Published in final edited form as:

Soc Sci Med. 2017 April ; 178: 11–18. doi:10.1016/j.socscimed.2017.02.001.

Sensitivity of measuring the progress in financial risk protection to survey design and its socioeconomic and demographic determinants: A case study in Rwanda

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Abstract

Reliable and comparable information on households with catastrophic health expenditure (HCHE) is crucial for monitoring and evaluating our progress towards achieving universal financial risk protection. This study aims to investigate the sensitivity of measuring the progress in financial risk protection to survey design and its socioeconomic and demographic determinants. Using the Rwanda Integrated Living Conditions Survey in 2005 and 2010/2011, we derived the level and trend of the percentage of the HCHE using out-of-pocket health spending data derived from (1) a health module with a two-week recall period and six (2005)/seven (2010/2011) survey questions (Method 1) and (2) a consumption module with a four-week/ten-/12-month recall period and 11(2005)/24 (2010/2011) questions (Method 2). Using multilevel logistic regression analysis, we investigated the household socioeconomic and demographic characteristics that affected the sensitivity of estimating the HCHE to survey design. We found that Method 1 generated a significantly higher HCHE estimate (9.2%, 95% confidence interval 8.4%–10.0%) than Method2 (7.4%, 6.6%–8.1%) in 2005 and lower estimate (5.6%, 5.2%–6.1%) than Method 2 (8.2%, 7.6% – 8.7%) in 2010/2011. The estimated trends of the HCHE using the two methods were not consistent between the two years. A household's size, its income quintile, having no under-five children, and educational level of its head were positively associated with the consistency of its HCHE status when using the two survey methods. Estimates of the progress in financial risk protection, especially among the most vulnerable households, are sensitive to survey design. These results are robust to various thresholds of catastrophic health spending. Future work must focus on mitigating survey effects through the development of statistical tools.

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Keywords

Rural Rwanda; Measuring catastrophic health expenditure; Measuring out-of-pocket health expenditure; Survey design; Financial risk protection; Survey instruments; Developing countries

1. Introduction

Protecting households from financial risks of illness has been identified by the World Health Organization (WHO) as one of the fundamental social outcomes of health systems (WHO, 2000). In recent years, advocacy for universal health coverage has experienced a global resurgence, which is reiterated by the importance of financial protection in ensuring equity of access to care and health outcomes (WHO, 2005; WHO, 2010). A common measure for financial risk protection, proposed by the WHO, is proportion of households with catastrophic health expenditure (HCHE) (Xu et al., 2003, 2007). Reducing HCHE has frequently been a declared policy objective of governments and has already catalyzed the enactment of major legislation and health system reform in countries such as Mexico, China, and Rwanda (Knaul et al., 2006; Lu et al., 2012; Lu et al., 2011). Reliable and comparable information on the HCHE is crucial for monitoring and evaluating our progress towards achieving universal financial risk protection.

In developing countries, the HCHE is measured with household out-of-pocket health spending (OOPS) data collected mainly through household surveys, such as Living Standards Measurement Study (LSMS) (The World Bank Development Research Group, Various years), World Health Survey (WHS) (WHO, 2003), or a country's income and/or consumption surveys. Household data are likely to be plagued with non-sampling errors, which may result from survey instrument design in recall period, disaggregation in health payment questions, and/or the framing of such questions (Beckett et al., 2001; Clarke et al., 2008; Deaton and Grosh, 2000; UN Department of Economic and Social Affairs, 2005). In 2009, we published a pioneering investigation on the effect disaggregation in health payments questions plays in estimating the HCHE across 43 developing countries and found that the number of survey questions can significantly affect the estimate of a country's percentage of HCHE: fewer questions generated a lower estimate in the majority of the 43 countries (Lu et al., 2009). Other studies also observed variation in HCHE estimates, which may be the result of using different survey instruments or of other factors (Lavado et al., 2013; Raban et al., 2013; Xu et al., 2009).

Across household surveys, variation in the number of survey questions on the OOPS is often accompanied by variation in both recall periods and the focus of survey modules. We presented some examples from the most commonly used surveys for collecting the OOPS in Table 1 to illustrate the variation in survey instruments across countries and over time: the number of survey questions on household OOPS information could be either one general question (on total OOPS) or multiple questions on each component of the total OOPS (Tanzania and Vietnam); the recall period ranged from two weeks (Ghana) to 12 months in all the listed LSMS surveys. In addition, the OOPS information was framed in different modules: some countries included it in the health module that focuses on health service

usage and its related costs (Ghana, Mexico, Tanzania, and Vietnam), and some countries included it in both the health and consumption modules (Bulgaria, China, and Guatemala). Even if the same survey was conducted in the same country, the recall period and number of questions for collecting the OOPS information may vary over time (Vietnam).

Concerns have been raised regarding the effects of survey design on measuring the HCHE (Heijink et al., 2011; Lavado et al., 2013; Lu et al., 2009; Raban et al., 2013; Xu et al., 2009). Taking advantage of a nationally representative repeated cross-sectional household survey, the Rwanda Integrated Living Conditions Survey (EICV in French) (Rwanda National Institute of Statistics 2000, 2005, 2010/2011), the present study has undertaken a new analysis that extends the previous work in the following ways. Firstly, we were able to single out the survey effect on the level and trend of HCHE estimates resulting from combined variation in recall periods, number of survey questions, and survey modules. The EICV asked the same respondents to report health expenditure data in both the health and consumption modules, with both differing recall periods and a differing number of survey questions. As the data were collected from the same households at the same time by the same survey team, we were able to compare the HCHE estimates resulting purely from the variation in survey design. Secondly, this study was to explore household characteristics that may affect the sensitivity of HCHE estimation to survey design. In survey literature, differential item functioning (DIF), a phenomenon in which the same survey instrument can generate different response patterns in sampled populations with different socio-demographic backgrounds, has been found in developed countries (Dodeen, 2004; Holland and Wainer, 1993; Perkins et al., 2006). The existence of DIF presents big challenges for obtaining knowledge regarding specific subsets of the sampled population. When measuring the HCHE, policy usually aims to target the most vulnerable households (low-income, having children under age five, poorly educated, etc.) in developing countries, and thus it is important to know whether survey design affects the estimation of HCHE status for those households. To our knowledge, this is the first study on the DIF in HCHE estimation at the sub-national level in developing countries. Knowledge gained will provide necessary evidence for future studies on developing a statistical algorithm for mitigating survey effects.

2. Methods

2.1. Data

The EICV is a nationally representative household income and expenditure survey, which has been conducted every five years since 2000 by the Rwanda National Institute of Statistics. The 2005 survey started in January 2005 and ended in December 2005; the 2010/2011 survey was commenced in November 2010 and finished in October 2011. Each of the surveys lasted for 12 months. There were 6900 and 14,308 rural households in the 2005 and 2010/2011 EICV respectively. Households were selected based on a stratified two-stage sample design, with sampling village at the first stage and sampling households from sampled village at the second stage. These data have been used in previous studies to measure the HCHE in Rwanda for policy evaluation (Lu et al., 2012). As a country with a gross domestic product per capita of US\$595 in 2011 (Rwanda National Institute of Statistics, 2013), and with 85% of its population living in rural areas (Rwanda Ministry of

Health, 2011), the Government of Rwanda has adopted a variety of policies to protect rural households from catastrophic health spending (Lu et al., 2012). Tracking the effect of these policies in reducing the HCHE in rural areas is an essential component of assessing the progress of achieving universal health coverage in Rwanda. Our study, therefore, focused on measuring the trend of HCHE in rural areas.

2.2. Survey design for collecting the OOPS in the EICV

The EICV asks a household to report its OOPS information in both the health and consumption modules, and the health module was placed prior to consumption module in the questionnaire in both 2005 and 2010/2011. The survey questions can be found in supplementary Table A. The health module uses a recall period of two weeks, and had five survey questions in 2005 and six survey questions in 2010/2011 intended to solicit information on the OOPS. This module also includes a household's annual spending on vaccinations. The consumption module in 2005 used recall periods of 12 and 10 months, and had 9 questions regarding OOPS information. In 2010/2011, for information on the OOPS, the consumption module used recall periods of 12 months and four weeks, and contained 22 questions (Table 2).

2.3. Measuring annualized OOPS and percentage of HCHE

The HCHE in this study was measured using the annualized OOPS data, derived from either the health module or from the consumption modules, as described in Table 3. When using data from the health module (Method 1), we annualized the OOPS by multiplying the cost of each item in the two weeks prior to the survey by 26, as following previous practices (Lu et al., 2012; Xu et al., 2003, 2007). When using data from the consumption module (Method 2) in 2005, we annualized the spending on medicine and medical equipment by multiplying the cost of each component reported with a 10-month recall period by 1.2. In 2010/2011, we annualized the spending on medicine and medical equipment by multiplying the cost of each component reported with a four-week recall period by 13. Annual spending on transportation to health facilities, determined by multiplying by 26, and vaccination was also added to the estimates derived from both methods (Table 3). To ensure the comparability of the estimates between years, we converted the value of the OOPS and all other household expenditure-related items to the value of the Rwanda franc in 2010.

Using the WHO's approach (WHO, 2000), a household was defined as having catastrophic health spending if its annual OOPS exceeds 40% of its annual capacity to pay, where capacity to pay was measured by household's total expenditure, excluding spending on basic subsistence needs. Basic subsistence needs were calculated as the average annual food expenditure of households whose food shares were in the 45th and 55th percentiles. The EICV includes questions about household spending items such as food, housing, education, durable goods, agriculture, etc. We were able to construct food spending (including self-made products and excluding alcohol, cigarettes, and restaurants) and total expenditure for each household. For each household, the value of the HCHE is "1" if the ratio of a household's annual total OOPS to its capacity to pay was 0.4 or above, and "0" if otherwise.

2.4. Statistical analysis

(1) Sensitivity of estimating the level and trend of rural-level average annualized OOPS and % of HCHE between 2005 and 2010/2011 when using the two survey methods—Using the OOPS data derived from the two survey methods, we produced the estimates for rural-level average annual OOPS, percentage of the HCHE, and their 95% confidence intervals in 2005 and 2010/2011, respectively. In each year, we made comparisons of the estimates derived from the two survey methods by examining their confidence intervals. We investigated the sensitivity of directions and the magnitudes of the trends of the two estimates to survey design between 2005 and 2010/2011. We also examined the percentage of HCHE by household income quintiles.

Knowledge about which component is the largest contributor to a household OOPS assists policy makers in identifying interventions that can reduce the OOPS. We estimated the average proportion of each component in total OOPS using the OOPS information obtained from two survey methods in 2005 and 2010/2011.

(2) Identifying rural household characteristics that affect the sensitivity of HCHE estimation to survey design—We investigated the effects of a rural household's socioeconomic and demographic characteristics on the consistency of its HCHE status when using the two survey methods. A dichotomous outcome variable was constructed to indicate whether household status on catastrophic health spending was consistent when using the OOPS data collected from the two survey methods, with value “1” as consistent and “0” as otherwise. Independent variables included household socioeconomic characteristics (age/gender/educational level/health insurance status of the head of a household, a household size, and its income quintile), as well as household health care needs (whether a household had under-five children, or members with chronic diseases). A categorical variable was constructed to indicate age group of the head-of-household (“below 30”, “30–39”, “40–49”, “50–59”, and “60 or above”). A categorical variable was constructed to indicate the educational level of the head-of-household (“no schooling”, “primary school or less”, and “secondary/vocational school and above”). When analyzing the combined data of both 2005 and 2010/2011, a year dummy (1 = 2010/2011, 0 = 2005) was constructed to indicate time effect and to address unobserved confounders that may vary between the two years. Summary statistics of socio-economic and demographic variables are presented in supplementary Table B.

For regression analyses in 2005 and 2010/2011, a three-level logistic model with random intercepts by village (primary sampling unit of the EICV) and district was used to control for potential clustering effects at the village and district levels (Goldstein, 2003). Using Equation (1) below, we estimated the association between household socioeconomic and demographic variables and the likelihood of a household having the same HCHE status when using the two different survey methods.

$$\text{Logit}(CATA_{ijk}) = \beta_0 X_0 + \beta X_{ijk} + v_{0k} + u_{0jk} \quad (1)$$

where $\text{Logit}(\text{CATA}_{ijk})$ represents the probability of having the same HCHE status for the i th household in the j th village and k th district, X_0 is a constant, β is a vector of coefficients for $\mathbf{X}_{ijk}$ which is a vector of variables on household characteristics for the i th household in the j th village of the k th district, and ν_{0k} and μ_{0jk} represent between-district random-variation and between-village/within-district random variation, respectively.

To test whether the effect of survey design varied over time, we also conducted analyses with pooled EICV data from 2005 to 2010/2011. Due to the change of administrative areas in 2006, we were not able to map the districts and villages in 2010/2011 to those used in 2005. We therefore used the logistic regression model to analyze the pooled data. We used Stata 13.0 for all analyses.

To test robustness of the results, we used HCHE thresholds of 0.1, 0.2, and 0.3 in analysis. We also adopted a revised Method 1 in the 2010/2011 survey by excluding the households who only reported “costs on healthcare without details” (18.87% of total sample households in 2010/2011), which allowed us to compare the difference between the two years with the same number of items included in the OOPS of Method 1.

3. Results

3.1. Level and trend of the annual average household out-of-pocket health spending (OOPS) in rural Rwanda derived from the two survey methods

When comparing the annual average household OOPS estimates generated from the two methods, we found that, in both 2005 and 2010/2011, Method 1 produced significantly higher estimates (21,047 Rwanda francs with 95% CI 18,710–23,384 in 2005; 14,091 Rwanda francs with 95% CI 12,779–15,404 in 2010/2011) than did Method 2 (8046 Rwanda francs with 95% CI 6932–9159 in 2005; 7550 Rwanda francs with 95% CI 6784–8316 in 2005). When excluding households only reporting “costs on healthcare without details” in 2010/2011, the difference between the OOPS using the two methods became statistically insignificant in 2010/2011 (6897 Rwanda francs with 95% CI 5929–7865 using Method 1 and 5870 Rwanda francs with 95% CI 5105–6635 using Method 2).

The estimated trends of the annual average OOPS between 2005 and 2010/2011 were found to be the same in their directions but different in their statistical significance: when using Method 1, there was a significant reduction between the two years; when using Method 2, there was not significant reduction between the two years. When excluding households only reporting “costs on healthcare without details,” the reduction of OOPS between 2005 and 2010/2011 was found to be significant. (Fig. 1).

When using the two methods, the average percentage of each component in household total OOPS was also found to differ (Fig. 2). When using Method 1, spending on medicine and medical equipment was the largest contributor to the OOPS (58% in 2005, 55% in 2010/2011, and 62% in 2010/2011 after excluding households only reporting “costs on healthcare without details”). When using Method 2, the largest contributor was spending on outpatient care (41% in 2005 and 54% in 2010/2011).

3.2. Level and trend of percentage of households with catastrophic health expenditure (HCHE) derived from the two survey methods

In 2005, Method 1 generated significantly higher estimate (9.2% with 95% CI 8.4%–10.0%) than Method 2 (7.4% with 95% CI 6.6%–8.1%). In 2010/2011, it was the opposite: the estimate was 5.6% (with 95% CI 5.2%–6.1%) using Method 1 and 8.2% (with 95% CI 7.6%–8.7%) using Method 2. In 2010/2011, excluding households only reporting “costs on healthcare without details,” the results remained the same: the HCHE estimate using Method 1 (3.1% with 95% CI 2.7%–3.6%) was significantly lower than that using Method 2 (7.5% with 95% CI 6.9%–8.2%) in 2010/2011. Between 2005 and 2010/2011, when using Method 1, the percentage of rural households with catastrophic health spending was significantly reduced from 9.2% to 5.6%, or 3.1% after excluding households only reporting “costs on healthcare without details”; when using Method 2, there was an increase between the two years of no significance (from 7.4% in 2005 to 8.2% or 7.5% in 2010/2011) (Fig. 3).

Results of the HCHE estimation using alternative HCHE thresholds (10%, 20%, and 30%) were consistent with the ones using the 40% threshold, except in 2010 when, using a 10% threshold, the estimate derived from Method 1 was not statistically different from the one derived from Method 2 (Supplementary Figure A).

Results on the level of the HCHE by household income quintiles, using various HCHE thresholds (10%, 20%, 30%, and 40%), are presented in supplementary Figure B. For the poorest households (income quintile 1), Method 2 consistently generated higher estimates of the HCHE than did Method 1, although no significance was detected in 2005. Households in other income quintiles (income quintile 2–5) had varying results: in 2005, Method 2 always produced lower estimates of the HCHE than did Method 1; in 2010, however, there was no significant difference between estimates using the two methods (except for that of income quintiles 4 and 5 using the threshold of 10% and income quintile 2 using the threshold of 40%).

3.3. Determinants of consistency in HCHE status when using the two survey methods

Household status on catastrophic health spending was probable to change between the two survey methods (Table 4). For example, when using 40% threshold of HCHE, in 2010/2011, 5.43% of households (656) were classified as having catastrophic health spending when using Method 1, but, when using Method 2, 41.46% (272) of them were no longer classified as having catastrophic health spending. Similarly, when using Method 2 for OOPS data from 2010/2011, 7.88% of households (953) had catastrophic health spending, but, when using Method 1, 59.71% (569) of them were no longer classified as having catastrophic health spending. In 2010/2011, results on HCHE status using alternative thresholds (10%, 20%, and 30%) or excluding households reporting only “costs on healthcare without details” remained unchanged (Supplementary Table C). For example, in 2010/11, when using Method 1, 12.12%, 8.14%, and 6.43% of households were identified as having HCHE using the thresholds of 10%, 20%, and 30%, respectively; when using Method 2, however, 54.40%, 50.41%, and 46.33% of these households, respectively, switched to having no HCHE.

Table 5 shows the effect of household socio-economic and demographic characteristics on the likelihood of no change in the HCHE status when using the two survey methods. Across the three sets of regression results generated from the 2005 EICV, 2010/2011 EICV and the pooled data of the two years, a household's size, income quintile, and the education level of the head-of-household had a significantly positive association with consistency of HCHE status. For example, in 2005, when compared to households in the lowest income quintile, households in the highest income quintile were about seven times more likely to have the same HCHE status when survey instruments were changed (odds ratio 7.98, 95% CI 4.93 to 12.94). Households with a head-of-household who had received secondary school education, vocational school education or more were 44 percent more likely to have the same HCHE status than households whose head-of-household had no schooling (odds ratio 1.44, 1.06 to 1.95). Having children under-five in a household was inversely associated with consistency of HCHE status (odds ratio 0.58, 0.45 to 0.75). When pooling the data of the two years, compared to households in 2005, households in 2010/2011 were more likely to have the same HCHE status when different survey methods were used (odds ratio 1.37, 1.19 to 1.57).

Regression results using alternative thresholds (10%, 20%, and 30%) or excluding the households only reporting "costs on healthcare without details" in 2010/2011 are presented in supplementary Table D. Similar to the results using the threshold of 40%, presented in Table 5, there was a positive association between a household's HCHE status and either its size, income quintile, or the education level of the head-of-household and an inverse association between its HCHE status and having children under age five.

4. Discussion

This study has two salient findings. First, survey design had a significant effect on estimating the level and trend of the HCHE in Rural Rwanda, and that this effect is not consistent over time: a health module with a shorter recall-period and fewer questions on the OOPS yielded a significantly higher estimate of percentage of the HCHE in 2005 and a significantly lower estimate in 2010/2011 than a consumption module with a longer recall period and more questions. Secondly, regression results provided evidence that the HCHE status for households with certain characteristics (in the lowest income quintile, or having children under age five, or head of households without education) are more likely to change than other households when survey instruments vary, suggesting the existence of differential item functioning in estimating percentage of HCHE.

The findings add new evidence to the confounding effects of survey design on estimating the HCHE, as presented in the previous studies. For example, our finding on HCHE in 2005 is consistent with a study in India (Raban et al., 2013) indicating health surveys with fewer questions generated a higher level of HCHE than did consumption surveys with more questions. It has been suggested that a health module primed the respondents to focus more on health events and related expenditure than did a consumption module (Lu et al., 2009). Meanwhile, more questions on OOPS have been found to lead to a higher level of HCHE in most of studied countries (Lu et al., 2009). In our 2005 results, the effect emanating from survey framing might be greater than the effect of number of questions. However, the 2010 health module generated lower estimate of HCHE than did the consumption module. This

could indicate that the effect of number of questions was greater in 2010, as the 2010/2011 survey used more questions in the consumption module than the 2005 survey (2 in 2010 vs. 1 in 2005 for inpatient care, and 18 in 2010 vs. 6 in 2005 for medicine and medical equipment). The present study clearly indicates that, when combining effects from recall period, survey framing, and number of questions, it is hard to predict which factor will have a dominant effect on the level of HCHE.

Why were the poorest households more likely to change their HCHE status and had higher percentage of HCHE when using the consumption module? We do not have direct evidence to answer this question, but suspect that a shorter recall period might be less capable than a longer period in capturing medical spending for the poorest households. If there was a medical need in a two-week period (health module), the poorest households might have difficulty gathering sufficient money to pay for care, especially during the non-harvest season, and would therefore have to forgo medical care. Thusly, these households would then not incur catastrophic health spending in these households. However in a 12-month period (consumption module), especially during the harvest season, the poorest households may have cash or have adopted various coping strategies (e.g. borrowing, selling land) to pay for medical care, and catastrophic health spending could then be incurred.

The present study further provides evidence that (1) the confounding effect exists in evaluating the progress of reducing the HCHE, and (2) policy recommendations towards reducing the HCHE may differ when using data derived from the two different survey methods: Method 1 would cause policy to focus on costs of medicine and equipment, and Method 2 would cause policy to focus on costs of outpatient care. Even though Method 2 had a greater number of questions than did Method 1 on medicine spending, the share of medicine spending in OOPS derived from Method 1 is significantly larger than that derived from Method 2, suggesting that recall period might have had a dominant effect on the estimation of medicine spending. In addition, analysis on household factors suggests a technical challenge exists in evaluating progress towards protecting the most vulnerable populations (the poorest households, households with under-five children, and heads without education) from catastrophic health spending.

Previous studies have proposed recommendations, such as standardizing survey instruments across countries (Lu et al., 2009; Saksena et al., 2014; Xu et al., 2009). In practice, however, it is difficult to implement such a proposal for two main reasons. Firstly, without existing evidence on which survey instrument generates estimates closest to the “true” expenditure, it is difficult to decide which should be adopted for standardization, and it would be troublesome to convince countries to adopt the proposed instrument. Secondly, as we have demonstrated, the effect of survey design is not consistent across countries¹⁵ or over time (in the present study), which suggests that interpreting survey effect in a one-directional manner is problematic, and a “one-size-fits-all” solution may not exist. Another proposed solution is to supplement the household survey data with data collected from health care provider side (such as conducting provider surveys that capture both charges and tax returns for health providers) (Lu et al., 2009; OECD et al., 2011). Here feasibility is again an issue, especially in low-income countries, due to poor accounting practices and the absence of effective health financial information tracking systems. In addition, at the household level, how to

match provider-side data to patient-side data and process validation requires technical solutions and capacity that might not be easily available in those countries.

Our study has the following limitations. Firstly, data used was collected from rural areas in Rwanda, which limited the generalizability of the results to other countries. Secondly, our study was not able to differentiate the effect of survey design resulting from recall period, survey framing, and number of questions, respectively. Future exploration will be needed.

As household surveys will continue to be the main data sources for measuring the HCHE, future studies may focus on developing statistical tools to mitigate survey effects, so as to improve the reliability and comparability of the HCHE estimates. The present study identified household factors that can be used to predict the consistency of HCHE status when survey instruments varied. This information will help us understand the response patterns to the variation of survey design for households with different socioeconomic backgrounds in Rwanda. Would these factors have the same predictive power in other countries? Or, do different countries have different predictors? Future studies on these questions will enable us to explore various statistical predicting algorithms to adjust the HCHE measures by accounting for differences in the survey instruments.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2017.02.001>.

Fig. 1.

Estimated average annual household out-of-pocket health spending (OOPS) (in 2010 RWF) in rural Rwanda using the two survey methods.^a

^aOOPS_m* = out-of-pocket health spending when using method *; OOPSdetailonly_m* = out-of-pocket health spending when using method * and excluding the households only reporting “costs on healthcare without details”.

Fig. 2.

Estimated share of each component in household out-of-pocket health spending (OOPS) in rural Rwanda using the two survey methods.^a

^aOOPS_m* = out-of-pocket health spending when using method *; OOPSdetailonly_m* = out-of-pocket health spending when using method * and excluding the households only reporting “costs on healthcare without details”.

Fig. 3.

Estimated level and trends of percentage of households with catastrophic health expenditure (HCHE) in rural Rwanda using the two survey methods.^a

^aHCHE_m* = proportion of households with catastrophic health expenditure when using method *; HCHEdetailonly_m* = proportion of households with catastrophic health expenditure when using method * and excluding the households only reporting “costs on healthcare without details”.

Households surveys using various survey instruments for household out-of-pocket health spending (OOPS) information.^a

Table 1

Country	Survey year	Survey name	Survey modules	Number of items	Recall period
Bulgaria	2001	LSMS	Health	Costs of consultation, treatment and drug for diseases, injury, and ailment	One month
China	2011	CHARLS	Consumption	Costs of outpatient and inpatient care, medicine, dental care, and optical equipment	12 months
			Health	Costs on outpatient services and self-treatment	One month
				Costs on inpatient services	12 months
			Consumption	Total medical costs	12 months
Ghana	1998	LSMS	Health	Costs on outpatient and inpatient care and medicine	Two weeks
				Costs on birth control	One month
				Costs on vaccine and pre/post-natal care	12 months
Guatemala	2000	LSMS	Consumption	Total costs on medical services	12 months
			Health	Costs on outpatient and inpatient care, medical exams, and medicine	One month
Jamaica	1989–2000 1993, 1994	LSMS	Health	Costs in public/private health facilities and on medicine	Four weeks
				Costs on hospitalization	12 months
Mexico	1989–2000 2005–06	ENSANut	Consumption	Costs on medicine and medical services	12 months
			Health	Costs on inpatient care	12 months
				Costs on outpatient care, medical exams, medicine, and others	Two weeks
Tanzania	2008	LSMS	Health	Medicine, tests, consultation, and inpatient fees	Four weeks
50 developing countries	2002–2003	WHS		Total costs on medical services	12 months
			Health	Costs on outpatient and inpatient care, medicine, dental, medical exams, medical products, and others	Four weeks
				Costs on hospitalization	11 months
Vietnam	1992	LSMS	Health	Costs on outpatient and inpatient care and medicine	Four weeks
				Total spending in health	12 months
				Cost on outpatient and inpatient care	12 months
				Total spending in medical care	Four weeks
	2002, 2004			Costs on outpatient and inpatient care, medicine, and health tools	12 months
				Total spending in health	12 months

^aLSMS: Living Standards Measurement Study (The World Bank Development Research Group, various years); CHARLS: China Health and Retirement Longitudinal Study (Zhao et al., 2013); ENSANut: Nacional de Salud y Nutrición 2005–2006 (México Instituto Nacional de Salud Pública, 2006); WHS: World Health Survey (WHO, 2003).

Table 2

Survey instruments on household out-of-pocket health spending (OOPS) in the EICV.

	EICV 2005 (n = 6900)	EICV 2010/2011 (n = 14,308)
Health module		
Outpatient care	2-week/1 question	2-week/1 question
Medical exams	2-week/1 question	2-week/1 question
Inpatient care	2-week/1 question	2-week/1 question
Medicine and medical equipment	2-week/1 question	2-week/1 question
Transportation	2-week/1 question	2-week/1 question
Costs on healthcare without details	NA	2-week/1 question
Vaccination	12-month/1 question	12-month/1 question
Consumption module		
Outpatient care	12-month/1 question	12-month/1 question
Medical exams	12-month/1 question	12-month/1 question
Inpatient care	12-month/1 question	12-month/2 questions
Medicine and medical equipment	10-month/6 questions	(12-month+4-week)/18 questions

Table 3Estimating the annualized OOPS with different survey instruments.^a

	EICV (2005)		EICV (2010/2011)	
	OOPS_m1 (2005)	OOPS_m2 (2005)	OOPS_m1 (2010/2011)	OOPS_m2 (2010/2011)
Health Module				
Outpatient care	2-week*26		2-week*26	
Medical exams	2-week*26		2-week*26	
Inpatient care	2-week*26		2-week*26	
Medicine and medical equipment	2-week*26		2-week*26	
Costs on healthcare without details	NA		2-week*26	
Transportation	2-week*26	2-week*26	2-week*26	2-week*26
Vaccination	12-month	12-month	12-month	12-month
Consumption Module				
Outpatient care		12-month		12-month
Medical exams		12-month		12-month
Inpatient care		12-month		12-month
Medicine and medical equipment		10-month*1.2		12-month + 4-week*13

^a m1 = Method 1, m2 = Method 2; 2-week = two-week recall period, 4-week = four-week recall period, 10-month = ten-month recall period, 12-month = 12-month recall period.

Table 4
Percentage of households with different HCHE status when using different survey methods.^a

Type	2005			2010/2011		
	N	Frequency	Percent	N	Frequency	Percent
HCHE_m1 = 1	5257	485	9.23	12,092	656	5.43
HCHE_m1 = 1, but HCHE_m2 = 0	485	303	62.47	656	272	41.46
HCHE_m2 = 1	5257	392	7.46	12,092	953	7.88
HCHE_m1 = 0, but HCHE_m2 = 1	392	210	53.57	953	569	59.71

^aN = total number of households; HCHE_m1 = proportion of households with catastrophic health expenditure when using method 1; HCHE_m2 = proportion of households with catastrophic health expenditure when using method 2.

Table 5

Multilevel logistic regression results for the consistency of the HCHE status when using the two survey methods in rural Rwanda.^a

	2005 (N = 5237)			2010/2011 (N = 12,040)			2005 + 2010/2011 (N = 17,277)		
	OR	(95% CI)	P Value	OR	(95% CI)	P Value	OR	(95% CI)	P Value
Head: age group <30 (reference)	1.00	(Ref)	–	1.00	(Ref)	–	1.00	(Ref)	–
Head: age group 30–40	0.69	(0.50,0.95)	0.023	1.07	(0.84,1.35)	0.586	0.92	(0.76,1.11)	0.383
Head: age group 40–50	0.67	(0.47,0.95)	0.023	1.25	(0.95,1.64)	0.111	0.99	(0.80,1.23)	0.937
Head: age group 50–60	0.94	(0.62,1.40)	0.745	1.29	(0.96,1.72)	0.093	1.15	(0.91,1.46)	0.235
Head: age group >60	0.66	(0.45,0.97)	0.035	1.17	(0.88,1.56)	0.285	0.96	(0.76,1.21)	0.747
Head: female	1.07	(0.84,1.36)	0.575	0.91	(0.76,1.09)	0.319	0.96	(0.83,1.11)	0.591
Head: no schooling (reference)	1.00	(Ref)	–	1.00	(Ref)	–	1.00	(Ref)	–
Head: primary school	1.08	(0.86,1.35)	0.504	1.17	(0.98,1.40)	0.083	1.12	(0.97,1.29)	0.115
Head: secondary/vocational school & above	1.44	(1.06,1.95)	0.019	1.69	(1.33,2.16)	0.000	1.62	(1.34,1.96)	0.000
Head: having health insurance	1.50	(1.21,1.86)	0.000	1.12	(0.95,1.31)	0.166	1.23	(1.08,1.39)	0.002
Income quintile 1 (reference)									
Income quintile 2	2.13	(1.66,2.73)	0.000	2.51	(2.08,3.03)	0.000	2.33	(2.00,2.70)	0.000
Income quintile 3	3.26	(2.45,4.32)	0.000	4.81	(3.84,6.03)	0.000	4.09	(3.43,4.88)	0.000
Income quintile 4	6.74	(4.67,9.72)	0.000	9.84	(7.39,13.09)	0.000	8.45	(6.75,10.58)	0.000
Income quintile 5	7.98	(4.93,12.94)	0.000	20.06	(12.83,31.37)	0.000	13.75	(9.92,19.07)	0.000
Household having child	0.58	(0.45,0.75)	0.000	0.59	(0.48,0.73)	0.000	0.58	(0.49,0.68)	0.000
Household having disabled people	0.82	(0.64,1.06)	0.128	0.88	(0.72,1.07)	0.189	0.85	(0.73,0.99)	0.042
Household size	1.18	(1.11,1.26)	0.000	1.23	(1.17,1.30)	0.000	1.21	(1.16,1.26)	0.000
Year 2005 (reference)							1.00	(Ref)	–
Year 2010/2011							1.37	(1.19,1.57)	0.000
Constant	2.80	(1.79,4.36)	0.000	1.83	(1.29,2.59)	0.001	1.77	(1.33,2.35)	0.000

^aN = sample size; OR = odds ratio; CI = confidence interval; HCHE = households with catastrophic health expenditure.