complained that we collected their details but they did not receive any call from us to find out how they are doing and yet when they visit again we are still asking same questions… I think after taking the contact information, providers should sometimes make some follow up calls to ask about the effect of the medicine on the health of their clients. That will encourage people to provide contact information" (IDI-In charge, Chemical shop)

Additional staff at the providers

For most private health providers, respondents mentioned that given the workload, employing additional staff will ease the workload, workflow and improve recording.

"…to me, when you bring somebody here to sit and collect the data it will help a lot. That person's sole responsibility will be to collect that information and will have the skills to convince people to provide the needed information" (IDI-In charge, Pharmacy shop) "I have been able to record just a few patient details, but the fact is that, normally when you are alone in the shop and the clients begin to come, your attention will be how to serve quickly so that you can attend to everyone. In such cases, i think we need to be two in the shop so that one will be writing, and the other will be interviewing and dispensing" (IDI-In charge, Chemical shop)

Introduction of computer-based recording system at providers

Few of the respondents mentioned the introduction of a computer-based recording system as a suggestion to improve patient data capturing. They reported that the computer system will help speed data capturing and avoid repeatedly asking for contact information any time the person comes to the shop to buy medicine. For instance, with preloaded medicines, they do not need to waste time to write the names of the medicines. Also, there will be no need for the provider to ask contact information of a buyer after the first contact information has been captured during the first visit given that is will be stored into the computer.

"I learnt that there are computers that you can enter all the names of the drugs that are here, so that when the person comes, you ask the person's name and where the person is from and you just click on the drug. You do not need to waste time to type the drugs (IDI-In charge, Chemical shop)

"If our computers are well design, when we collect the first contact information of a client, we do not need to continue to bore that person about contact information any time he/she comes here to buy drugs again" (IDI-In charge, Pharmacy shop)

Monetary motivation to providers

Very few respondents mentioned that monetary incentive will have motivated them in collecting the additional information, since it is additional work for them.

"Oh, hmm, if we get some money it will motivate us to collect the information. You know collecting that information is not easy. Some people are very difficult, and you need to talk a lot to convince them" (IDI-In charge, Chemical shop)

6.4 Discussion

There has not been any published study on linking community reported health expenditures directly to records of providers in any survey. This study presents evidnec on the extent to which it is possible to directly link community reported health expenditures to health provider records. We present evidence of expenditures that successfully linked with provider records before and after attempting to improve the recording of patient records in some providers. In this paper we also compare results from linking individual to provider records before improving recording systems in some providers to results from linkage after improving the recording systems. We also explore the factors that influence the non-linkage of records and suggest recommendations for increasing linkages based on our experience in the iHOPE project. We discuss our results in 3 parts, linking rates before improving patient recording, challenges expressed by providers that affect linking efforts and finally results on linkages after improving recording system.

Before improving the recording of patient information at selected providers, we generally observed differences in proportion of household information that correctly linked with provider records depending on the type of provider or service accessed. Though proportions that accurately linked were comparable between private providers and public health providers, proportions were much lower for cases in Hospitals settings and community health Centre (CHC) settings than in Community Health and Family Planning Service Compounds (CHPS) within the public health providers space. In a similar trend, the proportion of individuals the accurately linked with provider records decreased as one moves from lower level of care (primary) to higher level (secondary/tertiary) of care. Our study revealed that, the increasing number of services (consultations, laboratory test, dispensary service, purchase of medical products) offered as you move from a lower to higher level of care played a role in the extent to which individuals are accurately linked to their provider records. This is so because, separate unlinked records are kept by each unit in the same facility thereby making it difficult to track an individual who had multiple expenditures in different units of the same facility for the same episode of care. In some cases, additional expenditures incurred in another provider for the same episode of care is lost since the name of the provider is not kept in the records of the patient. The experience was different among private providers. Because most private providers tend to operate without generating linked and reliable patient records. To achieve the aim of the iHOPE project, private providers (Pharmacy and chemical shops) who did not keep records of patient visits were engaged to collect patient details and expenditures during consultation

prior to the commencement of the project. For these providers, the proportion of individuals correctly identified where considerably higher than the public providers where patient data was routinely collected. However, much more desired proportion of linkages were required for the iHOPE project. To this end, efforts were made to improve completeness and accuracy of patient data at these private providers thus providers where engaged to explore ways of improving the completeness and accuracy of the data. No attempt was made to improve the data recording at public providers because these providers already had well established structures approved by the Ministry of Health.

During the engagement of these providers, several challenges were identified to influence the completeness and accuracy of patient data. Confidentially of patient data was a major concern expressed by most clients when providers request for details This was particularly related to stigmatized illnesses or complications from illnesses such as diabetes, STI, and family planning devices such as condoms. Stigmatization has been found (McDaniel et al., 1995; Sirey et al., 2001) to influenced patients' response to the providers. Sirey et al, found stigmatization as a major barrier to adherence to antidepressant drug for treatments of mental illness (Sirey et al., 2001) while McDaniel et al in their study assessing patient willingness to reveal health history information revealed that, a significant number of patients provided inaccurate or incomplete information to questions routinely asked on dental health history form (McDaniel et al., 1995). The findings in our study area falls in a similar context where stigma and shame especially among STI patients stem from prevalent socio-cultural norms since sex has historically been a stigmatized behavior and as a consequence STI. Morris et al, argued that, sexual stigma combined with the perpetuated notion of individual responsibility for not adopting certain behaviors has made STIs the symbols of irresponsible behavior (Morris et al., 2014). Patients who feared to be stigmatized refused or provided wrong details to the providers.

The consumption of non-prescription drugs illegally came up strongly as a factor that influenced completeness and accuracy of patient data. Self-medication is widespread in the study area and some drugs such as tramadol and other prescriptions medicines which require a prescription from a qualified health professional before they can be dispensed have been found to be the reason for the limited or inaccurate patient data in most private providers. Individuals who consume these class of medicines are mostly unwilling to provide any details for recording. Tramadol, a narcotic-like pain relief drug was reported by providers as one of such drugs being consumed illegally by some individuals in the study area. In the first quarter of 2018, Ghana recorded a nationwide high levels of tramadol related crime (Ansah, 2018; GNA,

2018; GFDA, 2018). At the time of writing this paper, the Food and drugs Authority in Ghana had closed down some private drug sellers for dispensing tramadol illegally over the counter to individuals without prescription (GFDA, 2018). As a consequence, most private providers expressed fears of losing their customers who were purchasing these non-prescribed medications. As found in this study, Nga et al, found in Vietnam that, private pharmacy shops owners feared losing customers if they stopped dispensing antibiotics to clients without prescription (Nga et al., 2014). It is no secret that when clients feel uncomfortable with one provider they tend to seek care from alternative providers. In the light of this phenomenon, most providers subtly ignore to record details of clients who were receiving care or medicines on non-prescribed medications. These challenges were particularly experienced among private providers.

Private providers are generally profit driven and are the major suppliers of pharmaceutical products in the study area, it is a highly competitive industry that gives individuals easy access to all sorts services and products with or without prescription from a qualified health professional. Due to this, patient who feel uncomfortable with one provider will choose to see another provider to access the same service or product. Since most of these private providers did not routinely collect patient data, forgetfulness, lack of motivation and workload where issues identified in this study that influenced completeness of patient data among private providers. Public providers, challenges were generally about the accuracy of the information given out by the patients for provider records. The non-existence of a proper home address system in study area limited efforts in patient identification and linking. Though the study was carried out in a demographic surveillance system (DSS) area under the NHRC where household compounds are uniquely identified for the purpose of population surveillance, most people could not remember the identification numbers when asked by health care providers and for some of those who remembered these IDs either misquoted the whole address or missed out some parts of the ID. The alternate option of using phone numbers provided either were out of coverage, incomplete or belong to a distant relative who were mostly unwilling to provide details about the patient without prior consent.

To improve the recording of patient data at the private providers, the iHOPE project implemented some strategies within its scope of work to mitigate some of the challenges expressed by the providers. The project; 1. Performed weekly monitoring visits to these providers to remind them to collect patient data, 2. providers compensated monthly as motivation and 3. additional staff were recruited to assist some provider in their shops to

reduce the workload. These interventions yielded positive results as the proportions of individuals whose records where accurately identified increased by about 21%. However, most of the challenges would require a broad and comprehensive approach to holistically address the issues surrounding provider health records as discussed in this paper.

6.5 Conclusion

Accuracy and completeness of documentation on patient personal details in the context of OOPs was found to be the major challenge in linking individuals to their provider data for the purpose of improving the measurement of OOPs, efforts should not only be focused on improving the survey designs and tools for the accurate measurement of OOPs but also, on the factors the drive the availability, reliability and accuracy of these sources of data. This paper has provided in-depth information about heath expenditure data recording which is an essential component in NHA for tracking progress towards universal health coverage and we hope that this paper will provide or add up to the sparse literature available other future studies.

Chapter 7

General discussions, conclusions and recommendations

7.1 General discussions

This thesis intended to test and validate alternative methods of measuring household out-of-pocket payment with the aim of improving the current methods. The findings of 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.

Out-of-pocket health payments have gained considerable amount of attention over the years due to the burden that they have on households economies. As a financing scheme, out-of-pocket health payments have critical limitations for the purpose of mobilizing and locating money within the health system. The pooling of funds is not possible because individuals pay only when seeking care.

This form of health system financing exposes households seeking health care to the risk of catastrophic health expenditure (CE) or impoverishment. Globally, 808 million people in 2010 incurred catastrophic health spending as a result of out-of-pocket health payments (Wagstaff, 2018). Recent statistics also show that, reliance on out-of-pocket spending is declining globally in most regions, declining from 56% in 2000 to 44% in 2016. The share of out-of-pocket payment relative to total current expenditure has also seen some decline going from 46% to 36% in African region (includes 47 countries) which covers about 25% of the world's population, . Despite these declines, the levels of out-of-pocket health payments still remain high and pose a threat to achieving some of the sustainable development goal targets (Chapter 1 section 1.3). The declines were driven largely by increase in the resources generated by other financing mechanisms, such as health insurance schemes, and not to a decline in absolute levels of out-of-pocket payments. The incidence of catastrophic health expenditure (CE) and impoverishment are two key indicators for assessing the burden of OOPs on households. Using a threshold of 10%, Wagstaff et al estimated the incidence of CE as 11.7% in 2010 globally. They argued that, increasing the share of total health spending raised through taxes and mandatory contributions was a better approach than health insurance or increased GDP per person in reducing the incidence of CE. An earlier study (Aryeetey et al., 2016) in Ghana found 7-18% incurred CE among insured households whilst 29-36% incurred CE in the uninsured households. For both insured and uninsured, 3-5% became impoverished. The available evidence has shifted the focus on how to appropriately positioned health systems to protect

households against financial shocks when accessing health care.. Financial risk protection in health is often discussed in relation to the objectives health systems should have; that is to protect people from the financial risks associated with accessing health care. This concept focuses on the burden of health care costs due to the utilization of heath care services.

The recent inclusion of universal health coverage (UHC) as a sustainable development goal (SDG) target has questioned the focus on financial hardship exclusively. Indeed the SDG target 3.8 particularly opened up the discussion about how to appropriately measure the levels of OOPs in order to track progress towards achieving universal health coverage. Out-of-pocket measure is important given that it constitutes the largest source of health care financing in most low and middle income countries (Chapter 1 section 1.3). In practice, out-of-pocket spending is a difficult indicator to measure especially in the context of national health accounts. Different institutions, including the World Health Organization, OECD and the USAID have proposed innovative tools that can facilitate the preparation of National Health Accounts (NHA) for tracking resources (UN System Task Team 2013). National Health Accounts (NHA) is the most commonly used tool to track health care expenditure across countries through third party payments and out-of-pocket payments. The challenge in preparing NHA is in getting accurate and reliable data to estimate out-of-pocket payments. Current approaches to estimate out-of-pocket payments rely on data from national surveys, like Living Standard Surveys (LSS) and Household Budget Surveys (HBS). Since these surveys are not specifically designed to capture health care expenditures, they suffer a number of limitations when used to prepare country NHAs (Heijink et al 2011: Lavado et al. 2013; Xu ke et al., 2003).

WHO and development partners have recognized that the accuracy and reliability of OOPs estimates is critical in the context of health system financing especially in LMIC where it is the largest source of financing (SHA 2011). Due to its importance, many countries as well as global development partners are requesting WHO to estimate OOPs in WHO National Health Account in order to track investments and the financial burden on key health care priority interventions particularly in the era of the SDGs (SDG 3.8). The preparation of NHA requires valid, reliable and comparable health data. To strengthen the preparation of NHA in countries, some guidelines were developed: WHO guide to producing national health accounts (WHO 2003) and the system of health accounts guidelines: practical guidance for implementing a system of health accounts (SHA 2011). Despite the existence of these guides, the estimations of OOPs continue to pose a challenge in many countries. In wake of these challenges, a number of studies (Heijink et al., 2011; Lavado, Brooks & Hanlon, 2013a; Lu et al., 2009; Xu et al., 2009) have attempted to provide some practical suggestions to improve the estimation of OOPs. Little

progression have been made so far due to the lack of gold standard to compare and recommend a better method. For instance, Lu et al found average OOPs to be larger in higher number of health expenditure items than in a single health item question on health expenditure in 86% of countries from a WHS.

Heijink et al also using data from WHS found aggregated health expenditures to be larger than reported total expenditures. The evidence available suggests that the higher the number of health expenditure items or questions, the higher the average OOPs. However, due to the lack of a gold standard, these estimates are not validated and therefore it is uncertain, which estimates area more accurate and reliable (Heijink et al., 2011)

There has been a general consensus among researchers and health accountants to find alternative innovative ways to improve the measurement of OOPs in surveys to be able to produce more reliable and comparable OOPs estimates.

In line with the growing demand for innovative approaches, the indepth-network in collaboration with the Swiss Tropical and Public Health Institute and the WHO launched the Indepth-network household out-of-pocket expenditure (iHOPE) project (Chapter 1 section 1.6.2) to develop and test alternative methods of gathering information on out-of-pocket expenditures. The project was developed prioritizing the development of new innovative tools by repurposing existing tools and taking into consideration the limitations in the existing methods (Chapter 1 section 1.4.3). Specifically, this research work focused on Randomizing number of health expenditure items/specificity in a health expenditure module to identify the optimal number of health expenditure items to be included in a health expenditure or utilization module in a household survey (Chapter 3). The on randomizing different recall periods in a health expenditure module to identify the appropriate recall period for different health expenditure components in a household survey (Chapter 4). Lastly it focused on testing which structure of a health expenditure module captures more reliable OOPs estimates: household module or health seeking and utilization module (Chapter 5) and documenting the challenges associated with implementing such a large validation study (Chapter 6).

Unlike in previous studies (Heijink et al 2011: Lavado et al. 2013; Xu ke et al., 2003) where researchers used data from nationally representative surveys to compare different approaches of measuring OOPs, this project adopted an experimental approach (validation study). Within the design of this project were three stages. The first stage involved literature review to identify the gaps and limitations in current methods of measuring OOPs (Chapter 1 section 1.4). In the second stage, the findings from the first stage were used to develop new instruments by repurposing existing instruments to be sensitive to the gaps and limitations

identified in stage 1(Chapter 2 section 2.6). In the third and final stage, we developed a validation strategy to test the new instruments (Figure 2. 2). The validation strategy included a cross-sectional survey and provider data collection. This research work relied on the cross-sectional study to generate data from the new tools to for validation with provider data. 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.

Methodological considerations

The intention of the study was to assess how strong estimates from different survey instruments agree with a gold standard (provider data). The correct statistical approach to assess the degree of agreement is seldom obvious. Most validation studies have often focused on assessing the validity, reliability and generalizability of observational techniques using statistical techniques such as means, standard errors of the mean, intraclass correlation coefficients (ICCs), kappa coefficients, and Spearman correlation coefficients. The most frequently proposed methods are correlation and regression methods. However, correlation studies assess the linear relationship between one variable and another, not the difference, and they are not recommended as a method for assessing the comparability between two quantitative methods (Giavarina, 2015). Bland-Altman proposed an alternative (chapter2 section 2.7) analysis when the intention is to assess the agreement between two quantitative methods of measurement. Adopting this analytical approach, two useful measures of agreements were assessed, that is, the overall bias (how well the methods agree on average) and the variability (how well the methods agree for individual households). The calculated differences between the recorded provider-level costs and a given survey instrument type for the individual households gives a measure of the overall bias. Bland-Altman regression was then used to establish relationship of bias and variability to different survey instruments to establish the best method (Chapters 3 - 5).

Contributions and policy implications for improvement in the measurement of OOPs

This study produced evidence from an experimental perspective that potentially provides a starting point for discussions towards improving current methods of estimating OOPs. This study explored the main spending categories from COICOP 2018 main classes: inpatient care, outpatient care, preventive care, other health services (emergency transportation), medicines and health products. The main drivers of out-of-pocket health expenditures in this study were inpatient care and medicines (chapter 3 table 3.3 and chapter 4 table 4.3). Expenditures on the other pending categories were seldom reported by households. Most importantly, this study

identified and quantified the amount of bias introduced into OOPs estimates when different survey instruments are used and how these biases behave within different spending sub-groups. To the best of our knowledge, this study is the first of its kind that has attempted to validate current methods of gathering health expenditure data even at the sub-class level. The success of this project has also demonstrated the feasibility of collecting household health expenditure data using classifications from the revised versions of the classification of individual consumption according to purpose (COICOP 2018). In this study we provide evidence of validated health expenditures using a 'gold standard'. Each chapter from chapter 3 to chapter 6 details the evidence per the research questions.

Specifically, in Chapter 3, we identified and quantified the amount of bias introduced into OOPs estimates with respect to different levels of disaggregation of health expenditure items and specificity. Using COICOP 2018, chapter 3 provides evidence of how health expenditures are reported (proportions and average OOPs) by households at different levels of disaggregation of the health expenditure items within each main COICOP spending class which is usually not the case in current methods.

In current methods, the effect of number of health items on OOPs was often assessed for either total reported or aggregated OOPs. Using this study's approach of assessment, we found that specificity which is a consequence of further disaggregation the main class of health expenditure items, has different effect on OOPs estimates in each spending class (Chapter 3.Table 3.4). Generally, having an expenditure module that is less detailed (or less specific) or having fewer number of health expenditure items generate relatively lower average OOPs compared to a health expenditure modules that is more detailed or is more disaggregated on health expenditure items particularly for medicines and inpatient care. These estimates we found to be more desirable if the intention is to produce relatively more reliable and accurate OOPs estimates (Table 3.5).

In current methods, different number of health items are included depending on the focus or purpose of the survey. However, in the context of national health accounts, the interest is on producing out-of-pocket estimates that are accurate, reliable and comparable. The findings from this chapter are important for informing development partners regarding the number of questions on health expenditure to include in general household surveys. Chapter 4 provides evidence of the effect of a very important measurement error that affects all surveys that are recall based and more importantly when dealing with health care reporting. The reliance on household surveys for out-of-pocket health spending data makes recall period an important topic of interest. Individuals generally remember events differently depending on the type or

severity of the event. Individuals are more likely to remember events that occur in a more recent time that those that occurred in a further time. Individuals also tend to remember events that happened to them or events that were more severe than the ones that did not happen to them or that were less severe. In the context of health expenditures, the issue of the effect of recall period on reported health expenditures still remains a great concern. Several studies (Kjellsson et at., 2014; Stull et al., 2009; Bhandari and Wagner, 2006; Heijink et al., 2011) compared different recall periods across different surveys to assess the differences in estimates. These studies were limited in that, they were unable to identify the most optimal recall period for specific health expenditure classes even though the preference was towards longer recall periods. This study quantified the bias introduced into OOPs if a shorter recall period was used relative to using a longer recall, and further assessed how the bias behaved within each COICOP main spending class. Findings from this study provide some experimental evidence that explains how different recall periods impact the measurement of OOPs in household surveys by comparing such estimates with a 'gold standard'. The findings in this study reflect what is often practiced in most households' surveys, that is, a preference for longer recall period for infrequent health expenditures such as hospitalization (inpatient care in a hospital) and short recall period for frequent health expenditures such as medicines (Table 1.3). Except for medicines and preventive care, shorter recall period produced slightly larger average OOPs in all other spending classes though there was no evidence of real difference in the ratios (Table 4.4). However, annualization of OOPs estimates in the two recall period groups yielded a significantly large annual OOPs estimate in the shorter recall period group (79% high). This difference was largely driven by large expenditures on less frequent utilized health items such outpatient care, preventive care and medical products in a shorter recall period relative to longer recall periods. Annualization of OOPs estimates is performed by multiplying the recall period by a scaler, naturally multiplying a large estimate from a shorter recall group increases such estimated by that scaler. This evidence exposes the limitation of annualization procedure of health expenditures and further identify the spending components that contributes to this behavior. Another important measurement error that arises from current household survey methods is the structure of the expenditure modules in the surveys. There are generally two design structures in most surveys: the household module and the individual of utilization module (Table 1.2). Household modules and health seeking and utilization modules are used in different surveys to achieve different purposes. Despite, the structural differences in these survey designs, national health accountants still rely on them to prepare national health accounts. The costs and time required for implementing each survey type are different. Health

seeking behavior and utilization survey designs are usually individual based and therefore tend to be more expensive and time consuming to implement (Grosh and Glewwe, 2000). As surveys get expensive to implement, identifying the most cost effective design is of paramount interest to survey designers. In chapter 5, we established the difference between the two expenditure designs and further suggested which survey design is best for adoption. This study found higher average OOPs in Household module type survey than in utilization module type even though the observed differences were not statistically significant (Chapter 5 Table 5.4). The household module was also found to produce more accurate OOPs estimates in longer recall period (4 weeks compared to 2 weeks) particularly for the purchase of medicines; the main driver of out-of-pocket expenditures (Chapter 3 table 3.3; chapter 4 table 4.3). There is generally paucity of literature on this subject matter especially in the area of health expenditure surveys. Over the years, some studies have looked at differences in these surveys designs to offer cost effective approaches (Beegle et all, 2012; Jonker and Kosse, 2009). However, the evidence is inconsistent leaving us with the same questions as to which design offers cost effective and accurate health expenditure estimates. The results from chapter 5 provides evidence to recommend household modules for health expenditure data when the interest is in household level aggregated data. Development partners and organizations may fund specific surveys to collect data on specific diseases such as HIV/AIDS, Malaria, Tuberculosis and Child health programs and will demand data at individual level to inform policy. Yet this study seems to indicate that, the context of National Health Accounts (NHA), the best approach is a household level module.

Limitations and challenges

There were several challenges encountered during the design, implementation and analysis that impacted on the overall outcome of this study. The challenges were broad and multi-faceted so we discuss them according to where they emanated from. Chapter 6 of this thesis was dedicated to discussing the various forms of challenges and limitations. Different challenges were faced at different stage of this study. The challenges were rather peculiar because this study was implemented in a poor resource setting.

Designing an appropriate survey tool required a careful understanding of the limitations and gaps in the existing tools. This involved several consultations with stakeholders and technical experts from a variety of disciplines. It was a great challenge managing diverse technical views and gaining a consensus on a final product for the study. Implementing such a large validation study came with a lot of challenges. The project implemented five different survey instruments

in the cross-sectional survey simultaneously using 50 field workers and six field supervisors. Due to the long nature of the consumption module (health and non-health items) in the survey instruments, it took longer time to administer a single questionnaire to a household by a field worker and have it checked by a field supervisor before onward submission to the central data processing centre in the project office. This affected the project duration by extending the data collection period by four months and this affected the financing of the entire project.

In a much more broader perspective, since the project was not a validation study and the identification of a clear analytical approach for the validation strategy was not clear. Due to the number of questionnaire versions (survey instruments) involved in the study, and the probabilities of OOP spending in the study area, adopting a probabilistic sampling approach was not feasible, so a conservative approach proposed by Bland-Altman was adopted, this approach affected the final sample size thereby limiting our validation analysis to only two COICOP 2018 main spending classes (Inpatient care and medicines)

Since the research design was a validation design that used provider data as gold standard for comparison, the total sample size per each spending class for every questionnaire version (survey instrument) was influenced by the number of household that could be successfully matched to their corresponding provider data. There were challenges in accurately identifying household members in provider records. The challenges as discussed in chapter 6 resulted in incomplete and inaccurate provider data for some household members.

7.2 Conclusions

This thesis was conducted within the framework if the iHOPE project with the aim of developing testing and validating newly developed household health expenditure instruments that are better positioned to better capture household out-of-pocket expenditures. This research has provided concrete and actionable 'experimental' evidence that will lead the discussions on how to improvement of OOPs. In this study we identified three important sources of biases that have been found to limit comparability of OOPs estimates across different surveys and we further quantified the errors and biases introduced into the estimates when different surveys instruments are used.

Particularly, we demonstrated that, it is more preferable to have a general household survey instrument that has less specificity of health expenditure items if the focus is on reliability and accuracy of the estimates. Previous studies have always been inconclusive on the optimal number of health expenditure items or questions, however, the variations in number of items or questions in current methods limit the comparability and reliability of estimates in the

current methods. Adopting and integrating new expenditure modules that have been designed to account for the variables number of items in current methods will offer a platform to reduce if not eliminate the bias that it introduces into OOPs in current approaches.

Again, this study has provided evidence to deal with the inconsistencies in literature about the optimal recall period to use in health expenditures. Some studies have offered practical suggestions on the optimal recall period in other areas and particularly in self-reporting for health care use. The preference has mostly been towards longer recall for infrequent events and shorter recall period for frequent events. The contention has always been which recall provides accurate and reliable estimates. Haven (ref) investigated varying recall periods for health expenditure reporting, we provided 'experimental' evidence to support what most studies recommend. We also provided evidence to show that, recall period in the context of health expenditure estimation affects reporting of expenditures, magnitude of the expenditure and the accuracy of the expenditures differently by spending components. As expected longer recall periods are more desirable for infrequent health expenditures such as inpatient care and more households reported to have incurred health expenditures than in short recall period. We also found that frequent health expenditures such as medicines are better captured in shorter recall periods. This evidence is suggestive that, an expenditure module that combines long recall for infrequent expenditures and short recall for frequent expenditures will yield much more accurate health expenditure estimates. Adopting this new strategy and integrating it into current approaches will help improve that measurement of OOPs in current methods. In additions, we established that, household based survey designs are better positioned to capture OOPs than utilizations modules.

An important contribution of this study is the demonstration of feasibility of conducting a validation of health expenditures in a large study. Despite the challenges in setting up and implementing this ambitious study, the iHOPE project successfully developed tested and validated new health expenditures modules that have provided important evidence that will guide policy discussions. The important lessons learnt will serve as a guide for future similar studies. We provide insight into the challenges that could potential derail the success of a validation study that will attempts to use provider records as a benchmark for comparison

7.3 Key Messages

1. Inpatient care and medicines are the main drivers of out-of-pocket health payments in households.
2. Recall period does not significantly affect OOPs estimates by spending category but significantly influence annual estimates.
3. Household OOPs estimates are overestimated relative to health provider estimates
4. OOPs estimates for inpatient care are relatively more accurate and reliable in longer recall period and relative more accurate and reliable in shorter recall for medicines though no statistical significance was established relative to the other recall groups.
5. Household survey combining long recall period for inpatient care and short recall period for medicines is more preferred to obtain relatively more reliable and accurate household OOPs estimates.
6. Increasing specificity under estimates means OOPs in Outpatient care, medicines and preventive care
7. Increasing specificity of health items significantly decreases level of agreement between household data and provider records for only inpatient care and medicines
8. Having less detailed health expenditure items produces relatively more accurate and reliable OOPs estimates in household surveys.
9. Household modules produce higher and more reliable OOPs estimates than individual modules
10. In the context of National Health Account, it is more desirable to collect OOPs data in household module than in utilization module

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Appendices

Appendix I: Health Provider data collection tool

PROVIDER NAME:			PROVIDER CODE:			PROVIDER TYPE:				
sn	Name of Client	Address/ Location	Insured (Y/N)	Prescribed (Y/N)	Diagnosis	Drug name	Qua'ty	Unit cost (GHC)	Total Cost	Date

**GHC -Money currency for Ghana (Ghana cedi)

Appendix II: Sample questionnaire for household health expenditure module questions

I T E M	Health Item List here	
1. **Did you or any member of your household make any payment for this /these health item over the Recall period ? Excludes transport costs unless for emergency reasons.**	Yes…….1 (>> 2) No……..2 (>> 7)	
2. **How much was spent on … in the last Recall period altogether? (amount >>3)**		
3. **Which of the following sources did you use to pay for … over the last Recall period ?**	**3a. Source** **3b. Amount**	
Yes…….1 (>>>3b); No……..2 (>>>4); DK/NA ….8 (>>>4) 3b. Amount financed with each source (GH¢). DK/NA…88888	1.household's income 2. remittance/ (money) gift 3. savings 4. selling of goods/barter of goods 5. loans 6. Insurance/ government program 9. other source (specify)	
4. **Beneficiaries of the expenditure on … over the last Recall period ?** (ID if hhd member and name)	ID	NAME
5. **For each beneficiary you just mentioned, can you give me the name of provider of the … over the last Recall period ?** (ID in 4 -provider name- provider number, e.g. 01-Navrongo memorial hospital-01) **Was household member admitted for this health expenditure?**	Yes……1 No……..2	
6a. **For each provider and each beneficiary you just mentioned, can you tell me when admitted** (code) **and when discharged** (code) **over the last Recall period ? Your best estimate is fine.** (HHD member ID-provider number-admission/discharge code. e.g. 01-01-1)	When admitted	When discharged
Admission code: 1- during the last 15 days; 2- 16 days to 30 days ago; 3- a month to 2 months ago; 4 – 3 months to 4 months ago; 5 – 5 months to 6 months ago *Discharge code:* 1-not yet; 2- during the last 15 days; 3- 16 days to a 30 days ago;4- a month to 2 months ago ; 5 – 3 months to 4 months ago; 6 – 5 months to 6 months ago **Name/type of medicine/service purchased/received at provider.** **Name of the person who bought the medicine at the providers.**	Provider 1	Provider 2 provider 3
7. **Has any member of the household received … without incurring any expenditure over the last Recall period ?**	Yes…….1 No……..2 >>> next item	

Appendix III: COICOP 2018 Level of disaggregation of health items list and respective recall period

Table D2- 2nd level of disaggregation of health items

Type of information	Level of *D*isaggregation - *D*2 – 11 items	Recall periods: D- days/ M-Months				
		15d	30d	3M	6M	12M
	COICOP code 06.2.3 Inpatient care services					
To be asked in bold Examples are given in brackets for more see explanatory notes. **If helpful can add at the end of the explanations:** **for patients with disabilities, the elderly (or those who requires permanent surveillance or constant help due to limited functional capacity)**	**I.LONG. Medical treatment and / or care that required overnight stay in a nursing home; (medical convalescent homes; palliative care establishments) or any other long term care medical facility**				X	X
	I.CURR. Medical and dental treatment that required an overnight stay in any type of facility (e.g. hospitals, clinics) **excluding long term care medical facility**				X	X
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to I.LONG & I.CURR	Includes payments for all medical services, diagnostic and laboratory tests, medicines and medical products needed during the overnight stay. Also include emergency transportation services and emergency rescue. Excludes: non-emergency transportation and non-medical costs for patient's relative.					
	COICOP code 06.2.1 Preventive care services					
	P.IMMV. Immunization/vaccination services including for maternal and child care			X	X	
Inclusion/Exclusion criteria to be specified when asking about the amount	Includes ; travel and tourism vaccination as well as any other immunization/vaccination service.					
	P.OTHR. Other preventive services such as prenatal/postnatal care, child growth and development visits, family planning, screening, tests, consultations to detect communicable or non-communicable diseases before symptoms appear (e.g. diabetes, heart problems)			X	X	
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to both P.IMMV & P.OTHR	Includes diagnostic and laboratory tests needed to provide preventive services but exclude payments for the vaccine itself when separately invoiced from the service.					
	COICOP code 06.4.2 Emergency transportation and emergency rescue					
Alternative wording: transportation for medical emergency reasons (e.g. by ambulance)	**O.EMER. Patient emergency transportation services and emergency rescue services (excluding those associated with an overnight stay)**	X	X			
Inclusion/Exclusion criteria to be specified when asking about the amount	Excludes non-emergency transportation services					
	COICOP code 06.2.2 & 06.2.3 Outpatient dental & other outpatient services					
	O.DENT. Dental consultations and services that did not require an overnight stay;	X	X			
Inclusion/Exclusion criteria to be specified when asking about the amount	Includes dental diagnostics services and laboratory tests needed to provide outpatient dental services (e.g. X-rays, blood tests) For any dental illness, disease, injury or health problem; from any type of provider; inside or outside a hospital setting					
	O.CRRL. other medical consultations and services than dental and preventive that did not require an overnight stay	X	X			
Inclusion/Exclusion criteria to be specified when asking about the amount	Includes any diagnostic and laboratory test needed to provide outpatient medical services (e.g. X-rays, blood/urine tests), but excludes emergency transportation services and emergency rescue					
	COICOP code 06.1.1					

	M.HERH. Herbal medicines (tablets or syrups) and homeopathic products for consumption outside a health facility or institution.	**X**	**X**			
	M.MVCP. Medicines (branded, generic)**, vaccines, oral contraceptives, vitamins and minerals and other pharmaceutical preparations for consumption outside a health facility or institution.**	**X**	**X**			
	COICOP code 06.1. 2 medical diagnostic products, prevention and protective devices					
Inclusion/Exclusion criteria to be specified when asking about the amount	**D.** (Pregnancy tests, incontinence products and absorbent including diapers for the aging population, inhalers, mechanical contraceptives; insecticide treated mosquito nets, blood pressure devices) **and other medical health products for personal use outside a health facility or institution**.	**X**	**X**			
Only applies to some diagnostic products	Includes repair, rental and maintenance					
	COICOP code 06.1.3 Assistive products for vision, hearing, mobility and daily living.					
	A. Purchase, repair, rental/maintenance of (glasses for vision; hearing aids; crutches & wheelchairs; therapeutic footwear; walkers; pressure relief mattresses) **and all other assistive health products** .				**X**	**X**

Table D4- 4th level of disaggregation of health items

Type of information	Level of *D*isaggregation - *D*4– 44 items	Recall periods: D- days/ M-Months				
		15d	30d	3M	6M	12M
	COICOP code 06.2.3 Inpatient care services					
To be asked in bold Examples are given in brackets for more see explanatory notes **If helpful can add at the end of the explanations:** **for patients with disabilities, the elderly (or those who requires permanent surveillance or constant help due to limited functional capacity)**	**I.LONG. Medical treatment and / or care that required overnight stay in a nursing home; (medical convalescent homes; palliative care establishments) or any other long term care medical facility** **If yes**					
	I.LONG.SP.1 medical services during the overnight long term care				X	X
	I.LONG.SP.2 medicines during the overnight long term care				X	X
	I.LONG.SP.3 medical products during the overnight long term care				X	X
	I.LONG.DT. diagnostic and laboratory tests				X	X
	I.LONG.NM. Non-medical cost for the patient (cooking, cleaning, accommodation) during the overnight long term care				X	X
	I.LONG.ER.1 Emergency transportation and rescue services by ambulance or other vehicles specially adjusted for medical purposes				X	X
	I.LONG.ER.2 Emergency transportation services and rescue by ordinary vehicles or airplanes (not specially adjusted for a medical purpose)				X	X
	I.CURR Medical and dental treatment that required an overnight stay in any type of facility (e.g. hospitals, clinics) **excluding long term care medical facility** **If yes**					
	I.CURR.SP.1. medical, dental services during overnight stay				X	X
	I.CURR.SP.2. medicines for medical or dental treatment during overnight stay				X	X
	I.CURR.SP.3. medical products for medical or dental treatment during overnight stay				X	X
	I.CURR.DT. diagnostic and laboratory tests for medical or dental treatment during overnight stay (e.g. x-rays, scans, blood tests)				X	X
	I.CURR.NM. Non-medical costs for the patient (cooking, cleaning, accommodation)				X	X
	I.CURR.ER.1. emergency transportation and rescue services by ambulance or other vehicles specially adjusted for medical purposes				X	X
	I.CURR.ER.2. Emergency transportation services and rescue by ordinary vehicles or airplanes (not specially adjusted for a medical purpose)				X	X
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to both I.LONG.SP.1 & I.CURR.SP.1	*If possible* exclude diagnostic and laboratory tests during the overnight stay I.LONG.DT/ I.CURR.DT. and emergency transportation services and emergency rescue (I.LONG.ER / I.CURR.ER)					
Applies to all I.LONG. & I.CURR	Excludes: non-emergency transportation and non-medical costs for patient's relative.					
	COICOP code 06.2.1 Preventive care services					
	P.IMMV.MC. Immunization/vaccination services for maternal and child care			X	X	
	P.IMMV.OV. Travel and tourism vaccination, any other compulsory or voluntary immunization/vaccination service.			X	X	

Inclusion/Exclusion criteria to be specified when asking about the amount Applies to P.IMMV.OV	Includes; travel and tourism vaccination as well as any other immunization/vaccination service.					
Applies to both P.IMMV.MC and P.IMMV.OV	Excludes payments for the vaccine itself when separately invoiced from the service.					
	P.OTHR. Other preventive services than immunization/vaccination					
	P.OTHR.GH.1 Family planning, counselling, prenatal/postnatal care services for both the mother and new born (during the six weeks or 42 days)			X	X	
	P.OTHR.GH.2 Child growth and development consultation visits and any other consultations to monitor "good" health of children and adults			X	X	
	P.OTHR.DI. screening, tests, consultations to detect communicable or non-communicable diseases before symptoms appear (e.g. diabetes, heart problems)			X	X	
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to all P.IMMV & P.OTHR	Includes diagnostic and laboratory tests needed to provide preventive services					
	COICOP code 06.4.2 Emergency transportation and emergency rescue					
Alternative wording: transportation for medical emergency reasons (e.g. by ambulance)	**O.EMER. Patient emergency transportation services and emergency rescue services (excluding those associated with an overnight stay)**					
	O.EMER.AV. by ambulance or other vehicles specially adjusted for medical purpose	X	X			
	O.EMER.NA. by ordinary vehicles or airplanes (not specially adjusted for a medical purpose)	X	X			
Inclusion/Exclusion criteria to be specified when asking about the amount	Excludes non-emergency transportation services					
	COICOP code 06.2.2 & 06.2.3 Outpatient dental & other outpatient services					
	O.DENT Outpatient dental care					
	In a hospital setting					
	O.DENT.CS.1 Dental consultations and services that did not require an overnight stay in a hospital setting	X	X			
	O.DENT.DT.1. Diagnostic and laboratory tests needed to provide dental consultations and services in a hospital setting	X	X			
	Outpatient settings (e.g. private practice, office, medical center, clinics, polyclinics)					
	O.DENT.CS.2. Dental consultations and services that did not require an overnight stay Outpatient settings (e.g. private practice, office, medical center, clinics, polyclinics)	X	X			
	O.DENT.DT.2. Diagnostic and laboratory tests needed to provide dental consultations and services Outpatient settings (e.g. private practice, office, medical center, clinics, polyclinics)	X	X			
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to O.DENT.CS..1 & O.DENT.CS.2	Excludes dental diagnostics services and laboratory tests needed to provide outpatient dental services (e.g. X-rays, blood tests)					
	O.CRRL. Other medical consultations and services than dental and preventive that did not require an overnight stay In a hospital setting					
	O.CRRL.CS.1.1 consultations and services of specialists (paediatricians, surgeons, cardiologists, ophthalmologist, mental health)	X	X			
	O.CRRL.CS.1.2 consultation and services of general doctors	X	X			
	O.CRRL.CS.1.3 consultation and services of nurses, midwifes and other health care practitioner	X	X			
	O.CRRL.DT.1 diagnostic and laboratory tests needed to provide other medical services that did not require an overnight stay in a hospital setting	X	X			

	Outpatient settings (e.g. private practice, office, medical center, clinics, polyclinics)					
	O.CRRL.CS.2.1 consultations and services of specialists (paediatricians, surgeons, cardiologists, ophthalmologist, mental health)	**X**	**X**			
	O.CRRL.CS.2.2 consultation and services of general doctors	**X**	**X**			
	O.CRRL.CS.2.3 consultation and services of nurses, midwifes and other health care practitioner	**X**	**X**			
	O.CRRL.DT.2 diagnostic and laboratory tests needed to provide other medical services that did not require an overnight stay outside a hospital setting	**X**	**X**			
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to all O.CRRL.CS.1 & O.CRRL.CS.2	excludes diagnostic and laboratory test needed to provide outpatient medical services (e.g. X-rays, blood/urine tests)					
	COICOP code 06.1.1					
	M.HERH. Herbal medicines (tablets or syrups) and homeopathic products for consumption outside a health facility or institution.	**X**	**X**			
	M.MVCP. Medicines (branded, generic)**, vaccines, oral contraceptives, vitamins and minerals for consumption outside a health facility or institution.**					
	M.MVCP.IA. antibiotics	**X**	**X**			
	M.MVCP.IO.Other medicines (branded, generic, homeopathic) to treat (presumed or diagnosed) bacterial infections (e.g. malaria, diarrhoeas, dysentery, increased frequency of stools with or without blood and mucus in stools; worms infestations)	**X**	**X**			
	M.MVCP.CD. medicines to treat (presumed or diagnosed) non-communicable diseases or chronic diseases (e.g. diabetes, hypertension)	**X**	**X**			
	M.MVCP.FP. oral contraceptives and contraceptives in the form of injections	**X**	**X**			
	M.MVCP.SY medicines to treat fevers, pain and other symptoms (e.g. nausea; vomiting, constipation; inflammation)	**X**	**X**			
	M.MVCP.VM. vitamins, mineral	**X**	**X**			
	M.MVCP.OM. other medicines and pharmaceutical preparations not elsewhere specified	**X**	**X**			
	COICOP code 06.1. 2 medical diagnostic products, prevention and protective devices					
	D. (Pregnancy tests, incontinence products and absorbent including diapers for the aging population, inhalers, mechanical contraceptives; insecticide treated mosquito nets, blood pressure devices) **and other medical health products for personal use outside a health facility or institution**.	**X**	**X**			
Inclusion/Exclusion criteria to be specified when asking about the amount Only applies to some diagnostic products	Includes repair, rental and maintenance					
	COICOP code 06.1.3 Assistive products for vision, hearing, mobility and daily living.					
	A.PURC. Purchase of (glasses for vision; hearing aids; crutches & wheelchairs; therapeutic footwear; walkers; pressure relief mattresses) **and all other assistive health products** .				**X**	**X**
	A.RRMN. Repair, rental/maintenance of (glasses for vision; hearing aids; crutches & wheelchairs; therapeutic footwear; walkers; pressure relief mattresses) **and all other assistive health products** .				**X**	**X**

Table D5- 5th level of disaggregation of health items

Type of information	Level of *D*isaggregation - *D*5–56 items	Recall periods: D- days/ M-Months				
		15d	30d	3M	6M	12M
	COICOP code 06.2.3 Inpatient care services					
To be asked in bold Examples are given in brackets for more see explanatory notes If helpful can add at the end of the explanations: for patients with disabilities, the elderly (or those who requires permanent surveillance or constant help due to limited functional capacity)	**I.LONG. Medical treatment and / or care that required overnight stay in a nursing home; (medical convalescent homes; palliative care establishments) or any other long term care medical facility** **If yes**					
	I.LONG.SP.1 medical services during the overnight long term care				X	X
	I.LONG.SP.2 medicines during the overnight long term care				X	X
	I.LONG.SP.3 medical products during the overnight long term care				X	X
	I.LONG.DT. diagnostic and laboratory tests				X	X
	I.LONG.NM. Non-medical cost for the patient (cooking, cleaning, accommodation) during the overnight long term care				X	X
	I.LONG.ER.1 Emergency transportation and rescue services by ambulance or other vehicles specially adjusted for medical purposes				X	X
	I.LONG.ER.2 Emergency transportation services and rescue by ordinary vehicles or airplanes (not specially adjusted for a medical purpose)				X	X
	Medical and dental treatment that required an overnight stay in any type of facility (e.g. hospitals, clinics) **excluding long term care medical facility** **If yes**					
	I.CURR.SP.1. medical, dental services during overnight stay				X	X
	I.CURR.SP.2 medicines for medical or dental treatment during overnight stay				X	X
	I.CURR.SP.3 medical products for medical or dental treatment during overnight stay				X	X
	I.CURR.DT. diagnostic and laboratory tests for medical or dental treatment during overnight stay (e.g. x-rays, scans, blood tests)				X	X
	I.CURR.NM. Non-medical costs for the patient (cooking, cleaning, accommodation)				X	X
	I.CURR.ER.1.emergency transportation and rescue services by ambulance or other vehicles specially adjusted for medical purposes				X	X
	I.CURR.ER.2. Emergency transportation services and rescue by ordinary vehicles or airplanes (not specially adjusted for a medical purpose)				X	X
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to both I.LONG.SP.1 & I.CURR.SP.1	*If possible* exclude diagnostic and laboratory tests during the overnight stay I.LONG.DT/ I.CURR.DT. and emergency transportation services and emergency rescue (I.LONG.ER / I.CURR.ER)					
Applies to all I.LONG. & I.CURR	Excludes: non-emergency transportation and non-medical costs for patient's relative.					
	COICOP code 06.2.1 Preventive care services					
	P.IMMV.MC Immunization/vaccination services for maternal and child care			X	X	
	P.IMMV.OV Travel and tourism vaccination, any other compulsory or voluntary immunization/vaccination service.			X	X	

Inclusion/Exclusion criteria to be specified when asking about the amount Applies to P.IMMV.OV	Includes; travel and tourism vaccination as well as any other immunization/vaccination service.					
Applies to both P.IMMV.MC and P.IMMV.OV	Excludes payments for the vaccine itself when separately invoiced from the service.					
	P.OTHR. Other preventive services than immunization/vaccination					
	P.OTHR.GH.1 Family planning, counselling, prenatal/postnatal care services for both the mother and new born (during the six weeks or 42 days)			X	X	
	P.OTHR.GH.2 Child growth and development consultation visits and any other consultations to monitor "good" health			X	X	
	P.OTHR.DI. screening, tests, consultations to detect communicable or non-communicable diseases before symptoms appear (e.g. diabetes, heart problems)			X	X	
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to all P.IMMV & P.OTHR	Includes diagnostic and laboratory tests needed to provide preventive services					
	COICOP code 06.4.2 Emergency transportation and emergency rescue					
Alternative wording: transportation for medical emergency reasons (e.g. by ambulance)	**O.EMER. Patient emergency transportation services and emergency rescue services (excluding those associated with an overnight stay)**					
	O.EMER.AV by ambulance or other vehicles specially adjusted for medical purpose	X	X			
	O.EMER.NA by ordinary vehicles or airplanes (not specially adjusted for a medical purpose)	X	X			
Inclusion/Exclusion criteria to be specified when asking about the amount	Excludes non-emergency transportation services					
	COICOP code 06.2.2 & 06.2.3 Outpatient dental & other outpatient services					
	O.DENT Outpatient dental care					
	O.DENT.CS.1 Dental consultations and services that did not require an overnight stay in a hospital setting	X	X			
	O.DENT.DT.1 Diagnostic and laboratory tests needed to provide dental consultations and services in a hospital setting	X	X			
	O.DENT.CS.2 Dental consultations and services that did not require an overnight stay Outpatient settings (e.g. private practice, office, medical center, clinics, polyclinics)	X	X			
	O.DENT.DT.2 Diagnostic and laboratory tests needed to provide dental consultations and services Outpatient settings (e.g. private practice, office, medical center, clinics, polyclinics)	X	X			
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to O.DENT.CS.1 & O.DENT.CS.2	Excludes dental diagnostics services and laboratory tests needed to provide outpatient dental services (e.g. X-rays, blood tests)					
	O.CRRL. Other medical consultations and services than dental and preventive that did not require an overnight stay					
	In a hospital setting					
	O.CRRL.CS.1.1 consultations and services of specialists (paediatricians, surgeons, cardiologists, ophthalmologist, mental health)	X	X			
	O.CRRL.CS.1.2 consultation and services of general doctors	X	X			
	O.CRRL.CS.1.3 consultation and services of nurses, midwifes and other health care practitioner	X	X			
	O.CRRL.DT.1 diagnostic and laboratory tests needed to provide other medical services that did not require an overnight stay in a hospital setting	X	X			

	Outpatient settings (e.g. private practice, office, medical center, clinics, polyclinics)					
	O.CRRL.CS.2.1 consultations and services of specialists (paediatricians, surgeons, cardiologists, ophthalmologist, mental health)	**X**	**X**			
	O.CRRL.CS.2.2 consultation and services of general doctors	**X**	**X**			
	O.CRRL.CS.2.3 consultation and services of nurses, midwifes and other health care practitioner	**X**	**X**			
	O.CRRL.DT.2. diagnostic and laboratory tests needed to provide other medical services that did not require an overnight stay outside a hospital setting	**X**	**X**			
Inclusion/Exclusion criteria to be specified when asking about the amount Applies to all O.CRRL..CS1 & O.CRRL..CS.2	excludes diagnostic and laboratory test needed to provide outpatient medical services (e.g. X-rays, blood/urine tests)					
	COICOP code 06.1.1					
	M.HERH. Herbal medicines (tablets or syrups) and homeopathic products for consumption outside a health facility or institution.					
	M.HERH.PR prescribed	**X**	**X**			
	M.HERH.OC over-the-counter (self-prescription)	**X**	**X**			
	M.MVCP. Medicines (branded, generic)**, vaccines, oral contraceptives, vitamins and minerals for consumption outside a health facility or institution.**					
	prescribed					
	M.MVCP.PR.IA. antibiotics	**X**	**X**			
	M.MVCP.PR.IO. Other medicines (branded, generic, homeopathic) to treat (presumed or diagnosed) bacterial infections (e.g. malaria, diarrhoeas, dysentery, increased frequency of stools with or without blood and mucus in stools; worms infestations)	**X**	**X**			
	M.MVCP.PR.CD. medicines to treat (presumed or diagnosed) non-communicable diseases or chronic diseases (e.g. diabetes, hypertension)	**X**	**X**			
	M.MVCP.PR.FP. oral contraceptives and contraceptives in the form of injections	**X**	**X**			
	M.MVCP.PR.SY. medicines to treat fevers, pain and other symptoms (e.g. nausea; vomiting, constipation; inflammation)	**X**	**X**			
	M.MVCP.PR.VM. vitamins, mineral	**X**	**X**			
	M.MVCP.PR.OM. other prescribed medicines and pharmaceutical preparations not elsewhere specified	**X**	**X**			
	over-the-counter (self-prescription)					
	M.MVCP.OC.IA. antibiotics	**X**	**X**			
	M.MVCP.OC.IO Other medicines (branded, generic, homeopathic) to treat bacterial infections (e.g. malaria, diarrhoeas, dysentery, increased frequency of stools with or without blood and mucus in stools; worms infestations)	**X**	**X**			
Examples on NCD should list the most prevalent in country/site	**M.MVCP.OC.CD medicines to treat (presumed or diagnosed) non-communicable diseases or chronic diseases** (e.g. diabetes, hypertension)	**X**	**X**			
	M.MVCP.OC.FP oral contraceptives and contraceptives in the form of injections	**X**	**X**			
	M.MVCP.OC.SY medicines to treat fevers, pain and other symptoms (e.g. nausea; vomiting, constipation; inflammation)	**X**	**X**			
	M.MVCP.OC.VM vitamins, mineral	**X**	**X**			
	M.MVCP.OC.OM other self-prescribed medicines and pharmaceutical preparations not elsewhere specified	**X**	**X**			
	COICOP code 06.1. 2 medical diagnostic products, prevention and protective devices for personal use outside a health facility or institution					
	D.DIAG. (pregnancy tests; thermometers, glucose-meters, blood pressure meters) **and other medical diagnostic products**	**X**	**X**			

	D. PREP condoms and other mechanical contraceptive devices, masks , medicinal stockings (e.g. compression stockings), medicinal gloves, insecticide treated mosquito – nets **and other prevention, protective medical devices**	**X**	**X**			
	D.TRTM inhalers, syringes, humidifiers, nebulizers, hot bags, ice packs, first aid kits, bandages **and other treatment devices for personal use**	**X**	**X**			
Inclusion/Exclusion criteria to be specified when asking about the amount Only applies to some diagnostic products	Includes repair, rental and maintenance					
	COICOP code 06.1.3 Assistive products for vision, hearing, mobility and daily living.					
	A.PURC.VH. Purchase of glasses for vision; white canes, glass eyes, contact lenses, hearing aids and **other assistive products for vision and hearing**				**X**	**X**
	A.RRMN.VH. Repair, rental/maintenance of assistive health products for vision and hearing				**X**	**X**
	A.PURC.MD. Purchase of crutches & wheelchairs; therapeutic footwear; walkers; pressure relief mattresses **and all other assistive health products for mobility and daily living.**				**X**	**X**
	A.RRMN.MD. Repair, rental/maintenance of assistive health products for mobility and daily living.				**X**	**X**

Appendix IV: Sample household questionnaire for food and non-medical household items

SECTION 3 - **Version I**: HOUSEHOLD EXPENDITURE . PART 3.1: FREQUENTLY PURCHASED AND CONSUMED ITEMS

RESPONDENT IS HOUEHOLD INFORMANT, IF NEEDED IN COLLABORATION WITH MEMBERS LISTED BELOW (TO BE COPIED Table 1 & 4 in page 9)

NAME & ID OF PEOPLE THAT MUST BE AVAILABLE DURING THE INTERVIEW FREQUENCLY PURCHASED ITEMS (to be copied from Table 1 & 4 in page 9) DURING THE INTERVIEW INDICATE WITH A CROSS IF THEY ACTUALLY ARE	NAME	ID	AVAILABILITY	NAME	ID	AVAILABILITY
	Date of this visit					

I am first interested in your frequently *food* and non-alcoholic purchased and consumed food and non-alcoholic items at home	1 Was any money spent by the household on ….**over the last 7 days?** Yes…….1 No……..2 (>> 3)	2 How much was spent **on** …….. in the **last 7 days** altogether?	3 What quantity of the ……was consumed by this household as a gift or out of own production in the **last 7 days**? If yes, please tell me the quantity and unit IF NONE PUT '00' for quantity&>>NEXT ITEM		4 What is the monetary value of the …item… consumed (in Ghana cedis)?" (NEXT ITEM)
		AMOUNT	QUANTITY	UNIT	VALUE
1. Bread, rice, maize, millets and all other forms of cereals					
2. Sweet potato, yam, cassava and all other roots, tubers & plantains					
3. Dawadawa, ground nuts, all kind of other nuts and seeds and all kind of beans					
4. All vegetables					
5. All fruits					
6. Meat, poultry, and offal					
7. Fish and sea food					
8. Milk and milk products					
9. Eggs					
10. Oils and fats					
11. Sugar, jam, honey, cholate & sweets					
12. Ginger, pepper, yeast, baking powder and all other condiments, spices & baking agents.					

Appendix V : Full list of food and non-medical items and respective recall period

Non-health items	**Recall period**		
	last 7 days	**last 30 days**	**last 12 months**
1. Bread, rice, maize, millets and all other forms of cereals	**x**		
2. Sweet potato, yam, cassava and all other roots, tubers & plantains	**x**		
3. Dawadawa, ground nuts, all kind of other nuts and seeds and all kind of beans	**x**		
4. All vegetables	**x**		
5. All fruits	**x**		
6. Meat, poultry, and offal	**x**		
7. Fish and sea food	**x**		
8. Milk and milk products	**x**		
9. Eggs	**x**		
10. Oils and fats	**x**		
11. Sugar, jam, honey, cholate & sweets	**x**		
12. Ginger, pepper, yeast, baking powder and all other condiments, spices & baking agents.	**x**		
13. Other food items not mentioned elsewhere	**x**		
14. Non-alcoholic beverages	**x**		
15. Alcoholic beverages (spirits; wine; beer) consumed at home in the last 7 days	**x**		
16. Food, non-alcoholic and alcoholic beverages consumed outside the home by all the different members of your household (for example, at street stalls; mobile vendors; restaurants; cafes; bars; take-away; canteens etc…) ?	**x**		
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	**x**		
18. Toilet paper, personal soaps, toothpaste, sanitary towels/tampons, diapers and all other personal hygiene items in the last 30 days		**x**	
19. Make-up/make-up removal products, hair products, shave products, razors and all other beauty products and personal non-electronic appliances		**x**	
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.		**x**	
22. Diesel, petrol and other fuels and lubricants for personal vehicles (cars, motor cycles etc…)		**x**	
21. 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		**x**	
24. 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		**x**	
23. 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 Exclude internet/telephone/television services (next item)		**x**	
26. Electricity, heating and cooking fuel; gas; water supply/sewage collection and other housing utilities		**x**	
25. Rent/mortgages for primary and secondary residences and garages			**x**
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			**x**
28. Clothing and footwear including their cleaning, repair and hire.			**x**
29. Services and/or materials for the regular maintenance and repair of the dwelling.			**x**
30. Lighting equipment, household textile and all household and garden furniture, including repair and ren			**x**

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.			**x**
32. Domestic services by paid staff, services and goods for routine household maintenance			**x**
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.			**x**
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			**x**
35. Sporting services and goods; music instruments; audio-visual media; services provided by cinemas, and other leisure services, religious and cultural goods and services			**x**
36. Games, toys and hobbies including games console and game software			**x**
37. Plants and flowers and other garden products; pets and related products; Veterinary and other services for pets			**x**
38. Newspapers, books, educational material, drawing material and other stationery)			**x**
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).			**x**
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			**x**
41. Accommodation services(hotels, motels, inns and similar accommodation services; holiday centres, camping sites, youth hotels; boarding schools when accommodation priced separately).			**x**
42. All other goods and services not elsewhere specified excluding health expenditures			**x**

Appendix VI: Supplementary tables

Table S1: Summary of mean OOPs for unmatched and matched households by spending categories

	Questionnaire Version 1				Questionnaire Version 2				Questionnaire Version-3			
	11 disaggregated health items				44 disaggregated health items				56 disaggregated health items			
	N	Unmatched Household OOPs Mean (SD)	N	Matched Household OOPs Mean (SD)	N	Unmatched Household OOPs Mean (SD)	N	Matched Household OOPs Mean (SD)	N	Unmatched Household OOPs Mean(SD)	N	Matched Household OOPs Mean (SD)
Outpatient	81	64 (135)	44	66 (128)	181	43 (130)	126	43 (150)	105	44 (78)	47	31 (78)
Inpatient	171	319 (527)	91	226 (279)	177	398 (809)	99	314 (504)	193	287 (716)	100	215 (456)
Medicines	487	41 (140)	302	36 (157)	560	29 (78)	381	25 (56)	609	29 (76)	354	30 (90)
Preventive care	137	59 (95)	80	49 (83)	92	34 (53)	67	31 (53)	46	31 (44)	22	20 (29)
Other medical services	8	203 (201)	2	43 (4)	5	113 (217)	3	15 (10.5)	2	12 (4)	2	12 (4)
Health products	36	71 (133)	19	84 (176)	25	160 (250)	14	178 (289)	18	165 (232)	7	6 (5)

Table S2: Summary of mean OOPs for matched households and provider data by spending categories

	Questionnaire Version 1				Questionnaire Version 2				Questionnaire Version-3			
	11 disaggregated health items				44 disaggregated health items				56 disaggregated health items			
	N	Provider OOPs Mean (SD)	Household OOPs Mean (SD)	Estimated ratio (HH/provider) of the means (95% CI)	N	Provider OOPs Mean(SD)	Household OOPs Mean (SD)	Estimated ratio (HH/provider) of the means (95%CI)	N	Provider OOPs Mean(SD)	Household OOPs Mean (SD)	Estimated ratio (HH/provider) of the means (95%CI)
Outpatient	44	34 (46)	66 (128)	1.92	126	22 (52)	43 (150)	1.98	47	14 (15)	31 (78)	2.23
Inpatient	91	49 (74)	226 (279)	6.5	99	48 (97)	314 (504)	6.54	100	21 (38)	215 (456)	10.34
Medicines	302	26 (67)	36 (157)	1.39	381	21 (57)	25 (56)	1.19	354	12 (21)	30 (90)	2.54
Preventive care	80	32 (47)	49 (83)	1.53	67	38 (75)	31 (53)	0.81	22	12 (18)	20 (29)	1.73
Other medical services	2	11 (11)	43 (4)	4.05	3	16 (7)	15 (10.5)	0.94	2	9 (9)	12 (4)	1.33
Health products	19	44 (61)	84 (176)	1.9	14	21 (28)	178 (289)	8.66	7	36 (31)	6 (5)	0.17

Table S3: Households with out-of-pocket payments by spending category for matched household on reported expenditures

	Questionnaire Version 1 (Short recall period)					Questionnaire Version 2 (Long recall period)				
Spending category	Recall period	Households with positive OOPs N=722		proportion matched		Recall period	Households with positive OOPs N=431		proportion matched	
		n	%	n	%		n	%	n	%
inpatient care services	6 months	89	12	17	19	12 months	53	12	19	36
preventive services	3 months	18	3	12	67	6 months	19	5	13	68
Other health services	2 weeks	0	0	0	0	4 weeks	1	0.23	0	0
Outpatient	2 weeks	25	4	17	68	4 weeks	10	2	8	80
Medicines	2 weeks	278	39	222	80	4 weeks	185	43	147	79
health products	6 months	5	0.7	0	0	12 months	1	0.23	1	100

Table S4 Comparison of mean OOPs in household samples by spending category

	Questionnaire Version 1 (short recall period)			Questionnaire Version 2 (Long recall period)			Ratio (mean v1/mean v2) (95% CI)
	n	mean	sd	N	mean	sd	
Inpatient	89	478	1726	53	404	806	1.18 (0, 2.45)
Medicines	278	15	44	185	18	38	0.82 (0.42, 1.23)
Outpatient	25	46	83	10	24	21	2.21 (0, 5.18)
Preventive care	18	24	31	19	98	253	0.19 (0, 0.66)
Other medical services	0	0	0	1	200	-	-
Health products	5	21	21	1	4	-	5.3 (0.60, 10)

Table S5: Mean bias and variability in measurement of OOPs by recall period

Spending category	Number of observations	Mean bias	95% limits of agreement	Estimated difference in bias (qu2 vs qu1) & CI & p-value	Estimated difference in SD (qu2 vs qu1 (& CI & p-value
Medicines					
2 weeks recall period (qu1)	222	1.38	0.40 – 4.77	-	-
4 weeks recall period (qu2)	147	1.35	0.37 – 4.92	1.04 (0.82 – 1.33) 0.73	1.02 (0.86 – 1.21) 0.84

Table S6: Information on health in HCES

Table S6: Health modules	Number of surveys	Percentage of total	Total number of surveys
Survey with a health module	81	81.00%	100
Health domain			
General health	74	74.00%	100
Anthropometric	36	36.00%	100
Immunization	42	42.00%	100
Maternal health	46	46.00%	100
Child health	15	15.00%	100
Family Planning	22	22.00%	100
Chronic disease	8	8.00%	100
HIV/AIDs	5	5.00%	100
Mental health and/or disability	17	17.00%	100
Only one health domain (conditional on any health module)	15	18.50%	81

Source: World Bank non-food assessment survey, WHO calculations

Table S7: Information on health seeking behavior and utilization in HCES

Table S7: Health care utilization	Percentage of surveys with	Number of surveys	Total number of surveys
Health module but no health care utilization module*	2.50%	2	81
Data collected on health care use	80.00%	80	100
Any restriction on information collected on utilization (by age, illness, other)	43.80%	35	80
if any restriction: how often is it related to being sick or injured ?	94.30%	33	35
How detailed is the information on health care use			
Is there information on:			
Type of health care facility	88.70%	71	80
Including traditional healers	57.50%	46	80
Type of health care personnel	60.00%	48	80
Including traditional healers	55.00%	44	80
Type of treatment/medication/exams received	20.00%	16	80
Number of visits	51.20%	41	80
Distance/time to health care facility used	28.70%	23	80
Transportation to health care facility	22.50%	18	80
Hospitalization	43.80%	35	80

Notes: The two countries with a health module but no utilization module are Brazil (with a module on maternal health only) and Dominicana (with one question on confinment to bed during the last month and another on presence of chronic conditions in the household - diabetes, high blood pressure, health condition, cancer)

Source: World Bank non-food assessment survey, WHO calculations

Appendix VII: Curriculum vitae

Last name: **AGORINYA**	
First name: ISAIAH AWINTUEN	
Profession: Epidemiologist & Statistician	
Nationality: GHANAIAN	
Date of birth: 24 JUNE 1985	
Home address:	
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Personal profile:	
I am an energetic, ambitious person who has developed a mature and responsible approach to any task that I undertake, or situation that I am presented with. I am excellent in working with others to achieve a certain objective on time and with excellence. I have over 10 years working experience in data analysis, data management, database design/programming, research design and project coordination. I am self-motivated and capable of taking leadership roles. I have dealt with different people in the research and academic environments, building up loyal and beneficial relationships. I am a strong team player, an efficient multi-task personality and have a challenge driven mentality.	
Education / Professional qualifications:	
2016 - 2019	***PhD Fellow**, Epidemiology (Health Systems Research)- Swiss TPH, University of Basel, Switzerland,*
2011-2014	***Master of Science**, Biometry - University For Development Studies, Ghana*
2004-2008	***Bachelor of Science,** Mathematical Science (Statistics) - University For Development Studies, Ghana*
Work experience:	
1. Duration	As of 2016
Position	PhD fellow/Indepth-Network Navrongo iHOPE project technical coordinator
Key responsibilities	· iHOPE project protocol/proposal development
	· Project implementation, coordination, monitoring and evaluation
	· Design of data entry programme in CSPro 7 platform
	· Report writing
	· Development of manuscripts for publications
Institution	Navrongo Health Research Centre, Ghana
2. Duration	2013-2016
Position	Senior Research Officer (Data Analyst/Database Programmer/IT Manager)
Key responsibilities	· Perform data analysis using Statistical Software; Stata, Epi info, SPSS, R and Microsoft Excel spreadsheet.
	· Lead in the Design of databases using Open data kit (ODK), RedCap, CSPro, Epi data, Epi Info and SPSS for NHRC projects
	· Report writing
	· Review Research Protocol
	· Coordinate and supervise data entry of project data
	· Project coordination
Institution	Navrongo Health Research Centre, Ghana
3. Duration	2009 – 2013

Position	Research Officer (Data Manager/ Deputy IT Administrator)
Key responsibilities	Project Coordination, Data Management, Analysis and Database programming
Institution	**Navrongo Health Research Centre, Ghana**
3. Duration	2008 - 2009
Position	Research Assistant (Data Manager/ IT Administrator)
Key responsibilities	Data Management, Analysis and database programming
Institution	**Navrongo Health Research Centre**
Country	**Ghana**
Conferences, workshops and seminars:	
July-19	Oral Presenter, International Health Economics Association (iHEA) congress, University of Basel, Basel, Switzerland
May-19	Swiss TPH Spring symposium, Health Resources for Health-Innovations in Medical education, Vocational training and continuing education, Basel, Switzerland
Nov-17	Visiting scholar - Data analysis workshop, Prenatal and maternal health project (PREMAND), University of Michigan, US
Sep-17	Indepth-Network household out-of-pocket payment project workshop, FilaBavi HDSS, Hanoi, Vietnam
Mar-17	Indepth-Network household out-of-pocket payment project workshop, FilaBavi HDSS, Hanoi, Vietnam
Nov-15	Indepth-Network International Scientific Conference, Young Scientist presenter, Addis Ababa
Oct-15	Data Analysis workshop-H3A's Awi-Gen Project, Wits, South Africa
Jun-15	Use of GIS in Monitoring and Evaluation, USAID, -Accra, Ghana
Jun-15	Migration of HRS2 to OpenHDS database, Indepth-Network Nanoro-Ouagadougou-Burkina Faso
April-14	Short course on GWAS by SBIMB and H3Africa, H3Bionet, Wits, South Africa
Feb – 2014	H3Africa AWI-Gen Technical workshop, Wits, South Africa
July – 2013	Data Management workshop-H3A's Awi-Gen Project, Wits, South Africa
Jan – 2013	MVP Scientific dissemination conference-WHO/PATH, Accra, Ghana
June – 2012	Scientific paper writing workshop- Indepth-Network Effectiveness and Safety Studies on Malaria (INESS), HO, Ghana
Oct – 2011	Oral Presenter, International Scientific conference (ISC)-Indepth-Network, -Maputo, Mozambique
Feb – 2011	Data Analysis Workshop by Indepth-Network Effectiveness and Safety Studies on Malaria (INESS), Dar salaam, Tanzania
Nov-11	Technical workshop on QUALMAT (Quality Maternal Health) Project, (2011)-Tanzania
Nov-10	Workshop by Indepth-Network Effectiveness and Safety Studies on Malaria (INESS) on Biometric Data collection, Tanzania
May-10	Workshop on the use of Personal Digital Assistant (PDA) in health Demographic data collection -Accra, Ghana
Nov – 2008	Workshop on Good Clinical Practice (GCP) by Meningitis Vaccine Project (MVP) Navrongo Health Research Centre, Ghana
Oct-08	Seminar on "Attaining Financial Independence" by DATABANK Universities Economic School -Navrongo, Ghana
Consulting experience:	
2015 - date	Technical consultant at Millennium Consult Limited Ghana

Nov.-Dec 2015	West Africa Resilience Innovation Lab Resilient Africa Network Deliberative Polling, University for Development studies, Tamale-Ghana
Sept.-Dec 2015	International Finance Cooperation World Bank Group, African Health Market for Equity, Accra. Ghana
Jun.-August 2015	The African Women's Development Fund, Upper East Regional Health Directorate, Bolgatanga. Ghana
Aug.-Sept 2015	SEND-Ghana, Tamale-Ghana
Jan.-Feb 2015	West Africa Resilience Innovation Lab Resilient Africa Network Deliberative Polling, University for development studies, Tamale-Ghana
Jun.-July 2015	Toende Rural Bank, Pusiga-Ghana
Mar.-Apr 2015	Anglican Diocesan Development and Relief Organization (ADDRO), Bolgatanga-Ghana
2014	Anglican Diocesan Development and Relief Organization (ADDRO), Bolgatanga-Ghana
2012	Anglican Diocesan Development and Relief Organization (ADDRO), Bolgatanga-Ghana
2011	Anglican Diocesan Development and Relief Organization (ADDRO), Bolgatanga-Ghana
2010	Upper East Regional Health Directorate-Ghana

Professional/Academic affiliations
Indepth-Network, Accra Ghana
Swiss Tropical and Public Health institute
University of Basel, Switzerland

Teaching Experience
Institution/course: Navrongo Community Health and Nursing Training School, Navrongo/ Seminars in public health - 2017
Institution/course: Navrongo Community Health and Nursing Training School, Navrongo/ Research Methods - 2014
Institution/course: Navrongo Senior High School, Navrongo/Core and elective mathematics - 2009

Reference #1:	***Reference #2:***
Mr. Martin Adjuik Position: Head of Department, Department of Epidemiology and Biostatistics, School of Public Health, University of Health and Allied Science, Hohoe Email: madjuik@gmail.com Mobile: +233 0201488377	Dr FabrizioTediosi Position: Group Leader Epidemiology and Public Health, Health Systems Research. Swiss TPH, University of Basel Email: Fabrizio.tediosi@swisstph Mobile: +41 612848719
Reference #3:	
Dr. James Akazili Position: Deputy Director Organization: Ghana Health Service HQ, Accra Email: jakazili@gmail.com Telephone: +233 (0)20 9691313 +233(0)244834435	

Published in peer review journals

1. **Agorinya IA**, Dalaba M, Mensah NK, Chatio ST, Le LM, Bacha YD, et al. Challenges and experiences in linking community level reported out-of-pocket health expenditures to health provider recorded health expenditures: Experience from the iHOPE project in Northern Ghana. PLOS ONE. 2021 Sep 7;16(9):e0256910.

2. **Agorinya IA**, Kanmiki EW, Nonterah EA, Tediosi F, Akazili J, Welaga P, et al. Socio-demographic determinants of low birth weight: Evidence from the Kassena-Nankana districts of the Upper East Region of Ghana. PLOS ONE. 2018 Nov 14;13(11):e0206207.

3. **Agorinya IA**, Ross A, Flores G, TanTorres Edejer T, Dalaba MA, Mensah NK, et al. Effect 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 May;11(5):e042562.

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5. Kanmiki EW, Bawah AA, **Agorinya IA**, Achana FS, Awoonor-williams JK, Oduro AR, et al. Socio-economic and demographic determinants of under-five mortality in rural northern Ghana. BMC International Health and Human Rights. 2014 Aug 21;14(1):24.

6. Kanmiki EW, Bawah AA, Akazili J, **Agorinyah IA**, Awoonor-Williams JK, Phillips JF, et al. Unawareness of health insurance expiration status among women of reproductive age in Northern Ghana: implications for achieving universal health coverage. Journal of Health, Population and Nutrition. 2019 Nov 27;38(1):34.

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10. Nonterah EA, Adomolga E, Yidana A, Kagura J, **Agorinya IA**, Ayamba EY, et al. Descriptive epidemiology of anaemia among pregnant women initiating antenatal care in rural Northern Ghana. African Journal of Primary Health Care & Family Medicine. 2019

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11. Nonterah EA, **Agorinya IA**, Kanmiki EW, Kagura J, Tamimu M, Ayamba EY, et al. Trends and risk factors associated with stillbirths: A case study of the Navrongo War Memorial Hospital in Northern Ghana. PLOS ONE. 2020 Feb 21;15(2):e0229013.

12. Nonterah EA, Kanmiki EW, **Agorinya IA**, Sakeah E, Tamimu M, Kagura J, et al. Prevalence and adverse obstetric outcomes of female genital mutilation among women in rural Northern Ghana. Eur J Public Health [Internet]. [cited 2019 Oct 27]; Available from: https://academic.oup.com/eurpub/advance-article/doi/10.1093/eurpub/ckz195/5602182

13. Ramsay M, Crowther N, Tambo E, Agongo G, Baloyi V, Dikotope S, et al. H3Africa AWI-Gen Collaborative Centre: a resource to study the interplay between genomic and environmental risk factors for cardiometabolic diseases in four sub-Saharan African countries. Glob Health Epidemiol Genom [Internet]. 2016 Nov 22 [cited 2018 Aug 2];1. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5732578/

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1. Testing and validating the optimal recall period in the measurement of household out-of-pocket health expenditure. Evidence from an experimental study northern Ghana..

2. Testing the effect of level of health expenditure questionnaire (Household-level versus Individual-level) on the estimation of out-of-pocket health expenditure: Evidence from an experimental study northern Ghana.