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Assessing progress towards universal health coverage in Cambodia: Evidence using survey data from 2009 to 2019

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ABSTRACT

Over the past decades, many low- and middle-income countries have implemented health financing and system reforms to progress towards universal health coverage (UHC). In the case of Cambodia, out-of-pocket expenditure (OOPE) remains the main source of current health expenditure after several decades of reform, exposing households to financial risks when accessing healthcare and violating UHC's key tenet of financial protection. We use pre-pandemic data from the nationally representative Cambodia Socio-Economic Surveys of 2009 to 2019 to assess progress in financial protection to evaluate the reforms and obtain internationally comparable estimates. We find that following strong improvements in financial protection between 2009 and 2017, there was a reversal in the trend thereafter. The OOPE budget share rose, and the incidence of catastrophic spending and impoverishment increased in nearly all geographical and socioeconomic strata. For example, 17.7% of households experienced catastrophic health expenditure in 2019 at the threshold of 10% of total household consumption expenditure, and 3.9% of households were pushed into poverty by OOPE. The distribution of all financial protection indicators varied strongly across socioeconomic and geographical strata in all years. Fundamentally, the demonstrated trend reversal may jeopardize Cambodia's ability to progress towards UHC. To improve financial protection in the short term, there is a need to address the burden created by OOPE through targeted interventions to household groups that are most affected. In the medium term, our findings emphasize the importance of expanding health pre-payment schemes to currently uncovered vulnerable groups, specifically the near-poor. The government also needs to consider extending the scope of services covered and the range of providers to include the private sector under these schemes to reduce reliance on OOPE.

1. Introduction

Progressively realizing universal health coverage (UHC) is the centerpiece of health financing strategies, policies, and mechanisms in most low- and middle-income countries (LMICs) globally. The path towards UHC requires substantial reform efforts and investment to strengthen health systems and reduce reliance on financing healthcare services through out-of-pocket expenditure (OOPE). High OOPE can force households to forego necessary care for reasons of affordability and expose those accessing services to financial risks and financial hardship. In addition, OOPE is non-prepaid, unpooled and therefore runs counter to the objectives of UHC of increasing the aggregate level of prepaid funds and maximizing their redistributive capacity (Kutzin et al., 2016).

After the near-total destruction of the health system under the Khmer rouge, the Government of the Kingdom of Cambodia (the government of

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Cambodia) initiated health system and financing reforms early on. The 1995 Health Coverage Plan provided the framework for infrastructure development to ensure geographical access (Ministry of Health, 1995). The Health Financing Charter 1996 authorized the collection of user fees at public facilities (Ministry of Health, 1996). Starting in 2000, the Health Equity Fund (HEF) was established, granting the poor user fee exemptions to increase equitable access to healthcare and financial protection. The scheme was expanded progressively to nationwide coverage in 2015 and covered approximately three million people in 2019 (Kolesar et al., 2020). Additional health financing mechanisms were implemented over the coming years, including performance-based financing and demand-side interventions (Ensor et al., 2017; Van de Poel et al., 2016), though these were integrated in the HEF.

Further major health system reforms focused on guiding patient flows from the private to the public sector by strengthening quality, efficiency, and equity of public service delivery (World Health Organization, 2015). However, the Cambodian population has demonstrated a persistent inclination towards seeking private services, with about 70% opting for private providers as first choice in 2019 (National Institute of Statistics, 2020). The private sector consists of a diverse range of for- and not-for-profit providers with variable levels of qualifications, and remains largely unregulated (Fontaine, 2020; World Health Organization, 2015). Private services are paid out-of-pocket largely on a fee-for-service basis – hence incentivizing overprovision of health services – and at generally higher prices than public care since no private sector price controls are in place (Asante et al., 2019; World Health Organization, 2015).

The Cambodian health sector has traditionally received relatively low levels of government expenditure against suggested relative spending targets on health. For example, domestic general government health expenditure (GHE) per capita was US$32.1 in 2020(World Health Organization, 2022a) – considerably below the recommended US$200 benchmark above which financial protection was shown to improve rapidly (Jowett et al., 2016). Additionally, GHE as a share of Gross Domestic Product was 2.1% in 2020 (World Health Organization, 2022a), below the 5%-target recommended for reducing the share of OOPE to 20% of current health expenditure (CHE) (Ottersen et al., 2017). Consequently, this leaves a vacuum to be filled by OOPE, which has fluctuated around 60% of CHE-level over the past two decades (World Health Organization, 2022a).

Reform efforts were accelerated with the adoption of Cambodia's Third Health Strategic Plan 2016–2020 and the National Social Protection Policy Framework 2016–2025, outlining the government's commitment towards UHC by expanding solidarity- and social equity-based pre-payment schemes (Government of the Kingdom of Cambodia, 2017; Ministry of Health, 2016). In addition to the HEF, the social health protection (SHP) landscape currently includes social health insurance schemes for salaried formal workers and civil servants, managed by the National Social Security Fund (NSSF). Enrolment was expanded rapidly from 2016 onwards to around 2.3 million members in 2021 (National Social Security Fund, 2021). Total effective coverage by both schemes combined is at around 30% (Kolesar et al., 2020), leaving large sections of the Cambodian population uncovered.

Cambodia has undergone a major social and economic transition over the past two decades with an average annual growth rate of 7.7% between 1998 and 2019, lifting large population swaths out of poverty (World Bank, 2022a). Nevertheless, pre-COVID-19 estimates indicate that close to 50% of Cambodians are economically vulnerable and have escaped absolute poverty by a narrow margin (World Bank, 2017). This high level of vulnerability combined with low levels of GHE, limited coverage under SHP and other pre-payment schemes, and bias towards seeking private care imply serious health-related financial risks for households.

Previous analyses of financial protection showed positive results with progress towards financial protection in Cambodia for the years 2004 to 2014 and 2009 to 2016, suggesting that the government's reforms have had the desired effects (Fernandes Antunes et al., 2018; World Health Organization, 2019). It is essential to continue monitoring ongoing reform efforts such as the rapid expansion of the NSSF from 2016 onwards with thorough analyses of OOPE trends and their effects on household-level financial protection to support evidence-informed policymaking in Cambodia and other LMICs relying heavily on OOPE. Moreover, the COVID-19 pandemic has had an unprecedented impact on health systems governance and financing. Data on OOPE for 2020 and 2021 are yet to be made available in many LMICs, in part because of the challenges of implementing large household expenditure surveys during the pandemic (Kurowski et al., 2021). In the meantime, it is important to establish a strong baseline of pre-pandemic estimates of OOPE and the level of financial protection enjoyed by the Cambodian population. Our analysis shows that a negative trend has already existed between the years 2017 and 2019 before any pandemic-related impact.

On this backdrop, our study aims to provide an assessment of the Cambodian health system's performance in terms of financial protection. We use nationally representative data to measure progress in the OOPE budget share, catastrophic health expenditure, and poverty effects of OOPE for the period 2009 to 2019. Using the 2021 World Health Organization's (WHO) guide on measuring financial protection indicators in Cambodia, our results serve as a baseline for future analyses carried out in the country and inform the global assessment of progress towards financial protection and UHC.

2. Materials and methods

2.1. Data sources

This analysis relies on data from the Cambodia Socio-Economic Survey (CSES) for 2009–2010, 2012–2017, and 2019–20 (hereinafter referred to as 2019). The CSES is a cross-sectional nationally representative household survey conducted by the Cambodian National Institute of Statistics that collects data on living conditions on the individual and household level. Since 2004, the CSES has been carried out nearly annually with approximately 3,600 households, and with larger sample sizes of between 10,000 to 12,000 households every five years (2009, 2014, and 2019). The CSES involves a three-stage stratified sampling process, with details described in the survey reports (Ministry of Planning, 2022). All selected CSES waves had low non-response rates (Supplementary Table S1).

2.2. Indicators and measures of financial protection

We estimate a set of generally reported financial protection indicators, including the OOPE budget share, incidence and intensity of catastrophic health expenditure, and the poverty headcount, incidence of impoverishment, normalized poverty gap, and normalized poverty impact (O'Donnell et al., 2008). The methods, assumptions, and key variables used for this analysis are based on internationally recognized and standardized methodologies (O'Donnell et al., 2008; Wagstaff et al., 2020; Xu, 2004), and follow the WHO 2021 guide on measuring financial protection in Cambodia. In particular, the indicators are:

- **OOPE**: Household annual direct medical spending on healthcare at any provider at the point of service delivery. Net of health insurance premiums/reimbursements, third-party payer subsidies, and health-related transportation. See Supplementary Box S1 for details.
- **Total household consumption expenditure (THCE)**: Household annual monetary and in-kind consumption expenditure, and the monetary value of consuming home-made products measured across five classes of expenditure: food; nonfood nondurables (including OOPE); consumer durables; housing; and education. We established one year as uniform reference period and annualized recorded amounts for shorter recall periods by the appropriate time-neutral annualization factor.

- **OOPE budget share:** Relates OOPE to consumption to reflect the financial burden of OOPE on households. Measured as share of THCE spent on total annual household OOPE.
- **Incidence of catastrophic health expenditure (headcount):** The fraction of households with OOPE as a share of THCE equaling to or exceeding the two thresholds used in the official Global Sustainable Development Goal indicators: a lower threshold of 10% and a higher threshold of 25% of THCE (United Nations Statistics Division, 2022).
- **Intensity of catastrophic health expenditure:** Indicates how much households expend on OOPE beyond the defined thresholds for catastrophic health expenditure. Measured by two indicators: i) catastrophic overshoot (average degree by which the share of OOPE spent on THCE exceeds the thresholds used to define catastrophic health expenditure) and ii) mean positive overshoot (average level by which OOPE, by households experiencing catastrophic expenditure, exceeds the 10% and 25% thresholds) (O'Donnell et al., 2008).
- **Incidence of impoverishment:** Households are considered impoverished by OOPE if their THCE is above the poverty line gross of OOPE and below the poverty line net of OOPE (O'Donnell et al., 2008; Wagstaff et al., 2020; Xu, 2004). We applied the 2021 stratified national poverty line (NPL) set by the Cambodian Ministry of Planning at $2.74 in the capital Phnom Penh, $2.39 in other urban areas, and $2.23 in rural areas (Ministry of Planning, 2021).
- **Normalized poverty gap:** The severity of poverty. The fraction of households who are poor, multiplied by their average expenditure shortfall from the stratified NPL (the amount needed to bring a household below the NPL to the NPL) (O'Donnell et al., 2008).
- **Normalized poverty impact:** The effect of OOPE on the normalized poverty gap, i.e. the increases in the severity of poverty resulting from OOPE. Calculated as the difference in the normalized poverty gap before and after subtraction of OOPE (O'Donnell et al., 2008).

2.3. Statistical methods

Analyses were weighted using individual- and household-level CSES sampling weights to generate representative data for the national level and all defined strata.

All monetary values are reported in 2019 International-Dollar ($). Values were adjusted for inflation and converted to 2019 real (constant) values using the Cambodian National Institute of Statistics' Consumer Price Index (National Institute of Statistics, 2021) and converted into $ using the average 2019 exchange rate of US$1 = 4000 Khmer Riel.

Similar to most other LMICs, the effect of OOPE on household welfare in Cambodia may differ depending on the geographical domain of a household. We therefore performed analyses for the geographical domains defined by the National Institute of Statistics (the capital Phnom Penh, other urban areas, and rural areas). We also stratified by socioeconomic status and created expenditure quintiles, ranked in ascending order by equivalized per capita THCE based on the constructed consumption aggregate (referred to as quintiles 1 to 5 where 1 = poorest and 5 = richest). Following recommendations by Koch (2018), we considered alternative equivalence scales (0.36, 0.46, 0.52), though these had a negligible impact on average THCE and results for the measured indicators. All indicators were calculated separately for the subgroup of households in which at least one member sought care in the 30 days preceding the survey (referred to as care-seeking households), with values tabulated in the Supplementary Information. Conducting separate analyses for care-seeking households allows policymakers and researchers to consider the real financial costs of seeking healthcare and the related effects on household financial protection and ensure that this is not masked behind the focus on national averages.

We report variable means and absolute and relative differences between the survey years to illustrate trends in the selected indicators over time. We tested for statistical significance of differences in the estimates across survey years using Adjusted Wald Tests. To account for reduced statistical power in the smaller sample sizes (2010–2013 and 2015–2017), particularly in the stratified analyses, we also tested for statistical significance using only data from 2009, 2014, and 2019 with larger sample sizes. The tabular representations in the publication focused on these years, with detailed estimates for all years provided in the Supplementary Information. Despite the smaller sample sizes for the years 2010–2013 and 2015–2017, overall trends at national level followed those seen in the analyses using only data from 2009, 2014 and 2019 for all measured indicators. We conducted all analyses in Stata version 16.0.

3. Results

Table 1 illustrates the results for the key indicators for 2009, 2014, and 2019. Further details are outlined in the following sections, focusing on the key trends visible over time.

Households in nearly all geographical domains and quintiles saw a significant rise in their THCE throughout the period 2009 to 2019, with THCE increasing by 45.9% from $4675 to $6825 (Table 1). Rural dwellers and the poorest household groups (quintiles 1 and 2) experienced the largest increases (Supplementary Table S3).

Over the same period, OOPE rose significantly from a national average of $334 to $404.8. OOPE showed a decreasing trend between 2009 and 2014, followed by an increase from 2015 to 2019; between the years were not significant. Other urban areas were generally the strata with the highest OOPE, though this alternated with rural areas for some years. OOPE was progressive and increased from the lowest to the upper quintiles in all years. However, the socioeconomic gradient decreased over time since there was a larger increase in OOPE in the lowest quintiles than the richer ones (Supplementary Table S4).

3.1. OOPE budget share

The OOPE budget share declined significantly from 6.4% in 2009 to 4.2% in 2014 and fluctuated around this level up until 2017. In contrast, the period between 2017 and 2019 saw a significant 28.8%-increase in the budget share to a national average of 5.5%. Supplementary Table S5 provides detailed estimates for the budget share for all strata.

Fig. 1 illustrates the trend in the OOPE budget share over the study period by geographical domain. In all survey years, the budget share was consistently highest in rural households, though capital and urban households experienced the greatest significant growth in their share of THCE spent on OOPE from 2017 to 2019. Consequently, their 2019 budget share increased over 2009 figures (not significant), while it diminished significantly in rural dwellers over the ten-year period.

The socioeconomic distribution of the OOPE budget share demonstrated a progressive pattern and rose strongly with level of wealth in all survey years as illustrated in Fig. 2. The significant increase over the three-year period between 2017 and 2019 was particularly pronounced in the poorest two quintiles, where the OOPE budget share nearly rose to 2009 levels, while it decreased in the richest households.

3.2. Incidence and intensity of catastrophic health expenditure

Table 2 and Supplementary Tables S6A and S6B, respectively, provide detailed estimates of the incidence of catastrophic health expenditure, stratified by geographical domains and expenditure quintiles.

At the lower threshold of 10% of THCE, the incidence of catastrophic expenditure fell significantly from 19.1% in 2009 to 13.3% in 2014 and continued to decline to 13.1% of households by 2017. As was seen with the OOPE budget share indicator, trends in catastrophic expenditure showed a turning point in 2017. Over the two-year period up until 2019, the incidence increased significantly to a national average of 17.7% in 2019. These trends were robust by use of the alternative higher threshold at 25% of THCE. Translating the incidence of catastrophic expenditure to absolute numbers, results showed that approximately 650,000 households spent catastrophic amounts on OOPE at a cut-off of

Table 1
Key indicators for 2009, 2014 and 2019 (mean; year-over-year difference).

	2009			2014			2019			09–14	14–19	09–19	09–14	14–19	09–19
	Mean	95% CI	SE	Mean	95% CI	SE	Mean	95% CI	SE	Absolute difference[&]			Relative difference		
THCE	$4675	(4525–4825)	77	$5275	(5150–5400)	63	$6825	(6550–7100)	141	$600*	$1550*	$2150*	13%*	29%*	46%*
OOPE	$334	(311–357)	11.7	$282.6	(256–310)	13.7	$404.8	(376–434)	14.6	-$51*	$121*	$71*	−15%*	43%*	21%*
Budget share	6.4%	(0.061–0.067)	0.001	4.2%	(0.040–0.045)	0.001	5.5%	(0.052–0.057)	0.001	−2%*	1%*	−1%*	−34%*	29%*	−14%*
CS 10% of THCE	19.1%	(0.180–0.201)	0.005	13.3%	(0.124–0.142)	0.005	17.7%	(0.168–0.186)	0.005	−5%*	4%*	−1%	−30%*	33%*	−7%
CS 25% of THCE	6.3%	(0.058–0.068)	0.003	4.4%	(0.039–0.049)	0.002	5.1%	(0.046–0.056)	0.003	−2%*	0.7%*	−1%[#]	−31%*	16%*	−20%[#]
Impoverishment	5.4%	(0.049–0.058)	0.002	3.8%	(0.034–0.042)	0.002	3.9%	(0.035–0.044)	0.002	−2%*	0.2%	−1%*	−30%*	5%	−27%*

* p-value<0.05 [#] 0.05 < p-value<0.1 [&] Values indicated as 0% are below 0.05%. ***Abbreviations:*** 95% CI = 95% confidence interval; CS = catastrophic spending; OOPE = out-of-pocket expenditure; SE = standard error; THCE = total household consumption expenditure.

Fig. 1. OOPE budget share at national level between 2009 and 2019, disaggregated by geographical domain (mean; 95% confidence intervals). **Abbreviations**: THCE = total household consumption expenditure.

Fig. 2. OOPE budget share at national level between 2009 and 2019, disaggregated by expenditure quintiles (mean; 95% confidence intervals). **Abbreviations**: 1–5 = quintile 1–5; THCE = total household consumption expenditure.

10% of THCE (comprising over 3.2 million Cambodians). Fig. 3 outlines trends in catastrophic expenditure over time for both thresholds.

Geographical and socioeconomic differences in the incidence of catastrophic health expenditure were pronounced throughout the entire study period, with the strongest trends observed following those described for the national average at both thresholds. Rural households were considerably more affected by catastrophic spending compared to capital and urban households across the years. For example, 20.5% of rural households spent over 10% of their THCE on OOPE in 2019 compared to 8.2% of those in Phnom Penh. Geographical differences narrowed slightly over time at the lower threshold, while they increased at the 25% of THCE benchmark.

Levels of catastrophic health expenditure displayed a pro-rich concentration in all years at the two thresholds. However, the socioeconomic gradient in both indicators diminished slightly between 2009 and 2019 because the proportion of households spending catastrophic amounts on OOPE reduced more steeply in the richer quintiles. For example, at 10% of THCE, households in quintile 1 saw a statistically insignificant reduction in their incidence of catastrophic spending by 2.8% from 14.6% in 2009 to 14.2% in 2019, while those in quintile 5 experienced a significant 15.8% decrease from 20.5% to 17.2%.

Table 2
Incidence of catastrophic health expenditure (10% of THCE) for 2009, 2014 and 2019, disaggregated by geographical domains and expenditure quintiles (mean; year-over-year difference).

	2009			2014			2019			09–14	14–19	09–19	09–14	14–19	09–19
	Mean	95% CI	SE	Mean	95% CI	SE	Mean	95% CI	SE	Absolute difference			Relative difference		
Average	19.1%	(0.180–0.201)	0.005	13.3%	(0.124–0.142)	0.005	17.7%	(0.168–0.186)	0.005	−6%*	4%*	−1%	−30%	33%*	−7%
Phnom Penh	7.2%	(0.050–0.094)	0.011	4.1%	(0.032–0.054)	0.006	8.2%	(0.065–0.103)	0.009	−3%*	4%*	1%	−42%	99%*	14%
Urban	13.3%	(0.109–0.157)	0.012	9.2%	(0.077–0.110)	0.008	16.2%	(0.145–0.179)	0.009	−4%*	7%*	3%	−31%	75%*	22%#
Rural	21.0%	(0.198–0.223)	0.006	15.2%	(0.142–0.164)	0.006	20.5%	(0.193–0.217)	0.006	−6%*	5%*	−1%	−28%	34%*	−3%
Quintile 1	14.6%	(0.128–0.163)	0.009	8.9%	(0.076–0.104)	0.007	14.2%	(0.126–0.159)	0.008	−6%*	5%*	−0.4%	−39%	60%*	−3%
Quintile 2	17.6%	(0.157–0.195)	0.010	11.6%	(0.101–0.132)	0.008	18.3%	(0.164–0.203)	0.010	−6%*	7%*	1%	−34%	58%*	4%
Quintile 3	19.4%	(0.175–0.213)	0.010	14.4%	(0.127–0.162)	0.009	18.8%	(0.170–0.209)	0.010	−5%*	4%*	−1%	−26%	31%*	−3%
Quintile 4	23.3%	(0.213–0.252)	0.010	15.0%	(0.133–0.169)	0.009	19.9%	(0.180–0.220)	0.010	−8%*	5%*	−3%*	−36%	33%*	−14%*
Quintile 5	20.5%	(0.185–0.224)	0.010	15.2%	(0.137–0.169)	0.008	17.2%	(0.153–0.194)	0.011	−5%*	2%	−3%*	−26%	13%	−16%*

* p-value<0.05 # 0.05 < p-value<0.1 ***Abbreviations***: 95% CI = 95% confidence interval; SE = standard error; THCE = total household consumption expenditure.

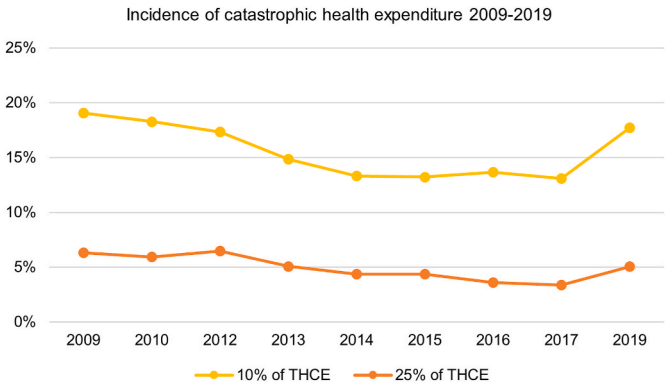

Fig. 3. Incidence of catastrophic health expenditure between 2009 and 2019 at 10% and 25% of THCE. **Abbreviations**: THCE = total household consumption expenditure.

Catastrophic expenditure remained high among the middle quintiles across all years and for both thresholds. Fig. 4 illustrates trends over the analyzed 10-year period by expenditure quintiles (10% of THCE).

As Fig. 5 and Supplementary Figure S4 illustrate, the mean positive overshoot showed few significant changes across the studied 10-year period, though the point estimates indicated a decreasing trend over time. In 2019, households spent on OOPE in excess of the lower threshold of 10% of THCE by an average of 12.6%. This indicates that households overspending 10% of their THCE on OOPE spent approximately 22.6% on health in 2019.

Supplementary Tables S7A and S7B outline stratified estimates of the intensity of catastrophic health expenditure measured by the catastrophic overshoot and the mean positive overshoot for both thresholds. Coincidentally with the previous analyses, the overshoot indicator differed both geographically and socioeconomically in all years. For example, the poorest overspent the lower threshold by an average of 8.5%, in contrast with 19.64% for households in the richest quintile.

3.3. Poverty headcount, incidence of impoverishment, poverty gap, and poverty impact

Table 3 and Supplementary Table S8 outline the results of the impoverishing effects of OOPE using the stratified Cambodian NPL. The poverty headcount, normalized poverty gap, and poverty impact are presented in Table 4 and Supplementary Table S9 (only stratified by

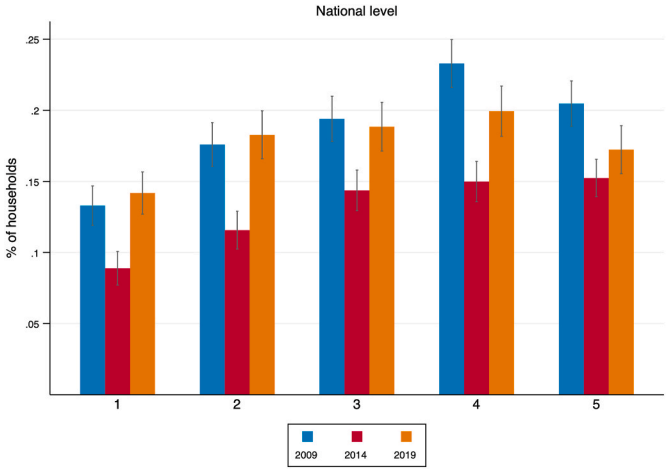

Fig. 4. Incidence of catastrophic health expenditure for 2009, 2014, and 2019 at 10% of THCE, disaggregated by expenditure quintiles (mean; 95% confidence intervals). **Abbreviations**: 1–5 = quintile 1–5; THCE = total household consumption expenditure.

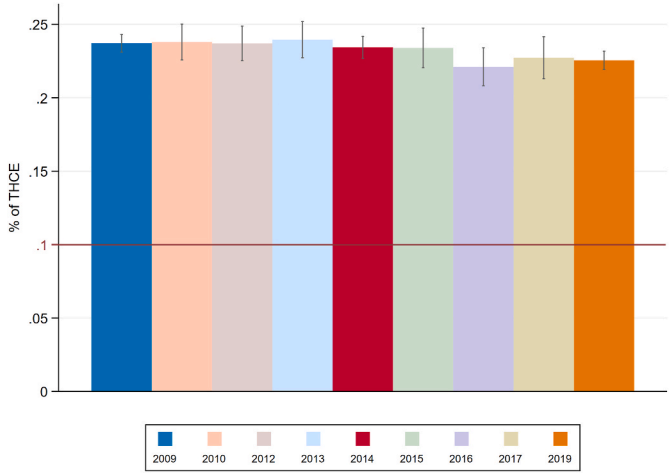

Fig. 5. Intensity of catastrophic health expenditure between 2009 and 2019 at 10% of THCE (mean; 95% confidence intervals). **NB**: The red line signifies 10%/THCE. **Abbreviations**: THCE = total household consumption expenditure. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

geographical domain).

All indicators used to measure the implications of OOPE for poverty showed a strongly decreasing trend over time. The conventional methodology of measuring poverty, i.e. the poverty headcount gross of OOPE, yielded a steadily and significantly decreasing pattern between 2009 and 2019, from 54.1% to 19.7%. However, poverty levels net of OOPE were higher in all years, indicating that OOPE impoverished additional households. After exhibiting a steady downward trend from 5.4% in 2009 to 2.9% in 2017, the incidence of impoverishment increased significantly over the following two-year period to 3.9% in 2019. As shown in Table 3, we observed similar disparities across geographical domains as highlighted in the previous analyses. The results revealed that rural households were least protected against impoverishment throughout the years.

Fig. 6 illustrates the effect of OOPE on household consumption and poverty in 2009 and 2019 in rural areas. The graph shows that OOPE impoverished a considerable proportion of households. OOPE are largest at the right tail of the THCE ranking (i.e. in richer households) in both years, although, over time, the proportion of households brought below the NPL by OOPE was increasingly shifted to the middle and lower half of the distribution.

Notably, the incidence of impoverishment between 2009 and 2017 was zero in the poorest quintile since these households were already living below the poverty line in these years (Supplementary Table S8). With rising income levels, the incidence of impoverishment was increasingly shifted from middle-to lower-income quintiles. In 2019, the second quintile was most vulnerable to OOPE with 13.7% of households becoming impoverished, while less than 1% of households in the two richest quintiles were pushed into poverty.

Moreover, OOPE aggravated the normalized poverty gap across all years. Fig. 7 shows the normalized pre-OOPE and post-OOPE poverty gap. As with the incidence of impoverishment, the normalized poverty impact dwindled significantly between 2009 and 2017, before exhibiting an unexpected and significant trend increase between 2017 and 2019 to 1.1% (Supplementary Table S9), largely driven by rural areas.

4. Discussion

Our estimates show that from 2009 to 2017, Cambodia made strong progress toward financial protection with the OOPE budget share, catastrophic health expenditure, and the poverty effects of OOPE displaying a strong downward trend. However, estimates from analysis of

Table 3
Incidence of impoverishment at the stratified National Poverty Line, disaggregated by geographical domain and expenditure quintile (mean; year-over-year difference).

	2009			2014			2019			09–14	14–19	09–19	09–14	14–19	09–19
	Mean	95% CI	SE	Mean	95% CI	SE	Mean	95% CI	SE	Absolute difference			Relative difference		
Average	5.4%	(0.049–0.058)	0.002	3.8%	(0.034–0.042)	0.002	3.9%	(0.035–0.044)	0.002	−2%*	0.2%	−1%*	−30%*	5%	−27%*
Phnom Penh	1.8%	(0.007–0.028)	0.005	1.3%	(0.009–0.020)	0.003	1.1%	(0.005–0.026)	0.005	−0.5%	−0.3%	−0.6%	−26%	−14%	−36%
Urban	3.8%	(0.027–0.050)	0.006	1.8%	(0.012–0.027)	0.004	2.9%	(0.022–0.037)	0.004	−2%*	1%*	−1%	−53%*	58%*	−25%
Rural	5.9%	(0.054–0.065)	0.003	4.4%	(0.039–0.049)	0.003	5.0%	(0.044–0.056)	0.003	−2%*	0.6%	−1%*	−26%*	13%	−16%*
Quintile 1	0%	–	–	0%	–	0.000	2.8%	(0.019–0.040)	0.005	0%	3%*	3%*	–	–	–
Quintile 2	0%	–	–	8.9%	(0.077–0.103)	0.007	13.7%	(0.121–0.155)	0.009	9%*	5%*	14%*	–	54%*	–
Quintile 3	13.1%	(0.117–0.144)	0.007	7.1%	(0.060–0.083)	0.006	1.9%	(0.014–0.027)	0.003	−6%*	−5%*	−11%*	−46%*	−73%*	−85%*
Quintile 4	10.8%	(0.094–0.122)	0.007	2.1%	(0.015–0.028)	0.003	0.8%	(0.004–0.013)	0.002	−9%*	−1%*	−10%*	−81%*	−64%	−93%*
Quintile 5	2.9%	(0.022–0.037)	0.004	0.8%	(0.005–0.013)	0.002	0.5%	(0.002–0.010)	0.002	−2%*	−0.3%	−2%*	−73%*	−41%	−84%*

* p-value <0.05 ***Abbreviations:*** 95% CI = 95% confidence interval; SE = standard error.

Table 4
Poverty headcount, normalized poverty gap, and poverty impact disaggregated by geographical domain (mean; year-over-year difference).

	2009			2014			2019			09–14	14–19	09–19	09–14	14–19	09–19
	Mean	95% CI	SE	Mean	95% CI	SE	Mean	95% CI	SE	Absolute difference[&]			Relative difference		
Poverty headcount pre-OOPE															
Average	54.1%	(0.524–0.557)	0.008	34.1%	(0.327–0.355)	0.007	19.7%	(0.189–0.205)	0.004	−20%*	−14%*	−34%*	−37%*	−42%*	−64%*
Phnom Penh	13.6%	(0.105–0.167)	0.016	13.4%	(0.101–0.166)	0.017	4.7%	(0.028–0.066)	0.010	−0.2%	−9%*	−9%*	−2%	−65%*	−65%*
Urban	34.3%	(0.295–0.391)	0.025	23.6%	(0.199–0.273)	0.019	15.5%	(0.132–0.178)	0.012	−11%*	−8%*	−19%*	−31%*	−34%*	−55%*
Rural	60.9%	(0.590–0.627)	0.010	38.7%	(0.370–0.404)	0.009	24.8%	(0.230–0.265)	0.009	−22%*	−14%*	−36%*	−36%*	−36%*	−59%*
Normalized poverty gap pre-OOPE															
Average	17.9%	(0.170–0.187)	0.004	8.1%	(0.076–0.085)	0.002	4.3%	(0.039–0.046)	0.002	−10%*	−4%*	−14%*	−55%*	−47%*	−76%*
Phnom Penh	3.4%	(0.025–0.043)	0.004	2.8%	(0.019–0.037)	0.005	0.8%	(0.003–0.014)	0.003	−1%	−2%*	−3%*	−17%	−70%*	−75%*
Urban	10.2%	(0.083–0.120)	0.009	5.5%	(0.044–0.066)	0.006	3.0%	(0.025–0.035)	0.003	−5%*	−2%*	−7%*	−46%*	−45%*	−71%*
Rural	20.3%	(0.194–0.213)	0.005	9.2%	(0.087–0.098)	0.003	5.6%	(0.051–0.061)	0.002	−11%*	−4%*	−15%*	−55%*	−40%*	−73%*
Normalized poverty impact															
Average	2.7%	(0.026–0.029)	0.001	1.2%	(0.011–0.013)	0.001	1.1%	(0.010–0.012)	0.000	−2%	−0.1%	−1.7%*	−56%	−11%	−61%*
Phnom Penh	0.4%	(0.002–0.005)	0.001	0.2%	(0.001–0.003)	0.000	0.2%	(0.001–0.006)	0.001	0%	0%	−0.2%	−43%	−20%	−54%
Urban	1.3%	(0.011–0.016)	0.001	0.6%	(0.005–0.008)	0.001	0.6%	(0.008–0.013)	0.001	−1%	0%	−0.7%*	−53%	2%	−52%*
Rural	3.1%	(0.029–0.033)	0.001	1.4%	(0.013–0.016)	0.001	1.4%	(0.020–0.024)	0.001	−2%	0%	−1.7%*	−55%	1%	−54%*

* p-value <0.05 # 0.05 < p-value<0.1 & Values indicated as 0% are below 0.05% ***Abbreviations:*** 95% CI = 95% confidence interval; OOPE = out-of-pocket expenditure; SE = standard error.

2019 data exhibited a significant reversed trend in terms of progress in financial protection from the 2017 figures. The OOPE budget share rose, and the incidence of catastrophic spending and impoverishment increased in nearly all geographical and socioeconomic strata. Progress was limited to a diminishment of the poverty headcount and normalized poverty gap. This contradicts expectations and, with a view to the financial protection policies implemented over the years, gives ground for concern for Cambodian health and social protection policy and the country's ability to promote the progressive realization of UHC.

4.1. OOPE and OOPE budget share

The increases in OOPE in absolute terms noted across the years are likely attributable to the consistent rise in average disposable household income seen in the continuous increase of THCE, enhanced levels of availability and utilization of (advanced, higher cost) services in particular in the private sector, combined with the limited population coverage under the existing SHP and other pre-payment schemes. Importantly, as the population got wealthier, people maintained their preference for private health services. About 70% opted for a private provider as first choice in 2019, following significant increases in private healthcare-seeking up from approximately 48% in 2009 and 61% in 2014 (National Institute of Statistics, 2020, 2009). This was accompanied by a rapid expansion of the supply and availability of private providers from 3,755 in 2009 to 14,416 in 2019 (Ministry of Health, 2016, 2019), compared with a smaller increase of public facilities from 1,203 to 1,474 (Ministry of Health, 2019, 2008). Data on private sector price levels are not available, though these are reportedly higher than public fees (World Health Organization, 2015). With the current trajectory, higher income levels will likely result in further increased demand for private services, accompanied by increases in mean household OOPE.

Changes in household consumption and OOPE impacted the OOPE budget share. In the years leading up to 2017, THCE rose faster and compensated any increases in OOPE, resulting in a declining budget share. In contrast, the years between 2017 and 2019 showed a higher rate of growth of OOPE relative to THCE in all quintiles but the richest group, causing the observed trend reversal in the OOPE budget share. This is in line with the findings of the 2021 Global UHC Monitoring Report published by WHO and the World Bank, reporting a higher growth rate for OOPE relative to private consumption as a driver for the increase in the aggregate OOPE budget share seen globally (World Health Organization and World Bank, 2021). Notably, results for the period between 2017 and 2019 showed that the OOPE budget share increased most sharply and significantly in the first two quintiles (the poorest groups). The diminishing marginal utility of income suggests that the opportunity cost of OOPE by these low-income earners – and key target groups for financial protection – are greater than that by higher-income households (O'Donnell et al., 2008). This may thus obstruct equity in health financing, a guiding principle of UHC (van Doorslaer et al., 1992). The trend reversal requires further investigation and careful monitoring over the years to come.

Internationally, there is considerable variation in the OOPE budget share, though available global or regional studies are limited. Our estimates largely coincide with a preceding analysis, reporting the budget share for Cambodia to be above the global median at 2.9% and larger than the median values for the East Asia and Pacific and South Asia regions at 2.6% and 4.7%, respectively (Wagstaff et al., 2020; Wang et al., 2018).

4.2. Catastrophic health expenditure and poverty effects of OOPE

The rise in the incidence of catastrophic spending between 2017 and 2019 suggests that increases in the OOPE budget share were strong enough to drive more households into financial catastrophe, corroborating earlier findings that the two indicators are highly correlated

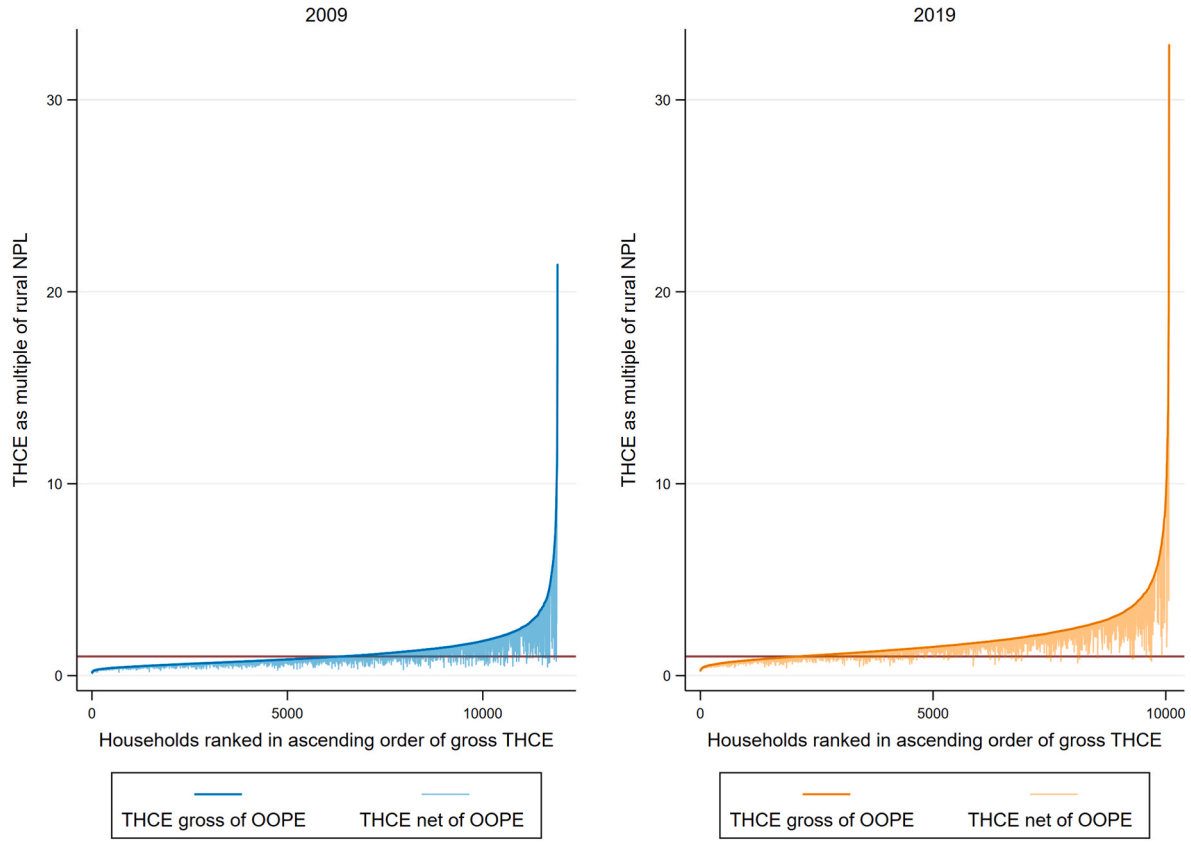

Fig. 6. Pen's Parade graphical representation of the effect of OOPE on THCE and poverty in rural areas in 2009 and 2019. **NB:** Households are ranked based on their THCE distribution gross of OOPE (curved line) and net on OOPE (vertical bar, or "paint drip") as multiple of the NPL. The vertical line represents the rural NPL. A paint drip crossing the NPL indicates that a household is not considered poor considering gross THCE but is pushed into poverty due to OOPE. **Abbreviations**: NPL = national poverty line; OOPE = out-of-pocket expenditure; THCE = total household consumption expenditure.

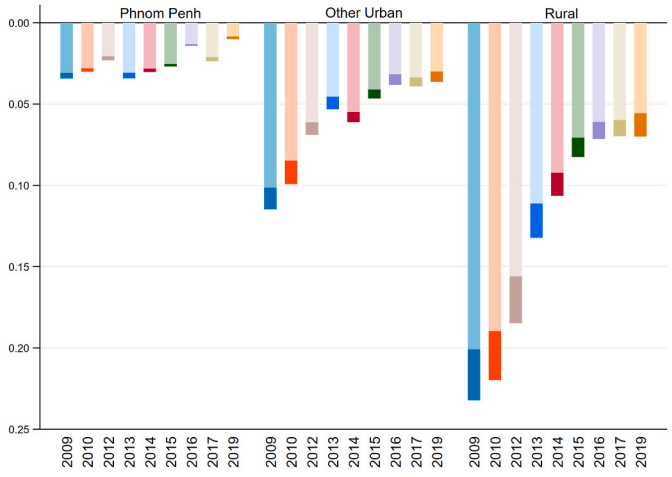

Fig. 7. Normalized poverty gap pre-OOPE and post-OOPE. **NB:** Attenuated colors indicate the normalized poverty gap pre-OOPE and enhanced colors illustrate the normalized poverty impact. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

(Wagstaff et al., 2020). The trend reversal points to the need for further research into the determinants of catastrophic spending as a basis for targeted policy measures. Previous work for Cambodia between 2004 and 2016 showed having a household member with a noncommunicable disease to be a strong determinant for catastrophic OOPE (Jacobs et al., 2016; World Health Organization, 2019).

In comparison with other countries, a global study reported similar results to those recorded in our analyses. Of over 120 countries analyzed in only 26 – including Cambodia – over 15% of households expended over 10% of THCE on OOPE. The incidence of catastrophic health expenditure was at 11.7% (10%/THCE) globally and lay at 12.8% in the Asian region (Wagstaff et al., 2018a, 2020). Moreover, both WHO and the World Bank provide publicly available data to monitor financial protection indicators across countries and regions. Our results are consistent with those reported in the WHO Global Health Observatory for the analyzed period (though with minor differences due to differences in the level of geographical stratification applied) (World Health Organization, 2022b), strengthening the confidence in the validity of our results. Importantly, our estimates align with global and regional trends reported in both databases and the corresponding 2021 Global Monitoring Report, similarly showing a negative trend in the incidence of catastrophic spending over several years. The strongest increases in catastrophic spending were reported for the WHO Southeast Asia and Western Pacific regions (World Bank, 2022b; World Health Organization, 2022b; World Health Organization and World Bank, 2021).

The pro-rich concentration in the incidence and intensity of catastrophic spending revealed in our analysis is consistent with earlier work (Grépin et al., 2020; Sas Trakinsky et al., 2020), and aligns with our findings of lower OOPE in poorer households. Both indicators are insensitive to the underlying socioeconomic distribution and count all households spending in excess of the thresholds and all dollars spent on OOPE over the threshold equally (O'Donnell et al., 2008). This may introduce a bias in tracking the distribution of catastrophic health expenditure (Grépin et al., 2020), particularly in the Cambodian context where disproportionately large proportions of wealthier households incur discretionary spending at private providers both inside the country

and overseas. Such concerns merit cautionary interpretations of the level of financial protection enjoyed by households across quintiles.

The high incidence of catastrophic spending in the middle quintiles at all thresholds and across all years is also noteworthy. This indicates a large financial burden on a population segment that largely comprises of near-poor and nonpoor workers in low-paid, insecure (self-)employment with little or no access to the existing SHP schemes or other forms of social protection (Nguyen and Simoes da Cunha, 2019).

The unproportionally larger incidence of catastrophic and impoverishing spending among rural households pushed up the averages across all years. This is consistent with earlier findings for Cambodia and echoes the situation of other Asian countries (Fernandes Antunes et al., 2018; Thu Thuong et al., 2021; Wang et al., 2018). Rural households are commonly at a double disadvantage since they tend to have larger health needs while their available economic resources are severely limited (Saksena et al., 2010), reflecting the correlation between geographical domain and socioeconomic status (e.g. in 2019, 50% of households in quintiles 1 and 2 were rural households, while 79% of those in quintile 5 lived in the capital and other urban areas).

As the poverty headcount declined over time, the incidence of impoverishment was increasingly shifted to lower-income households. The high share of quintile 2 households impoverishing throughout the years highlights that a large proportion of households that graduated from absolute monetary poverty have continued to exist on the verge of poverty, unable to move to financial security (World Bank, 2017). This also reflects the findings of a recent multidimensional poverty assessment conducted for Cambodia, showing that the near-poor suffer similar deprivations and are affected by negative external shocks such as OOPE in similar ways than households officially classified as poor and eligible for social assistance and the HEF (Andersen, 2019). The concept of multidimensional poverty also captures some of the intersectionality between social, demographic, and economic factors. These may further jeopardize near-poor households' chances for upward mobility into financial security (Witter et al., 2017), and risk not to achieve the equity goals entrenched in UHC unless financial protection gaps for this group are closed.

The differences in the socioeconomic concentration of the burden of catastrophic health expenditure and impoverishment emphasize that catastrophic spending does not necessarily imply impoverishment and vice versa (Wagstaff et al., 2018a, 2018b; Wagstaff and van Doorslaer, 2003). Richer households may experience catastrophic but not impoverishing spending, while those in lower-income quintiles are susceptible to falling into poverty due to OOPE which may not be considered catastrophic. Our analysis showed that the overlap between households incurring catastrophic and those experiencing impoverishing OOPE was small in all years (data not shown), confirming the necessity of regularly analyzing both indicators to monitor the real burden of poor financial protection caused by OOPE (World Health Organization and World Bank, 2021).

Nonmedical costs not accounted for in this analysis often accrue due to illness and care-seeking and may pose financial barriers to access. Previous work showed that transport spending amounts to approximately 11% of total health-related expenditure in Cambodia, with a disproportionate burden on the poor – despite that they are entitled to transport cost reimbursements by the HEF (World Health Organization, 2019). Opportunity costs of uncompensated income losses may also arise. Data for 2019 indicated that self-reported illness/injury resulted in a mean inability to engage in normal activities for working-age people of 11 days (National Institute of Statistics, 2020). This can constitute a large burden on households, especially on those in informal employment without adequate social protection. It is critical to integrate income security and protection against nonmedical costs in UHC policy discourse and to improve data availability for these issues.

4.3. Limitations

We relied on data from general household surveys which may affect the nature of the reported health-related data for several reasons. Firstly, the questionnaires vary in comprehensiveness and degree of commodity detail related to consumption across the years, which could have influenced annual THCE. However, the consulted WHO guide on measuring indicators in Cambodia provides detailed guidance on which items to select to calculate consumption for each year to minimize any effect on the measured indicators. Secondly, the OOPE-related recall periods and the level of granularity differ between the survey years in the CSES expenditure section. To assess the magnitude of influence of this on the results, we also estimated OOPE and related financial protection indicators with the CSES health section, which uses identical recall periods (30 days) for all years. All indicators lay in a similar range and the observed trend reversal between 2017 and 2019 was even more accentuated, hence confirming the validity of the results reported in this study. Thirdly, the CSES does not contain sufficient data on health-related saving and borrowing that would allow for adjustments for covering OOPE through dissaving and borrowing, which may lead to an overestimation of catastrophic and impoverishing spending. Lastly, particularly in the stratified analyses, the smaller sample sizes in the years 2010–2013 and 2015–2017 led to a higher variability and results may not be nationally representative.

5. Policy implications

Our analysis suggests that existing SHP schemes have not fundamentally changed levels of OOPE and the related financial protection indicators OOPE budget share, catastrophic health expenditure, and impoverishment. Importantly, the higher growth of OOPE relative to THCE from 2017 onwards is of concern and requires reforms targeted towards reducing OOPE that are based on rigorous research on the drivers of high OOPE in Cambodia.

Financial protection tends to improve in countries channeling higher shares of their CHE through pre-payment schemes such as SHP schemes and other forms of pre-paid and pooled systems of health financing (Wagstaff et al., 2020). Given the low share of approximately 3% of CHE channeled through such schemes in Cambodia in 2019, our findings point towards a renewed call for efforts aimed at expanding pre-payment schemes for uncovered groups in Cambodia and beyond. In particular, the disproportionate share of impoverishment among households in quintile 2 and the high burden of catastrophic health expenditure in the middle quintiles are important for policy. Given the limited contributory capacity of households in these quintiles, expanding non-contributory schemes (e.g. the HEF) and offering subsidies may be advisable and can be protective against poverty. Data on capacity to pay across quintiles may be expedient to acquire an understanding of options for determining contributions to schemes (World Health Organization, 2019). Such an approach is further consistent with the concept of proportionate universalism, which postulates that the largest reform investments should target the most vulnerable to raise the impetus for equity in UHC (Francis-Oliviero et al., 2020). In a context of high informal employment with constraints in raising direct taxes, like in Cambodia and many other LMICs, available evidence suggests increasing reliance on general revenues sourced from indirect taxes (Kutzin et al., 2016) and health taxes imposed on products with a negative impact on public health to be promising (Kaiser et al., 2016). Efforts ensuring that all (prospective) members of pre-payment schemes are cognizant of their coverage and benefit entitlements need to be made.

The under-utilization of public health services continues to be a concern. Notwithstanding their subsidies for accessing public care, similar results were reported for HEF beneficiaries (Jacobs et al., 2018). Several factors appear to play a role, including distance, perceived low quality of care and limited availability of relevant services and

commodities in public facilities, long waits, and mistrust (World Health Organization, 2015), reinforcing that financial protection is closely linked to treatment quality and experience in public facilities (Barasa et al., 2017). In this light, the reforms initiated by the government of Cambodia to strengthen the supply side with a deliberate focus on improving quality of care seem promising and should be further strengthened (Pheakdey et al., 2020). Additionally, a recent study showed a large potential supply-side service space in the public sector, particularly for lower-level providers (Kolesar et al., 2022). Such supply-side interventions have been shown in other countries to have a larger and longer-lasting effect on improving financial protection than demand-side interventions.

Moreover, recognizing the general population's propensity to seek private health services and the likelihood that this trajectory will continue, in the short-to medium-term, effectively involving private providers seems expedient if OOPE is to be reduced to achieve a higher measure of financial protection. To this end, the NSSF could consider increasing the number of contracted private facilities and the Ministry of Health could consider adapting the packages of services to be provided at public health facilities to include private services based on contracts with empaneled or accredited providers.

The geographical differences revealed in the analyzed indicators across all years point to the continuous need for an increased and accelerated focus on rural areas in financial protection policies and strategic public investments as part of rural development policies – particularly because 61% of the Cambodian population are rural dwellers (National Institute of Statistics, 2020).

The CSES 2019 data captured the first five months of the pandemic, though this is unlikely to reflect the true impact of the pandemic in Cambodia since the brunt of the caseload was recorded in 2021. The COVID-19 pandemic had a strong socioeconomic impact at the household level in Cambodia, with severe reductions in household employment and income. An impact assessment confirms the magnitude of the household shock, with over 60% of respondents estimating an income decrease of over 50% and a strong increase of low-income earners in 2021 (Asian Development Bank, UNICEF, 2021). The confluence of these aspects is likely to have reduced household resources available to pay for health services out-of-pocket, especially among poor and vulnerable households. Targeted policy interventions are needed to reduce related financial barriers to access healthcare. An emergency cash transfer program to mitigate the impacts of COVID-19 for poor households has shown promising results (United Nations Development Program, 2022), but further proactive policy responses will be needed for recovery and to accelerate progress towards financial protection and UHC. Furthermore, in post-pandemic analyses of financial protection indicators, it is crucial to carefully analyze observed changes jointly with service coverage to ensure these reflect trends financial protection and not incomplete or foregone care (Sparkes et al., 2021).

6. Conclusion

As LMICs continue to implement health financing and system reforms to move towards UHC, policymakers at country and global level need to continuously monitor progress with a comprehensive set of indicators and evaluate these reforms and their effects on financial protection. The case of Cambodia illustrates the urgency with which such efforts need to be conducted, where well designed, planned, and largely competently implemented reforms have fallen short of providing effective financial protection to vulnerable population groups. Analyses using robust research methods – including quantitative, qualitative, and implementation-based – can contribute to an improved understanding of the facilitating factors and barriers to effective reform that countries face. More specifically, continued and sustained efforts are needed to shed further light on the reasons for any trend reversal and to determine factors rendering households vulnerable to poor financial protection. Importantly, private health sector behavior should be further studied to determine pricing and service provision levels. Additionally, the private sector's role in driving high catastrophic and impoverishing spending, among other factors, requires careful examination as a basis for effective private sector regulation. These issues go beyond the current Cambodian context and are relevant in most other LMICs.

Credit author statement

Andrea Hannah Kaiser: Conceptualization, Data curation, Formal analysis, Methodology, Project Administration, Visualization, Writing-Original draft preparation. **Okore Okorafor:** Formal analysis, Methodology, Validation, Writing- Reviewing and Editing. **Björn Ekman:** Writing- Reviewing and Editing, Validation. **Srean Chhim:** Writing-Reviewing and Editing. **Sokunthea Yem:** Writing- Reviewing and Editing. **Jesper Sundewall:** Conceptualization, Supervision, Writing-Reviewing and Editing.

Data availability

The authors do not have permission to share data.

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