Health Equity Funds as the Pathway to Universal Coverage in Cambodia: Care Seeking and Financial Risk Protection

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Abstract

Cambodia has developed the Health Equity Fund (HEF) system to improve access to health services for the poor and this strengthens the health system toward the universal health coverage (UHC) goal. Given rising healthcare costs, Cambodia has introduced several innovations and accomplished considerable progress in improving access to health services and catastrophic health expenditures for the targeted population groups. Though this is improving in recent years, HEF households remain at higher risk of catastrophic spending as measured by the higher share of HEF households with catastrophic health expenses being at 6.9% compared to the non-HEF households of 5.5% in 2017. Poverty targeting poses another challenge for the health system. Nevertheless, HEF appeared to be more significantly associated with decreased OOPE among those who sought care from public providers. Increasing population and cost coverages of the HEF and effectively attracting beneficiaries to the public sector will further enhance the financial protection and pave the pathway towards universal coverage. Our recommendations focus on leveraging the HEF experience for expanding coverage and increasing equitable access, as well as strengthening the quality of health care services.

Key words: Financial risk protection, health care utilization, out-of-pocket expenditure, universal health coverage, health equity funds

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Introduction

While the health of Cambodia's population has improved significantly over the past two decades, challenges remain in achieving population health outcomes alongside ensuring financial risk protection. According to the World Health Organization (2019a), out-of-pocket expenditure (OOPE) remains high at approximately 60% of the country's 2016 total health expenditure. High OOPE increases the risk of household catastrophic health expenditure (CHE) and increases the risk of poverty while perpetuating existing poverty. This indicates the inadequacy of government's health spending and the protection afforded thereby. Given Cambodia's poverty rate of 13.5% as reported in 2014, and a significant share of population being vulnerable to impoverishment, there continues to be a need to improve financial risk protection for health care, especially among vulnerable groups (World Bank, 2017).

Recognising that user fees introduced in public health facilities in 1996 may create financial barriers to accessing care, the country implemented the Health Equity Fund (HEF) system in the early 2000s to provide financial coverage for essential health services and thereby, reduce barriers to access for the poor. The country's main social health protection scheme for the poor today, HEF finances user fee exemptions, OOPE for transport-related to seeking care, and other hospitalisation OOPE for its beneficiaries (Hardeman et al., 2004; Jacobs and Price, 2004, 2008; Jacobs et al., 2008, 2016, 2018; James et al., 2006). HEF was implemented in all public health facilities by 2015 (Nagpal et al., 2019). Its administration was transferred from a Non-Governmental Organisation (NGO)-supported implementer to an autonomous entity under the Ministry of Health (MOH) in 2017. The scheme's benefits are defined by a Minimum Package of Activities (MPA) at health centres and Complementary Package of Activities (CPA) at referral hospitals.

Before the HEF era, and after a prolonged period of fragility, the country faced a growing burden of chronic disease, limited health infrastructure, and poor staff performance, especially in remote areas (Annear, 1998). Only 25% of the population could access health services (Ministry of Health/WHO, 1995). Studies suggest that HEF led to improved access to health services for the poor and increased utilisation of public health facilities (Hardeman et al., 2004; Noirhomme et al., 2007; Annear et al., 2008, 2013, 2019). Flores

et al. (2013) estimated that HEF reduced OOPE among households by 35%; this effect was as much as 42% for poorer households and 57% for those mainly accessing public health care. Similarly, Ensor et al. (2017) found that HEF was associated with a decline of OOPE for the poor.

Despite these successes, more than 90% of HEF patients reported having experienced some form of OOPE for health in 2016 (Nagpal et al., 2019). Jacobs et al. (2018) indicated that a substantial proportion of the poor still use health care services at private facilities, where they incurred considerable OOPE. Though about 80% of HEF households were aware of their entitlement to free medical services at public facilities, half of both HEF and non-HEF households visited a private pharmacy and/or drug seller for health services in 2016 (Nagpal et al., 2019). While much OOPE among the poor may be accounted for by care seeking in the private sector, a study of care seeking behaviour and OOPE indicated that almost 70% of poor patients residing in rural areas seeking care from public facilities with the HEF coverage still pay, on average, 11.61 United States Dollar (USD) (Kolesar et al., 2019).

Despite HEF's financial support for the poor, households in the poorest wealth quintile have a higher chance of indebtedness due to treatment expenses for illness (Hanvoravongchai and Fernandes Antunes, 2011; Hanvoravongchai et al., 2014). Ir et al. (2019) also found that borrowing with interest to pay for healthcare costs is strongly associated with household poverty, including among HEF households. Nagpal et al. (2019) documented that both HEF and non-HEF households coped with financial shocks due to health care expenses primarily by using loans and savings, while some households received help from family or a friend, or used income from selling their land, property, or assets.

Asante et al. (2019) evaluated the benefits of health spending in the public sector and found that public money was generally allocated in favor of the poor. Nevertheless, similar to other such programs elsewhere in the world, HEF implementation struggles with 'leakage' to the non-poor – that is, some non-poor populations unexpectedly benefit from HEF (Tangcharoensathien et al., 2011). Having assessed household eligibility for HEF in one province in 2008, Ir et al. (2008) found that 26-43% of cardholder households were not eligible for HEF and that 44-57% of non-cardholders were eligible for HEF. In a more recent

study, Kolesar et al. (2019) showed that 36% of people under the national poverty line did not have access to HEF benefits, suggesting that HEF is not yet fully reaching its target population. A 'post-ID' system instituted under HEF partially addresses these errors of exclusion by allowing hospital-based processes to enroll eligible beneficiaries at the point of care, which is valid until the next round of enrolment (Nagpal et al, 2019).

This study aims to characterise the recent trends in health care seeking behaviours and financial risk protection by patterns in household OOPE in the population. Greater understanding into how HEF affects households based on OOPE across wealth thresholds could further elucidate the far-reaching impacts of HEF on the poor as well as the non-poor. In this study, we describe trends of healthcare utilisation, care seeking behaviour, and financial risk protection in Cambodia from 2004-2017. We also consider trends of HEF coverage, exclusion and inclusion errors, and CHE in HEF and non-HEF households for 2014-2017. We then evaluate the influence of HEF coverage across the distribution of OOPE per illness using quantile regression.

Data and Methods

Data sources

This study uses nationally representative household survey data from the Cambodia Socio-Economic Survey (CSES) 2014-2017 to analyse associations of patient utilisation, care seeking behaviour, and financial risk protection. HEF coverage information was available from 2014 onwards. To consider longer trends, we also used these indicators for CSES 2004 and 2009. The sample sizes were 15,000, 12,000, and 3,800 households for years 2004, 2009/2014, and 2015-2017, respectively. The basic descriptive characteristics of households and population are reported in Table A1 from Appendix.

Illness, care seeking, and health care utilisation by provider type in the last 30 days were self-reported. Types of provider include (a) public, (b) private, and (c) non-medical providers. Public providers included

national hospitals, provincial hospitals, district hospitals, health centres, and other designated public facilities. Private providers included private hospitals, private clinics, private pharmacies, and other private services. Non-medical providers referred to shops selling drugs, markets, traditional healers, and traditional birth attendants. CSES reports direct OOPE on transportation, medical products, and services per illness in the past 30 days. For this analysis, we aggregated OOPE at the household level to compute the household CHE.

Sample weights were applied for national estimations as well as those for specific cohorts. All monetary values were converted into real inflation-adjusted values in 2016 Cambodian riel (KHR); one USD is equivalent to 4,000 KHR. To measure poverty, this study used the national poverty line per person per month, equaling the 2016 monetary values of about 193,200 KHR (48 USD) for Phnom Penh, 132,500 KHR (33 USD) for other urban areas, and 106,600 KHR (27 USD) for rural areas. 'Poor' status is determined based on whether a household's per capita consumption was below the poverty line. The deflator series for household expenditure and poverty lines were derived from consumer price index data available from the World Bank's World Development Indicators.

Definition of key indicators

This study applied standard techniques for health equity and CHE analysis using household survey data (Xu et al., 2003, 2005; Xu, 2005; Wagstaff et al., 2011, 2018). OOPE includes spending related to transportation and all healthcare services, including doctor fees, hospital charges, and medical supplies. CHE is defined as health-related OOPE equal to or exceeding 40% of the household's capacity-to-pay (CTP). CTP is a proxy indicator for household disposable income calculated by deducting subsistence expenditures from total consumption. Therefore, we have:

$$CTP_i = EXP_i - SE_{45-55i^{th}}$$

where EXP_i is the total household consumption, and subsistence expenditure ($SE_{45-55i^{th}}$) is defined as the average food expenditure for all households whose share of food consumption is between the 45th and 55th

percentile. The subsistence expenditure was adjusted for household size according to a consumption equivalence scale (β) of 0.56:

$$eqsize = hhsize^{\beta},$$

where $eqsize$ is the number of consumption equivalents in the household and $hhsize$ is the actual household size. CTP is defined as the subsistence spending on average which is preferable than a household's total income or spending that is subject to random shocks. Detailed methodology for analysis of household catastrophic health expenditure is discussed in Xu et al. (2003, 2005), Xu (2005), Wagstaff et al. (2011, 2018), Hanvoravongchai and Fernandes Antunes (2011), and Hanvoravongchai et al. (2014).

HEF beneficiaries are defined as those households in possession of the Equity Card (i.e., IDPoor Card) or Priority Access Card (PAC). In this study, HEF coverage was defined at the household level, in accordance with HEF implementation. CSES collected information on HEF status beginning in 2014, thus our analyses comparing HEF and non-HEF populations are limited to information available between 2014 and 2017.

Descriptive analysis

Basic trends of key outcomes for population and study cohorts were estimated using sampling weights and take cluster sampling and stratification of the survey data into consideration. Descriptive analysis was conducted to understand patient utilisation and care seeking behaviour as well as OOPE with respect to the household CTP. This study evaluated HEF targeting using the identification of HEF coverage of households compared with their wealth quintile or poverty status. The exclusion error was quantified as the proportion of the poor or vulnerable population who were omitted from the HEF benefits despite they mostly need financial risk protection, and the inclusion error was quantified as the proportion of the HEF beneficiaries who were eligible for HEF benefits despite not being poor (Jacobs et al., 2007a, 2007b; Jacobs and Price, 2008).

Estimation and specification

In addition to descriptive analysis, this study applied quantile regression techniques to estimate the influence of HEF entitlement along the distribution of OOPE (Koenker and Bassett, 1978). The standard linear regression captures the relationship between a set of regressors and the outcome variable based on `the conditional mean function, but it provides only a partial view of the relationship on average. Quantile regression provides the capability to describe the relationship at different points in the distribution of the outcome variable. For example, one can consider the relationship between the HEF entitlement regressor and the OOPE outcome at different locations of the OOPE distribution, instead of looking at the average relationship of HEF to OOPE with the ordinary least squares (OLS) regression.

The conditional distribution of OOPE per illness controlled for other factors considered to be potential confounders of the relationship between OOPE per illness and HEF beneficiary status. These factors included age and sex of the sick household member, whether she or he had been sick for more than a year (i.e., chronic illness), whether she or he was hospitalised, type of provider last visited, household poverty status (i.e., poor vs. non-poor), rural residence, province, district, and year. The square of the individual's age was also included to control for the potential non-linear relationship between their age and OOPE for their illness.

Specifically, we evaluated the association of each of explanatory variable at every 0.05th percentile of the log of OOPE per illness. Estimated coefficients are obtained by characterising the conditional distribution by estimating a set of "representative" quantiles. We define a sick individual paying OOPE at the τ^{th} quantile of the reference distribution, if this individual person pays *more* than the proportion τ and *less* than the proportion (1-τ). The log of OOPE Y can be characterised by its distribution function, $F(Y) = \text{Prob}(Y \leq y)$ while for any 0<τ<1, $Q(\tau) = \inf\{y: F(y) \geq \tau\}$ is called the τ^{th} quantile of Y. Therefore, we can split the OOPE distribution into proportions τ below and (1-τ) above, such that $F(Y_\tau) = \tau$ and $Y_\tau = F^{-1}(\tau)$. The quantile regression estimator for quantile τ minimises the objective function:

$$Q(\beta_\tau) = \sum_{i:Y_i \geq X_i'\beta}^{N} \tau|Y_i - X_i'\beta_\tau| + \sum_{i:Y_i < X_i'\beta}^{N} (1-\tau)|Y_i - X_i'\beta_\tau|$$

The quantile regression method is especially useful when the effect of covariates on OOPE per illness differs for each quantile of the conditional OOPE distribution. This approach may better characterise who is impacted by HEF entitlement and to what degree rather than expressing the average effect of the scheme across the whole population.

These regression quantile estimates can convey information on OOPE differentials arising from non-observable characteristics among sick HEF beneficiaries who are otherwise observationally equivalent to sick individuals without HEF coverage. By using quantile regression, we can determine if sick HEF beneficiaries that rank in different positions across the conditional OOPE distribution (e.g., sick individuals that pay higher and lower OOPE per illness than predicted by observable characteristics) experience different OOPE per illness in comparison to sick individuals not covered by HEF. The robust covariance matrix used for the inferential statistics in this study is calculated following techniques described in Powell (1984), Chamberlain (1994), and Angrist et al. (2006).

We summarise the estimated effect of HEF on OOPE per illness from the quantile regression by predicting the conditional expenditure distribution with and without HEF at every τ^{th} quantile of OOPE. First, we derive the total OOPE per illness from the fitted regression values of the quantile regression at every τ^{th} quantile, conditional on the observed average characteristics including the HEF participation. Then, the estimated impacts are evaluated by the amount covered under HEF using the estimated coefficients of whether patients are from a HEF household across the expenditure distribution. The actual OOPE per illness after the HEF coverage are calculated by deducting the amount covered by HEF from the total OOPE per illness at every τ^{th} quantile. Using this procedure, we determine the total OOPE per illness episode, the amount covered by HEF, and the actual OOPE per illness under HEF coverage, ceteris paribus. We conducted this calculation for two patient populations: (i) all patients who sought care from any provider

types and (ii) patients who visited the public facilities. These simulation scenarios illustrate how HEF associates with OOPE per illness for each τ^{th} quantile of the expenditure distribution. For comparison, we also report the OLS regression estimations to describe the average relationships.

Results

HEF coverage

Between 2014 and 2017, some well-off households received HEF benefits. About 7% of the upper 60% of households or about 4% of the richest wealth quintile self-reported that they were eligible for free or subsidised healthcare services under the HEF coverage, as shown in Figure 1. On the other hand, those in vulnerable groups reported lack of HEF coverage. Only about 26% and 17% of households in the poorest and second poorest quintiles reported being covered by HEF in 2017.

[Figure 1]

Over time, the country has made progress in its targeting systems for providing HEF coverage to poor households. The fraction of poor households covered by HEF increased from 20% in 2014 to 27% in 2017. The poorest provinces tended to have a greater proportion of HEF beneficiaries. However, there are provinces in which many poor households reported to not be covered by HEF, such as Phnom Penh, Kandal, Kampon Speu, Banteay Meanchey, Siem Reap, Preah Vihear, and Stung Treng. Figure A2 in Appendix illustrates the HEF coverage in poor and bottom 40% population maps by province.

Health care seeking behaviour and OOPE per illness

The proportion of households reporting sickness in the last 30 days decreased from 19% in 2004 to 15% in 2017. For more than a decade, about 30% of children under 5 years of age and 40% of the elderly (aged ≥60 years) reported having any form of sickness. Among sick individuals, chronic illness increased with age. About 50% of the sick elders reported having this illness for more than one year.

HEF households tended to seek care more than non-HEF households. The difference was small but statistically significant at 95% confidence level: 90% vs. 92% in 2014 and 95% vs. 99% in 2017 for non-HEF and HEF households, respectively. These figures represent substantial increases in the sick population seeking health care from formal medical facilities as well as non-medical care providers such as drug stores, pharmacies, and traditional healers from 66% in 2004 to 96% in 2017 (Table 1). Correspondingly, the use of non-medical providers in Cambodia declined significantly from 21% in 2004 to 3% in 2017, implying that about 97% of current utilisation was using qualified health professionals by 2017.

Utilisation of public providers was steady between 2004 and 2017, at about 20%. The use of private providers increased from about 60% in 2004 to 75% in 2017. The main driver was a rise in the utilisation of private pharmacies from 16% in 2004 to 35% in 2017. The use of public providers among HEF households was still higher than among non-HEF households in 2017, i.e. 29% vs. 20%, respectively.

The inflation-adjusted OOPE per illness rose over the study period. Private spending on health services increased significantly per illness, from 71,000 KHR (18 USD) in 2004 to 149,000 KHR (37 USD) in 2017, corresponding to an average annual growth of 5%. However, the average OOPE in HEF households with sick members decreased by -3% annually – from 105,000 KHR (26 USD) in 2004 to 69,000 KHR (17 USD) in 2017. HEF households also had lower OOPE per illness compared to the national average or non-HEF households. The differences in OOPE per illness between HEF and non-HEF households with sick members increased from 26,000 KHR (6 USD) in 2014 to 94,000 KHR (23 USD) in 2017. Between 2014 and 2017, the average of OOPE per illness for transportation of the entire sample increased by more than 10%, from 14,000 KHR (3.6 USD) in 2014 to 15,500 KHR (3.9 USD) in 2017. However, the average OOPE per illness spent on transportation among HEF households decreased by 12% per year over the same period.

Catastrophic health expenditure in households

The national average share of OOPE to total household consumption remained steady, around 4% since 2004. Between 2014 and 2017, while the share of OOPE for the non-HEF households was steady at 4.4%,

the share of OOPE for HEF households decreased from 6.3% in 2014 to 4.6% (Table 1). Among HEF households with sick members, CHE incidence decreased significantly from 11% of households in 2014 to 7% in 2017 (Table 1). Furthermore, 14% and 4% of HEF households which their OOPE equal or exceed 10% and 25% of total consumption in 2017, respectively.

[Table 1]

Table 2 reports OOPE per illness episode for outpatient and inpatient treatments by HEF coverage status, pooled across the years 2014 to 2017 due to small sample size for inpatient care among HEF households. OOPE spent on transportation was statistically similar among HEF and non-HEF households for both outpatient and inpatient treatments. However, OOPE for health care services between HEF and non-HEF households were statistically different. The difference in outpatient OOPE between HEF and non-HEF households was 38,000 KHR (9.50 USD). The difference in the inpatient OOPE was 768,000 KHR (192 USD).

[Table 2]

Despite HEF coverage, beneficiaries continued to pay OOPE, even if they sought care from public providers. Compared with non-HEF beneficiaries, the average OOPE per illness for HEF beneficiaries was generally lower (Figure 2). However, there was no statistically significant difference in OOPE for private providers between HEF and non-HEF beneficiaries. This suggests that HEF households were still subjected to private healthcare spending, especially as 70% of care was sought through private providers among HEF beneficiaries. The reason for lower OOPE spent on private providers compared to public providers is that private provider utilisation primarily occurred at pharmacies and stores. Figure A3 illustrates that there are no distributional differences in OOPE for private providers and non-medical providers between HEF and non-HEF beneficiaries.

[Figure 2]

Results from the OLS regression (Appendix, Tables A2-A3) using individual-level data of those who were sick and seek health care suggested that HEF status was associated with a 25% lower OOPE on average. OOPE per illness was 72% higher for those with chronic illness or sick for more than a year. Quantile regressions estimations showed that the association between HEF coverage and OOPE was larger for those with lower expenditure per illness, e.g. compared the 25th with 50th or 75th quantiles. This implies that HEF coverage significantly removed CHE proportionally for the basic or primary care treatments with lower medical expenditure especially in public health centres.

When considering only sick individuals who sought care from public providers, the impacts from HEF were significantly larger. Chronic illness and OOPE were less associated when seeking care from the public sector, though hospitalisation was similarly associated with OOPE. HEF entitlement was differentially associated with different levels of OOPE. Differences in OOPE between those with and without HEF coverage were greatest for individuals in the lowest OOPE quantiles, varying from the 34% in the 10th quantile to 11% in the 90th quantile (Figure 3a). This suggests that HEF members benefit most when health care-related charges remain low, but that HEF fails to provide the same degree of financial protection if charges are high or accrue over time. When considering only individuals who seek care from public providers (Figure 3b), the association with HEF in each quantile of the OOPE distribution is higher compared to that represented in Figure 3(a). Differences in OOPE on public providers varied from 87% at the 10th quantile to 18% at the 90th quantile.

[Figure 3]

Examining OOPE per illness at different levels of the reference distribution show that, after deducting the estimated amount covered under HEF, OOPE remained high (Figure 4). Among those who sought care from any provider categories, total OOPE per illness ranged from 14,000 KHR (4 USD) at the 10th quantile to 70,000 KHR (17 USD) at the median (50th quantile) to 390,000 KHR (97 USD) at the 90th quantile. HEF covered a 5,000 KHR (1 USD) at the 10th quantile to 17,000 KHR (4 USD) at the median to 44,000 KHR (11 USD) at the 90th quantile reduction in total OOPE.

HEF appeared to be more significantly associated with decreased OOPE among those who sought care from public providers. However, amounts of OOPE per illness among those who visited public providers were higher than among all sick individuals seeking care from any provider types, including private pharmacies. The total OOPE per illness of those who visited public providers was estimated to be between 20,000 KHR (5 USD) at the 10th quantile to 108,000 KHR (27 USD) at the median (50th quantile) to 578,000 KHR (144 USD) at the 90th quantile. Among those who sought care from public providers, HEF coverage was associated with a reduction in OOPE by an average of 18,000 KHR (4 USD) at the 10th quantile to 59,000 KHR (15 USD) at the median to 103,000 KHR (26 USD) at the 90th quantile reduction in total OOPE.

[Figure 4]

Discussion

We considered trends in health care seeking behaviours and applied standard techniques for health equity and catastrophic expenditure analysis to update the knowledge on the Cambodia's progress, and identify some remaining challenges for HEF. Over the entire study period, Cambodia made considerable progress in improving access to health care among the poor population, narrowing the gap in utilisation between poor and rich households, and reducing utilisation of informal, untrained providers. Evaluating the differences in OOPE per illness between patients *with* and *without* HEF coverage at different OOPE levels show that HEF mainly covered expenditures for the basic or primary care treatments due to the lower medical costs associated with such services. However, households' uncovered OOPE per illness for more expensive health care services remained high despite having HEF coverage, even for those beneficiaries who seek care from public facilities.

Our study confirms previous findings from Annear et al. (2019) that HEF reduces households' financial risk, which implies improved access to public providers for the poor. However, our findings do not indicate that HEF increased utilisation of public services in 2014-2017. We also confirm previous results that utilisation in public facilities of HEF beneficiaries during 2014-2017 was not much higher than among the

non-HEF population, and that a high proportion of the poor choose private providers (Jacobs et al., 2018; Korachais et al. 2019; Nagpal et al. 2019).

HEF beneficiary households are at risk of CHE, and the inclusion and exclusion gaps in HEF coverage continue to be a challenge, further highlighting the importance to strengthen the post-ID mechanism. These findings also point to the importance of investments in achieving universal coverage, either via HEF or other means, to reach the poorest and other vulnerable groups most efficiently and effectively. Specifically, the immediate solution is to attract the poor to public providers and guarantee that they will receive health services of an appropriate quality for free, especially at the hospital level.

HEF is associated with a greater reduction in percentage points for OOPE among those with lower OOPE. However, about 7% of HEF households still incurred CHE. The OOPE share of CTP was higher for HEF households at almost 10% of CTP. This highlights the persistent financial difficulties of those experiencing high OOPE on health despite HEF coverage, and this possibly reflects limited *de facto* service availability at the facility level, or the need to update what is expected to be provided by the public health facilities under the benefit package. Furthermore, OOPE per illness of those HEF beneficiaries visiting public providers was higher than of those who seek care from other provider categories. One possible explanation is the high utilisation of private pharmacies which may also be for lower levels of severity, which tend to be less expensive and where expenses are not covered by HEF. Korachais et al (2019) argued that HEF only increased the poor's utilisation of nearby public health centres. Nevertheless, the patients covered under HEF were more likely to seek care from public providers, and this may be the critical factor in providing some level of financial risk protection.

Despite increased likelihood of seeking care in the public sector, this study also highlights persistently high utilisation of private providers among HEF households, especially pharmacies and clinics which treat minor injuries and illnesses. This supports previous findings that the primary reason for not seeking care from a health facility is perceived low severity of illness, given the possible opportunity costs to seek care (Nagpal et al., 2019). One potential driver of high utilisation of private providers among HEF households may be

limited service availability at public providers, reflecting a constraint of the health system. In particular, service availability for non-communicable diseases may be an important factor, given that these diseases are widely prevalent (Oum et al., 2010; World Health Organization, 2014; IHME, 2020) and yet have very limited availability at the health center level, though this situation is expected to improve in the near future (World Bank, 2018).

Limitations

First, this analysis relies on the descriptive approaches, including quantile regression. Therefore, the interpretation of results requires understanding of the country context and does not imply causality.

This study includes within the OOPE measure funds spent on transportation related to health care seeking. This allows for comparability with the findings of Flores et al. (2013) and reflects that HEF benefits also cover transport costs. However, this limits interpretation of findings, as Table 1 suggests that poor people tend to spend very little on transport.

A further limitation of this study is the comparison of HEF beneficiaries and non-HEF beneficiaries in the general population, rather than non-HEF beneficiaries who have similar socioeconomic status and should be HEF-eligible. However, this aligns with existing literature. Two previous studies compared HEF and non-HEF beneficiaries: Ir et al. (2019) provided an analysis comparing HEF-entitled households and households without HEF entitlement on distress health financing. Flores et al. (2013) directly included a dummy variable of HEF coverage in the regression analysis. However, we recognise that these populations may be different in ways not fully captured by analyses comparing HEF beneficiaries to the 'near-poor', who are not covered by HEF.

This study does not provide a complete picture as the incidence of impoverishment and depth of poverty to monitor healthcare-related financial hardship are not provided. Furthermore, we do not conduct analysis on probabilities of healthcare seeking or public providers consultations among sick individuals as they are also not directly aligned with the scope of this study.

In addition, the CSES data is not a survey designed specifically for health or health system analysis. Therefore, interpretations are subject to the definition of questions and may not necessarily provide a comprehensive description of the health system.

We find discrepancies between CSES indicators of HEF coverage and those available in administrative data: the CSES indicates 12% of population was covered by HEF in 2017, while administrative data showed 19% (Jacobs et al., 2018). Annear et al. (2015) also noted that HEF achieved 16% coverage of the total population in 2013, also higher than 10% of population from CSES 2014. One explanation for these differences is that the CSES defines HEF coverage by whether households physically possess the Equity Card (i.e., IDPoor Card) or Priority Access Card while the administrative data also includes patients who have received a subsequent 'post-ID' coverage. Another possible reason for these differences is that CSES excludes people living in institutional households (e.g., boarding houses, military barracks, prisons, student dormitories, etc.), homeless households, boat population households, and transient households.

The -212% difference of OOPE per illness in inpatient treatments for HEF households (Table 2) requires careful interpretation. Our empirical analysis indicates the extent to which HEF has assisted poor people from an inpatient sickness episode. However, we do not have information on the service coverage to identify whether HEF benefits provide an equal level of service for non-HEF patients.

Finally, it is worth noting that our analysis on OOPE does not presume to provide a proxy measure by which to evaluate HEF performance. The intention of HEF is to remove user fees at government facilities, not necessarily to eliminate OOPE, which requires broader health system policy and context considerations covered in the National Health Strategic Plan 2016-2020 and the National Social Protection Framework 2016-2025. Instead, our study seeks to understand the nuanced impacts of HEF implementation given different levels of OOPE for health services across the population.

Policy implications

Our findings suggest that more attention and investment may need to be dedicated to tackling challenges of the national health care financing system for a stronger public health sector and to build a solid foundation for the national UHC agenda (see also Kruk, 2013).

Encouraging HEF-funded utilisation of services in the public sector may also require ensuring appropriate quality of care at public providers and improved availability of essential services, including for non-communicable diseases, given that chronic diseases have been associated with a much higher OOPE. Research from around the world suggests that perceived quality of care among patients has an effect on health care utilisation patterns and the decision to seek care from public facilities; higher quality primary facilities have been associated with higher utilisation (Kruk et al. 2018).

Previous studies have identified quality of care and access as challenges. Fernandes Antunes et al. (2018) suggested that more public resources need to be devoted to increasing the quality of care and degree of financial risk protection, particularly in rural areas, in Cambodia. Jacobs et al. (2018) recommended efforts to attract vulnerable households to public services under improved HEF arrangements. Their study found that, when HEF included hospital and health centre services and was complemented by added interventions, the scheme attracted HEF beneficiaries to use public services and lowered their OOPE (Jacobs et al., 2018). Jacobs et al. (2012) also suggested to address demand-side and supply-side barriers concurrently and that the country must provide a combination of interventions to tackle specific access barriers. In addition, Jacobs et al. (2020) suggested enhancing access to free health care at the health centres by engaging a wide range of accountable community representatives.

This study shows that the current level of protection from the HEF scheme is a good start but by itself would not be sufficient for Cambodia to achieve UHC. For instance, sick individuals with HEF benefits still have to pay some level of OOPE for hospitalisation in public hospitals. Indeed, Cambodia's government views HEF as only a first and partial step toward UHC. Subsequent efforts could expand coverage to provide

more comprehensive and effective protection that prioritises the poor (Ir et al., 2019). Public health spending currently comprises only about 20% of the country's total health expenditure. There are opportunities to increase the public share of health spending and allocate the budget strategically to improve the quality of health services at all levels of the health system (Asante et al., 2019).

In addition, the current targeting approach for HEF could be improved, e.g., with a mix of universal eligibility and a considered degree of targeting to provide greater benefits for poorer people (Ravallion, 2016). The government's recent efforts to expand HEF to non-formal workers is, therefore, an important step in the right direction (Kwon and Keo, 2019; World Health Organization, 2019b).

Conclusions

Although HEF provides important benefits to Cambodia's poor, there remain persisting challenges such as gaps in financial risk protection, low utilisation, and deficient targeting. These issues could be addressed in various ways, e.g., by revising the benefit package, improving the quality of care at public facilities, and reconsidering the current approach to targeting. As one important ingredient of Cambodia's broader commitment to UHC, HEF can continue to be used for expanding coverage and increasing equitable access, as well as strengthening the quality of health care services.

Key messages

- HEF implementation in Cambodia is associated with improved access to public health services and lower catastrophic health expenditures among HEF beneficiary households between 2014 and 2017.
- However, there remain issues with gaps in financial risk protection, low utilization of public providers, and deficient targeting.
- Policy efforts should focus on expanding HEF coverage for non-communicable diseases and increasing equitable access, such as expanding to non-formal workers, as well as strengthening the quality of public health care services.

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Table 1: Key outcome indicators by HEF/non-HEF coverage

	2004	2009	2014	2015	2016	2017
Health care seeking behaviour (if sick)						
CAMBODIA	66.2%	93.2%	90.2%	95.5%	93.2%	95.8%
Non-HEF households	n.a.	n.a.	90.0%	95.4%	92.7%	95.4%
HEF households	n.a.	n.a.	91.9%	96.0%	95.6%	98.5%
Difference (%)	n.a.	n.a.	1.9% **	0.5%	2.9%	3.1% **
Transportation cost per illness [KHR]						
CAMBODIA	n.a.	9,559	14,431	16,584	10,780	15,517
Non-HEF households	n.a.	n.a.	14,258	17,241	11,412	16,414
HEF households	n.a.	n.a.	15,550	13,177	7,603	10,467
Difference	n.a.	n.a.	1,292	-4,063	-3,809**	-5,947
Health care cost per illness [KHR]						
CAMBODIA	71,331	81,375	127,683	172,471	167,277	148,600
Non-HEF households	n.a.	n.a.	131,130	184,119	185,136	162,664
HEF households	n.a.	n.a.	105,364	111,999	77,404	69,023
Difference	n.a.	n.a.	-25,767**	-72,120	-107,733	-93,641*
Out-of-pocket expenditure (OOPE) share of total household consumption expenditure						
CAMBODIA	3.7%	4.8%	4.5%	4.7%	4.6%	4.4%
Non-HEF households	n.a.	n.a.	4.4%	4.5%	4.4%	4.4%
HEF households	n.a.	n.a.	6.3%	6.0%	5.9%	4.6%
Difference (%)	n.a.	n.a.	1.9% ***	1.5% **	1.4% ***	0.2% *
OOPE share of capacity-to-pay (CTP)						
CAMBODIA	7.2%	12.7%	8.7%	8.7%	8.4%	8.2%
Non-HEF households	n.a.	n.a.	8.2%	8.1%	7.9%	8.0%
HEF households	n.a.	n.a.	13.0%	13.0%	12.5%	9.7%
Difference (%)	n.a.	n.a.	4.8% ***	4.9% ***	4.6% ***	1.7% ***
% households with catastrophic health expenditure (CHE)						
CAMBODIA	6.0%	7.8%	6.4%	6.2%	5.1%	5.6%
Non-HEF households	n.a.	n.a.	5.8%	5.8%	4.9%	5.5%

	2004	2009	2014	2015	2016	2017
HEF households	n.a.	n.a.	10.9%	9.2%	6.7%	6.9%
Difference (%)	n.a.	n.a.	5% ***	3.4% **	1.8% ***	1.5% ***
% of households with share of OOPE equal or exceed 10% of total household consumption expenditure						
CAMBODIA	10.7%	11.3%	13.4%	14.1%	13.9%	14.0%
Non-HEF households	n.a.	n.a.	12.7%	13.6%	13.6%	13.6%
HEF households	n.a.	n.a.	19.8%	16.9%	16.4%	17.1%
Difference (%)	n.a.	n.a.	7.1% ***	3.3% *	2.9% ***	3.5% ***
% of households with share of OOPE equal or exceed 25% of total household consumption expenditure						
CAMBODIA	4.4%	4.5%	4.7%	4.8%	4.3%	3.8%
Non-HEF households	n.a.	n.a.	4.4%	4.6%	4.2%	3.9%
HEF households	n.a.	n.a.	7.1%	6.5%	4.9%	3.5%
Difference (%)	n.a.	n.a.	2.7% ***	1.9%	0.6% **	-0.4%

Source: CSES 2004-2017

* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Note: 1 USD = 4,000 KHR. CHE is defined as health-related OOPE equal to or exceeding 40% of the household's CTP.

Table 2: Out-of-pocket expenditure (OOPE) per illness episode by HEF/non-HEF and OPD/IPD (KHR)

	Households		*Difference (non-HEF vs. HEF)*	
	Non-HEF	HEF	absolute	relative
Outpatient treatments				
Transportation	9,039	7,338	1,702	23%
Health care	109,137	71,108	38,029**	53%
Inpatient treatments				
Transportation	110,149	71,539	38,610	54%
Health care	1,131,151	362,865	768,286***	212%

Source: Pool data of CSES 2014-2017

* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Note: 1 USD = 4,000 KHR

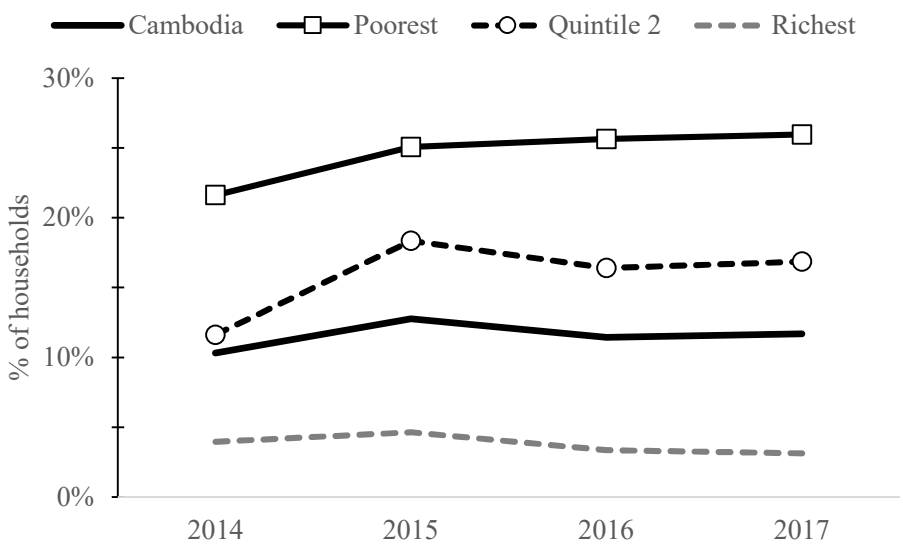


Figure 1: HEF beneficiary households by wealth quintile, 2014-2017

Source: CSES 2014-2017

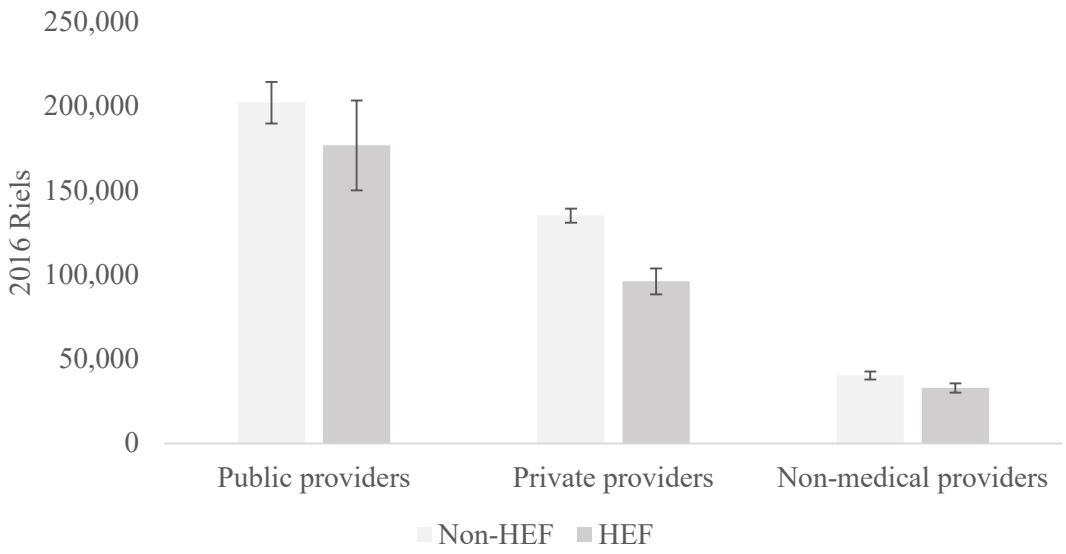
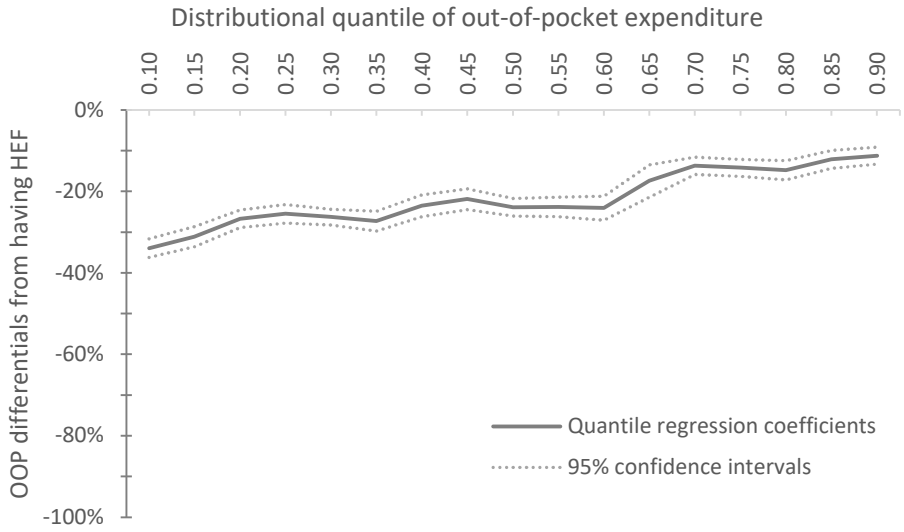


Figure 2: Mean out-of-pocket expenditure per illness by health provider and HEF coverage

Source: CSES 2014-2017

The conditional means are from the fitted normal regression with model setting as in Table A2 in Appendix.

(a) All sick individuals who seek care



(b) Only sick individuals who visited public providers

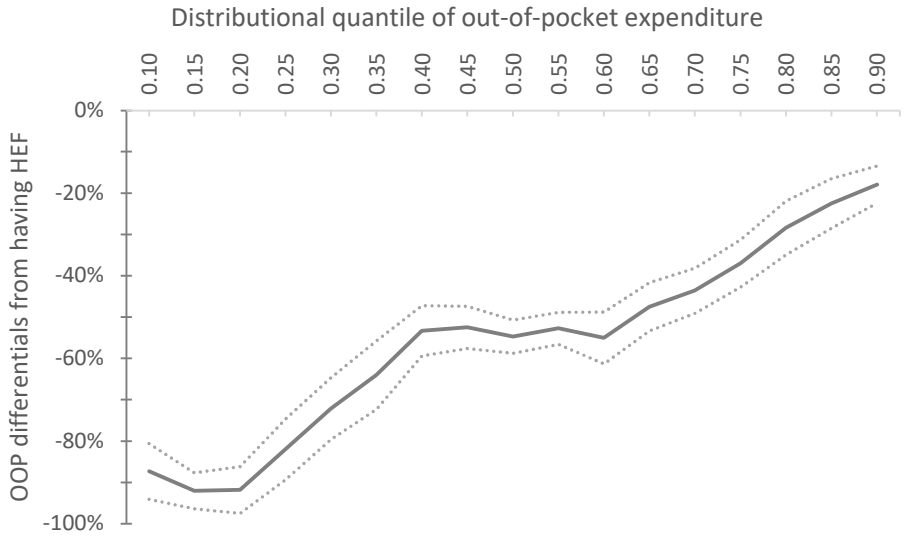
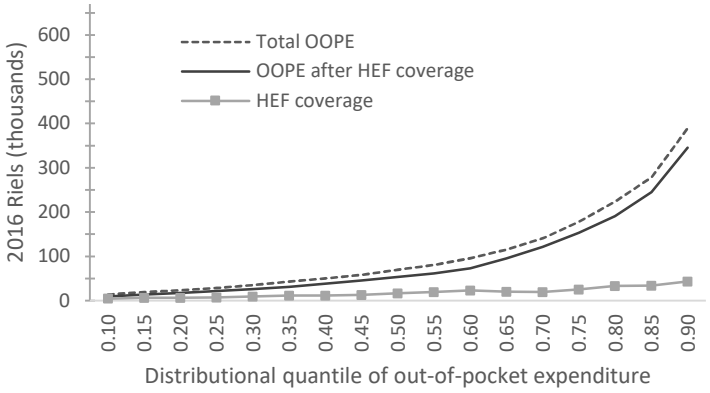


Figure 3: Differences in OOPE per illness between HEF and non-HEF beneficiaries across the OOPE distribution

Source: CSES 2014-2017

Conditional quantile regression's estimated coefficients (solid) and their associated 95% confidence intervals (dotted) at every 5 percentiles are plotted. The full models for the quantile regression for the 0.25th, 0.50th, and 0.75th quantiles are reported in the Appendix (Tables A2 and A3).

(a) All sick individuals who seek care



(b) Only sick individuals who visited the public providers

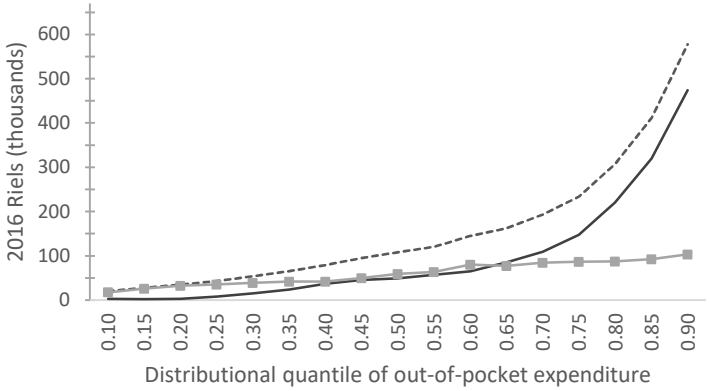


Figure 4: Estimated OOPE per illness with HEF coverage

Source: CSES 2014-2017

The total out-of-pocket expenditure (OOPE) per illness is the fitted regression values obtained from the conditional quantile regression at every 5 percentiles of the OOPE distribution. The OOPE after the HEF coverage are derived from the HEF coverage's estimated quantile regression coefficients.

Appendix

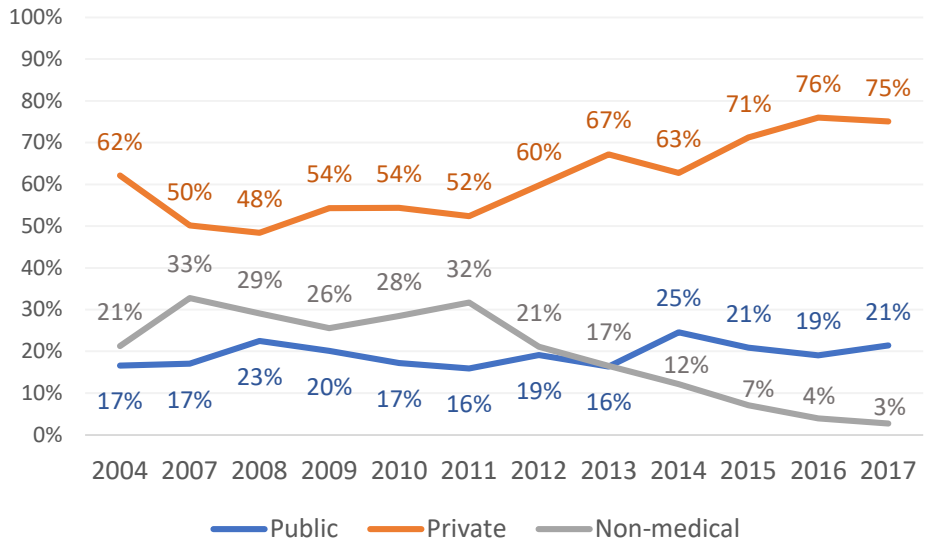
Supplementary Table A1: Summary data from the CSES surveys

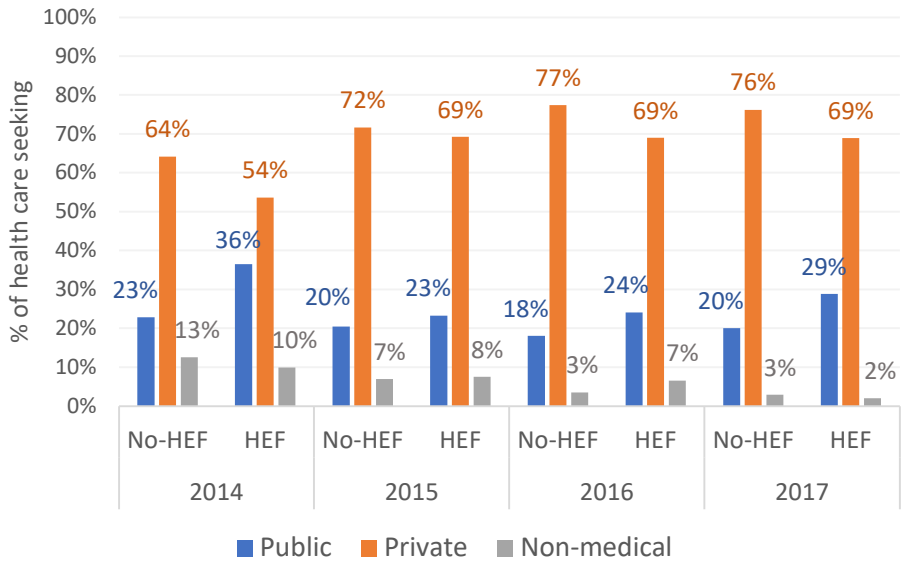
	2004	2009	2014	2015	2016	2017
Individual characteristics						
% of aged						
0-5	11.9%	12.1%	11.0%	10.8%	10.8%	10.5%
6-15	26.9%	22.6%	20.1%	20.4%	19.0%	19.5%
15-60	55.5%	59.1%	61.2%	60.6%	61.5%	61.2%
60+	5.7%	6.3%	7.7%	8.2%	8.6%	8.9%
Household characteristics						
% of households with HEF coverage	n.a.	n.a.	10.3%	12.8%	11.4%	11.7%
% of households in the capital	8.4%	9.4%	11.4%	12.5%	11.1%	10.9%
% of households in other urban areas	10.5%	9.7%	11.4%	11.0%	11.2%	10.8%
% of households in other rural areas	81.2%	81.0%	77.2%	76.6%	77.7%	78.3%
Average household size	4.93	4.78	4.46	4.49	4.38	4.40
% of head of household's education						
No education	30.2%	25.0%	22.7%	20.5%	16.3%	18.6%
Below primary	35.9%	36.8%	35.7%	39.4%	40.4%	39.1%
Primary	20.6%	22.9%	22.9%	22.3%	23.2%	22.4%
Lower secondary	8.8%	9.9%	10.6%	10.7%	11.5%	11.7%
Upper secondary	4.0%	4.3%	5.8%	4.6%	6.0%	5.8%
Bachelor or higher	0.5%	1.2%	2.2%	2.6%	2.7%	2.5%
% of head of household's sector						
Not working	12.2%	9.8%	11.9%	14.4%	11.8%	11.4%
Agriculture	50.9%	53.1%	46.0%	43.0%	40.7%	42.7%
Manufacturing	10.1%	11.5%	14.1%	14.3%	16.0%	16.0%
Services	26.9%	25.7%	28.1%	28.3%	31.5%	30.0%
% of head of household's employment status						

	2004	2009	2014	2015	2016	2017
Employee	23.5%	25.2%	34.1%	36.6%	37.8%	38.0%
Employer	0.2%	0.3%	0.2%	0.2%	0.1%	0.2%
Own account worker	72.3%	73.6%	65.4%	62.9%	61.9%	61.6%
Unpaid family worker	3.1%	0.8%	0.3%	0.3%	0.2%	0.1%
Others	0.9%	0.1%	0.1%	0.0%	0.0%	0.0%
Number of household observations	14,984	11,971	12,090	3,839	3,839	3,840
Number of individual observations	74,735	57,105	54,013	17,304	16,989	16,909

Source: CSES 2004-2017

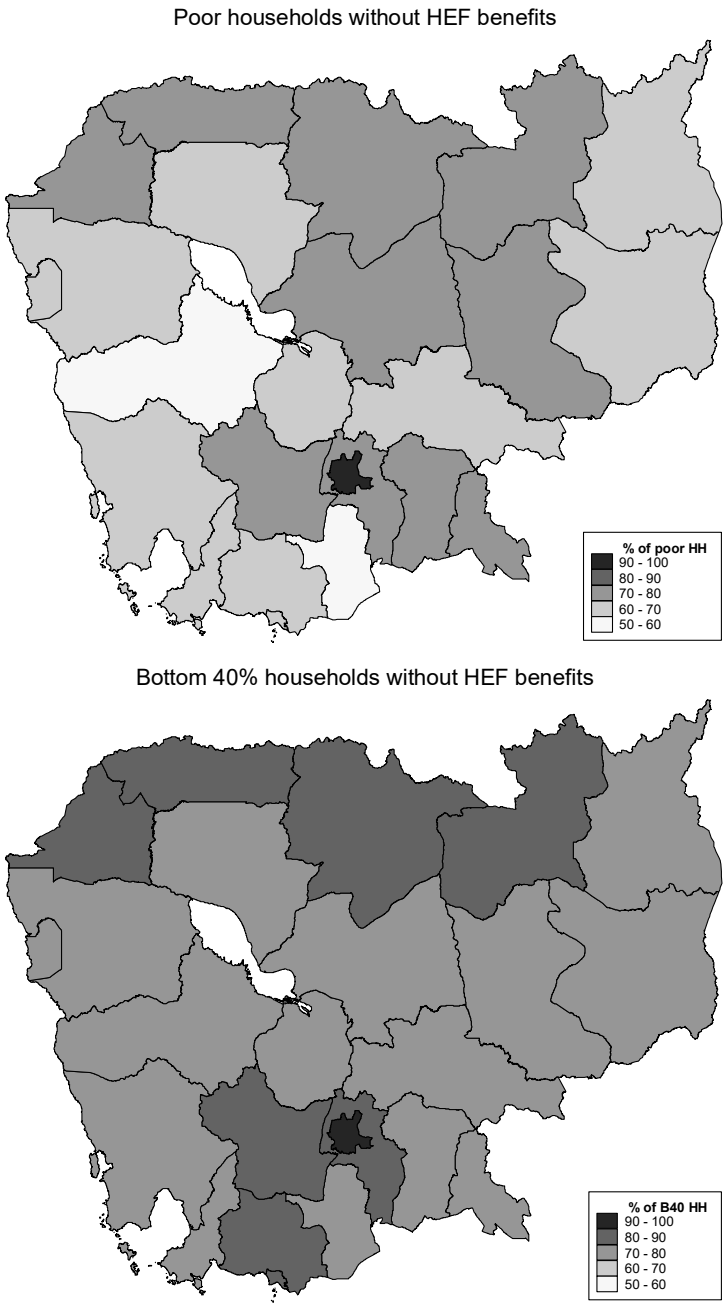
Note: This table reports descriptive characteristics which reveals that HEF coverage has been steady at around 10-13% of households between 2014 and 2017. In 2017, most households were still in rural areas, 80% of heads of households had education at primary level or lower, 43% of household heads worked in the agricultural sector, and more than 60% engaged in informal or self-employment. The predominance of low education levels, agricultural work, and informal employment implies that many households remain financially vulnerable to any natural or economic shocks including risk of catastrophic health expenditure.





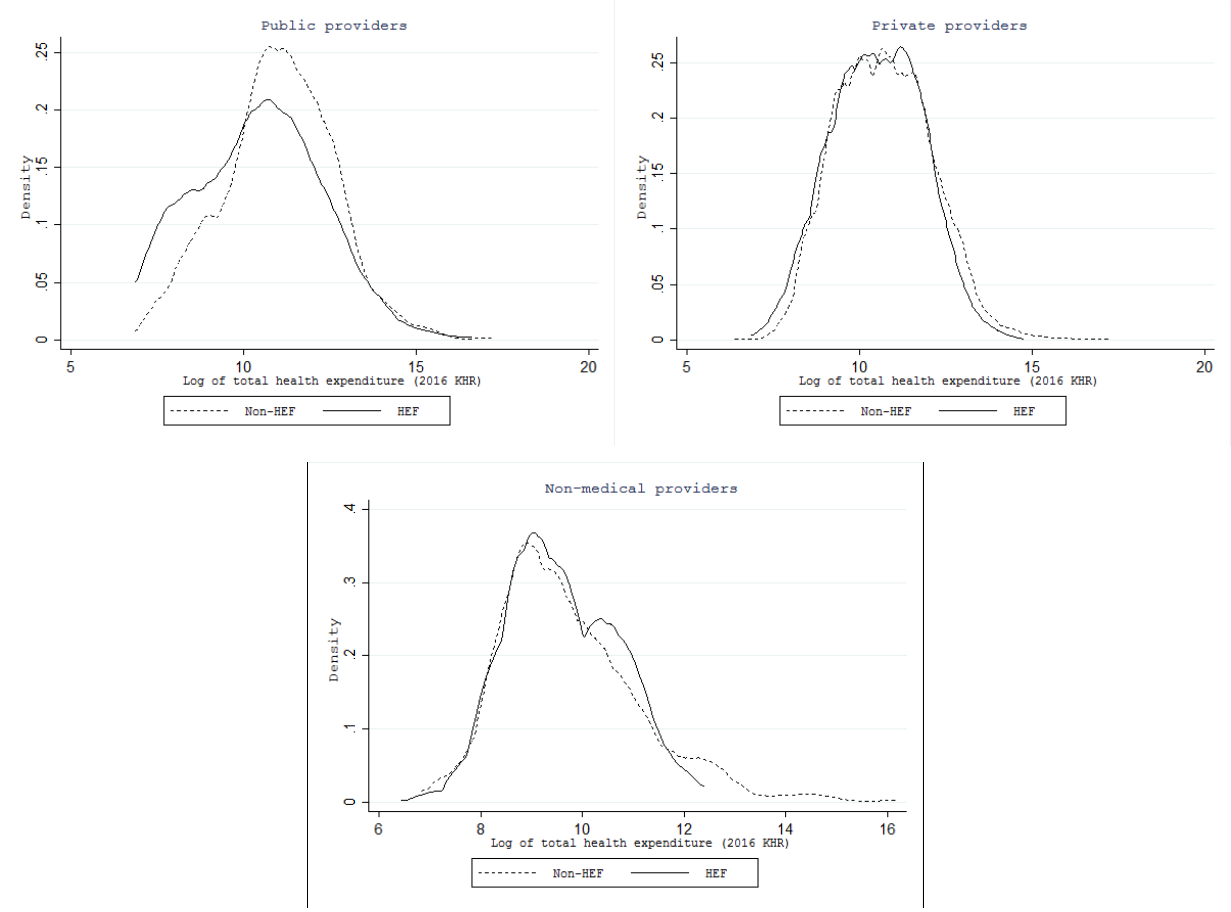
Supplementary Figure A1: Choice of health care provider for (a) national level and (b) HEF and non-HEF beneficiary households

Source: CSES 2004, 2007-2017.
Note: Overseas medical service is not shown.



Supplementary Figure A2: HEF exclusion in poor and bottom 40% households by province

Source: Pool data of CSES 2014-2017.



Supplementary Figure A3: Unconditional probability density function of health expenditure

Source: Pool data of CSES 2014-2017.

Note: Kernel density estimations of OOPE per illness in 2016 Riels. The Kolmogorov-Smirnov equality-of-distributions tests show that the distributions for OOPE for public providers between HEF and non-HEF sicknesses are statistically different at 1% significance level. But there are no distributional differences between HEF and non-HEF sicknesses for each of private and non-medical providers.

Supplementary Table A2: OLS and conditional quantile regression of OOPE per illness

	OLS	Q(.25)	Q(.50)	Q(.75)
HEF covered (relative to non-HEF)	-0.246***	-0.255***	-0.239***	-0.142***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Sick for more than a year	0.725***	0.756***	0.793***	0.654***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Hospitalized for treatment	1.862***	1.881***	1.811***	1.830***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Private providers (relative to public providers)	0.0997*	0.154***	-0.0236	-0.00408
	(0.010)	(<0.001)	(0.438)	(0.885)
Non-medical providers (relative to public providers)	-0.707***	-0.591***	-0.886***	-0.946***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Overseas Medical Service (relative to public providers)	1.809***	1.820***	1.574***	2.176***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Age	0.0164***	0.00832***	0.0143***	0.0237***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Age^2	-0.000157***	-0.0000509**	-0.000139***	-0.000246***
	(<0.001)	(0.006)	(<0.001)	(<0.001)
Female (relative to male)	-0.0324	0.00300	-0.00160	-0.0612**
	(0.261)	(0.885)	(0.948)	(0.004)
Poor household (relative to non-poor)	-0.758***	-0.661***	-0.801***	-0.792***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Banteay Mean Chey (relative to Phnom Penh)	-0.397	-0.703***	-0.828*	-0.848*
	(0.219)	(<0.001)	(0.015)	(0.049)
Kampong Cham (relative to Phnom Penh)	0.350	-0.548***	-0.418	0.128
	(0.083)	(<0.001)	(0.120)	(0.588)
Kampong Chhnang (relative to Phnom Penh)	-0.390	-1.143***	-0.706	-0.814
	(0.181)	(<0.001)	(0.084)	(0.107)
Kampong Speu (relative to Phnom Penh)	-0.0215	0.179	0.393	0.638*
	(0.901)	(0.562)	(0.273)	(0.027)
Kampong Thum (relative to Phnom Penh)	-0.0563	0.249	0.386	0.230
	(0.820)	(0.275)	(0.094)	(0.256)
Kandal (relative to Phnom Penh)	-0.118	-0.287	0.354	0.434
	(0.692)	(0.257)	(0.391)	(0.087)

	OLS	Q(.25)	Q(.50)	Q(.75)
Kratie (relative to Phnom Penh)	0.152	0.335*	0.521	0.324
	(0.593)	(0.012)	(0.172)	(0.547)
Prey Veaeng (relative to Phnom Penh)	-0.124	-0.361*	-0.542	0.0667
	(0.725)	(0.029)	(0.149)	(0.739)
Pousat (relative to Phnom Penh)	-0.592**	0.569	0.607	0.420
	(0.010)	(0.246)	(0.054)	(0.300)
Siem Reab (relative to Phnom Penh)	-1.507***	-0.800***	-0.740**	-0.263
	(<0.001)	(<0.001)	(0.001)	(0.784)
Svay Rieng (relative to Phnom Penh)	-0.198	0.125	0.120	0.222
	(0.380)	(0.234)	(0.653)	(0.613)
Takaev (relative to Phnom Penh)	-0.219	-0.460**	-0.370	-0.300
	(0.512)	(0.009)	(0.144)	(0.110)
Oudor Mean (relative to Phnom Penh)	-0.105	-0.0845	0.00937	-0.326
	(0.774)	(0.547)	(0.987)	(0.506)
Bat Dambang/Krong Pailin (relative to Phnom Penh)	-0.538	-1.542**	-0.385	-0.0406
	(0.068)	(0.008)	(0.338)	(0.948)
Kampot/Krong Kaeb (relative to Phnom Penh)	-0.180	-0.757**	0.00718	-0.162
	(0.788)	(0.005)	(0.975)	(0.794)
Kaoh Kong/Krong Preah (relative to Phnom Penh)	0.380	-1.247**	-1.590***	-2.035***
	(0.200)	(0.001)	(<0.001)	(<0.001)
Preah Vihear/Stueng Traeng (relative to Phnom Penh)	0.434	0.106	-0.225	0.526**
	(0.377)	(0.371)	(0.925)	(0.006)
Mondul Kiri/Rattanak Kiri (relative to Phnom Penh)	0.963***	1.226***	0.760**	0.515
	(<0.001)	(<0.001)	(0.003)	(0.510)
Rural (relative to urban)	0.107	0.152*	0.131*	0.0590
	(0.096)	(0.015)	(0.035)	(0.438)
Year = 2015 (relative to year = 2014)	0.0549	0.154***	0.0547*	-0.0471
	(0.132)	(<0.001)	(0.050)	(0.111)
Year = 2016 (relative to year = 2014)	-0.0560	0.0101	-0.0612	-0.0840**
	(0.127)	(0.718)	(0.071)	(0.006)
Year = 2017 (relative to year = 2014)	-0.0126	0.0250	-0.0531	-0.0425
	(0.732)	(0.328)	(0.139)	(0.119)

	OLS	**Q(.25)**	**Q(.50)**	**Q(.75)**
Constant	10.29***	9.547***	10.41***	11.14***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Number of observations	13,523	13,523	13,523	13,523
R-squared	0.284			

Note: Authors' estimates using individual-level data from CSES 2014-2017. Dependent variable is the logarithmic transformation of out-of-pocket expenditure (OOPE) per illness (in 2016 Riels). Independent variables are dummy variables of HEF coverage, chronic illness, whether sickness was hospitalized, types of health service provider; age and gender of sick person; and dummy variables of poverty incidence, province, rural area, year, and district. The poor household is measured whether consumption per capita is lower than the national poverty line (NIS 2014). The statistically significant coefficients report a percentage change in OOPE per illness from a unitary change or when dummy variable changes from 0 to 1, holding all other variables constant (i.e. ceteris paribus). The district dummy coefficients are not reported. Robust *p*-values are in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Supplementary Table A3: OLS and conditional quantile regression of OOPE per illness (Only public providers)

	OLS	Q(.25)	Q(.50)	Q(.75)
HEF covered (relative to non-HEF)	-0.563***	-0.820***	-0.547***	-0.370***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Sick for more than a year	0.539***	0.447***	0.547***	0.516***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Hospitalized for treatment	1.752***	1.728***	1.898***	1.744***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Age	0.0198***	0.0127***	0.0163***	0.0246***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Age^2	-0.000172**	-0.0000918	-0.000144***	-0.000237***
	(0.005)	(0.052)	(<0.001)	(<0.001)
Female (relative to male)	-0.118	-0.126*	-0.0623	-0.191***
	(0.078)	(0.015)	(0.084)	(<0.001)
Poor household (relative to non-poor)	-0.886***	-0.877***	-1.100***	-0.964***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Banteay Mean Chey (relative to Phnom Penh)	0.0751	-0.910	-1.512***	-1.005
	(0.882)	(0.525)	(<0.001)	(0.055)
Kampong Cham (relative to Phnom Penh)	-0.438	-1.598	-0.603	0.726
	(0.421)	(0.435)	(0.225)	(0.075)
Kampong Chhnang (relative to Phnom Penh)	-1.812**	-1.516	0.737	1.144
	(0.003)	(0.693)	(0.790)	(0.490)
Kampong Speu (relative to Phnom Penh)	0.344	0.198	0.568	1.618
	(0.266)	(0.620)	(0.293)	(0.102)
Kampong Thum (relative to Phnom Penh)	-0.132	0.370	0.425	0.609
	(0.689)	(0.232)	(0.229)	(0.162)
Kandal (relative to Phnom Penh)	-1.174**	0.206	0.503**	0.826*
	(0.001)	(0.701)	(0.004)	(0.045)
Kratie (relative to Phnom Penh)	0.0335	-0.781	-0.352	0.273
	(0.948)	(0.548)	(0.349)	(0.640)
Prey Veaeng (relative to Phnom Penh)	0.839*	-0.800	-0.941***	0.516
	(0.039)	(0.117)	(<0.001)	(0.322)
Pousat (relative to Phnom Penh)	-0.352	0.0405	-0.477*	-0.396
	(0.343)	(0.895)	(0.035)	(0.691)
Siem Reab (relative to Phnom Penh)	-0.974	-1.804***	-1.518	-0.376

	OLS	Q(.25)	Q(.50)	Q(.75)
	(0.230)	(<0.001)	(0.144)	(0.733)
Svay Rieng (relative to Phnom Penh)	-2.741***	0.176	0.0569	0.989
	(<0.001)	(0.772)	(0.954)	(0.160)
Takaev (relative to Phnom Penh)	-0.863	-1.237*	-0.596	0.0182
	(0.170)	(0.018)	(0.165)	(0.969)
Oudor Mean (relative to Phnom Penh)	-0.393	0.0954	0.812	0.871*
	(0.691)	(0.906)	(0.155)	(0.034)
Bat Dambang/Krong Pailin (relative to Phnom Penh)	-0.0985	-0.585	-0.520	-0.469
	(0.821)	(0.365)	(0.053)	(0.255)
Kampot/Krong Kaeb (relative to Phnom Penh)	0.992**	1.064	0.788	1.425
	(0.004)	(0.951)	(0.770)	(0.770)
Kaoh Kong/Krong Preah (relative to Phnom Penh)	-0.652	-1.652***	-1.363	-1.747
	(0.080)	(<0.001)	(0.707)	(0.709)
Preah Vihear/Stueng Traeng (relative to Phnom Penh)	-0.576	0.386	-0.478	-0.809
	(0.308)	(0.955)	(0.902)	(0.948)
Mondul Kiri/Rattanak Kiri (relative to Phnom Penh)	0.748*	0.878	0.617	0.603
	(0.042)	(0.748)	(0.223)	(0.346)
Rural (relative to urban)	-0.0239	-0.0231	0.234*	0.0895
	(0.899)	(0.898)	(0.044)	(0.688)
Year = 2015 (relative to year = 2014)	-0.0765	0.224**	-0.0924	-0.333***
	(0.404)	(0.001)	(0.167)	(<0.001)
Year = 2016 (relative to year = 2014)	-0.0362	0.170	0.0624	-0.209*
	(0.711)	(0.096)	(0.394)	(0.010)
Year = 2017 (relative to year = 2014)	-0.0581	0.216**	0.0242	-0.0881
	(0.529)	(0.006)	(0.762)	(0.269)
Constant	10.53***	10.07***	10.52***	11.02***
	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Number of observations	2,732	2,732	2,732	2,732
R-squared	0.383			

Note: Authors' estimates using individual-level data from CSES 2014-2017 (only those seeking care from the public service providers). Dependent variable is the logarithmic transformation of out-of-pocket expenditure (OOPE) per illness (in 2016 Riels). Independent variables are dummy variables of HEF coverage, chronic illness, whether sickness was hospitalized; age and gender of sick person; and dummy variables of poverty incidence, province, rural area, year, and district. The poor household is measured whether consumption per capita is lower than the national poverty line (NIS 2014). The statistically significant coefficients report a percentage change in OOPE per illness from a unitary

change or when dummy variable changes from 0 to 1, holding all other variables constant (i.e. ceteris paribus). The district dummy coefficients are not reported. Robust *p*-values are in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.