From Pockets to Policies: Understanding Out-of-Pocket Health Expenditures and Financial Protection Among Informal Workers in Cambodia

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2025

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FACULTY OF
MEDICINE

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DOCTORAL DISSERTATION

Doctoral dissertation for the degree of Doctor of Philosophy (PhD) at the Faculty of Medicine at Lund University to be publicly defended on May 15, 2025 at 9am in Jubileumsaulan, Jan Waldenströms gata 1, Malmö

Faculty opponent
Kara Hanson, Professor
London School of Hygiene & Tropical Medicine

Organization: LUND UNIVERSITY

Document name: Doctoral Dissertation   **Date of issue:** 2025-04-16

Author(s): Andrea Hannah Kaiser

Sponsoring organization: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, Improving Social Protection and Health Project, Cambodia

Title: From Pockets to Policies: Understanding Out-of-Pocket Health Expenditures and Financial Protection Among Informal Workers in Cambodia

Abstract:

Out-of-pocket health expenditures (OOPE) remain a major challenge for low- and middle-income countries striving toward universal health coverage (UHC). In Cambodia, OOPE account for approximately 60% of current health expenditure, one of the highest proportions globally, exposing households to health-related financial risks. Notably, 59% of the population—primarily nonpoor informal workers and their dependents—are excluded from prepayment schemes. These households, referred to as uncovered households in this thesis, face heightened vulnerability to financial hardship in the event of illness or injury. This thesis examines the level of financial hardship experienced by uncovered households in Cambodia and identifies the determinants of OOPE and the OOPE budget share within this group.

The analysis draws on data from the Cambodia socioeconomic survey (2009–2023) and a 2023 household survey of uncovered households. Financial hardship was assessed using established methods for measuring catastrophic and impoverishing health expenditure, along with coping strategies employed to manage OOPE. Determinants of OOPE and the OOPE budget share, encompassing *healthcare*, *health*, and *social* factors, were analyzed at the mean using generalized linear models (GLMs) and across the distribution of these outcomes using unconditional quantile regression (UQR). Shapley decomposition was employed to quantify the contributions of these factors to the explained variance in OOPE and the OOPE budget share, both at the mean and across the distribution.

The findings reveal widespread financial hardship among uncovered households, with high levels of catastrophic and impoverishing health expenditure and frequent reliance on consumption- and finance-based coping strategies. *Healthcare* factors emerged as the primary determinants and contributors to the explained variance in OOPE and the OOPE budget share, including private sector utilization, higher levels of care, and the number of medications. *Health* factors, notably the severity of illness, days lost to illness/injury, and noncommunicable diseases, were also significant determinants and contributed substantially to both outcomes. The wealth quintile was identified as the only *social* determinant making notable contributions to the explained variance.

Based on the empirical findings, this thesis suggested pathways for reducing OOPE and improving financial protection in Cambodia through a comprehensive approach integrating financial protection policies, health system reforms, and patient-level interventions. Specifically, recommendations include expanding prepayment coverage to uncovered households, engaging strategically with the private sector, addressing medication costs and rational use, and implementing complementary health system reforms and patient education initiatives. Further research is needed to refine these strategies and ensure their effective implementation.

Key words: Cambodia, financial protection, informal employment, out-of-pocket health expenditures, universal health coverage

Classification system and/or index terms (if any)	Supplementary bibliographical information
Language: English	**ISSN and key title:** 1652-8220
ISBN: 978-91-8021-694-4	**Number of pages:** 159

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From Pockets to Policies

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Financial Protection Among Informal Workers in Cambodia

Andrea Hannah Kaiser

LUND
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I dedicate this thesis to the generations of women who came before me, whose dreams of education remained unfulfilled. Your stories, both told and untold, have guided and inspired my journey.

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List of publications

This thesis comprises four publications, which I will reference by their Roman numerals throughout.

Study I

Kaiser AH, Rotigliano N, Flessa S, Ekman B, Sundewall J. Extending universal health coverage to informal workers: A systematic review of health financing schemes in low- and middle-income countries in Southeast Asia. *PLOS ONE*. 2023;18(7): e0288269. DOI: https://doi.org/10.1371/journal.pone.0288269

Study II

Kaiser AH, Okorafor O, Ekman B, Chhim S, Yem S, Sundewall J. Assessing progress towards universal health coverage in Cambodia: Evidence using survey data from 2009 to 2019. *Soc Sci Med*. 2023;321: 115792.[1] DOI: https://doi.org/10.1016/j.socscimed.2023.115792

Study III

Kaiser, AH, Mao, S, Sundewall, J, Ross, M, Koy, S, Vorn, S, Koeut, P, Ekman B. Assessing the determinants of out-of-pocket health expenditures among Cambodian households in informal employment using survey data. *Int J Equity Health* 24, 33 (2025). DOI: https://doi.org/10.1186/s12939-025-02394-6

Study IV

Kaiser AH, Vorn V, Ekman B, Ross M, Mao S, Koy S, Koeut P, Sundewall J. What contributes to out-of-pocket health expenditure in Cambodia's uncovered population? A distributional and decomposition analysis using survey data. *Sco Sci Med*. 2025; 367:117783. DOI: https://doi.org/10.1016/j.socscimed.2025.117783

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[1] During the revision at the peer-review stage, we rephrased the paper's title to 'Assessing Financial Protection from Out-of-Pocket Health Spending in Cambodia: Evidence Using National Survey Data from 2009 to 2019,' as the paper focuses solely on financial protection rather than service coverage. However, this change was not reflected in the final production of the paper by the editorial office.

Abstract

Out-of-pocket health expenditures (OOPE) remain a major challenge for low- and middle-income countries striving toward universal health coverage (UHC). In Cambodia, OOPE account for approximately 60% of current health expenditure, one of the highest proportions globally, exposing households to health-related financial risks. Notably, 59% of the population—primarily nonpoor informal workers and their dependents—are excluded from prepayment schemes. These households, referred to as uncovered households in this thesis, face heightened vulnerability to financial hardship in the event of illness or injury. This thesis examines the level of financial hardship experienced by uncovered households in Cambodia and identifies the determinants of OOPE and the OOPE budget share within this group.

The analysis draws on data from the Cambodia socioeconomic survey (2009–2023) and a 2023 household survey of uncovered households. Financial hardship was assessed using established methods for measuring catastrophic and impoverishing health expenditure, along with coping strategies employed to manage OOPE. Determinants of OOPE and the OOPE budget share, encompassing *healthcare*, *health*, and *social* factors, were analyzed at the mean using generalized linear models and across the distribution of these outcomes using unconditional quantile regression. Shapley decomposition was employed to quantify the contributions of these factors to the explained variance in OOPE and the OOPE budget share, both at the mean and across the distribution.

The findings reveal widespread financial hardship among uncovered households, with high levels of catastrophic and impoverishing health expenditure and frequent reliance on consumption- and finance-based coping strategies. *Healthcare* factors emerged as the primary determinants and contributors to the explained variance in OOPE and the OOPE budget share, including private sector utilization, higher levels of care, and the number of medications. *Health* factors, notably the severity of illness, days lost to illness/injury, and noncommunicable diseases, were also significant determinants and contributed substantially to both outcomes. The wealth quintile was identified as the only *social* determinant making notable contributions to the explained variance.

Based on the empirical findings, this thesis suggested pathways for reducing OOPE and improving financial protection in Cambodia through a comprehensive approach

integrating financial protection policies, health system reforms, and patient- and household-level interventions. Specifically, recommendations include expanding prepayment coverage to uncovered households, engaging strategically with the private sector, addressing medication costs and rational use, and implementing complementary health system reforms and health education initiatives. Further research is needed to refine these strategies and ensure their effective implementation.

Popular science summary

In Cambodia, many families pay for healthcare directly from their own pockets, which makes up 60% of the country's total health spending. For the 59% of the population who don't have health insurance—mostly informal workers and their families—paying for healthcare directly can lead to serious financial struggles when someone gets sick. These families, often referred to as "uncovered households," are left vulnerable to high medical costs that can force them to cut back on essentials like food or education, borrow money, or even sell their belongings.

By using socioeconomic survey data from the Cambodian government (2009–2023) and a special 2023 survey of uncovered households, this thesis examined why some uncovered households spend more on healthcare than others, how they manage these costs, and how this affects their lives.

The findings are striking. Many uncovered households face financial hardship. Some spend so much that they risk not having enough money for essential spending like food or education, others use coping strategies such as borrowing money, while some end up spending so much on healthcare that they risk falling into poverty. Private healthcare, specialized providers, and medications were some of the biggest contributors to these expenses. Health issues like serious illnesses, chronic diseases like hypertension, and injuries also add to their financial burden. These challenges highlight how difficult it is for families without health insurance to maintain financial stability when health needs arise.

To help these families, the thesis proposes several strategies. Providing health insurance for informal workers is an important first step. Integrating private clinics and pharmacies into the system could improve affordable access to care, while efforts to lower medication costs and promoting rational prescribing and consumption could lower overall expenses. Improving how the healthcare system works, like offering better primary care closer to communities, could also help reduce the need for costly hospital visits. Lastly, educating families about how to remain healthy, how to access health services, and how health insurance works can empower them to make better healthcare decisions. To help ensure these recommendations are implemented effectively, this thesis also identifies areas where more research is needed. With these combined efforts, Cambodia can move closer to a future where every family can access essential medical care without the fear of financial hardship.

Acronyms and abbreviations

AAAQ	Availability, accessibility, acceptability, and quality
BMZ	German Federal Ministry for Economic Cooperation and Development
CHE	Current health expenditure
CMS	Central medical store
CSES	Cambodia socioeconomic survey
D&D	Decentralization and deconcentration
GDP	Gross domestic product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GLM	Generalized linear model
GS-NSPC	General Secretariat for the National Social Protection Council
HEF	Health Equity Fund
ILO	International Labour Organization
KHR	Khmer riel
MNNDs	Maternal, neonatal, and nutritional diseases
MOH	Ministry of Health
NCDs	Noncommunicable diseases
NECHR	National Ethics Committee for Health Research
NEML	National essential medicines list
NSSF	National Social Security Fund
OLS	Ordinary least squares
OOPE	Out-of-pocket health expenditures
PPP	Purchasing power parity
SDG	Sustainable development goal
SHP	Social health protection
UHC	Universal health coverage
UPOS	Household survey of the uncovered population
UQR	Unconditional quantile regression
US$	United states dollar
WHO	World Health Organization

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Acknowledgements

I am deeply fortunate to have had Jesper Sundewall as my main supervisor throughout my PhD journey. Jesper's academic guidance, balancing skill, experience, pragmatism, and a sense of 'good enoughness' (which was so helpful for a recovering perfectionist!), was key in completing this thesis. Beyond a supervisor, Jesper became the mentor I did not know I needed—believing in me so strongly that, eventually, I too was convinced to believe in myself. His patience, humor, kindness, and positivity made him the perfect companion every PhD student should have in this otherwise quite solitary journey. I am equally grateful to my co-supervisor, Björn Ekman, whose commitment to scientific rigor (and his infamous question: *"Hannah, why do we need your research, and how are you pushing the evidence frontier?"*) significantly enhanced the quality of my work and helped me grow as a researcher. Björn's ability to challenge my thinking and ask the tough questions pushed me to consistently refine my ideas and improve my analysis.

This thesis would not have been possible without the love, encouragement, and support of my family. To my partner, Valentin, and our two furry boys, Bamboo and Milou, thank you for your patience, emotional support, and joyful distractions that kept me grounded throughout this journey. I am deeply grateful to my loving parents, who worked tirelessly their entire lives to provide me with my desired education and have always stood by my side. To my siblings, who have been my source of support from day one of my life—thank you. As I finish my PhD, I'm excited to move closer to all of you and spend more time together. And to all the incredible women in my life—though most of you are too far away—you have been an essential part of this journey. Thank you, thank you, thank you! My special gratitude goes to Maddie—you came to Phnom Penh at just the right moment, and your encouragement during those final months meant more to me than you could ever know.

I would like to extend my sincere thanks to the BMZ and the Improving Social Protection and Health project, implemented by GIZ Cambodia, for funding the fieldwork for the household survey. Special appreciation goes to Franziska Fürst, Corinna Heineke, Kristina Knispel, and Kelvin Hui for granting me the approval to pursue a PhD at Lund University. A particular thank you to Franziska, whose support, friendship, and mentorship from day one made all the difference in my Cambodian journey. I am also deeply grateful to Sokunthea Koy for her patience,

Prologue

Dara is 45 years old and works as a construction laborer in Phnom Penh. He works on day-to-day arrangements, typically putting in 12-hour shifts. In the evenings, he doubles as a transportation worker, driving a Tuk Tuk. To save money, *Dara* lives, eats, and sleeps in his Tuk Tuk, similar to many other drivers in Phnom Penh. Every week, he sends part of his earnings to his family in Kratie and uses the remaining money for food and to repay the loan he took to buy his Tuk Tuk.

Bopha is 69 years old. She lives in Battambang, where she cares for her daughter's four children, who works in a garment factory in Kandal and sends money home each month. *Bopha* stretches that money to cover her grandchildren's needs, as well as a small stipend for food for herself and her husband *Rith*. In front of their small house, *Bopha* put up a few stalls where she sells groceries to earn a few additional dollars each month. *Rith*, her 73-year-old husband, works as a subsistence farmer. He grows rice for the family, but earlier this year, a severe heatwave destroyed half of their harvest. Both *Bopha* and *Rith* suffer from hypertension and have made the difficult decision to take their medication only once or twice a week to prevent healthcare costs from overwhelming the household budget.

Sophea is 37 years old and sells Bai Sach Chrouk (rice with grilled pork) as a street vendor in Kampong Speu. Her day begins at 4 AM, when she prepares food to sell outside the garment factories by 6 AM. She has two young children, *Chhay* and *Phirum*, whom she brings to work with her each day, as she has no access to childcare and her husband, *Vireak*, is a fisherman who comes home only once a week. *Chhay* and *Phirum* are bored and play ball games on the side of the busy 4-lane street in front of the factory.

Nary is 28 years old and lives in Phnom Penh. Last year, she graduated with distinction in architecture. Currently, eight months pregnant with her first child, she and her husband *Samnang* are planning for the postpartum period. However, the architecture firm she works for has refused to grant her any paid maternity leave, leaving the couple at odds how to make ends meet with only *Samnang's* job once their baby has arrived while also having to pay for the delivery out-of-pocket.

Sokha is 19 years old. He left school early to financially support his parents and four younger siblings. After juggling multiple jobs, he now works as a delivery driver in Phnom Penh, spending up to 16 hours on the road in heat and tropical rain, delivering food and drinks. Paid around $0.6 per delivery, he bears the costs of his

motorbike and its maintenance. Every month, he sends money back to his family in Banteay Meanchey.

Panda, 32, works for a Cambodian microfinance institute. When his mother was diagnosed with cancer, his parents took out a $20,000 loan from the same institute to cover her palliative treatment in the six months before she passed. Now, with his mother gone and his father unable to repay the debt, the burden has fallen entirely on *Panda*. His own land, along with his sister's and father's, was used as collateral, leaving him no choice but to keep up with repayments or risk his family losing everything. Earning $650 per month, he must allocate $550 to repayments, leaving him with barely enough to survive. Unable to afford rent, he sleeps at the microfinance institute, where he informally serves as unpaid night guard.

Despite their differences in age, gender, profession, and living circumstances, *Dara*, *Bopha*, *Rith*, *Sophea*, *Vireak*, *Nary*, *Sokha* and *Panda* all share one thing in common: they are all working in informal employment. This means that they face irregular, low wages, lack savings, experience job insecurity, and work in unregulated conditions with limited access to social and legal protection. None of them falls below Cambodia's official poverty line, but none of them are financially secure. Additionally, they lack access to prepayment schemes, leaving them without financial protection against the potentially high costs of illness or injury.

Why am I sharing these stories in a PhD thesis? Because this thesis is not just about numbers or policies—it is about the lives of people such as *Dara*, *Bopha*, *Rith, Sophea*, *Vireak*, *Nary*, *Sokha, Panda*, and the over seven million other workers in Cambodia whose lives are hidden behind the label of "informal employment". They, like so many others, become statistical entities—easily overlooked and anonymized by numbers, disadvantaged by the rule of rescue[2], a tendency leading us (as readers, researchers, and others) to prioritize being interested in supporting and saving identifiable lives over addressing broader systemic issues represented by statistics. However, behind those numbers are real people, whose days are filled with hard work, difficult choices, and sacrifices that most of us struggle to imagine. When they don't work, they don't earn. Even worse, when they fall ill, they are faced with the dilemma of whether to seek necessary healthcare, spending what little they have, or delaying or foregoing treatment, risking prolonged illness. As you read this thesis, I urge you to look beyond the data. Picture *Dara* asleep in his Tuk Tuk after a 14-hour shift, *Bopha* skipping her medication so she can buy food for her family, or *Panda* sleeping in the microfinance institute, unable to pay any rent while repaying his deceased mother's medical debt. These are not just stories—they are reflections of broader systemic challenges. The decisions they make, and the trade-offs they endure, shape the reality of financial protection and healthcare access in Cambodia.

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[2] McKie J, Richardson J. The rule of rescue. Soc Sci Med. 2003 Jun;56(12):2407–19.

Outline of the thesis

This thesis is structured into four parts:

Part 0: Foundations lays the groundwork for the thesis. It begins with an introduction to the topic, followed by the research questions and the contributions this thesis makes. This section also provides an overview of key concepts, definitions, and terminology and reviews relevant literature, leading to a framework that conceptualizes the origins and dynamics around out-of-pocket health expenditures (OOPE) and financial protection.

Part I: Study context focuses specifically on the context of Cambodia, providing an overview of Cambodia's health and social health protection systems.

Part II: Diagnostics forms the empirical core of the thesis, presenting detailed methodologies and results from Studies II to IV. This part includes a detailed analysis of financial hardship in Cambodia, followed by an investigation of the determinants of OOPE and the OOPE budget share among uncovered households in Cambodia.

Part III: Discussion reflects on key findings and examines the implications of the empirical findings. It proposes a toolbox with policies and interventions aimed at reducing OOPE and improving financial protection, drawing from both Study I and global evidence, and makes specific recommendations for addressing OOPE and financial protection in Cambodia. This section also offers recommendations for future research and a final conclusion.

Part 0: Foundations

0.1 Introduction

Out-of-pocket health expenditures (OOPE) are widely recognized as inefficient and inequitable source of health financing that may impose significant burdens on household nonmedical consumption opportunities and overall financial wellbeing [1]. Financial protection against OOPE is a core pillar of universal health coverage (UHC), alongside access to essential services [2]. However, in both global UHC discourse and country-level implementation, financial protection has received comparatively less attention than service coverage [3]. Moreover, global monitoring reveals a concerning trend: financial protection has been deteriorating, with over two billion people experiencing financial hardship due to OOPE [2].

To reduce the financial burden of healthcare and advance toward UHC, many countries have adopted prepayment mechanisms such as health insurance schemes, general tax revenues, or a combination of both. These mechanisms aim to spread health and financial risks through prepayment and risk-pooling, thereby reducing reliance on OOPE [4]. However, the journey to UHC is often incremental, leaving large segments of the population uncovered during the transition. Coverage under prepayment schemes is typically first extended to "easier-to-reach" groups, including the poor, formal workers, and civil servants. In contrast, nonpoor workers in informal employment (hereafter referred to as informal workers) and their dependents are frequently left behind [5,6]. This group faces dual disadvantages: they lack access to prepayment schemes, requiring them to pay for health services out-of-pocket, and often work in precarious conditions with limited protection under labor laws [7,8].

In Cambodia, improving the financial protection of informal workers represents a key challenge on the country's path to UHC. OOPE account for approximately 60% of current health expenditure [9], while 59% of the population remains uncovered by existing prepayment schemes [10]. This group, hereinafter referred to as uncovered households predominantly consists of nonpoor informal workers and their dependents. Although classified as nonpoor, they often hover close to the poverty line, making them highly susceptible to economic and health-related shocks [11]. Without access to prepayment schemes, uncovered households commonly face high OOPE, increasing their risk of financial hardship.

By leveraging data from a recent, comprehensive household survey on healthcare utilization and expenditure, this thesis provides insights into the financial protection of uncovered households in Cambodia and identifies factors driving OOPE within this group.

0.2 Research questions

This thesis addresses the following main and sub-research questions:

Main research question

To what extent do OOPE lead to financial hardship among uncovered households in Cambodia, and which factors are determinants of this expenditure?

Sub-research questions

1. What were the trends in OOPE and financial hardship from 2009 to 2023 among the general Cambodian population and uncovered households?

2. What coping strategies do uncovered households use to finance OOPE, and how prevalent are the different types of coping strategies among those seeking outpatient and inpatient care?

3. To what extent do different dimensions of financial hardship overlap among uncovered households seeking outpatient and inpatient care in Cambodia?

4. What are the determinants of OOPE and the OOPE budget share among uncovered households in Cambodia, and how do these determinants vary in their relative importance?

5. Do the determinants and their relative importance among uncovered households in Cambodia differ across the distributions of OOPE and the OOPE budget share?

0.3 Contribution

This thesis makes several contributions to the study of OOPE and financial protection. First, it focuses on informal workers—a group that has often been left behind in UHC efforts across many low- and middle-income countries (LMICs) and is under-researched in academic research. By focusing on this group, this thesis highlights the importance of addressing the financial protection challenges faced by informal workers as countries progress toward UHC, not only in Cambodia but also across LMICs globally. Another contribution of this thesis lies in its comprehensive approach to examining financial hardship. It goes beyond traditional analyses of

catastrophic and impoverishing spending by incorporating an analysis of the coping strategies uncovered households employ to manage OOPE and analyzing the overlap between different forms of financial hardship. Moreover, this thesis addresses gaps identified in the literature by incorporating a broad range of *health* and *healthcare* factors into the analysis of the determinants of OOPE and the OOPE budget share in Studies III and IV—factors that are often excluded in existing research. Additionally, methodologically, Study IV employed a novel approach within the domain of financial protection research, combining unconditional quantile regression (UQR) and Shapley decomposition. These methods could lay a foundation for future studies, advancing how the determinants of OOPE and financial protection are analyzed.

0.4 Concepts, definitions and terminology

This section outlines key concepts, definitions, and terminology that will be used throughout this thesis.

Uncovered households

Uncovered households refer to those in which no member has been enrolled in any prepayment scheme within the past 12 months, with 12 months being the recall period for inpatient care, and whose members are engaged in informal employment. This includes Cambodian government schemes such as the Health Equity Fund (HEF) and the National Social Security Fund (NSSF), as well as local or international private health insurance schemes. Given that financial protection is commonly measured at the household level [12], this definition helps avoid potential bias that may arise from the membership of any household member in any prepayment scheme, which can influence both healthcare utilization and spending patterns. Further details on the screening method used to identify uncovered households during the household survey of the uncovered population (UPOS) and the measurement of their members' informal employment status are provided in section **II.1 Data**.

Informal employment and informal workers

The definition of informal employment follows the International Labour Organization (ILO) standards adopted by the 19th International Conference of Labour Statisticians [13], which is also used as a basis for the Cambodian Labour Force Survey [14] and the Cambodian government's National Strategy for Informal Economy Development 2023-2028 [15]. It is important to distinguish between

informal employment and employment in the informal sector. The latter is a narrower concept, encompassing only jobs (or persons working) in enterprises within the informal sector [13]. The definition of informal employment encompasses two dimensions: the type of job and the type of production unit. The type of production unit refers to enterprises in the formal sector, enterprises in the informal sector, and households. The type of job distinguishes between formal and informal employment on the basis of several employment categories. Informal jobs generally fall outside legal and regulatory frameworks, with jobs and thus, workers, often unprotected by national labor legislation [13]. According to this definition, informal employment covers a diverse range of employment situations, such as own-account workers in informal sector enterprises or subsistence farming, contributing family workers, and employees in the formal sector holding informal jobs that are not subject to labor legislation, employment benefits, social protection, or income taxation for various reasons. In essence, informal employment refers to the total number of informal jobs, regardless of the type of production unit in which they are carried out [13]. The ILO guidelines recommend including three key questions for defining and collecting data on jobs in informal employment, which were incorporated into the UPOS used for Studies III and IV. Additional details on this approach are provided in section **II.1 Data**. For simplicity, I use the term informal worker to refer to individuals engaged in informal employment throughout this thesis.

Remember *Sokha*, *Dara*, and *Nary*? All three are informally employed by formal sector enterprises as their jobs fall outside the scope of national labor legislation and social protection. *Bopha*, *Sophea,* and *Vireak* are own-account workers in informal employment, operating small, unregistered businesses without formal labor protections. *Rith*, as a subsistence farmer, is an own-account worker engaged in production for final use by their household, meaning he is outside the informal sector but still part of informal employment.

Universal health coverage

UHC, as defined by the World Health Organization (WHO), means that all people can access the health services they need, of sufficient quality, and without experiencing financial hardship [2]. In this thesis, the term UHC is used as an ongoing journey—a direction to aspire to and progress toward—rather than a fixed destination. Developments such as technological advancements, climate change and evolving behaviors and expectations mean that even the most advanced health

systems will need to continuously adapt, innovate, be strengthened and make progressive decisions to fulfill the promise of UHC [16].

Out-of-pocket health expenditures

The definition of OOPE adopted in this thesis follows the framework outlined in the 2023 Global Monitoring Report on UHC, which was jointly published by the WHO and the World Bank [2], with adaptations to the Cambodian context. OOPE refer to household monetary expenditures primarily undertaken for health-related purposes, involving the application of medical knowledge or technology[3] [2,17]. It includes payments made at the point of service delivery, by any type of provider, for preventive and curative care in outpatient, inpatient and home-based settings, as well as for any illness, injury, or health conditions [2]. Specifically, OOPE encompass consultation fees, medicines and health products, diagnostic and laboratory services for outpatient care, and fees for inpatient care. However, data on rehabilitative and long-term care services, rescue services, and emergency transportation are not available in the Cambodian context and are therefore excluded. Additionally, this definition excludes prepayments and reimbursements by third parties, such as insurers, the government, or NGOs, and does not account for indirect costs such as nonemergency transportation and opportunity costs, such as lost income [2].

Beyond defining OOPE, it is important to consider what makes this type of spending distinct from other types of consumption as well as its significance in measuring household financial protection. Wagstaff et al. provide a useful summary of these considerations. Illness and injury, and consequently curative health spending, are often unpredictable and irregular, occurring at seemingly random times and typically outside the control of the affected individuals [18]. Economic theory also suggests that individuals are generally risk-averse, preferring predictable prospects, such as regular payments to prepayment schemes, over the uncertainty of incurring high OOPE during health events [19]. Unlike other goods and services, the consumption of health services does not necessarily increase utility but rather aims to restore individuals' health and utility to pre-illness and preinjury levels—assuming that recovery to these levels occurs at all [18]. Furthermore, individuals with similar illnesses or injuries may incur vastly different OOPE due to factors such as comorbidities, the availability and affordability of medical goods or services, prepayment coverage, foregone or incomplete care, or even unnecessary treatments. This variability makes it difficult to use OOPE as a proxy for health improvements [18]. These characteristics highlight the distinct nature of OOPE and

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[3] This thus excludes recreational activities and associated costs, such as gym memberships or nutritional supplements, even though these may influence health [2,17].

their sensitivity to public policy interventions, making it a critical focus for both policymakers and researchers [18].

The importance of OOPE is particularly evident when viewed through the lens of financial protection. Absolute figures alone provide limited insight into the level of financial protection; rather, a meaningful understanding requires considering OOPE in relation to household resources, as elaborated in the following section.

Financial protection

Ensuring financial protection is a core function of a health system and one of the final coverage goals of UHC [2,20]. Its primary aim is to protect essential nonmedical consumption from being compromised because of the financial burden of paying for health services out-of-pocket [21]. Financial protection is grounded in two underlying principles or concepts.

First, financial protection is rooted in the theoretical foundations of economics and health insurance, which emphasize the economic value of reducing uncertainty around the financial risks associated with illness and care-seeking. Health insurance is designed to mitigate income variability by shielding individuals from unpredictable and high medical expenses, thereby providing financial protection to the population [19,22,23].

Second, financial protection relates to the financial burden—or hardship—that households may experience due to OOPE in contexts where the insurance function is not adequately provided. In such cases, financial barriers may even lead households to forego care altogether [22].

While the concept of financial protection includes reducing financial uncertainty, the indicators commonly used—including those applied in this thesis, such as catastrophic and impoverishing spending—focus on measuring financial hardship experienced by households due to insufficient financial protection. These indicators do not fully capture the value of reduced uncertainty but provide insights into the financial burden of OOPE on households [23]. The way financial protection is measured in this thesis is detailed further in the flow chart presented in Figure 1.

Consider an individual in perceived need of healthcare who does not have access to a prepayment scheme, a member of an uncovered household. This individual faces two potential choices: either to utilize health services or not to utilize them.

A. Utilization

If the individual decides to utilize health services, two scenarios may unfold: OOPE are incurred or OOPE are not incurred.

In the first scenario, if OOPE are incurred for the services received[4], it is not the absolute amount of OOPE that matters but rather their impact on the household's financial protection. More broadly, this refers to how OOPE affect non-health aspects of a household's life, such as its ability to meet other essential needs [23]. Financial protection is traditionally assessed via two indicators: catastrophic health expenditure and impoverishment, which estimate the extent to which OOPE exceed defined thresholds relative to household resources [2].
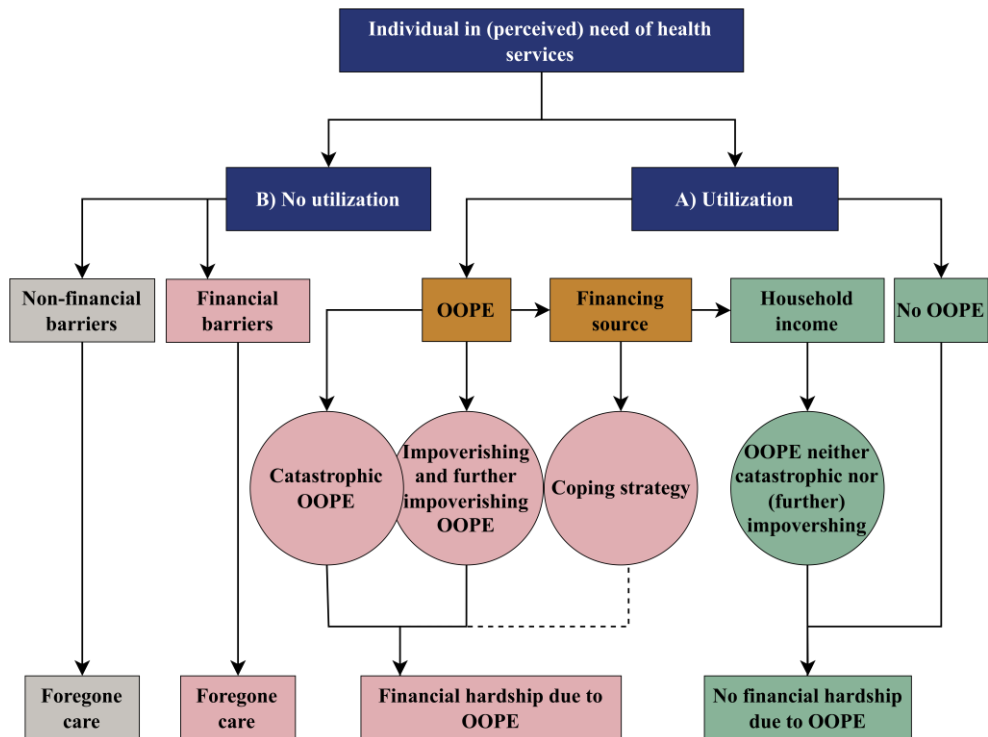
Figure 1. Pathways to health service utilization and their implications for financial protection.
Source: Adapted from [2].

Catastrophic health expenditure

OOPE are considered *catastrophic* when they exceed a specified threshold of household resources, typically set as a percentage of either total household consumption expenditure (THCE) or capacity-to-pay (CTP) [2]. The underlying assumption is that when OOPE surpass a certain share of household resources, they result in relative financial hardship. This means that OOPE cause a large percentage

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[4] The following description only refers to direct OOPE for medical care, while not accounting for indirect costs (e.g. expenditure for transport and escorts), which can worsen financial hardship, while potentially also posing financial barriers and leading to foregone care for financial reasons.

reduction in a household welfare, forcing the household to forego consumption of other necessities compared with their welfare in the absence of the illness or injury necessitating OOPE [23,24]. The incidence of catastrophic health expenditure is the most commonly used measure to assess catastrophic OOPE and is currently the single indicator included in the SDG framework for monitoring financial protection under UHC (SDG 3.8.2) [2]. In addition to catastrophic health expenditure, this thesis extensively uses the OOPE budget share, a continuous measure of OOPE relative to THCE, which serves as the basis for calculating catastrophic health expenditure. This measure provides a more nuanced understanding of the financial burden OOPE impose on households, beyond simply determining whether a specific threshold has been exceeded.

A related sub-indicator is the intensity of catastrophic health expenditure, which measures the extent to which OOPE exceed the defined thresholds among the subset of households experiencing catastrophic OOPE. While the incidence of catastrophic expenditure tells us how common the issue is, the intensity reflects its severity for those affected [12].

Impoverishment and further impoverishment

Impoverishment refers to absolute financial hardship caused by OOPE: those that push a household below the poverty line. The poverty line represents a threshold below which even the most basic living standard is unavailable [23]. A household is considered impoverished by OOPE if it remains above the poverty line when OOPE are included in THCE but falls below it when OOPE are subtracted. This is commonly measured through the incidence of impoverishment, which quantifies the proportion of households pushed into poverty due to OOPE. Impoverished households are subsequently added to a country's poverty headcount [12,18]. The concept of impoverishment relies on a monetary definition of poverty, which does not account for multidimensional deprivation across different domains such as access to education or clean water [23,25]

Further impoverishment measures the extent to which OOPE exacerbate the poverty levels of households already living below the poverty line. This indicator assesses how much further these households are pushed into poverty due to OOPE [12,26].

Catastrophic, impoverishing, and further impoverishing OOPE all indicate financial hardship, reflecting the lack of financial protection against thresholds related to living standards. However, each provides different information: catastrophic spending captures relative financial hardship, whereas impoverishment highlights absolute financial hardship [18]. These indicators were the focus of Study II with additional results presented in **II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023**. Detailed information on their measurement, along with alternative measurement approaches, is provided in section **II.2. Methods**.

Coping strategies

While catastrophic health expenditure and impoverishment measure financial hardship, they do not account for how households finance their OOPE. Some households manage these expenditures through their income. However, it is not uncommon for households to resort to coping strategies[5] such as dissaving, borrowing, selling assets, or receiving remittances from social networks [3]. Additionally, less frequently discussed strategies are consumption-based coping strategies, such as reducing spending on essentials such as food or education [27]. While these strategies may help households avoid catastrophic or impoverishing expenditure in the short term, they often have long-term economic and health consequences [3,28]. Therefore, in this thesis, coping strategies are explicitly considered a form of financial hardship, even though they are not yet incorporated into global financial protection monitoring frameworks. This topic is explored further in the section **Coping strategies among uncovered households**.

> Consider *Panda*. When his mother was diagnosed with stage IV cancer last year, she had no health insurance, leaving her and her husband with no choice but to take out a $20,000 loan—at an 18% annual interest rate, plus an additional 3% for administrative fees—to cover her palliative treatment and extend her life by a few months. With his father unable to repay the debt, *Panda* now shoulders the financial burden alone. To make things worse, the necessary cancer medications were unavailable in Cambodia, forcing *Panda* to travel hundreds of kilometers to Vietnam each month to buy them over the counter—adding to the financial burden with additional travel costs.

If households' spending remains below the threshold for catastrophic OOPE, they avoid (further) impoverishment, and if they do not resort to coping strategies, they are considered not to have experienced financial hardship.

Similarly, some individuals utilizing health services may not incur OOPE at all—for instance through exemptions or personal connections with healthcare providers that eliminate direct costs.[6] In such cases, healthcare utilization does not lead to financial hardship, similar to households that can fully cover OOPE through their income without experiencing catastrophic OOPE or impoverishment.

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[5] In the available literature on financial protection, coping strategies are sometimes referred to as distress or hardship financing [3].

[6] In Cambodia, public health facilities are permitted to offer exemptions to individuals who appear or declare themselves unable to pay for health services, even if they are not enrolled in the Health Equity Fund (HEF) and/or did not bring their Equity card with them. See section I.2 Cambodia's health and social health protection system for more details on the HEF.

B. No utilization

Some individuals may choose or be forced not to utilize health services due to either nonfinancial or financial barriers [2].

Nonfinancial barriers

Nonfinancial barriers to healthcare utilization encompass issues such as inaccessibility, unacceptability, unavailability, inappropriateness, or poor quality of care [29]. For instance, long travel distances, poor quality services, or provider attitudes can discourage individuals from seeking needed care.

Financial barriers

High OOPE or lack of access to prepayment mechanisms can also lead to foregone care for financial reasons. This represents an important dimension of financial protection—or lack thereof: even when individuals avoid financial hardship by not incurring OOPE, they may do so at the cost of unmet health needs. Foregone care often remains underexplored in the literature [3], including in this thesis, due to data limitations.[7]

> Think of *Dara*, the construction worker and Tuk Tuk driver. He's been suffering from severe stomach pain, but his employer does not grant him time off. *Dara* is afraid of losing his job if he seeks medical care, especially since he's already struggling to pay off the loan he took to purchase the Tuk Tuk. He worries that the fees he would need to pay to the provider would only add to the financial strain, so he decides not to utilize care, hoping the pain will eventually subside on its own.
>
> Then, there's *Sophea*, the street vendor. This morning, while preparing rice with grilled pork, she cut herself, and the wound looked like it needed stitches. However, she recalls that last time she visited a clinic, she had to wait for hours and ended up with health expenditure greater than a day's income—in addition to the day's income she had lost while waiting. So, she applies a bandage and carries on with her day.

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[7] The Cambodia socioeconomic survey (CSES) (Study II) does not provide data on the reasons for foregone care. Additionally, the household survey of the uncovered population (UPOS, Studies III and IV, see section II.1 Data) was conducted among households where at least one member sought care during a defined recall period. By definition, this excludes households where no one sought care due to financial or nonfinancial barriers. Although estimates on foregone care were collected, households where at least one person sought care during the recall period are likely less 'at risk' of foregone care. This may bias the overall prevalence of foregone care, and thus, these estimates are not reported.

Private sector

In this thesis, the private sector in Cambodia refers to for-profit providers delivering health services or selling health commodities or products, including both registered and unregistered providers, as data do not currently distinguish between them. Traditional medicine and overseas care are purposefully kept separate in all analyses, even though overseas care, for example, likely also involves private providers.

0.5 Literature review

This section presents a review of the empirical literature on the determinants of OOPE and financial protection in LMICs, spanning studies published from 2010 to the present. The review aimed to guide the methodological approaches employed in Studies III and IV, while also informing the development of the conceptual framework and the proposed toolbox. The identified determinants were categorized in alignment with both the conceptual framework and the toolbox (see 0.6 Conceptual framework and III.2.1 Proposing a toolbox to address OOPE and financial protection).

0.5.1 Determinants of OOPE

A substantial body of evidence exists on the determinants of OOPE in LMICs, with 30 primary studies identified as relevant [30–60]. Over two-thirds of the studies (n=20) were from South Asia, primarily from Bangladesh (n=8) and India (n=7). The remaining studies focused on Sub-Saharan Africa (n=7), East Asia and the Pacific (n=2, both in China), and Latin America (n=1). Studies used varying definitions of OOPE, including total OOPE, OOPE for outpatient care, OOPE for inpatient care, and OOPE for medicines only. Most studies have focused on total OOPE and examined a range of *social*, *health*, and *healthcare*, and a limited number of *health system factors* and *financial protection policies*. Those identified as determinants of OOPE in at least one study were the following:

Social determinants

Social determinants included gender; age; education; literacy; employment; occupation; marital status;[8] household size; equivalent adults; family type; children and elderly individuals in the household; caste; nationality; geographic location; household consumption, income, wealth, assets, and property ownership; earning

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[8] Gender, age, education, employment, and marital status generally pertained to the head of household.

status; access to sanitation facilities; drinking water sources; toilet facilities; and mass media access.

The findings on *social* factors and their associations with OOPE are mixed. Some factors generally showed positive associations with OOPE, such as for older age[9], household size[10], children and elderly individuals in the household[11], dependency ratios[12], literacy[13], higher caste[14], increased household consumption or income and higher wealth quintiles[15]. Poor water, sanitation, and hygiene[16] were also positively associated with OOPE. However, associations were less consistent for factors such as gender[17], education[18], and rural[19] or urban residence[20].

Health determinants

Health determinants included chronic illness; disability; self-reported health status; type of illness; number of illness episodes; number of treatment episodes; health shocks; accidents/injuries; severity of disease; and the need for more accompanying persons. All studies that included these determinants reported positive associations with OOPE, particularly for chronic illness[21] and disability[22].

Healthcare determinants

Healthcare determinants, such as outpatient and care utilization; frequency of visits; length of stay; level of care; and sector of care (e.g. public, private, or traditional) were included in fewer studies but generally showed significant associations with OOPE. For example, private sector care[23], higher levels of care[24], traditional care[25], more illness episodes and visits[26], medicines[27], inpatient care[28], or longer inpatient

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[9] Older age: [33,36,40,50,52,57,59]
[10] Household size: [35,37,40,42–44,52]
[11] Children and elderly individuals in the household: [35,38,41,45,51,55,60]
[12] Dependency ratio: [50]
[13] Literacy: [38,60]
[14] Caste: [32,46]
[15] Increased household consumption and wealth quintile: [33,36–39,42–45,47,48,51,52,57,59]
[16] Poor water, sanitation, and hygiene: [35,38,41,47]
[17] Gender: [35,38,50,55]
[18] Education: [33,35,41,42,44,46–48,51,52,57]
[19] Rural residence: [36,48,50,56,57,59]
[20] Urban residence: [33,39,42,51,52]
[21] Chronic illness: [37,39,43–45,50,51,55,56,60]
[22] Disability: [41,50,57]
[23] Private sector care: [35,36,56,59]
[24] Level of care: [36]
[25] Traditional care: [60]
[26] Illness episodes and visits: [44,57]
[27] Medicines: [56]
[28] Inpatient care utilization: [39]

stays[29] all led to increased OOPE. One study reported that seeking care in the public sector[30] reduced OOPE.

Health system determinants

Health system determinants included proximity to public and private health facilities; the number of doctors and specialists in the area; the number of public hospital beds; and the number of dentists in public hospitals.

The few studies including these reported that longer distances to public facilities[31], larger numbers of doctors (including specialists) in public facilities[32], and shorter distances to private facilities[33] were associated with greater OOPE. Conversely, shorter distances to public facilities[34] and more beds and dentists in public hospitals[35] were associated with lower OOPE.

Financial protection policies

Two studies reported reductions in OOPE through social health insurance membership[36]. Additionally, another study reported that insurance for inpatient care[37] offered protection.

0.5.2 Determinants of financial protection

The review of the determinants of financial protection identified 93 primary studies: 81 examined catastrophic spending [30,43,44,48,52,53,56,58,61–139], three focused on impoverishing spending [108,140,141], and nine assessed both catastrophic and impoverishing spending [34,126,142–148]. An additional 12 systematic or scoping reviews were identified [149–161].

The vast majority of studies on catastrophic spending employed the CTP approach, using a threshold of 40% of nonfood subsistence expenditure. This was followed by the budget share approach, with thresholds of 10%, and, less commonly, 25% of THCE. For impoverishment, most analyses applied their respective national poverty lines.

The factors analyzed in these studies fell into the same five groups as the studies on OOPE but with a slightly narrower range of factors included. The following factors

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[29] Longer inpatient stays: [57]
[30] Public sector care: [57]
[31] Longer distances to public facilities: [36,38]
[32] More doctors and specialists in public facilities: [60]
[33] Shorter distance to private facilities: [60]
[34] Shorter distance to public facilities: [60]
[35] More beds and dentists in public hospitals: [60]
[36] Membership in social health insurance: [41,55]
[37] Insurance against inpatient care expenditure: [56]

were identified as determinants of catastrophic and/or impoverishing spending in at least one study:

Social determinants

Social determinants included age; gender; education; household composition (e.g. children, elderly, dependency ratio); employment; family structure; household size; marital status; religion; caste; ethnicity; membership in social safety net; geographic location; household consumption; income; and wealth quintile.

In contrast to OOPE, associations for *social* determinants were less consistent. Only older age[38], rural residence[39], and the presence of elderly household members[40] were consistently linked with higher risks of catastrophic spending. For other factors, such as gender[41], employment[42], education[43], household size[44], the presence of children in the household[45], and measures of socioeconomic status (including both income and consumption)[46], findings were more mixed, reporting positive, negative, and insignificant associations with catastrophic spending. Studies on impoverishing spending have been more consistent, showing positive associations with household size[47], the presence of children[48] and elderly individuals[49], and negative associations with household socioeconomic status[50].

Health determinants

Health determinants included chronic illness; disability; and the ratio, type, and severity of illnesses.

Studies have consistently reported positive associations between catastrophic spending and disability[51], chronic illness[52], and ratio[53], type[54], and severity of illness[55]. Similarly, chronic illness[56] was consistently positively associated with

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[38] Older age: [54,58,64,71,116,124,133,134,143]
[39] Rural residence: [56,61,65,68,77,86,87,99,101,108,120,126,135,140,145,146,148]
[40] Presence of elderly: [35,68,76,81,82,85,86,95,99,116,126,131,133–135,139,145–147,287]
[41] Gender: [58,62,82,83,99,116,120,125,143,144,146]
[42] Employment: [63,68,76,99,103,116,130,139,146,287]
[43] Education: [48,56,58,61–63,66,81,99,100,116,134,143,145,287]
[44] Household size: [52,61,64,68,76,94,99,100,116,122,126,133,134,136,145,287]
[45] Presence of children: [71,81,85,86,95,99,126,131,144,146,147]
[46] Socioeconomic status:
   [43,44,48,49,52,58,68,76,81,82,99,100,106,115,116,122,126,131,133,137,144–146]
[47] Household size: [140,141]
[48] Presence of children: [140,144,147]
[49] Presence of elderly individuals: [126,145–147]
[50] Socioeconomic status: [108,146]
[51] Disability: [61,64,86,100,114]
[52] Chronic illness: [43,44,71,81–83,86,99,100,103,122,130,136,137]
[53] Ratio of illness: [44,81]
[54] Type of illness: [49,63,71,81,87,115,121,122]
[55] Severity of illness: [56,87,138]
[56] Chronic illness: [87,108,141,142,145]

impoverishing spending, the only health factor explored in studies of impoverishment.

Healthcare determinants

Healthcare determinants included the frequency of visits; inpatient care utilization; length of stay; level of care; sector of care; and intensity of utilization.

Inpatient care utilization[57] was the most frequently studied factor, consistently showing positive associations with both catastrophic and impoverishing spending. Similarly, the use of higher levels of care[58] and the private sector[59] were positively associated with both measures. The use of public care[60] was found to be protective. Other factors linked to higher catastrophic spending included the frequency of visits[61] and the intensity of utilization[62], whereas longer inpatient stays[63] were associated with impoverishment.

Health system determinants

Health system factors were less commonly included in the analyses, with only a few studies examining the distance to health facilities; ambulance services; and the number of hospitals per 1,000 people.

One study reported positive associations between distance to health facilities and the absence of ambulance services[64] and catastrophic spending, whereas another reported a negative association between the number of hospitals and catastrophic expenditure[65].

Financial protection policies

Among the *financial protection policies*, the results for health insurance[66] were inconclusive, with studies reporting both decreased and increased risks of catastrophic spending among the insured, echoing the findings from Guo et al. [160].

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[57] Inpatient care utilization: Catastrophic OOPE:
   [44,49,52,56,61,71,89,99,100,103,122,130,131,135,139]. Impoverishing OOPE: [108]
[58] Higher levels of care: [82]
[59] Private sector care: [44,49,56,63,71,85,122,125,133,138,145]
[60] Public sector care: [30,36,53,63,71,120,121,132]
[61] Frequency of visits: [56,138]
[62] Intensity of utilization: [56,137]
[63] Longer inpatient stays: [141]
[64] Absence of ambulance services: [136]
[65] Number of hospitals: [138]
[66] Health insurance: [63,68,72,76,80]

0.5.3 Gaps and limitations in the literature

The review highlighted several gaps in the empirical literature concerning the determinants of OOPE and financial protection. Geographically, studies on OOPE are predominantly concentrated in South Asia, with limited representation from other regions, such as Sub-Saharan Africa and Latin America. Similarly, the literature on financial protection is confined to a small number of countries, particularly East Asia and the Pacific and the Middle East and North Africa regions [3,160]. Evidence on impoverishing spending is scarce [3,160] and there are no reviews available on the determinants of OOPE. Furthermore, most studies focused solely on *social* factors, potentially missing important associations with *health*, *healthcare* and *health system* factors, which were consistently found to be significant when included, as also highlighted by Rahman et al. [3]. The inconsistent findings related to various *social* determinants also make it difficult to draw definitive conclusions, underscoring the need for contextualized evidence. Additionally, studies have used different definitions of indicators and varying thresholds and have relied on diverse types of surveys (e.g. nationally representative, subnational, or targeted population surveys, as well as hospital-based data). These differences complicate comparisons across studies and limit the generalizability of findings.

0.6 Conceptual framework

Figure 2 presents a conceptual framework illustrating how OOPE and financial protection are conceptualized in this thesis, integrating insights from the literature review and incorporating broader contextual elements. This thesis begins with the premise that these outcomes are shaped by a complex interplay of supply-side, demand-side, and contextual factors, as highlighted in the literature review. The conceptual framework reflects an understanding that these factors collectively influence the origins, dynamics, and consequences of OOPE, as well as the extent and nature of financial hardship. The framework serves as the conceptual foundation for the empirical analyses presented in section **II.3 Findings**, which examine the determinants of OOPE and the OOPE budget share in Cambodia's uncovered households. Additionally, the framework connects to the proposed toolbox of policies and interventions in section **III.2.1 Proposing a toolbox to address OOPE and financial protection**, compiling strategies implemented in other contexts to reduce OOPE and improve financial protection.

The core pathway: from health need to financial protection

The innermost layer of the framework illustrates the pathway that begins with a (perceived) health need, such as illness or injury, progresses through interaction(s) with health services, and culminates in OOPE and the level of financial protection experienced by the household having a member with a health need. Specifically, an individual's health need including (perceived) severity and the desire to seek care [29] act as the initial input, triggering care-seeking behavior. Health service utilization then captures how individuals engage with and navigate in the health system to seek and receive services. This includes several key dimensions:

- **Sector of care:** The type of sector accessed, whether public, private, traditional, or overseas.
- **Level of care and type of provider:** The specific level within the health system, such as primary, secondary, or tertiary care, and the type of provider at each level.
- **Intensity of utilization:** The frequency and duration of healthcare utilization, such as the number of visits, length of hospital stays, or volume of care received.
- **Types of services received:** The range of services accessed, such as diagnostics, medications, and procedures.

The intermediate outcome—OOPE—is a direct result of the health services utilized by individuals based on the basis of their health needs. OOPE, in turn, influence the final outcome, which is the level of financial protection, reflecting the effect of OOPE on household welfare.
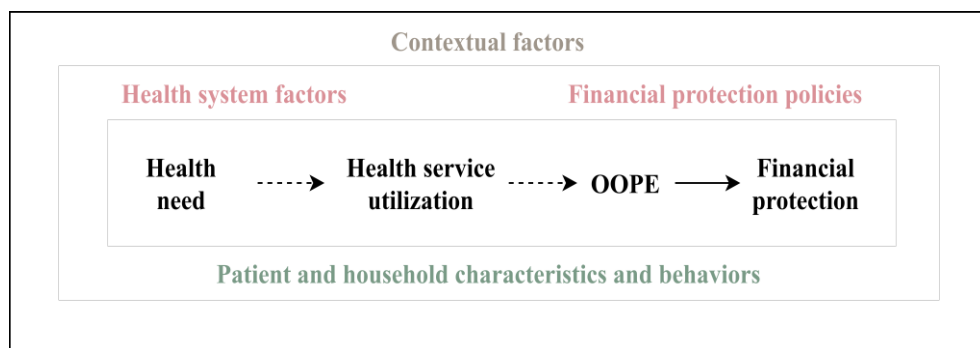
Figure 2. Conceptual framework for OOPE and financial protection.
Notes: The dashed lines between health need, health service utilization, and OOPE signify that not all individuals with a health need necessarily utilize health services, as some may forego care owing to financial or nonfinancial barriers. Similarly, not all individuals who utilize health services necessarily incur OOPE, as exemptions or coverage through prepayment mechanisms can mitigate OOPE.
Source: Author's elaboration.

Modulators: shaping the core pathway

The middle layer of the framework identifies supply-side and demand-side modulators that influence the pathway from health needs to financial protection. These factors influence individuals' health needs, care-seeking behaviors, the organization and regulation of healthcare services, and the affordability of these services. Specifically, the included modulators are as follows:

Financial protection policies are the most direct levers for influencing OOPE and financial protection by reducing the financial burden at the point of service. These policies primarily include prepayment mechanisms that operate across three dimensions. Inadequate or limited coverage across any of these dimensions increases OOPE at the point of service and reduces financial protection:

- **Population coverage (breadth of coverage):** Who is covered de jure and de facto.
- **Service coverage (depth of coverage):** The range of services and commodities included.
- **Cost coverage (height of coverage):** The level of cost-sharing, including co-payments, deductibles, and balance billing.

Health system factors encompass structural, organizational, and supply-side aspects across all health system building blocks: Leadership and governance, health financing, health workforce, service delivery, essential medicines, and health information [162]. Together, these elements establish the systemic conditions that influence the availability, accessibility, acceptability, and quality (AAAQ) of health services [163] and drive the extent to which individuals incur OOPE, the scale of those expenditures, and the extent to which financial protection policies can work effectively to offset them.

Patient and household characteristics and behaviors include demographic, socioeconomic, and behavioral factors that influence individual health needs, engagement with the health system, OOPE, and financial protection. These include:

- **Demographic factors:** Age, sex, household structure, and size influence health needs and access to care
- **Socioeconomic factors:** Education, employment, and income, among other factors, affect access to health information, occupational risk, and the ability to pay for care
- **Biological and genetic factors:** Predisposing individuals to certain health risks
- **Health-related knowledge, attitudes, behaviors, and preferences:** Health literacy, preventive care, and modifiable risk factors all influence the likelihood of needing and seeking appropriate care
- **Social support networks:** Provide informational and financial assistance.

While each modulator category independently shapes the core pathway, they also interact. For example, health system factors, such as workforce availability and service delivery infrastructure directly affect the effective depth of coverage in financial protection policies by determining which services are realistically available, accessible, and of adequate quality. Likewise, patient characteristics, such as socioeconomic status and health literacy, influence individuals' capacity to navigate and utilize financial protection policies, thereby influencing demand for services and OOPE. Recognizing these interactions is essential to understanding the complex, layered dynamics around OOPE and financial protection.

Contextual factors

The outermost layer captures broader contextual factors that shape both modulators and the core pathway. These factors include but are not limited to the following:

- **Economic factors:** Macroeconomic trends such as growth, inflation, or shocks can affect public health budgets, healthcare prices, and household disposable income, influencing health service utilization and financial protection
- **Technological advancements:** Innovations in medical technology and pharmaceuticals, influencing public health spending, health needs, service delivery, and costs
- **Epidemiological factors:** Disease outbreaks and pandemics can disrupt health systems and alter health-seeking behavior, leading to changes in OOPE and financial protection
- **Ecological factors:** Climate change and natural disasters can impact patient and household characteristics, health needs, utilization, and health system functioning
- **Political factors:** Political stability or conflict affects governance, resource allocation, and the overall functioning of the health system, as well as patient trust in public services
- **Demographic trends:** Population aging or urbanization shape health needs and health service utilization

Part I: Study context

This section provides information on the context of Cambodia, offering a brief overview of the country's economic progress, the challenges posed by informal employment, and an outline of Cambodia's health and social health protection (SHP) system.

I.1 Economic progress and the challenges of informal employment

Cambodia is a lower-middle income country in East Asia and the Pacific with a population of approximately 15.6 million as of 2019 [164]. Between 2009 and 2019, Cambodia experienced significant economic progress, with robust gross domestic product (GDP) growth averaging 7% annually, which was driven primarily by nonagricultural labor earnings [11]. This sustained growth led to improved incomes, living standards, and dramatic reductions in the poverty headcount based on the nationally defined monetary poverty line [165], which fell from 33.8% in 2009 to 17.8% in 2019. The poverty gap has also declined from 8.2% to 3.5% [11]. However, despite these improvements, many Cambodians remain concentrated near the poverty line, making them vulnerable to external economic shocks and life-cycle risks [11,166], as shown by the high sensitivity of the poverty rate to changes in the poverty line [167,168]. Additionally, nonmonetary deprivation levels have declined at a slower pace, with many households remaining in multidimensional poverty [11,25,167].

Cambodia's high labor force participation rate, averaging 85% between 2009 and 2019 for individuals aged 15 or older [14], is among the highest in East Asia and the Pacific and was a key driver of poverty reduction [11]. During this period, a structural shift occurred, with more productive and better-paying nonagricultural jobs being created in sectors such as services, industry, construction, manufacturing, and tourism [11]. However, the overwhelming majority of workers remain in informal employment. In 2019, approximately 88.3% of the employed population worked in informal jobs, rates that are among the highest regionally and globally [14,169].

Informal workers are highly heterogeneous in terms of their enterprises or business units as well as personal characteristics (e.g. age, gender, industry) but share common vulnerabilities such as lower incomes, longer working hours, and a lack of social protection and key labor rights such as paid annual and sick leave or pensions. For instance, in 2019, only 22.7% of employees were entitled to paid annual leave, and 22.4% were entitled to paid sick leave [14]. These figures highlight the significant gaps in Cambodia in relation to SDG 8, which aims to promote decent work for all [170].

The COVID-19 pandemic underscored the vulnerability of informal workers, who were disproportionately affected by employment and income shocks, with few receiving government cash or in-kind support—among other reasons due to the lack of data on their employment, business information, or registration [11,15,171,172]. For example, panel surveys from 2020-2022 revealed that 63% of informal workers were unable to meet their daily subsistence needs and 80% reduced their food expenditures [171]. While Cambodia's economic recovery accelerated in 2022 and returned to the growth trajectory seen pre-COVID-19 [173], the incomes of many informal workers have yet to fully recover.

The Cambodian government is making strong efforts to both extend social protection to informal workers and move towards their formalization. However, given the sheer size and diversity of the informal economy, this path remains long and challenging, with many informal workers still facing precarious employment conditions and limited improvements in living standards [8,15,166].

I.2 Cambodia's health and social health protection system

This section provides a brief overview of Cambodia's health system, which is structured around the WHO's health system building blocks [162]. It focuses on the performance of the health system, where data are available, while also considering select contextual factors that are relevant for system outcomes. Overall, challenges can be summarized by constraints on both the supply and demand sides, including limited public financing, shortages in health worker availability and training, insufficient availability and affordability of quality-assured essential medicines, concerns about quality of care, and gaps in data for decision-making.

Leadership and governance

The Ministry of Health (MOH) is responsible for defining health policies, regulations, guidelines, and strategic plans; mobilizing and allocating resources;

delivering public and governing private health services; monitoring, evaluation, and research; and managing health information systems. The MOH governance structure is divided into three General Directorates: (I) Health, (II) Administration and Finance, and (III) Inspection. Decentralization and Deconcentration reforms have been gradually implemented in the health sector since 2001. These reforms aim to expand governance of public health services to the subnational level, bringing responsibility and decision-making (including financial and human resource management) closer to service users. Under this structure, provincial administrations oversee provincial health departments, which are responsible for provincial service delivery. Provincial health departments manage provincial hospitals and operational districts, whereas operational districts oversee district referral hospitals, health centers, and health posts [174–176]. However, capacity constraints, unclear definitions of roles at the subnational level, and challenges in coordinating decision-making and health financing have hindered the effective implementation of the Decentralization and Deconcentration reforms, highlighting the need for further institutional strengthening at all levels [177,178]. Gaps in governance are particularly evident in the regulation of the large private sector, for example regarding quality control or monitoring and reporting standards for private providers [178].

The MOH collaborates closely with other line ministries and bodies, notably the General Secretariat for the National Social Protection Council (GS-NSPC), which has played a central role in coordinating the development of Cambodia's UHC Roadmap 2024-2035 [179]. This policy framework will guide the Cambodian government and development partners in advancing the country's progress toward UHC. The Roadmap's implementation will be overseen by the newly established UHC Sub-Committee and Secretariat under the NSPC.

Health financing

Social health protection and health financing reforms

Cambodia's SHP landscape comprises a combination of noncontributory social assistance and contributory social security, collectively covering approximately seven million people, or 41% of the population [10].

The social assistance component includes the HEF, established in 2000, which provides poor households with free treatment at public facilities, food stipends and transportation allowances for inpatient care, funerary grants, and stipends for caretakers. Eligibility is determined through proxy-means testing at the commune level. Since mid-2019, poor households have also been eligible for cash transfers targeting pregnant women and young children, aimed at improving maternal and child health outcomes. The HEF has undergone several expansions in recent years. In January 2018, coverage was extended to select groups—collectively covering

99,417 people[67]. In June 2023, coverage was further expanded to include female informal workers in the entertainment sector, covering 3,217 individuals. In September 2023, the government further extended HEF coverage to 491,243 "At-risk" households (1,821,056 people), defined as those with per capita consumption below 1.5 times the national monetary line. As of December 2023, approximately 706,280 households, comprising approximately 3 million people, were HEF beneficiaries [179]. The latest impact evaluation suggests that the HEF has increased public sector utilization rates among its beneficiaries while reducing their OOPE, although concerns around financial protection remain [180].

The contributory social security component, managed by the NSSF, covers formal sector workers since the end of 2016 and civil servants (including retirees and veterans) since early 2018. Both groups are entitled to medical treatment at all public facilities and 130 contracted private facilities. Formal workers also receive cash benefits for illness-related work absences, while civil servants benefit from no salary deductions during illness [181]. In August 2023, the NSSF was extended to cover dependents of formal workers and civil servants, and voluntary coverage was introduced for own-account workers in the informal economy and their dependents. By mid-2024, these schemes covered approximately 1.5 million formal workers (2,002 dependents), 400,800 civil servants (50,703 dependents), and 154,347 own-account workers (with 2,970 dependents). An impact evaluation of the NSSF health insurance schemes has not yet been conducted, but a recent report indicates that NSSF members continue to incur OOPE [182].

At the time of writing, approximately 2 million informal workers (and, partially, their families) were covered under Cambodia's existing SHP schemes.[68] While the government's efforts to expand prepayment coverage are commendable, approximately 59% of the population remains without coverage. As illustrated in Figure 3, this group primarily consists of nonpoor informal workers and their dependents, referred to as uncovered households throughout this thesis. This pattern of coverage—initiating social security for formal employees and civil servants and social assistance for poor and vulnerable households—is common across LMICs on their paths toward UHC [5,183]. Extending coverage to uncovered households through a combination of social assistance and social security is a key priority in Cambodia's UHC Roadmap [179] which, in the absence of a health financing strategy, is the policy document guiding health financing reforms from 2024 to 2035.

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[67] Informal workers (part-time, casual, and seasonal workers), village and commune personnel, athletes, tricycle and motor association drivers, cyclo drivers, and demining experts. Covered informal workers under this extension are less than 4,000.

[68] At the time of data collection in June-July 2023, coverage was at less than 10,000 informal workers.
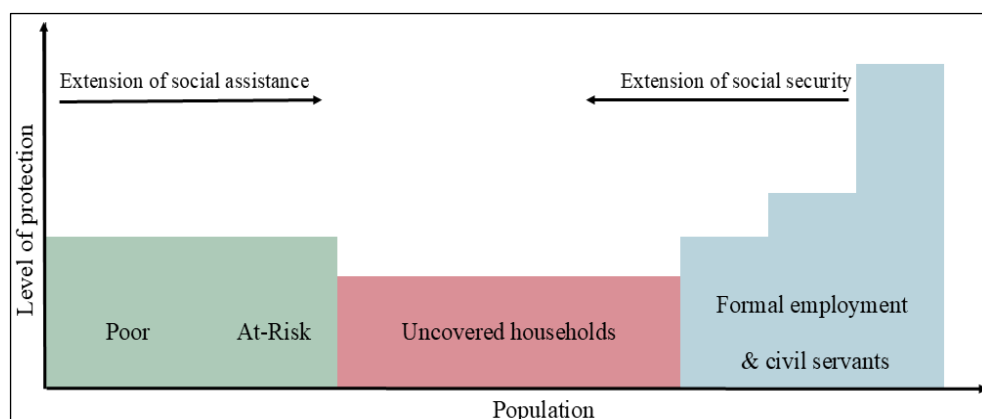
Figure 3. Simplified illustration of Cambodia's uncovered households and the government's strategy for extending coverage.
Note: The x-axis represents the population ranked by income, from lowest to highest.
Source: Adapted from [166].

Health expenditure and financing trends

Over the period from 2010 to 2021, Cambodia consistently spent a larger share of GDP on current health expenditure than neighboring LMICs did in East Asia and the Pacific region and the global average in LMICs, averaging between 6% and 7% from 2010 to 2021 (Figure 5). However, despite an increase in domestic general government health expenditure per capita (in purchasing power parities, PPPs) from $32.97 in 2010 to $95.78 in 2021, this figure remains one of the lowest in the region and well below the global average for LMICs at $311.20 (Figure 6) [184].
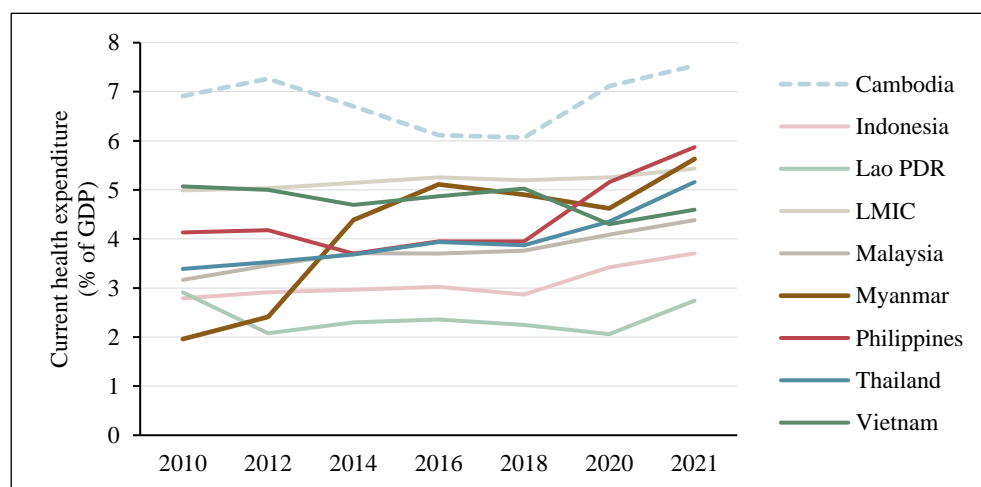
Figure 4. Current health expenditure as a percentage of GDP.
Source: Adapted from [184].

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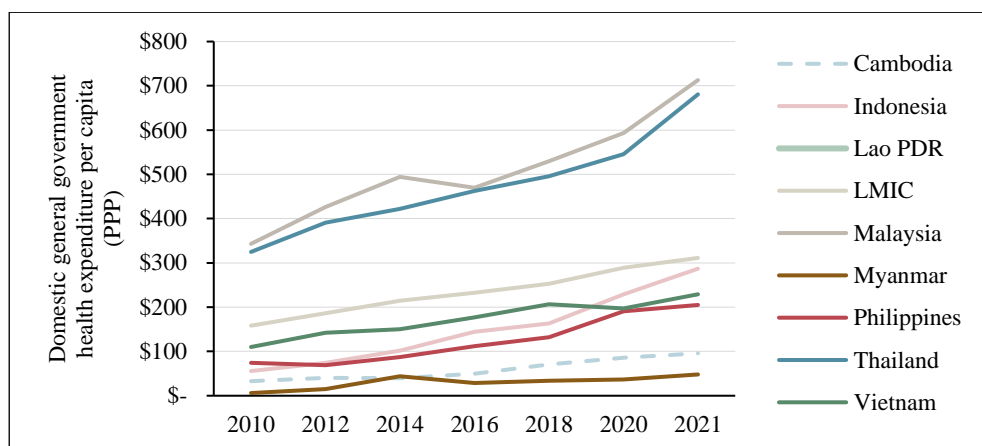
Figure 5. Domestic general government health expenditure per capita (PPP).
Source: Adapted from [184].

On the basis of the latest National Health Accounts data from 2019, domestic general government health expenditure accounted for a relatively low share (21.40%) of current health expenditure funded. As a result, OOPE have remained high, constituting approximately 60% of current health expenditure across the years and peaking at 64.39% in 2019 [9][69]—compared with approximately 35% in LMICs globally [184]. From a health financing perspective, this heavy reliance on direct household payments for health is both inefficient and inequitable, posing substantial risks of financial hardship, which is explored in detail in section **II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023**. External funding from development partners has steadily declined from 2012 to 2019 and is expected to decline further [175], although it still represented 10% of current health expenditure in 2019. External funding was largely earmarked for communicable diseases (e.g. tuberculosis, HIV/AIDS) and programs for maternal, neonatal, and child health, while only 1% of funding was allocated for noncommunicable diseases (NCDs) from 2008 to 2018 [175]. While the share of funding through public SHP schemes increased, particularly between 2017 and 2019, it remained modest at only 2% in 2019 [9]. It remains to be seen how the recent expansions of both HEF and NSSF will impact on the share of current health expenditure financed through these schemes. Contributions from private health

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[69] According to estimate by the WHO Global Health Expenditure database, OOPE dropped to 54.94% in 2021. In the absence of National Health Account data for the period post 2019, the OOPE estimate for 2021 was primarily informed by the Cambodia socioeconomic Survey (CSES), which indicated a decline in OOPE between 2019 and 2021. This is likely due to the impact of COVID-19 on both data collection and healthcare-seeking behavior. It should be noted that this assessment is based on my own judgement, as well as that of Cambodian and global health financing experts, given that no concrete data is currently available to fully substantiate this claim.

insurance schemes have remained below 1% (Figure 6). Regarding the distribution of spending across care levels, a 2019 study reported that over 80% of current health expenditure in Cambodia is allocated to secondary and tertiary care [185].
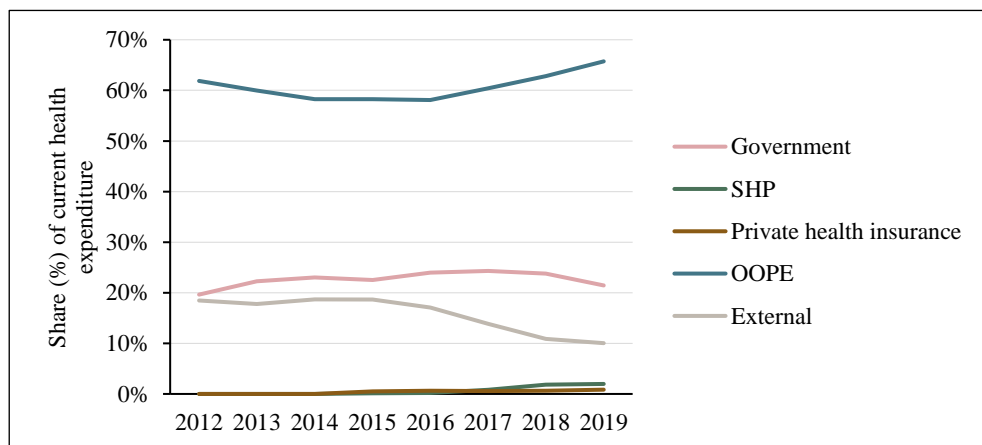
Figure 6. Health financing sources as a share of current health expenditure.
Source: Adapted from [9].

Public health spending

The recent World Bank Public Expenditure Review highlights that public health spending in Cambodia is allocated primarily to curative care (62%) and governance/health system administration (35%), with only 3% being directed to preventive care. In regional comparisons, Cambodia's spending on governance/administration is three to four times greater than that in Thailand, Malaysia, and Vietnam, while spending on curative and preventive care is among the lowest. Approximately 36% of the public health budget is allocated to provincial levels, primarily for wages. Provincial allocations may not adequately reflect provincial poverty levels and health needs. In terms of program categories, NCDs constitute only 0.07% of the public health budget, compared with 5.03% for maternal, neonatal, and child health, and 1.3% for communicable diseases. However, wage costs are consolidated into a fourth program in the MOH budget, so these estimates do not represent true program costs [175].

Progressivity of health financing

The most recent benefit incidence analysis of Cambodia's health financing system, which used data from 2012 to 2015, predates recent health financing reforms, including the expansion of SHP schemes. This analysis showed that public sector benefits generally favor the poor, with public hospital outpatient care being moderately pro-poor, and hospital inpatient care and primary care at health centers being substantially pro-poor. In contrast, private sector outpatient and inpatient care

was heavily pro-rich, with nearly half of the benefits concentrated in private pharmacies and facilities [185]. These findings align with data from the 2019 Cambodia National Health Accounts [9].

Human resources for health

Following decades of conflict and civil war, most notably the Khmer Rouge regime from 1975 to 1979, Cambodia faced severe shortages of health workers. Estimates suggest that only approximately 25 doctors remained in the country in the 1990s, with many executed for their professional skills [178].

Health workforce availability and distribution across sectors

Several Health Workforce Development Plans guided the production, deployment, training, and management of health workers from 1996 to 2020. By 2021, the workforce had grown to include approximately 50,000 professionals across both the public and private sectors [186]. However, shortages persist, with the ratio of doctors and nurses falling below global and regional averages [187][70], and a severe lack of specialists. The MOH estimates that an additional 5,331 doctors, nurses, and midwives are needed to deliver the minimum essential services defined in its care guidelines, increasing to 29,908 to meet the SDG health workforce requirements [186]. There are also critical shortages in cadres such as biomedical engineers, affecting equipment maintenance [178]. The majority of the 12,510 doctors work in the (better-paying) private sector (63.5%), while 58.4% of the 21,074 nurses and 62.3% of the 12,851 midwives are employed in the public sector. No detailed information is available on the distribution of the 599 medical assistants, 546 dentists, 859 pharmacists, 851 lab technicians, and 2,031 other staff [186]. Although women constitute the majority of healthcare workers, they are underrepresented among general practitioners, specialists, and in leadership roles [188,189].

Dual practice is common, with 50% to two-thirds of public sector workers simultaneously engaged in private practice [178,190]. Insufficient regulation around dual practice has led to issues such as absenteeism in public facilities and inappropriate referrals to private clinics [178,179].

Distribution of public health workers and the skill mix

Despite the establishment of a Human Resource for Health Management System, challenges remain in distributing the public health workforce. In rural areas, 63% of

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[70] According to WHO, these ratios lay at 0.21 doctors and 1.02 nurses per 1,000 people in 2019, far below the global averages of 1.28 doctors and 2.39 nurses in LMICs (and 1.90 doctors and 3.30 nurses per 1,000 people in LMICs in the East Asia and Pacific) [187]. However, own calculations based on the latest available figures of health workers from MOH in 2021 indicate slightly higher ratios at 0.81 doctors and 1.37 nurses.

health centers are understaffed, whereas 35% are understaffed in urban areas. The ratio of doctors to health centers is 1:1 in urban but 1:5 in rural areas [175]. Doctors are concentrated at the secondary and tertiary levels in urban centers and at the central level, with 19% and 50% working at these levels, respectively; only 11% work at the district level, and only 8% work at the commune level [175,179,186,189]. The concentration is even more pronounced for specialists, with 79% working at the central level, leaving critical gaps in specialist care at subnational levels [189].

Health worker competencies and training

Even when available, health workers may lack the knowledge, skills, and competencies needed to meet national and international standards, affecting the quality of care. Additionally, while large investments have been made in addressing maternal, neonatal, and nutritional diseases (MNNDs), workforce readiness remains low for NCDs, emerging diseases, and digital health [186].

As of 2020, Cambodia had 20 health education institutions (seven public, 13 private). Although preservice education has improved with increased regulation, standardized entry and exit requirements, and competency-based curricula, concerns persist about the quality of training, especially in private institutions. High student-teacher ratios and outdated materials in public institutions also remain issues [178]. Preservice education strengthening projects, implemented by the government and development partners, are ongoing [191]. In-service training and continued professional development opportunities are limited, raising concerns particularly for older workers who were educated before more recent improvements in education standards. In the private sector, estimates suggest that only 54% of private healthcare workers hold formal medical qualifications [175].

Service delivery

Overview of the health service delivery system

Cambodia operates a mixed service delivery system comprising public, private, and NGO-operated services. The public sector manages 1,567 facilities across four levels, namely: commune, district, provincial, and national, with services defined by the Minimum Package of Activities (MPA) and Complementary Package of Activities (CPA). As of 2023, there were 132 health posts and 1,305 health centers delivering primary healthcare at the commune level (MPA level). The district-level facilities included 61 hospitals operating at the CPA1 level, 39 at the CPA2 level, 21 provincial hospitals (CPA3 level) and 12 national hospitals [192]. Patients are encouraged to seek care first at the commune level, although referrals—except for HEF beneficiaries—are rarely enforced [179].

The private sector vastly outnumbers the public sector, with 18,095 registered providers in 2023. The majority (16,776) of these are small, lower-level facilities, including general practitioners, maternity wards, nursing rooms, or dental clinics. The remaining providers consisted of private clinics, poly clinics, and hospitals. An additional 3,747 private pharmacies are registered, as are 357 Depot A and 248 Depot B pharmacies, which are authorized to sell a limited number of medicines only[71] [192–194]. Cross-referrals between sectors are common, driven by dual practice and private providers referring severe cases back to the public sector [194].

A smaller number of local and international NGO providers also deliver health services, including notably for children, poor people, orthopedic care, and HIV and tuberculosis patients [178].

Service delivery statistics

Data from both the Cambodia socioeconomic survey (CSES) 2009 to 2021 and the UPOS indicate a strong propensity among Cambodians for private care. In 2021, 76% sought care from a private provider as their first contact, up from 54% in 2009 (Figure 7). Private sector utilization increased the most among uncovered households (19.9%), followed by HEF beneficiaries (18.1%) and NSSF beneficiaries (16.2%). The UPOS confirms this trend, with 92.10% of households using private care compared with 18.85% using public services.
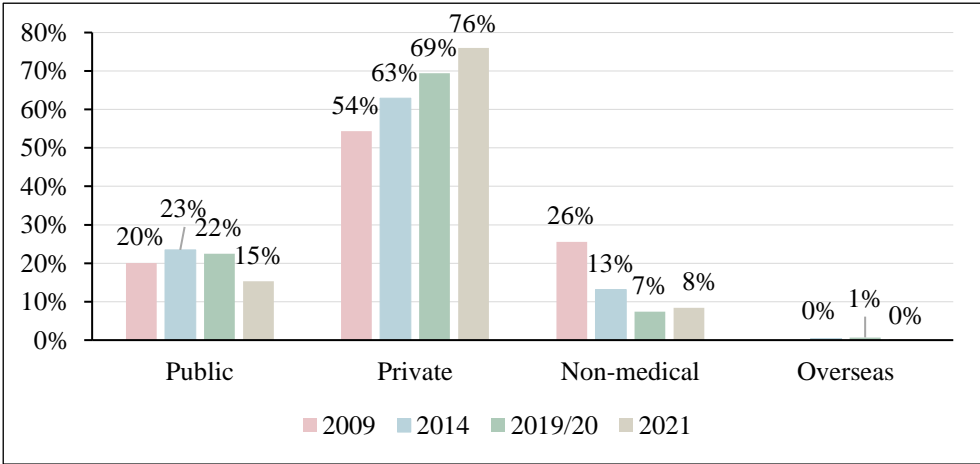
Figure 7. Type of sector first consulted from 2009 to 2021.
Source: Author's calculations based on the CSES 2009 to 2021, adapted from [195].

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[71] Depot A facilities are managed by secondary (assistant) pharmacists, while Depot B facilities are overseen by retired health professionals, such as nurses or midwives. Licenses for Depot B have not been issued since 2013, but those who obtained licenses prior to that year are allowed to continue operating until they close their Depot B.

A more detailed analysis revealed that 40.4% of first contacts were at private pharmacies, followed by private clinics, lower-level facilities, and hospitals (Figure 8).
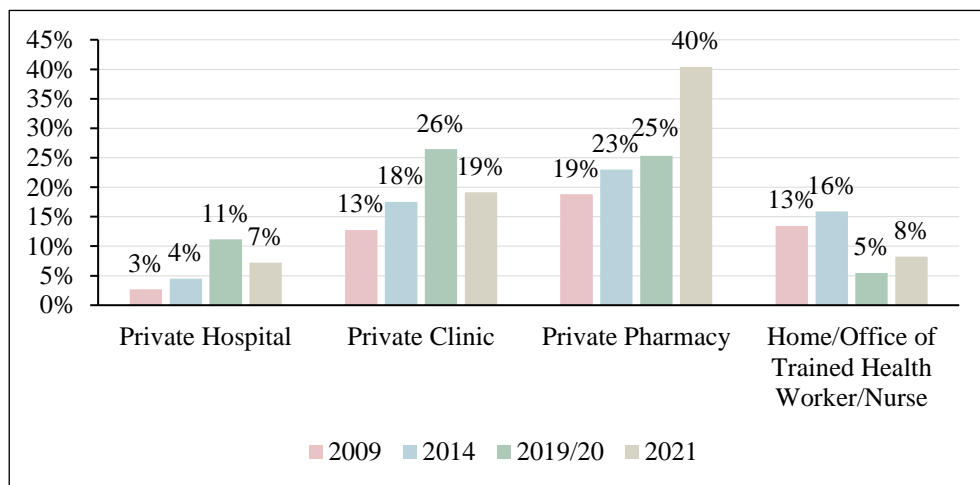
Figure 8. Type of private provider first consulted from 2009 to 2021.
Source: Author's calculations based on the CSES 2009 to 2021, adapted from [195].

Access

This section offers a brief overview related to access to health services in Cambodia, structured around the AAAQ framework [163].

Availability: Geographic disparities remain significant, particularly in rural areas, which have fewer public health workers (especially specialists), as well as essential equipment and supplies [175,178]. Private hospitals and laboratories are heavily concentrated in urban areas, with a strong presence in Cambodia's capital Phnom Penh. Nearly half of all private pharmacies (1,628 or 43%) are located in Phnom Penh alone [194]. The absence of comprehensive service availability and readiness assessments for both the public and private sectors limits the understanding of actual service availability. However, the limited evidence suggests low availability of public services and gaps between what is outlined in the MPA and CPA versus what is available in practice, primarily due to staff shortages, inadequate training, and lack of infrastructure and medicines [175,178,196,197]. For instance, only 20% of public facilities offer NCD screening and treatment, mainly due to insufficiently trained staff and a lack of medicine [175]. A recent assessment of public hospitals in one province revealed that insulin was unavailable in any of the public hospitals in that province [198]. Similarly, oral health services are not routinely available in the public sector, as they are not included in the MPA and CPA packages [199].

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Accessibility: Data from the CSES 2009 to 2021 indicate that 93% of individuals reporting illness or injury sought care, suggesting high accessibility of healthcare services. However, accessibility is uneven across the rural-urban and wealth divides. Physical accessibility is particularly challenging for low-income households, as the average distance to a public facility is approximately 3.2km, and reliable transportation is often lacking [175]. Public facilities also have limited opening hours due to staff shortages and absenteeism, whereas private facilities often operate 24/7, making them more accessible for individuals with limited occupational flexibility such as informal workers [178]. In terms of economic accessibility (affordability), care-seeking rates are similar across income quintiles (above 90%). However, wealthier households are more likely to use inpatient care (Figure 9), likely because of the associated high costs.
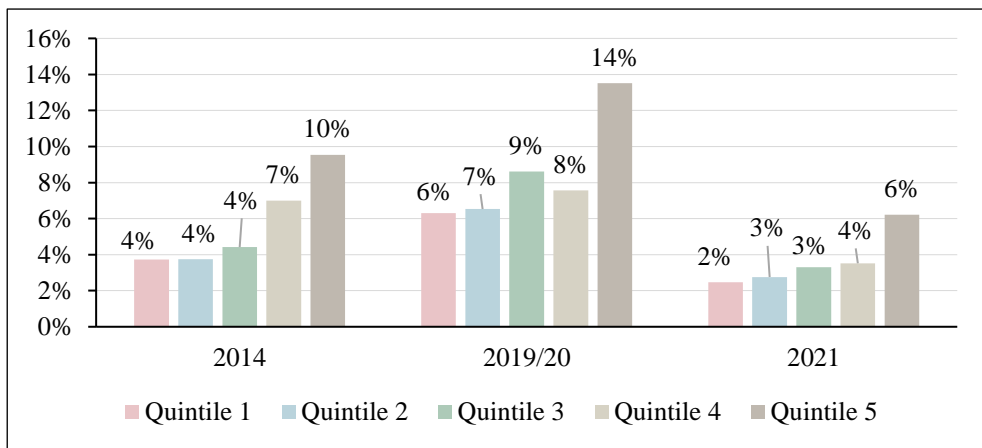
Figure 9. Utilization of inpatient care from 2014 to 2021 by expenditure quintile.
Source: Author's calculations based on the CSES 2014 to 2021, adapted from [195].

In contrast, poorer households are more dependent on pharmacies for care (Figure 10), raising concerns about equitable access to nonpharmaceutical services and potential foregone or incomplete care among poorer households. According to the UPOS, reliance on pharmacies was even greater at 58.92%. Transport costs average $0.9 for a one-way trip to a public facility [175], which may contribute to the preference for nearby private pharmacies due to their proximity, shorter wait times, and lower associated costs.

Acceptability: In Cambodian culture, doctors and other health professionals are highly regarded as authority figures, which can result in patients being reluctant to ask follow-up questions or challenge a doctor's judgment. Many Cambodians also express dissatisfaction with public providers' communication, including their attitude and level of respect—some of the reasons that have contributed to the shift toward private care and the reductions in acceptability of public care [178,197].

Additionally, reports indicate that people living with disabilities often face discrimination, driven by both systemic and behavioral factors [200].
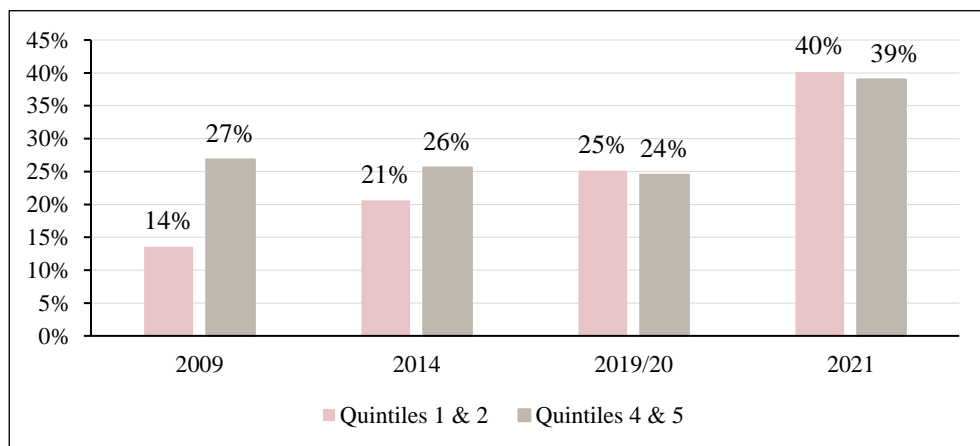
Figure 10. Utilization of private pharmacies by expenditure quintiles from 2009 to 2021.
Source: Author's calculations based on the CSES 2014 to 2021, adapted from [195].

Quality: A health systems review conducted in 2015 noted that "improving the quality of care is now the most pressing need in health system strengthening" [178]. Although recent quality assessments are scarce for both the public and private sectors, the available evidence suggests that quality issues persist [179]. Poor-quality care is driven by several factors, including insufficient clinical oversight, a lack of continuing education for healthcare workers, financial incentives to overprescribe or perform unnecessary procedures, and patient demand. Deviations from clinical practice guidelines are widespread, with reports of substandard laboratory results, questionable diagnostic practices, unnecessary surgeries, substandard or falsified medications, and the sale of inappropriate medicine combinations. These practices stem from a mix of patient demands, commercial practices, poor training, and inadequate equipment [193,201,202]. The MOH, with support from development partners, is working to address these issues by expanding the National Quality Enhancement Monitoring Program for the public sector [197,203]. Additionally, the UHC Roadmap outlines plans to introduce and enforce more rigorous licensing standards and accreditation for private providers [179].

Access to essential medicines

Public sector overview

The MOH Department of Drug and Food oversees regulation, procurement, monitoring, and the development of the Cambodia National Essential Medicines

list, the latest version dating from 2018 [204]. Medicines are allocated to public facilities according to the MPA and CPA levels. Procurement is centralized through the Department of Drug and Food and the Central Medical Store (CMS). Imported medicines are distributed from the CMS to public health facilities. Stockouts are common due to inefficiencies in the CMS supply chain and inadequate facility-level monitoring, leading public facilities to procure additional medicines from private pharmacies using their user fee revenues [175,194,205].

Private sector overview

The private sector is diverse and rapidly expanding. Approximately 605 importers are responsible for bringing medicines into the country. Wholesalers are not legally recognized in Cambodia and are instead referred to as pharmacy suppliers/traders. There are approximately 300 such suppliers/traders, who sell and distribute medicines to 3,747 private pharmacies and private health facilities. Roles are often ill-defined and poorly regulated across the supply chain, contributing to inefficiencies [194].

NGO sector overview

Population Services International is the primary NGO supplier, providing family planning and child health medicines to NGO facilities and private health providers, as well as public facilities during CMS stockouts [194,206].

Quality control and regulation

Ensuring medicine quality and adherence to regulations remains a challenge, especially in the private sector. The evidence suggests a high prevalence of substandard and unregistered medicines [207–210], along with illegal and parallel imports. Moreover, medicines are often distributed and stored improperly, particularly regarding refrigeration, potentially compromising their therapeutic value [193,211,212]. In retail, only approximately 25% of pharmacies have registered pharmacists [201,209,210]. Unqualified personnel, often family members, dispense medicines, whereby distinguishing between qualified and unqualified sellers is difficult for patients. There is also a high prevalence of 'invisible medicine sellers', including private providers, who by law are only allowed to stock medicines for emergency care, and laypersons selling medicines illegally from their homes or markets [193,213].

Availability of medicines

The evidence points to insufficient supply, particularly for NCDs [175], while for some diseases, including malaria and seizures, availability is high [202,214–216]. In the private sector, medicines for common conditions are widely available, with an overabundance of certain drugs such as analgesics and antibiotics (e.g. over 50

registered Paracetamol brands), while medicines with limited market potential, such as anticancer medicines and morphine derivatives, are often unavailable [212].

Affordability for patients and the health system

There are no price regulations, and public procurement relies on historical prices with large inefficiencies. In 2011, the MOH paid, on average, six times the international reference price for essential medicines [178]. Additionally, one study reported that medicine costs in the public sector were seven times higher than those in an NGO hospital [217]. Moreover, when public health facilities procure medicines from private pharmacies due to stockouts, they pay retail prices, which are inflated due to the lack of price controls in the private sector [205].

For patients, the cost of pharmaceutical OOPE per capita was $63 PPP in 2018 [218]. CSES data from 2019 and 2021 show that 85.21% and 82.3% of total OOPE, respectively, were spent on medicines, and this percentage increased to 87.02% in 2023. In the UPOS, 73.4% of total OOPE and 83.4% of outpatient OOPE were attributed to medicines. An impact evaluation revealed that households spent an average of $8.6 on medicines in the past 14 days [197].

Prescribing and dispensing practices

Prescribing practices face challenges, with medicines often dispensed without prescriptions, including antibiotics [213,219,220]. Pharmacy personnel typically lack training, relying on experiential knowledge, patient feedback, and package inserts. The widespread practice of dispensing 'mixed medicines', combining multiple (on average, four to eight) medications into 'cocktails', is prevalent [193,201,202,212].

Health-seeking behavior

Medicines are central to healthcare-seeking behavior. Many households, particularly informal workers without employment benefits, rely on medicines for (perceived) quicker recovery. The UPOS reported that 94.43% of households purchased medicines in the past 30 days, with an average of 5.03 medications per household. The wealthiest quintile reported purchasing more medicines than the poorest quintile did, with averages of 5.95 and 4.02, respectively. Studies suggest that patients often base the duration of their treatment on what they can afford, rather than on medical necessity as determined by prescribers or dispensers. Provider choice is influenced by perceived efficacy, convenient hours, flexible payment options, and the ability to buy incomplete courses of medicines [193,211,213,215].

Traditional medicine

The use of traditional medicine is declining, with 8.4% of the population seeking care from non-medical practitioners in 2021 (Figure 7 above). This rate varies by region, with higher use in rural areas (9.6%) than in Phnom Penh (2.0%). Traditional

practitioners are mostly informal, and patients typically turn to them as a second option, driven by convenience, trust, and financial reasons such as paying in installments [213,221,222].

Health information

The Department of Planning and Health Information at the MOH is responsible for developing systems and building the necessary capacities for health information management. Cambodia's health information landscape comprises several major systems under the MOH, including the Health Management Information System (HMIS); the Civil Registration and Vital Statistics system; the Human Resources for Health Management System; the District Health Information System; the Patient Management and Registration System under the HEF; the Pharmaceutical Registration System; the Logistic Management Information System; the Laboratory Information System; the Medical Equipment Information Management System; the National Quality Enhancement and Monitoring Program system; a donor data management system; and four disease-specific systems for HIV, TB, malaria, and NCDs. Furthermore, the NSSF operates a separate Social Protection Information System to manage its beneficiaries. This list is not exhaustive, as many additional, smaller systems and databases are being implemented across the country. The multitude of systems and databases already highlights one of the major challenges facing health information in Cambodia: the fragmentation of systems, which often operate in silos due to the verticalization of health services and programs and the fact that systems and databases are implemented by a variety of different entities and are not interoperable [223].

Challenges in coordination and data integration

A lack of coordination between the entities managing different systems and databases has resulted in several inconsistencies. For example, neither facilities nor patients currently possess unique identifiers, and similar indicators are often defined differently across systems. Moreover, frequent staff turnover, poor internet coverage, reliance on paper-based systems in some areas, hardware and software failures, and limited quality verification undermine data accuracy and quality [223]. These issues hinder the government's ability to conduct regular, rigorous data analysis to support planning and decision-making.

Incomplete private sector data

A major gap in Cambodia's health information landscape is the lack of comprehensive data from the private sector, which dominates outpatient service delivery. This results in incomplete and delayed information on healthcare utilization, limiting the government's understanding of population health needs and the full scope of service provision across the country [223].

External factors

Several external factors influencing Cambodia's health system are important to consider.

Demographic shifts

Cambodia's population is aging rapidly, which will likely increase the demand for healthcare and disability services, while placing financial pressure on households due to rising old-age dependency ratios[72]. The ratio is projected to rise from 14.36 to 20.14 by 2030, and further to 37.76 by 2050 [224]. Households with higher old-age dependency ratios have been shown to be at greater risk of catastrophic spending [106,225]. Figure 11 shows a declining proportion of the population under 29, while the proportion of those aged 30 and above has been increasing. Notably, the population aged 60 years and over expanded from 6.9% in 2009 to 9.4% in 2021.
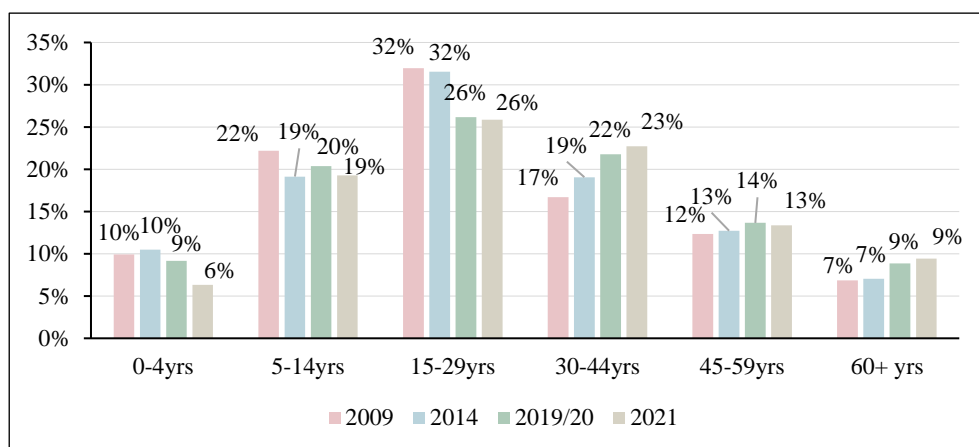
Figure 11. Trends in the age distribution of the Cambodian population 2009 to 2021.
Source: Author's calculations based on the CSES 2009 to 2021, adapted from [195].

Epidemiological transition

Like many countries, Cambodia is undergoing an epidemiological transition from communicable diseases to NCDs, driven by lifestyle changes and an aging population. NCDs now account for a substantial proportion of Cambodia's burden of disease and are the leading cause of premature deaths, primarily cardiovascular diseases, hypertension, diabetes, and cancer [175,226]. As noted above, the health system is not yet adequately prepared to manage the growing burden of NCDs

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[72] In Cambodia, the old-age dependency ratio compares the working population aged 15-59 to older persons aged 60 and above, whereas international standards typically use 65 years as the cut-off [394].

[175,186]. However, communicable diseases and MNNDs continue to contribute notably to morbidity and mortality, resulting in a 'double burden of disease' [175].

Environmental challenges

Climate change poses a growing threat to Cambodia's health system, with changes in rainfall patterns and an increasing frequency of extreme weather events, such as floods and heat waves, increasing the demand for health services [227]. This has also contributed to the rise of vector-borne diseases, such as dengue, which has spiked in both cases and deaths in recent years [228,229]. Additionally, rapid urbanization has led to high levels of air pollution, increasing the prevalence of respiratory illnesses, particularly among vulnerable population groups such as children [226] (Figure 12).
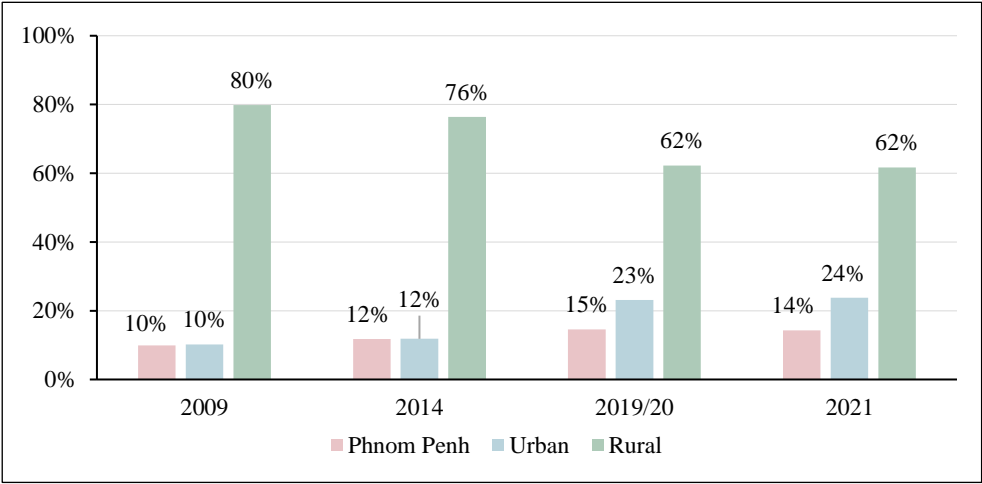
Figure 12. Trends in urbanization from 2009 to 2021.
Source: Author's calculations based on the CSES 2009 to 2021, adapted from [195].

Part II: Diagnostics

II.1 Data

II.1.1 The Cambodia socioeconomic survey

The CSES is the data underlying Study II, as well as the additional results presented in section **II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023**.

Overview of the CSES

The CSES is Cambodia's most comprehensive national socio-economic survey, conducted by the National Institute of Statistics under the Ministry of Planning. Over the past two decades, it has served as an important data source for policymaking on poverty reduction, economic development, and social welfare. Originally conducted with a large sample size every five years and supplemented by smaller annual surveys, the CSES transitioned from 2019/20 to a biennial schedule for large-sample surveys of around 10,000 to 12,000 households.

Impact of COVID-19 on CSES data collection and findings

The CSES 2021 was impacted by the COVID-19 pandemic, influencing both the data collection process and the resulting data. The year 2021 saw the peak of the pandemic in Cambodia, leading to curfews, lockdowns, and the temporary closure of essential services such as food markets in certain neighborhoods [11]. These movement restrictions, coupled with the economic downturn, disrupted spending and healthcare utilization patterns across the country. Consequently, these shifts likely affected the estimates of financial protection for 2021, as mentioned in section **II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023**.

Sampling and data collection

The CSES targets Cambodia's general population, employing a three-stage sampling design to ensure national representativeness. The first stage selects primary sampling units (PSUs) via systematic probability proportional-to-size sampling from a village frame, with the 2019 General Population Census providing

the size measure. This ensures proper representation of both urban and rural populations across different regions. In the second stage, one enumeration area is randomly selected from each PSU, followed by a systematic selection of 10 households from each enumeration area in the third stage. Each CSES survey typically covers between 10,000 and 12,000 households annually (Table 1), providing a robust sample for national estimates. Data collection is spread across all 12 months of the calendar year to account for seasonal variation and achieve reliable temporal and geographic distributions. The CSES consistently reports high response rates, exceeding 95%. Both individual and household sampling weights are included in all the CSES datasets.

Table 1. Number of observations in the CSES datasets.

Year	Households
2009	11,971
2010	3,592
2012	3,840
2013	3,840
2014	12,090
2015	3,839
2016	3,839
2017	3,840
2019/20	10,075
2021	10,080
2023	12,096

Source: Adapted from [230].

The CSES questionnaire

The CSES collects detailed information on households and their living conditions, including consumption, employment, education, housing, land ownership, crop production, livestock, victimization, disability, and health. Over time, the survey has undergone revisions to increase the granularity, accuracy, and reliability of the data collected. Unique questionnaires were used in 2009, 2012-2013, 2014-2017, and 2019/20-2023. Cambodia's methodological guidelines for measuring THCE and OOPE provide detailed instructions on which items to include in each year's measurement of THCE and OOPE to minimize the impact of changing questionnaire designs, and maintain comparability of estimates across years [231].

II.1.2 The household survey of the uncovered population

The UPOS serves as the primary data source underlying Studies III and IV, as well as the results for uncovered households presented in section **II.3 Findings**. The survey was implemented through a collaboration between the GS-NSPC and the

Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), with all the technical aspects led by me and with an agreement to utilize the data for Studies III and IV and this thesis. The implementation of the UPOS was supported by the research firm Causal Design (see section **Data collection and field procedures**).

Overview of the UPOS

The UPOS is a cross-sectional household survey conducted from June to July 2023. It was specifically designed to collect detailed information on healthcare utilization and OOPE among uncovered Cambodian households that are engaged in informal employment. Due to budget constraints and the survey's primary focus on OOPE, only households in which at least one member sought care during a defined recall period were included. The decision to use consultation rather than illness or injury as the inclusion criterion was intended to avoid extensive capture data on households with minor conditions for which no healthcare provider was consulted.

Sampling

The sampling approach for the UPOS was developed with support from Causal Design's research team, following a systematic approach to ensure adequate precision and representativeness.

Sample size calculations

The research team first conducted sample size calculations to determine the minimum required sample of both households and clusters (communes) necessary for reliable results. The power calculations were based on a significance level α of 0.05 and a conservative population prevalence estimate of 50% for binary outcomes of interest, which maximizes variance and leads to the most conservative sample size. The intra-cluster correlation coefficient was estimated at 0.15, which is consistent with previous studies in healthcare utilization and financing. To balance cost and precision, a margin of error of ±4.5% was targeted, leading to a minimum sample of 3,254 households across 81 clusters with a cluster size (i.e. households) of 40.

Province selection

To ensure geographical representation, seven provinces were purposively selected from Cambodia's five geographic zones on the basis of the geographical decomposition used in the CSES. The largest provinces in each region were chosen to capture population concentration, resulting in the selection of Battambang and Siem Reap, Kampot, Kampong Speu and Kratie, Prey Veng, and Phnom Penh. Together, these provinces represent approximately 46.28% of Cambodia's total population (Table 2).

Table 2. Cambodia's regions and provinces.

Zone	Provinces
Coastal	**Kampot**, Sihanoukville, Kep, Koh Kong
Plain	Kampong Cham; Tbong Khum; Kandal; **Prey Veng**; Svay Rieng; Takeo
Plateau/ mountainous	**Kampong Speu, Kratie,** Mondul Kiri, Preah Vihear, Ratanak Kiri, Stung Treng, Otdar Meanchey, Pailin
Phnom Penh	**Phnom Penh** (the capital)
Tonle Sap	Banteay Meanchey, **Battambang**, Kampong Thom, **Siem Reap,** Kampong Chhnang, Pursat

Source: Adapted from [232].

District, commune and village selection

The sample was clustered at the commune level, as communes were considered the most appropriate geographic unit to capture meaningful variation in the availability of healthcare providers. It was assumed that healthcare access, knowledge, and provider availability would be relatively consistent across all villages within a commune. To ensure equal representation across the selected provinces, all districts were included in the sampling process, accounting for potential differences in healthcare utilization, spending, or socioeconomic characteristics at the district level. One commune was randomly selected from each district, resulting in an initial selection of 75 communes. An additional six communes were randomly selected to ensure the required minimum sample of 81 communes was reached. Additional communes were selected in cases where we were not able to reach the required minimum sample size of households in the originally selected communes, leading to a final sample of 103 communes. Within each selected commune, surveys were conducted across all villages.

Household selection

Households were selected randomly using a systematic interval method, where enumerators visited every n^{th} house. The value of n was calculated through a structured process. First, the cluster size (40 households) was divided by the total number of villages in each commune, using data from the CSES, to estimate how many households to survey per village. Before data collection began, enumeration team supervisors verified these figures at the commune office to ensure accuracy. Next, the total number of households in each village was divided by the target number of respondents per village to determine the value of n, which served as the interval for selecting households. If a household was found to be ineligible, the enumerator moved on to the next n^{th} house. In cases of high ineligibility rates or limited household access, the random walk procedure was repeated within the same village, skipping previously visited households or using a smaller interval. In villages where only one or two households were required, enumerators used an interval of 25 and began the survey from a prominent village landmark, such as a pagoda.

Challenges

Some communes have posed logistical challenges. For example, some communes have a large number of villages, requiring extensive travel. Additionally, in Kampong Speu, many households were ineligible because their members held NSSF cards, due to extensive employment in local garment factories in this province. Additionally, since the survey period coincided with Cambodia's rainy season, this created travel difficulties in provinces such as Kampot due to heavy rains and flooding. Approximately 4.5% of the households decided not to participate, mainly because of the length of the survey interview.

Sampling weights

Sampling weights were calculated to account for the two-stage clustered design. The following formula was applied to calculate the weights:

$$\frac{Number\ of\ communes\ per\ district}{Sampled\ communes\ per\ district} * \frac{Population\ of\ commune}{Sampled\ population\ within\ commune}$$

Limitations of the sampling

The sampling design for the UPOS has several limitations that should be considered. First, the nonrandom selection of provinces may have introduced selection bias, and the findings may not be fully representative of Cambodia's regions. This purposive sampling systematically excluded smaller provinces and more remote, mountainous communities (e.g. in provinces such as Mondulkiri or Rattanakiri), who may have unique healthcare utilization and spending patterns. At the time of sampling and data collection, we also lacked access to data on the rural-urban status of Cambodia's villages and this information could not be considered in the sampling strategy. These data became available later, revealing that the UPOS sample overrepresents rural areas and Phnom Penh, and underrepresents other urban areas.

Another limitation is related to the clustering at the commune level, which may not account for variations within communes, especially in geographically diverse or larger communes. The sampling design assumes that healthcare access and utilization are consistent across all villages within communes, which may not hold in areas with significant intra-commune heterogeneity. Furthermore, the random selection of communes without considering their population size is another potential bias. Although the original intent was to use proportional-to-size sampling, the necessary data were unavailable during the sampling phase. In proportional-to-size sampling, larger communes would have had a greater likelihood of selection, better reflecting their share of the population. By selecting communes randomly without regard to size, smaller communes may be overrepresented, whereas larger communes may be underrepresented. This could skew results, especially if healthcare utilization and spending patterns differ between small and large communes. While sampling weights can adjust for these discrepancies to some

degree, they cannot completely eliminate the potential bias introduced by the random selection of communes without accounting for their population size.

While the intra-cluster correlation coefficient of 0.15 was based on previous studies, it may not perfectly capture the true correlation structure within Cambodian communes for this specific context. Moreover, conducting the survey during the rainy season potentially underrepresented remote households and created seasonal bias in healthcare utilization patterns. Additionally, while the non-response rate was low (4.5%), the weighting formula does not explicitly account for systematic differences between responders and non-responders. These factors combined may limit the generalizability of the findings to the broader Cambodian population.

Despite these limitations, the UPOS findings are likely to provide a robust and meaningful representation of uncovered households who sought care in Cambodia. The sampling approach employs a conservative population prevalence estimate of 50% for binary outcomes, which maximizes variance and ensures adequate statistical power to detect effects across a wide range of outcome variables, enhancing the reliability of findings even for less common healthcare utilization patterns. Additionally, the selection of seven provinces from five geographic zones captured 46.28% of Cambodia's total population, aiming to strike a balance between feasibility and national representativeness. Previous evidence suggests that sampling at least 100 communes distributed across Cambodia's five regions is generally sufficient to capture the heterogeneity of healthcare utilization and spending patterns. The expansion from the originally planned 81 communes to 103 communes demonstrates a responsive research methodology that maintained statistical power despite field challenges. Moreover, the comprehensive two-stage weighting formula specifically accounts for both district and commune-level selection probabilities, enhancing population representativeness by adjusting for the complex sampling design. Overall, while the limitations discussed may introduce some degree of bias, they are unlikely to undermine the overall validity of the conclusions, particularly given that the primary focus is on uncovered households, a group that tends to have relatively consistent patterns of healthcare utilization and spending across regions on the basis of existing literature.

The UPOS questionnaire

The UPOS questionnaire is comprehensive, an consists of five modules: eligibility screening; household composition, members, and characteristics; household consumption; health and disability status; and healthcare utilization and spending. It was administered to the head of the household and took an average of 120 minutes to complete per household. The questionnaire was developed in English, then translated into Khmer by one individual, and reviewed and edited by two independent Khmer-speaking individuals who were not involved in the initial translations to confirm the accuracy and reliability of all the translations. Once finalized, the draft questionnaire was coded into SurveyCTO in both languages for

further refinements and preparation for electronic data collection. SurveyCTO enables the preprogramming of automated skip patterns and input restrictions, minimizing human error and enhancing data reliability [233]. An internal review process between myself and the contracted research firm (see **Data collection and field procedures**) was conducted to ensure the accuracy of survey coding. The following section provides more details on each of the questionnaire modules:

Screening questions

These questions were used to determine household eligibility for the survey. Households were eligible if i) No household member was currently or had been enrolled in any prepayment scheme in the past 12 months (aligned with the recall period of inpatient care) and ii) at least one household member sought preventive, outpatient, or inpatient care within defined recall periods.[73]

Household composition, members, and characteristics

This section was fully aligned with the CSES 2023 questionnaire. It covered household size, ethnic origin, sex, age, maritala status, education, literacy for household members, membership in associations, receipt of government grants, savings and debts, household ownership, housing conditions, and household assets. Additional details on employment and occupation were gathered, with questions adapted from the 2019 Cambodia Labour Force Survey.

Household consumption

This module closely followed the CSES, collecting detailed information on household food and nonfood consumption over recall periods ranging from seven days to 12 months. Owing to time constraints, the items were condensed (e.g. fresh fish, dried fish, seafood, and processed fish were combined into one category, rather than into multiple categories, as is the case in the CSES). While this decision reduced the interview time, it may have led to some underreporting, which is discussed further in section **II.2.2 Measurement of welfare**.

Health and disability status

For each household member, this module captured information on chronic conditions, disabilities, and self-reported health status. The questions were adapted from the CSES 2023 and the Cambodia Demographic and Health Survey 2021.

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[73] The UPOS was conducted before the extension of the HEF to "At-risk" households in September 2023. Anticipating this expansion, the survey included a question asking whether households possessed "At-risk" cards, with only 34 households responding affirmatively. This indicates that even now, the vast majority of households in the sample remain uncovered, confirming their classification as uncovered households. The 34 households were retained for the analysis as identified households had not yet received any HEF benefits at the time of data collection.

Healthcare utilization

This section included separate modules for outpatient care (including visits to pharmacies), inpatient care, and preventive services, recorded at the visit level. Data on outpatient care and preventive services were based on a recall period of 30 days, whereas data on inpatient care were based on a 12-month recall. The enumerators received thorough training to ensure proper categorization of the consultations. If multiple visits were reported for different or identical health reasons, each visit was recorded separately. The questions covered the reasons for seeking care (with lists for illnesses/injuries and preventive services), illness severity, delays in seeking care, the number of visits and types of providers consulted, time spent at the provider, transport and costs, medication details (the number of medications obtained, and details on prescriptions and medical advice), OOPE (with a breakdown of consultation fees, diagnostic services, medications, informal payments, and other expenses), financing sources for OOPE and coping strategies, days lost to illness/injury, and satisfaction with care. These questions were adapted from various sources, including the CSES 2023, the Cambodia Demographic and Health Survey 2021, and a previous study from the East Asia and Pacific region [234]. The response options for the type of disease in our survey were aligned with the Burden of Disease study by the Institute of Health Metrics and Evaluation (IHME), whereby we included detailed response options for each of the broader categories outlined by IHME: communicable diseases; NCDs; MNNDs; and injuries, violence, self-harm, and accidents (referred to as injuries) [235]. Several questions, specifically those on the purchase of medications, were developed specifically for this survey.

Verification of informal employment status

While the screening questions did not explicitly inquire about the type of work household members were engaged in, this was a conscious decision made to avoid lengthening the screening process. Instead, a comprehensive set of questions on household members' employment and occupation was included in the full questionnaire. In line with guidelines from the ILO for measuring informal employment, two key questions were asked about access to employment benefits, specifically paid annual leave and paid sick leave [13]. Although the ILO's recommendations apply primarily to employees, these questions were posed to all individuals who reported working. The guidelines also suggest asking whether employers contribute to a pension fund [13]. However, as access to Cambodia's pension fund is currently limited to NSSF members (which are excluded from our sample), this question was omitted and replaced with a question regarding paid maternity/paternity leave [13].

The responses were as expected: only approximately 1% of individuals reported receiving any form of paid leave—annual leave, sick leave, or maternity/paternity leave (Table 3). These results confirm that the households in our sample are

predominantly engaged in informal employment, with little to no access to formal employment benefits. Households where any member reported access to these types of leave were retained in the analysis, given that they constituted a small minority.

Table 3. Access to formal employment benefits among individuals in the sample

Benefit	Percentage of respondents
Paid annual leave or compensation	1.05%
Paid sick leave	1.06%
Paid maternity or paternity leave	0.97%

Source: Author's calculations based on the UPOS.

Notes: No survey weights were applied, and the percentages reported are only representative of the households included in the sample.

The detailed employment and occupation characteristics reveal that the majority of individuals reported working as subsistence farmers (20.91%), followed by employees of private companies (16.39%) and self-employed small business owners without employees (5.82%). A notable proportion (20.73%) reported being outside of paid work, such as being engaged in unpaid domestic work, and 27.50% were students. Among those who reported working, the most common sectors of employment were construction, agriculture, and street vending, followed by retail/wholesale and transportation.

More than half (56.65%) reported working year-round, 41.60% worked seasonally or part-time, and 1.75% worked only occasionally. Notably, the overwhelming majority (94.54%) indicated that they had no written or oral employment contract, reinforcing the predominance of informal employment in the sample. Payment structures also reflect informal employment patterns, with 62.32% receiving daily wages and only 26.87% receiving monthly payments. On average, individuals worked 46.46 hours per week (median 49), with reported hours ranging from 4 to as many as 91 hours.[74] Approximately 8% of individuals reported holding more than one occupation.

Data collection and field procedures

Data collection was organized and conducted by an international research firm with a locally registered office in Cambodia, Causal Design, over an eight-week period from early June to the end of July 2023.

A total of 20 enumerators and four supervisors were hired, forming four enumeration teams. Prior to fieldwork, all supervisors and enumerators underwent

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[74] The number of hours worked per week was calculated based on responses to two questions: "How many days per week do you [NAME] usually work in your [NAME'S] main occupation?" and "How many hours per day do you [NAME] usually work in your [NAME'S] main occupation?" rather than asking for the total weekly hours directly.

comprehensive three-day training, which included an overview of the study's objectives, a detailed review of the survey questionnaire, in-depth discussions on challenging questions, mock interviews, ethical protocols, and practical training in the use of the SurveyCTO electronic data collection tool. The training was led by Causal Design's country and fieldwork managers, along with myself. Pilot testing was carried out in communes outside of the study sample, leading to minor refinements in the survey tool, including rephrasing certain questions, adjusting answer options, and refining skip logic.

Before starting each survey interview, the enumerators read a consent statement to the participants and explained the research aims and objectives, processes, and participants' rights to withdraw at any time. Verbal consent was obtained before proceeding with the interview (see section **II.1.4 Ethical considerations** for additional details).

The fieldwork was overseen by Causal Design's fieldwork manager and several members of their research team, along with one staff member from GIZ Cambodia. They accompanied each enumerator for at least one day in each province to observe interviews, ensure adherence to survey protocols, address any remaining issues, and verify that the survey tool functioned properly. Throughout the entire data collection process, the field work manager conducted regular field observations to ensure adherence to the data collection protocols. Additionally, supervisors conducted repeat interviews with 10% of the respondents to verify survey responses. The Causal Design research team performed frequent data quality checks, reviewing downloaded data to ensure accuracy and the survey tool functioned as intended.

Lessons learned: what I would do differently

Leading the effort to collect primary data for the UPOS was an invaluable learning experience. Reflecting on the process, there are several things I would approach differently in the future.

General reflections

I underestimated the complexity and challenges involved in leading a large household survey. While I am grateful for Causal Design's support throughout most steps, there were times when the responsibility of leading the UPOS felt overwhelming and somewhat isolating. In future surveys, I would engage more collaborators—especially individuals with experience in household survey design and leadership—to serve as thought partners and share the burden of decision-making.

Cross-sectional design

Although cross-sectional designs are effective for addressing specific research questions, such as those posed in this thesis, many important questions regarding

financial protection require panel data. For example, understanding how households that impoverished due to OOPE recover over time or how quickly they rebound is difficult with a cross-sectional approach. In future surveys, I would consider panel data collection or, at the very least, conduct multiple cross-sectional surveys to gather information on trends to track financial protection over time.

Logistics and planning

The timeline for certain stages of the UPOS was highly compressed. The finalization of the questionnaire, coding into SurveyCTO, testing, enumerator training, piloting, and the start of data collection all took place within just seven to ten days. This placed high pressure on both myself and the Causal Design team. For future surveys, I would allocate more time for each of these steps, particularly when testing the coding and skip patterns of the survey in the survey tool.

Sampling considerations

Although the UPOS data provided valuable data for addressing the research questions, there are improvements I would make in future surveys. Specifically, adopting a probability proportional-to-size sampling approach at the communes-level or incorporating rural-urban stratification in the sampling would strengthen the representativeness of the data across rural and urban settings. These approaches were not possible during the UPOS design, as the necessary data became available at the analysis stage only. Additionally, although the decision to include only care-seeking households was practical given time and budget constraints, it limits the generalizability of the findings to the broader population. Future surveys should include both care-seekers and non-care-seekers, enabling the collection of comprehensive data on illness incidence and foregone care—both of which are key factors for health and financial protection policy.

Questionnaire design

In future surveys, I would prioritize even greater alignment with national surveys such as the CSES to ensure data comparability. For example, instead of condensing the consumption expenditure module as I did in the UPOS, I would adopt the CSES module directly to avoid underreporting or bias that may result from grouping items together. This would enable more precise comparisons across datasets. I would also include imputed rent in future surveys, which was not considered in the UPOS. This could be approached by asking enumerators to collect data on house size and subsequently valuate these data with local market values per square meter at the analysis stage, for example. Moreover, the experience of leading the UPOS provided insight into which data are essential for analysis and how they should be formatted. In the future, I would focus more on prioritizing necessary information, reducing the collection of 'nice to have' data. For instance, the household assets section in the UPOS could have been shortened or omitted, freeing up time for a

more thorough consumption module. Additionally, certain sections of the UPOS questionnaire were unnecessarily complicated, creating difficulties for survey coding, data collection, and analysis. For example, OOPE data were collected differently for pharmacy visits than for other providers, adding complexity. In future surveys, I would more carefully consider how the questionnaire structure and skip patterns translate into potential challenges during data collection and management.

Funding

II.1.3 Comparison between the UPOS and CSES

Table 4 provides a comparison of select data points from the UPOS, CSES 2023, CSES 2021, and CSES 2019/20. The text focuses on the CSES 2023. To enhance comparability, the CSES estimates were stratified for households without prepayment coverage in all years with OOPE greater than zero. This stratification was applied rather than stratifying for households who sought consultation since it better aligns with the household screening approach applied for the UPOS.[75] All monetary values were converted to 2023 US$.

The UPOS captured 3,254 households, compared with 5,054 in the CSES 2023. The household size was slightly smaller in the UPOS (3.95) than in the CSES (4.28).

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[75] Across all three CSES years, more households reported OOPE compared to those reporting a consultation. In the CSES questionnaire, the question about consultations is only asked after inquiring about illness or injury within the household. As a result, households may purchase medications or health products for minor illnesses without reporting a visit to a healthcare provider. While the OOPE for these purchases would be captured in the consumption module, households might still indicate that they did not seek consultation. We chose to stratify OOPE greater than zero, as this approach aligns more closely with the screening section of the UPOS, given that households technically did seek care even if they did not explicitly report a consultation.

Table 4. Comparison between the UPOS and the CSES

	UPOS 2023	CSES 2023	CSES 2021	CSES 2019/20
Number of households	3,254	5,054	3,879	4,799
Demographic characteristics				
Household size	3.95	4.28	4.28	4.46
Age of head of household	46.75	49.33	49.46	49.49
Share HoHH who is female	35.56%	21.28%	19.82%	20.43%
At least 1 person <5	36.96%	33.94%	33.25%	36.14%
At least 1 person >60	27.11%	37.03%	37.26%	37.04%
Share primary education only	57.40%	60.50%	61.70%	60.02%
Health characteristics				
At least 1 HHM with chronic illness	50.32%	47.50%	33.63%	29.94%
THCE (2023 US$)				
Mean	$5,146	$6,300	$5,561	$7,025
Quintile 1	$2,361	$3,689	$3,195	$3,625
Quintile 2	$3,780	$4,740	$4,073	$4,775
Quintile 3	$5,024	$5,651	$4,927	$5,700
Quintile 4	$6,634	$6,391	$5,732	$7,225
Quintile 5	$11,634	$10,617	$9,171	$13,750
OOPE (2023 US$)				
Mean	$475	$536	$463	$681
Quintile 1	$187	$205	$166	$284
Quintile 2	$295	$318	$253	$400
Quintile 3	$362	$433	$352	$531
Quintile 4	$504	$505	$464	$703
Quintile 5	$1,016	$1,165	$988	$1,478
Financial protection indicators				
OOPE budget share	7.84%	7.23%	7.03%	8.52%
Incidence of CATA (10%)	24.24%	23.89%	20.82%	27.00%
Incidence of CATA (25%)	5.98%	6.43%	6.20%	8.04%
Incidence of impoverishment (NPL)	6.67%	6.03%	5.55%	5.59%

Abbreviations: CATA = catastrophic health expenditure; HHM = household member; HoHH = head of household; NPL = National Poverty Line; OOPE = out-of-pocket health expenditures; THCE = total household consumption expenditure.
Source: Author's calculations based on the CSES and the UPOS.

Household heads in the UPOS were slightly younger (47 years) than those in the CSES (49 years). Interestingly, the proportion of female-headed households was greater in the UPOS (35.56%) than in the CSES 2023 at 21.28%. Additionally, fewer UPOS households had members over the age of 60 at 27.11% compared to the CSES (37.03%), whereas the share of households with children under five years of age and members with primary education were similar across surveys.

With respect to health characteristics, the UPOS reported a slightly greater share of households with members suffering from chronic illness than did the CSES 2023. This discrepancy may be attributed to differences in the way chronic illness was captured in the surveys. The CSES identified chronic illnesses only if the respondent actively reported illness or injury in the last 30 days and indicated that it was a chronic condition. This can lead to underreporting, as some respondents may not recognize ongoing conditions as illnesses and household members with chronic conditions may not have sought care for this condition in the 30 days preceding the survey. Additionally, knowledge about chronic illnesses is still limited.[76] In contrast, the UPOS included a direct question about chronic illness in the health module. Additionally, during data management, for each household member who reported seeking care for a major NCD (e.g. diabetes, hypertension, cardiovascular disease, etc.) in the healthcare module, we cross-verified whether they had also indicated having a chronic illness in the health module. If the household member had not reported a chronic illness in the health module, but had sought care for an NCD, their response was corrected to reflect the presence of a chronic illness. This adjustment increased the proportion of households with at least one member reporting a chronic illness by about 15%.

Comparing THCE, the UPOS recorded a lower mean ($5,146) compared to the CSES 2023 value ($6,300). This difference was particularly notable in the lower quintiles, especially Quintile 1, which had a considerably lower THCE in the UPOS. Interestingly, Quintiles 4 and 5 have a higher average THCE in the UPOS compared to the CSES 2023. Additional details explaining these differences are provided in section **II.2.2 Measurement of welfare**.

In terms of OOPE, the mean in the UPOS was below the value for the CSES 2023, at $475 and $536, respectively. The CSES also showed slightly higher OOPE for households across all quintiles. Additional details are given in section **II.2.1 Measurement of OOPE**.

With respect to financial protection indicators, the UPOS reported a higher average OOPE budget share (7.84%) compared to the CSES 2023 (7.23%). Similarly, the

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[76] In a recently conducted baseline survey for an impact evaluation of Cambodia's Family Package social protection scheme, only 50% of respondents who sought care for an NCD reported it as a chronic illness. This further illustrates the potential for underreporting or misclassification of chronic conditions, impacting the accuracy of health data.

incidence of catastrophic spending at the 10% of THCE threshold (24.24% versus 23.89%) and the incidence of impoverishment (6.67% versus 6.03%) were also slightly higher in the UPOS. These differences likely indicates variations in survey methodologies, including the measurement approaches for OOPE and THCE (see sections **II.2.1 Measurement of OOPE** and **II.2.2 Measurement of welfare**).

II.1.4 Ethical considerations

Ethical approval for the UPOS was granted by the National Ethics Committee for Health Research (NECHR) of the Cambodian MOH in May 2023 (reference number 142). Further approval was sought and granted from all relevant provincial health authorities and local village authorities. The UPOS raised several ethical considerations, which were also included in the protocol submitted to the NECHR and are discussed in detail below.

Respondents and informed consent procedures

The respondents were adults over 18 years of age who could communicate verbally in Khmer. Individuals with cognitive impairments, severe illness, or signs of intoxication were excluded from the survey. Prior to participation, the respondents were provided verbal information on the study's aims, objectives, processes, potential risks, and right to withdraw from the study at any time without consequences. The respondents also received an information sheet and consent form in Khmer. Verbal consent was obtained before the survey interview commenced, in line with standard practices approved by the NECHR. Verbal consent was chosen over written consent for several key reasons: low literacy levels[77]; cultural sensitivity to and fears of signing documents and having their names on official documentation; concerns regarding confidentiality when signatures are recorded; the ability to build better rapport through conversational consent processes rather than formal paperwork; reduction of participation barriers that might exclude willing participants uncomfortable with documentation; and alignment with established research precedents that have demonstrated verbal consent to be more effective with similar populations in Cambodia.

Risks and burdens for respondents, and mitigation strategies

The UPOS posed few minor risks for respondents:

Time burden: The interview duration ranged from 60 to 180 minutes, which could disrupt respondents' routines and work schedules. To mitigate potential economic disadvantages, participants were allowed to reschedule the interview at a more convenient time, including evenings. As a token of appreciation, participants

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[77] In the UPOS, 36.57% of household members aged 15 years and above reported being unable to read Khmer.

received a small gift valued at approximately USD 2. This practice is common in Cambodia and was approved by the NECHR.

Sensitive topics: Certain questions related to health or financial situations might have been uncomfortable for respondents. The enumerators were trained to handle sensitive topics, and the respondents were informed that they could pause or discontinue the interview at any time. Instances of discomfort were rare, as most respondents were eager to share their experiences.

Privacy and confidentiality: The survey involved collecting sensitive data, such as health and financial information, and required strict adherence to privacy and confidentiality protocols. Supervisors, enumerators, and Causal Design's research team underwent thorough training on confidentiality obligations. By hiring experienced field staff, the study ensured a high level of awareness and adherence to confidentiality standards. The interviews were conducted in locations selected by respondents to maintain privacy and reduce the risk of coercion or being overheard by others, including local officials or community leaders. All collected data were immediately deidentified, and any personally identifiable information was accessible only to the Causal Design research team. Personally identifiable information was stored securely on encrypted, password-protected servers, with access strictly limited to the research team. Three months after the study's completion, all personally identifiable information was permanently deleted, with no physical or electronic copies retained. The final datasets were fully anonymized, retaining only nonidentifiable household and individual codes. Publicly available data, including those shared in this thesis, are presented exclusively in aggregate form, ensuring the privacy and confidentiality of respondents and their households.

Anti-harassment policy

Enumerators and field staff underwent training on anti-harassment policies to ensure that the respondents were treated respectfully and without discrimination. This training covered harassment based on race, religion, gender, sexual orientation, political affiliation, disability, and other factors. The enumerators were instructed to uphold these principles throughout the study.

Challenging situations and referral protocols

During fieldwork, enumerators occasionally encountered households facing severe health or economic challenges. Since enumerators are not medical professionals, clear guidelines were established. Respondents who had not yet accessed public health services were advised to visit the nearest health center. Enumerators were trained to refer cases requiring urgent care and, when necessary, seek guidance from supervisors on whether to arrange for evacuation to a public hospital. Fortunately, no such evacuations were needed during this study. In addition to providing such advice, no further medical or financial assistance was offered to the participants or their households, in line with the study's ethical protocols.

II.2. Methods

II.2.1 Measurement of OOPE

The measurement of OOPE followed the definition outlined in section **0.4 Concepts, definitions and terminology**. However, there are differences in how OOPE data were collected in the CSES compared with the UPOS, which are explained below.

OOPE data based on the CSES

In the CSES, OOPE data were derived from the consumption expenditure module, rather than the health module. The consumption module collects data on expenses for medicines (both prescription and over the counter), medical products, assistive devices, medical and dental consultations without overnight stays (over a 30-day recall period), and traditional medicine and inpatient treatments (over a 6-month recall period). This method technically captures preventive, outpatient, and inpatient-related OOPE.

Several reasons underpinned the decision to use OOPE from the consumption expenditure module. First, it ensured consistency with the THCE and OOPE estimates regularly published by Cambodia's National Institute of Statistics. Second, the 6-month recall period for inpatient care in the consumption module is longer than the 30-day recall period in the health module. Prior evidence suggests that shorter recall periods with annualization factors can overestimate OOPE [18]. By using the 6-month recall period, this method offers a more conservative estimate. Cambodia's methodological guidelines for measuring THCE and OOPE also recommend relying on the consumption expenditure section for OOPE data [231].

OOPE data based on the UPOS

Given that the UPOS was specifically designed to collect healthcare utilization and expenditure data from uncovered households, OOPE were captured through the detailed health modules, using recall periods of 30 days for outpatient/preventive services, and 12 months for inpatient services. For outpatient and preventive services, the UPOS collected information on consultation fees, diagnostic services, medications, herbs, informal payments, and other healthcare-related expenses. For inpatient care, additional expenses such as food, accommodation, and costs for accompanying persons were included. Only households unable to provide a detailed breakdown of expenses were requested to report their total OOPE for outpatient, preventive, and/or inpatient services as aggregate figures instead.

Data on preventive OOPE were excluded from the analysis, resulting in the removal of 40 observations. This decision was guided by two main considerations. Firstly, the sample size of households reporting preventive OOPE (450 households with 494

visits) was relatively small compared to those reporting outpatient (3,088 households with 5,234 visits) and inpatient (714 households with 814 visits) OOPE. Secondly, preventive care utilization typically follows a different rationale compared to curative outpatient and inpatient services; it tends to be planned, discretionary, and exhibits distinct price elasticity patterns. These differences could potentially bias the analysis of OOPE determinants. Andersen and Newman also noted considerable variation in the determinants of preventive services versus diagnosis and treatment services [236].

To validate the decision to use health module data in the UPOS, I compared total annualized OOPE estimates from both the consumption expenditure and health modules. The total annualized OOPE based on the consumption expenditure module was $490, while the estimate from the health module was slightly lower at $475. Although health modules typically yield higher OOPE estimates than consumption modules do [18], the difference in this case is likely explained by the exclusion of preventive care from the $475 estimate. When preventive care OOPE are included in the health module estimate, it increases to $485, closely aligning with the consumption expenditure module estimate, with only a 1% difference.

Comparison of OOPE between data from the UPOS and the CSES

As shown in Table 4 above, OOPE estimates from the UPOS ($475) are lower than those from the CSES 2023 ($536). This discrepancy can be attributed to differences in recall periods, the scope of healthcare expenditures captured, the inclusion of preventive care costs, and differing sampling approaches. First, the CSES uses a 6-month recall period for inpatient care, which may capture more recent and frequent expenses than the 12-month recall period used in the UPOS. The longer recall period in the UPOS might lead to underreporting of inpatient-related expenses, particularly for events that are less salient over time. Second, the CSES captures preventive care-related OOPE as part of its consumption expenditure module, whereas preventive care costs were excluded in the OOPE calculations based on the UPOS. This broader scope in the CSES likely contributes to its higher OOPE estimates. Third, sampling differences between the two surveys may influence the results, as the UPOS purposively selected provinces and overrepresented rural areas and Phnom Penh, while underrepresenting other urban areas, where OOPE tend to be substantially higher (Study II). Fourth, seasonal factors may have affected the UPOS data collection, which took place during Cambodia's rainy season (June-July 2023), potentially creating biases in healthcare access and utilization that are not present in the CSES data collected throughout the entire calendar year.

Calculation

For OOPE data from both the CSES and the UPOS, expenditure items with recall periods shorter than 12 months were annualized by multiplying them by the appropriate annualization factor, following established methodologies [12,18,237].

II.2.2 Measurement of welfare

In addition to measuring OOPE, the measurement of household welfare is critical in assessing financial protection, as it affects all the financial protection indicators used in this thesis.

Consumption versus income

Before delving into the measurement details, it is important to briefly explain why consumption in the form of THCE was chosen as the measure of household welfare over income. The primary rationale stems from the "smoothness argument", as outlined by Deaton and further elaborated by Mancini and Vecchi [237,238]. Empirical evidence shows that consumption tends to fluctuate less frequently and less severely than income over time, making it a more stable indicator of living standards over a short period of time [237,238].[78] Additionally, choosing consumption over income reflects whether the analysis aims to measure *actual* welfare (in terms of consumption) or *potential* welfare (income). Consumption is preferable when the objective is to assess living standards, while income might be more appropriate for measuring access to resources [237,239]. The concept of *actual* welfare is especially relevant in contexts of material deprivation [237], as is the case for many Cambodian households [11,25]. Moreover, a pragmatic reason is that the focus of this thesis is on informal workers, a group for which income measurement is often unreliable and unfeasible [21,240]. In the CSES 2023, for example, the mean income reported was significantly lower than the mean for consumption, indicating that the income data may be underestimated [232]. Finally, Wagstaff showed consumption to be a more reliable measure of household welfare in contexts where households borrow to finance their OOPE rather than save [24], which was shown to be the case in Cambodia in section **II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023**.

Items included in the THCE aggregate

The construction of the consumption aggregates in Studies II to IV follows Cambodia's methodological guidelines for measuring THCE and OOPE [231]. However, there are notable differences in the design of the consumption modules

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[78] There is, however, criticism regarding the "smoothness argument," particularly when considering covariate and idiosyncratic risks. Covariate risks, such as extreme weather events or major policy reforms, affect many households simultaneously, often preserving their relative positions in welfare rankings. In contrast, idiosyncratic risks—like illness or the death of household members or livestock—impact households individually, altering both their welfare levels and rankings over time. This distinction complicates the measurement of long-term living standards. While income may be more volatile but consistent across households in terms of ranking, consumption tends to be smoother but more affected by idiosyncratic risks, leading to potential re-ranking and making it less reliable for comparing long-term welfare across households [237].

between the CSES and the UPOS, as outlined below, which may affect the estimation of THCE derived from both surveys.

Food items: This includes the value of food consumed, whether purchased in the marketplace (including food consumed outside the home, such as meals and snacks), home-produced, or received in-kind [231,237]. Since neither the CSES nor the UPOS differentiated between food purchased and food consumed, food expenditure was measured based on acquisition (in terms of expenditure). The recall period in both surveys was seven days preceding the interview. The 2023 CSES questionnaire contained 64 items, while the UPOS condensed these into 19 categories.

Nonfood nondurable items: This category encompasses a wide range of items, including clothing, footwear, transportation, information and communication services, books, personal care, health expenditure[79], recreation, domestic services, postal services, personal effects, household furnishings and other household expenses. The recall periods for these items range from 30 days to 12 months. The methodological guidelines recommend including 37 nonfood nondurable items in the measurement of THCE, while the UPOS grouped these same items into 17 categories. Financial services were excluded because they relate to asset management, which is considered savings or investment [231,237].

Education: Cambodia's methodological guidelines recommend including two categories collected in the CSES for education in THCE: school fees and tuition fees. The UPOS collected data on these, although they were condensed into a single category.

Housing and utilities: This category includes expenditure related to housing, including maintenance and repair, water, electricity, garbage collection, and gas and other fuels. The CSES also collects data on rent and imputed rent (for those who do not pay rent but own their property), which were included in the calculation of THCE on the basis of the CSES (Study II). However, since the UPOS did not collect data on rent or imputed rent, these data were excluded from the THCE calculations in Studies III and IV.

Durable goods: This category includes certain types of nonproductive durable goods, including furniture, household appliances, and equipment. Cambodia's methodological guidelines provide specific recommendations on what to include for

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[79] The inclusion of health expenditure in the measurement of THCE is one of the most widely debated issues in welfare measurement. Mancini and Vecchi summarize the arguments for and against the inclusion of health expenditure, ultimately recommending their inclusion as a standard approach [237]. A recent study from Cambodia, however, constructed a consumption aggregate that excluded health expenditure and found differing trends in financial protection over time compared to studies that included it, including notably variations in observed inequality [61].

the CSES, covering 21 durable goods categories[80]. The UPOS included these goods but condensed them into seven categories.

Calculation

All consumption items with recall periods of less than 12 months in both the CSES and the UPOS were multiplied by the appropriate annualization factor, in line with established methodologies [12,18,237].

Limitations

The methodology applied for calculating THCE has several limitations worth noting. First, Cambodia's methodological guidelines recommend including durable goods such as vehicles and household appliances in THCE, which can physically persist for more than a year, countering recommendations in established methodologies for measuring THCE. The price paid for such items reflects their value over their entire lifespan and not just the period of purchase [237]. Additionally, social events such as funerals and weddings, which are considered 'lumpy expenditures' that are not recommended to be included, are included in THCE [237]. The methodological guidelines were influenced by the National Institute of Statistics' practices for measuring total household final consumption expenditure for the country to ensure comparability between the two [231].

Furthermore, methodological research from Vietnam has shown that standard questionnaires using a single question on food consumed away from home tend to underestimate this type of food consumption by as much as 33% [241]. In both the CSES and the UPOS, data on food and drinks consumed at work, school, and restaurants were collected across three categories, but this category may still be underestimated. Additionally, the level of detail in the consumption module of the CSES was greater than that in the UPOS, with research showing that increased granularity typically results in higher consumption estimates [237].

Finally, perhaps the most significant limitation is that the UPOS did not collect data on rent or imputed rent, unlike the CSES. Excluding rent or imputed rent can misrepresent homeowners as poorer than renters [237]. Given that 91.7% of Cambodian households legally owned the property they lived in as of 2021 [232], this omission likely underestimates THCE based on the UPOS, especially for poorer rural households who predominantly own their homes (96.2%). The decision to exclude imputed rent from the UPOS was based on the assumption that households might not be able to provide accurate estimates of the rental value of their homes

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[80] These include the following: bicycle, motorcycle, video/CD/DVD player, stereo, camera, electric fan, refrigerator, dishwasher, electric iron, sports equipment/musical instrument, air conditioner, electric/gas stove, sofa set, dining set, telephones, cellphones, washing machines, freezer, musical instrument, car, jeep/van [231].

[237]. The CSES uses advanced calculations to estimate imputed rent, which could not be replicated for the UPOS [232].[81]

Comparison of THCE based on the CSES and the UPOS

As shown in Table 4 above, the mean nominal THCE was lower in the UPOS ($5,146) compared to $6,300 in the CSES 2023. The largest discrepancies were observed in the lowest quintile. These differences likely stem from several methodological factors, including variations in the level of detail captured by the surveys and the exclusion of rent/imputed rent in the UPOS. Additionally, the sampling design, particularly the oversampling of rural households in the UPOS, may explain part of the disparity. Compared with urban households, rural households typically have lower THCE, reflecting generally lower income levels and higher poverty levels. Additionally, while the CSES is typically carried out across an entire year, the UPOS was limited to two months in Cambodia's wet season (June to July 2023), with previous research indicating that seasonality can have important effects on consumption preferences and prices [242].

II.2.3 Measurement of financial protection

OOPE budget share

The OOPE budget share is one of the key measures of financial protection used in this thesis. It is calculated as the proportion of THCE that is spent on OOPE [18]. This continuous measure reflects the financial burden imposed on a household by healthcare expenses. A higher OOPE budget share indicates a greater financial burden, while a lower share suggests a smaller burden and potentially better financial protection [18]. Unlike catastrophic and impoverishing spending, the OOPE budget share lacks a specific threshold or percentage to interpret the financial burden [18]. The focus of Studies III and IV was on the OOPE budget share, rather than other financial protection indicators, owing to its continuous nature, which allows for more comprehensive distributional analyses beyond the mean.

Incidence of catastrophic health expenditure

Measurement approaches

While the concept of catastrophic health expenditure is well-defined, its application has varied in the available literature, with ongoing debates around how to measure

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[81] The methodology used in the CSES for estimating income from owner-occupied dwellings treats the property's value as an investment. Imputed rent is calculated by subtracting any remaining debt from the market value of the home and then multiplying the result by the long-term interest rate for government bonds. This approach reflects the potential return on capital invested in the property [232].

household resources and which thresholds to apply to designate catastrophic OOPE. In this thesis, catastrophic health expenditure is defined as the proportion of total household resources, measured as THCE, allocated to OOPE. This approach evaluates the percentage reduction in THCE caused by OOPE and is commonly referred to as the budget share method [3,160] or the basic approach [24]. Households are classified as incurring catastrophic spending if their OOPE exceed 10% or 25% of THCE [2]. This approach was chosen for this thesis as it aligns with the indicators used in SDG 3.8.2[82] to monitor financial protection within UHC [2]. Additionally, Wagstaff and colleagues have recommended this method for applied research aiming to measure relative financial hardship associated with OOPE, highlighting its clear rationale for being concerned about catastrophic OOPE and independence from household-specific spending decisions across discretionary versus non-discretionary items [24].

While the budget share method was adopted in this thesis, several alternative approaches have been developed and seen widespread use in the available literature. For example, another method is the CTP approach, where households incur catastrophic expenditure if OOPE exceed a transformation of consumption that some scholars think better approximates their CTP [24]. A commonly applied threshold in this method is 40% of CTP. CTP is calculated by deducting an allowance for subsistence needs—traditionally, "essential" food expenses—from THCE, as food expenditures are considered necessary and should not be included in the resources available to pay for healthcare [23]. Two primary methods, as well as a combination of both, have been commonly employed to estimate subsistence needs within the CTP framework:

- **Normative food expenditure approach:** A standardized amount for food spending is subtracted on the basis of equivalized household size[83] [243–246].
- **Actual food expenditure approach:** The household's actual reported food expenses are deducted from THCE [3,12,243,244].

Despite its widespread application, the CTP approach has been subject to criticism. Wagstaff argued that it does not provide clear insight into whether or how close a

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[82] The WHO and the World Bank have proposed a revision to SDG indicator 3.8.2. Their suggested alternative is to measure the proportion of the population with OOPE exceeding 40% of household discretionary budget. In this approach, discretionary budget is defined as THCE (or income) minus the societal poverty line. The societal poverty line is either the international poverty line ($2.15 per person per day on the basis of 2017 PPPs) or calculated as $1.15 plus 50% of median household consumption expenditure (or income). This revised indicator recognizes that households living in or near poverty typically cannot afford to spend even 10% or 25% of their THCE on healthcare, thereby aiming to better capture financial hardship among poorer households. The final decision regarding the adoption of this revision is expected at the United Nations Statistical Commission meeting in March 2025.

[83] For example, a common method is to calculate the allowance as the average of food expenditure per capita for households within the 45th and 55th percentile range of household food expenditure, adjusted for consumption equivalize scales [195,243,252].

household is to failing to meet its basic needs due to OOPE [24]. Additionally, a recent systematic review concluded that the commonly held belief—that measuring catastrophic expenditure using the CTP approach better identifies financial hardship among poorer households—may be inaccurate. The review found that the budget-share method (10% of THCE) performed better than the CTP method in capturing catastrophic spending among poor households [160].

In response to the limitations of traditional methods, newer techniques have been developed.

- **Normative subsistence spending approach:** This method extends the concept of subsistence needs beyond food to include other essential expenses such as housing and utilities, aligning the measurement more closely with affordability considerations. Importantly, this method also classifies any OOPE incurred by households already below the poverty line as both catastrophic and further impoverishing. Proponents argue that this approach is more sensitive to financial hardship among the poor [244,245,247].
- **Excessive financial burden:** Antunes et al. introduced the concept of excessive financial burden, which measures health-related financial shocks by excluding OOPE from THCE. The authors showed that this approach captures 99% of cases of catastrophic spending identified via the CTP method while being more sensitive in identifying financial hardship among the poor [61].
- **Unified approach to catastrophic and impoverishing spending:** Wagstaff and Eozenou proposed a unified framework that links catastrophic, impoverishing, and further impoverishing spending into mutually exclusive outcomes. This approach provides a more comprehensive lens to analyze financial hardship, bridging the gap between relative and absolute financial hardship due to OOPE [248].

Limitations of catastrophic health expenditure indicators

The catastrophic health expenditure indicator faces several limitations that complicate its application for national monitoring and policy analysis—despite its widespread use. For national-level monitoring, perhaps the most common criticism relates to the definition of the threshold(s), which has been referred to as arbitrarily defined and lacks a defensible theory between spending above the threshold and the likelihood of households facing reductions in other essential spending [20].

Additionally, the indicator often exhibits a pro-rich incidence in many countries, including in Cambodia (Study II). This suggests that the most commonly used measures, the budget share and the CTP method, do not effectively capture financial hardship among poorer households, which goes against the equity goals embedded in the SDGs [20,23,249]. This is partly because these measures fail to distinguish between low utilization due to affordability challenges, such as foregone care, and low utilization stemming from an absence of health needs [250]. Richer households

also commonly incur discretionary health spending, such as the use of expensive private health services, which increases their OOPE budget share [250,251].

Although the CTP approach was once considered more sensitive to financial hardship among poorer households [243,245,247,252], recent evidence suggests that the 10% of THCE approach may be more effective for identifying catastrophic spending among the poor. Nevertheless, the authors also indicate that none of the commonly used indicators fully account for the financial hardship experienced by poorer households, who may report low or no OOPE due to constrained spending capacity [160]. In this context, Ataguba argued that thresholds should be adjusted for poorer households, given that they allocate a larger share of their resources to basic necessities [253].

Other limitations of the catastrophic health expenditure indicator across methods and thresholds relate to the underlying survey data, which may limit the ability to make comparisons across time and understand if these are due to changes in the numerator (i.e. OOPE, which can be influenced through health system reform) or the denominator (i.e. THCE, likely outside the realm of influence of the health system) [20]. Additionally, measuring the catastrophic expenditure indicator based on cross-sectional data, as has been done in this thesis, identifies only the proportion of households affected at a single point in time but fails to reveal the long-term economic consequences of catastrophic health expenditure on households, such as the cumulative impact of repeated health-related financial shocks [23].

Incidence of impoverishment

Measurement approaches

Impoverishment measures the proportion of households pushed into poverty due to OOPE, with variations in the literature primarily related to the choice of poverty line thresholds. In this thesis, impoverishment is measured via Cambodia's official 2019 national poverty line (NPL), which is stratified by geographical domain. The NPL is an absolute poverty line calculated based on subsistence needs and is defined as Khmer Riel (KHR) 10,951 (US$ 2.67) per person per day in the capital Phnom Penh, KHR 9,571 (US$ 2.33) in other urban areas, and KHR 8,908 (US$ 2.17) in rural areas [165].

Alternative approaches to measuring impoverishment include the international absolute poverty line, which is currently set at $2.15 per person per day on the basis of 2017 PPPs [254], relative food poverty lines, which calculate the cost of meeting basic caloric needs, and median income poverty lines [26,255]. However, due to challenges with the PPP conversion factor for Cambodia, the use of international absolute poverty lines is not currently recommended for the country.

Limitations of the incidence of impoverishment indicator

The impoverishment indicator has faced criticism for its underlying assumption. Specifically, it presumes that OOPE are financed entirely by foregoing other goods or services, without considering the possibility of households financing these expenses through savings, borrowing, or other means [21].

Moreover, the incidence of impoverishment is highly sensitive to the choice of poverty line thresholds, affecting both temporal comparisons within a country and cross-country analyses [256,257]. As with catastrophic spending, limitations related to the use of cross-sectional data and survey design also apply to the impoverishment indicator. Cross-sectional data, for instance, provide only a snapshot of households pushed into poverty at a single point in time, without capturing the longer-term economic repercussions of impoverishment on these households or if and how quickly they rebound [20,23].

Coping strategies

Depending on the amount of OOPE incurred and the household's financial position, regular income may be insufficient, prompting households to adopt coping strategies [3,28]. These can mitigate short-term shocks in household consumption of essential goods, but depending on the coping strategy employed, they can have severe long-term consequences [28]. While catastrophic and impoverishing spending reflect the burden of OOPE relative to household welfare, coping strategies reveal how households manage to pay for these expenses. These strategies thus offer unique insights into another layer of financial hardship, which is essential for gaining a full understanding of the financial hardship experienced by uncovered Cambodian households. Flores et al. proposed a hierarchy of coping strategies for financing healthcare: households first utilize current income, followed by dissaving and, as a last resort, households turn to asset sales and borrowing [28].

Importantly, while catastrophic and impoverishing expenditures capture the financial strain faced by households in the current period, coping strategies can seriously compromise household welfare in the medium to long term, while increasing their vulnerability to economic shocks [3,28]. For instance, consumption-based strategies may lead to malnutrition or reduced educational attainment, negatively affecting human capital accumulation [27]. This is especially relevant in Cambodia, where human capital outcomes are already relatively low due to high rates of stunting and low learning-adjusted school years [258]. Similarly, finance-based strategies, such as taking out loans, can reduce future financial stability by reducing disposable income through debt repayments and limiting households' ability to cope with future financial shocks [3,28].

Measurement approach

Coping strategies were measured as binary variables, indicating whether a household resorted to any coping strategy for at least one outpatient or inpatient healthcare episode undertaken by its members. The following categories of coping strategies were measured:

Consumption-based coping strategies: These strategies refer to households financing their OOPE through their income, but at the cost of compromising essential consumption. In this thesis, these expenses were measured as reducing food expenditures, cutting other essential expenses (e.g. clothing, shelter, utilities), lowering education expenditures, and increasing child labor hours. Although these strategies are less commonly examined in the literature on financial protection, existing evidence suggests that OOPE may crowd out essential spending, particularly on food and education [27,259]. Notably, the UPOS is the first survey in Cambodia to gather information on consumption-based coping strategies for healthcare[84]. Including consumption-based coping strategies in the analysis aligns with rationale that indicators of financial protection should provide information on the extent to which nonmedical consumption is protected from OOPE [21].

Finance-based coping strategies: This category encompasses dissaving, borrowing (with or without interest), selling household assets, selling future household production, and receiving remittances, donations, or gifts [3,28].

Limitations

The estimates for catastrophic and impoverishing spending reported in this thesis are not adjusted for finance-based coping strategies, such as dissaving or taking loans. These strategies can temporarily protect households from consumption shocks caused by OOPE [28]. Consequently, the measurement of THCE in this thesis assumes that OOPE were financed entirely from a household's current consumption, without considering that households may rely on coping strategies. As shown in section **II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023**, a nonnegligible proportion of uncovered households financed their OOPE through loans or asset depletion. This omission may lead to an overestimation of catastrophic and impoverishing spending, as the financial burden of OOPE is effectively shifted away from immediate consumption.

Moreover, the failure to account for finance-based coping strategies introduces potential bias into the distributional analysis of catastrophic and impoverishing spending by wealth status (Study II). For example, poor households that heavily rely

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[84] The CSES also gathers information on vulnerabilities and coping strategies, although these data are collected in a separate module and not specifically tied to healthcare utilization. This limits the ability to directly assess the coping mechanisms households employ in response to healthcare-related financial burdens.

on borrowing or dissaving to cover large OOPE may appear temporarily wealthier, as their THCE is inflated by the additional resources mobilized [21].

Conversely, this thesis may underestimate the incidence of catastrophic OOPE. As highlighted in section **II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023**, a substantial share of households reported reducing expenditure on necessities—such as food or education—despite not crossing the catastrophic expenditure threshold. This suggests that catastrophic spending thresholds, as currently defined, may fail to capture all forms of financial hardship associated with OOPE.

Additionally, given that the UPOS was carried out only from June to July 2023 (Cambodia's wet season), it does not account for potential seasonality effects. Previous research has shown that seasonal variations can significantly influence disease prevalence, healthcare utilization, consumption patterns, and the opportunity costs associated with seeking healthcare. These variations could, in turn, affect estimates of financial protection indicators [242,250].

Sensitivity analysis

To ensure the robustness of the findings, sensitivity analyses were conducted on OOPE, THCE and financial protection indicators, including the OOPE budget share, catastrophic health expenditure, and impoverishing spending. These analyses involved testing alternative data management approaches to evaluate their potential influence on the results.

Alternative equivalence scales were tested as replacements for the per capita consumption approach traditionally used [237,246]. However, the impact on THCE and the financial protection indicators was negligible, with differences that were not statistically significant. Given this minimal impact, and considering that per capita consumption is the standard method used by the Cambodian government for measuring THCE and the poverty headcount [237], the per capita approach was retained for consistency and comparability.

The effects of winsorizing OOPE and THCE were also evaluated by comparing winsorized and non-winsorized versions of these variables. Winsorization was applied at both the 1% and 5% thresholds to address extreme values with low probability. The differences between winsorized and non-winsorized data were small and not statistically significant, indicating that extreme values did not substantially influence the results. Therefore, the non-winsorized versions of all the variables were retained to maintain the integrity of the original dataset.

II.2.4 Statistical methods

This section outlines the statistical methods employed in Studies III and IV, which form the basis for the results on the determinants of OOPE and the OOPE budget share presented in section **II.3.2 Determinants of OOPE and financial protection**.

Outcome variables

The analysis focused on two continuous outcome variables:

- **Total OOPE:** This measure includes both outpatient and inpatient OOPE, capturing the overall monetary burden that households face due to curative health-related spending.

- **OOPE budget share:** Defined as the proportion of OOPE to THCE, this variable was chosen as a measure of financial protection due to its continuous nature, which enables detailed analysis across the entire distribution. Additionally, unlike categorical indicators such as catastrophic health expenditure, using the OOPE budget share avoids controversies surrounding the arbitrary selection of thresholds.

In addition to these primary outcomes, the analysis separately examined OOPE for outpatient and inpatient care. This distinction accounts for potential differences in cost structures: outpatient spending typically involves smaller, recurring expenses, whereas inpatient care often entails larger, one-time costs.

Independent variables

Table 5 outlines the independent variables included in the analysis, along with their measurement and a brief rationale for inclusion. The selection of these variables was informed by both empirical evidence and theoretical considerations. Specifically, the literature review on the determinants of OOPE and financial protection (see section **0.5 Literature review**) served as a key resource for identifying variables of interest. Additionally, established theoretical models, including Grossman's demand for health model and Aday's and Andersen's healthcare utilization model, informed the final inclusion decisions to ensure alignment with applicable theory [19,236,260,261].

The independent variables were categorized into three broad groups—*healthcare*, *health*, and *social* factors—following the approach of Haakenstad et al. These categories are based on the degree to which variables can be influenced by public policy [56].

Healthcare factors refer to variables that can be directly impacted by targeted health and financial protection policies, such as the extension of prepayment coverage or changes in health financing and service delivery. These factors are therefore of immediate relevance to policymakers focused on reducing OOPE and improving financial protection.

Health factors capture household-level health needs and conditions, such as the presence of chronic illnesses. Although these factors may be more difficult to modify in the short term through policy, they may be influenced indirectly through public health interventions, health promotion, and behavior change initiatives.

Social factors include broader demographic and socioeconomic factors, such as wealth, education, and household size. These factors are complex and often intersect with multiple sectors beyond healthcare, commonly necessitating multisectoral interventions [56]. These factors, though not directly modifiable through health and financial protection policies alone, may act as moderators as outlined in section **0.6 Conceptual framework**, affecting the effectiveness of policies and interventions aimed at reducing OOPE and financial hardship.

Table 5. Independent variables, measurement, and rationale for inclusion.

Variable	Measurement	Rationale for inclusion
Healthcare factors		
Sector of care	The sector type accessed by any HHM categorized according to the MOH framework [192]. 1 = Public outpatient care (ref) 2 = Public inpatient care 3 = Private outpatient care 4 = Private inpatient care 5 = Overseas 6 = Nonmedical	Related to the inputs (type of medical care) consumed to improve their health stock in Grossman [260]. Different sectors may provide varying levels of inputs at differing prices, affecting OOPE.
Level of care	The highest level of care accessed by any HHM categorized according to the MOH framework [192]. 1 = Ancillary (pharmacies, ref) 2 = Primary 3 = Secondary 4 = Tertiary	Similarly related to inputs in the health production function in Grossman [260]. Higher levels typically correspond to more specialized treatments and greater inputs in the health production function, leading to higher OOPE.
Number of inpatient nights	Annualized number of inpatient nights across HHMs.	Longer stays indicate higher input intensity, typically increasing OOPE through prolonged care consumption [260].
Number of outpatient visits	Annualized number of outpatient visits across HHMs.	Another measure of health investment in Grossman [260]. More visits reflect greater use of healthcare inputs.
Number of medications	Annualized number of medications across HHMs.	Medications are direct health inputs in the health production function [260]. More medications typically indicate higher utilization intensity and OOPE.

Health factors		
Share of HHM with chronic illness	Share (%) of HHMs who have a chronic illness.	Need factor in Aday and Andersen's model. Perceived illness, including chronic illnesses, is an immediate cause of health service use. In Grossman, chronic illnesses also represent a depletion of health stock [236,260,261].
Share of HHM with disability	Share (%) of HHMs with a disability, generated based on the Washington Group short set of questions on functioning recommended cutoff. At least one domain is 'a lot of difficulty' or 'cannot do at all' [262].	Disability is a need factor influencing health service utilization. People with disabilities may face higher OOPE due to specialized care needs. Additionally, people living with a disability may also experience a more rapidly deteriorating health stock [236,260,261].
Share of HHM in self-reported health <good	Share (%) of HHMs that report their health to be less than good. Self-reported health status was dichotomized into those who report their health status as "good" and "less than good" [12].	Poor self-reported health reflects perceived illness (need factor) and a deteriorated health stock. Poor self-reported health status may lead to more healthcare utilization and OOPE [236,260,261].
Severity score	Reflects both the severity and the prevalence of diseases within the household. Calculated as a prevalence-weighed score for each household. The perceived severity score of each illness was multiplied by the number of household members affected by that illness and scores were then summed.	A proxy for perceived illness severity, a key need factor influencing healthcare utilization and OOPE (Aday and Andersen included clinically judged severity of illness) [236,261]. Higher severity indicates greater health needs and costs.
Days lost to illness/injury	Combined number of days HHMs could not work due to inpatient or outpatient illness/injury.	Represents the illness impact on daily life (need factor) [236,261].
Number of HHM with NCDs	Number of HHMs who experienced an NCD. Defined based on IHME disease groupings [235].	Similar to chronic illness as a need factor [236,261]. NCDs can lead to higher OOPE due to ongoing treatment costs.
Number of HHM with MNNDs	Number of HHMs who experienced an MNND (including childbirth). Defined based on IHME disease groupings [235].	Included in Aday and Andersen as a need factor [236,261].
Number of HHM with injuries	Number of HHMs who experienced an injury. Defined based on IHME disease groupings [235].	Included in Aday and Andersen as a need factor [236,261].
Social factors		
Household size	Household size in integers.	Included in Aday and Andersen's model as a predisposing factor [236,261]. Larger household size may increase health needs and OOPE or lead to lower per capita OOPE due to resource sharing.

HoHH age	Age of HoHH in integers.	Included in Aday and Andersen (predisposing factor) and Grossman. Age affects health needs, service utilization, and ability to maintain health stock, potentially increasing OOPE [236,260,261].
HoHH gender	0 = male (ref) 1 = female	Gender is included in both Aday and Andersen's model (predisposing factor) and Grossman. Gender is related to health and illness, as well as decision-making [236,260,261], which can impact OOPE.
HoHH education	0 = no formal education (ref) 1 = primary 2 = secondary 3 = higher 4 = other	Education is a predisposing factor that influences knowledge about health services, care-seeking behavior, and health investments [236,261].
Employment ratio	Share of HHMs in any employment, divided by the household size.	Employment impacts financial stability and access to care (enabling factor in Aday and Andersen, health capital in Grossman). Higher employment rates can increase income available for healthcare spending [236,260,261].
Share of HHM over 60	Share (%) of HHMs over the age of 60.	Older members may have higher healthcare needs, making this an important predisposing factor. In Grossman, older individuals may require more healthcare to maintain health [236,260,261].
Share of HHM under 5	Share (%) of HHMs under the age of 5.	Young children have unique healthcare needs. Included as a predisposing factor (similar to HoHH age) and because young children potentially require greater health investments [236,260,261].
Wealth quintile	5 wealth quintiles based on per capita total annual household consumption expenditure. 1 = Quintile 1 (ref); 2 = Quintile 2; 3 = Quintile 3; 4 = Quintile 4 ; 5 = Quintile 5	Wealth is an enabling factor in Aday and Andersen and represents the ability to invest in health. Higher wealth leads to increased access to care and greater OOPE [236,260,261].
Total indebtedness	Total outstanding debt balance at the time of the survey in US$.	Acts as a proxy for financial vulnerability and is implicitly included in Andersen's enabling factors. Higher indebtedness may limit access to care and increase OOPE burden [236,261].
Geographic domain	Residence of a household 1 = Phnom Penh (ref) 2 = Other Urban 3 = Rural	Geographic location affects access to healthcare services (enabling factor). Rural areas may have less access, leading to lower utilization, but potentially higher OOPE due to fewer options. Additionally, differing local norms may influence behaviors [236,261].

Abbreviations: HHM = household member; IHME = Institute of Health Metrics and Evaluation; MNND = maternal, neonatal, nutritional disease; NCD = noncommunicable disease; OOPE = out-of-pocket health expenditures.
Source: Adapted from Study III, Additional File 1.

During the empirical testing of the models, alternative coding approaches were evaluated for several variables, such as severity, sector and level of care, category of illness, age dependencies, household members with chronic illness and disability, and employment. These tests yielded nearly identical results. Variables with theoretical relevance that did not improve model performance were excluded, including marital status, ethnicity of the head of household, access to water, sanitation, and hygiene, and variables related to community development and infrastructure, such as street lighting and rubbish removal. Additionally, the number of inpatient stays was excluded because of multicollinearity with secondary care, and instead, the number of inpatient nights was included. This variable provides a measure of the intensity of healthcare utilization while resolving the multicollinearity issue.

Despite their theoretical significance, several variables were excluded due to data unavailability. These include health system factors, such as distance to health facilities and healthcare personnel, and facility or bed-to-population ratios, which reflect societal determinants in Aday's and Andersen's framework [236,261]. Other important but unavailable variables include cultural norms and societal attitudes, as well as individual-level determinants such as beliefs about health, illness, and healthcare services [236,261]. Similarly, lifestyle factors, considered health inputs in Grossman's model, such as smoking or alcohol consumption, were not included due to data constraints (249). In future research, incorporating some of these variables could offer a more complete understanding of the factors driving OOPE and financial protection.

Regression analysis

This section details the methods underlying Studies III and IV, responding to sub-research questions 5 and 6.

Generalized linear model (Study III)

Several alternative models can be employed for analysis of the determinants of continuous positive outcomes such as OOPE. A particular challenge with OOPE is their commonly highly skewed distribution [263], also observed for total OOPE, outpatient and inpatient OOPE, and the OOPE budget share in the UPOS dataset (Study III). The two primary classes of estimators commonly used for such data are ordinary least-squares (OLS) applied to the natural log of the outcome (ln(y)) and GLMs with log links. OLS on ln(y) is appropriate when the OLS residuals on the log-scale are symmetric, not heavy-tailed, and homoscedastic (exhibiting constant variance) [264]. Conversely, GLMs are preferred when log-scale OLS residuals exhibit heteroskedasticity or are heavy-tailed [264]. GLMs also avoid retransformation issues inherent in OLS, such as the possibility of negative predictions [263,264].

I used a systematic model selection approach [263,264]. This process began with fitting a GLM with a log link and estimating the residuals on both the raw-scale and the log-scale. This indicated that the log-scale residuals were not heavy tailed, with kurtosis just below 3. I then applied the Park test to the raw-scale residuals, which examines how the variance of the raw-scale residuals relates to the predicted values. The test suggested a lambda value near 2 for all outcomes, aligning with the integer value for the gamma family. At this stage, two models remain viable options: a GLM with a log link and gamma family, and a homoscedastic log OLS model [264]. As a final step, I compared these models using the Akaike information criterion (AIC) and the Bayesian information criterion (BIC), as well as the predicted outcome means. The GLM slightly outperformed the log OLS model on these metrics, although both models yielded similar conclusions regarding the identified determinants and their coefficients.

I conducted additional empirical tests to confirm that the log link and gamma family were the best choices [263,264]. A Box-Cox analysis identified the log link as the most suitable link function, with Lambda values close to 0 for all outcomes. The Park test corroborated the gamma family as the appropriate distribution as mentioned above. Finally, a comparison of the AIC and BIC across alternative link functions and families further validated the choice of a GLM with a log link and gamma family.

Unconditional quantile regression (Study IV)

There are conceptual reasons to expect that the effects of explanatory variables may vary at different points along the distribution of the outcome variable [263]. Quantile regression is a useful method for exploring this heterogeneity. Two main types of quantile regression exist: conditional quantile regression and UQR [265,266]. The distinction between these methods can be best understood through an example.

Consider a model examining the effects of variables such as the number of medications, age, the share of household members with chronic conditions, and wealth quintile on OOPE.

In conditional quantile regression, individuals with identical characteristics are compared [266]. For instance, consider two individuals who are both 65 years old, belong to wealth quintile three, have two household members with chronic conditions and have purchased three medications. Despite these identical observable characteristics, their spending patterns may differ. Hypothetically, Person A is at the 25th percentile (Q25) of the conditional expenditure distribution, where an additional medication increases OOPE by \$30. In contrast, Person B, at the 90th percentile (Q90), experiences a much larger increase of \$120 for the same additional medication. Importantly, these effects are interpreted relative to others with the

same observable characteristics, allowing conditional quantile regression to reveal heterogeneity within groups of similar individuals [266].

In contrast, UQR provides a broader, population-level perspective by examining how explanatory variables affect the marginal distribution of OOPE across the entire population, not just within specific groups. For instance, suppose that at Q25, an additional medication increases OOPE by $40, while at Q90, the increase is $90. These estimates reflect the effects on the overall distribution of OOPE across all individuals, irrespective of their specific characteristics. The UQR, therefore, captures how the distribution of OOPE changes at different quantiles for the entire population [266].

This distinction highlights the different analytical approaches between the two methods: while conditional quantile regression examines heterogeneity within groups of individuals with similar characteristics, UQR assesses effects on the overall population distribution of the outcome variable [266]. More technically, UQR involves multiple steps following the method developed by Firpo et al. [265]:

1. **Estimating sample quantiles:** The first step involves ordering all observations from lowest to highest to identify the value corresponding to the desired quantile q_τ. For this thesis and Study IV, I estimated the 10th, 25th, 50th, 75th, and 90th quantiles, referred to as Q10 through Q90.

2. **Estimating the probability density function:** Second, the probability density function at each quantile of interest is estimated using kernel density estimation methods.

3. **Computing the recentered influence functions (RIFs):** Next, the RIF values are calculated using the following formula:

$$RIF(Y, q_\tau) = q_\tau + \frac{\tau - 1(Y \leq q_\tau)}{f_Y(q_\tau)}$$

where q_τ is the quantile from Step 1, τ is the quantile of interest, $1(Y \leq q_\tau)$ is an indicator function equal to 1 if Y is less than or equal to the quantile q_τ and 0 otherwise, and $f_Y(q_\tau)$ is the estimated density of Y at q_τ from Step 2 [265].

4. **Regression of RIFs:** Finally, an OLS regression is run, with the RIF values used as the dependent variable. This step involves regressing the RIF values against the *healthcare*, *health*, and *social* factors outlined in the previous section.

Shapley decomposition (Studies III and IV)

Shapley decomposition serves as a valuable complement to traditional regression methods. It quantifies the contributions of explanatory variables to the model's outcomes by fairly distributing the goodness-of-fit measure (R^2) across these variables based on a consistent mathematical framework [267,268]. In this thesis,

Shapley decomposition was applied in Studies III and IV to examine the contribution of *healthcare*, *health*, and *social* factors to total OOPE, outpatient and inpatient OOPE, and the OOPE budget share. The method identified which factors are most influential in explaining these outcomes—both at the group-level and for individual variables within each group. While Shapley decomposition does not provide causal effects, it is a useful tool for focusing attention on factors that are quantitatively more important in describing variations in the outcomes [269].

Shapley decomposition works by considering all possible combinations of explanatory variables and calculating the outcomes with and without each variable in every possible combination. It then computes each variable's marginal contribution by averaging these contributions across all sequences of eliminating variables. Contributions are expressed as proportions of the overall explained variance (R^2) [267,268].

The method has several key properties that make it robust and superior to other decomposition methods under several sound assumptions [267]. First, the efficiency property ensures that the total explained variance is fully distributed among explanatory variables. Second, its monotonicity property maintains logical consistency in attribution, ensuring that variables with greater marginal contributions are ranked higher. And third, its equal treatment (symmetry) property ensures fairness in attribution, assigning equal contributions to variables that contribute equally [267].

In Study III, Shapley decomposition was applied using a conventional OLS framework, following the methodology of Haakenstad et al. [56]. This allowed for the decomposition of the R^2 at the mean. Building on this, Study IV combined UQR with Shapley decomposition, following the approaches outlined in Davillas et al. and Sinha et al. [270–272]. This novel combination of methods allowed for the decomposition of the RIFs at the five specified quantiles, providing a detailed understanding of how group and individual variable contributions vary across the distribution of OOPE outcomes and the OOPE budget share. Practically, this allows the identification of the key contributors at different expenditure and budget share levels, revealing any heterogeneity across the distribution.

However, combining UQR with Shapley decomposition has several limitations. First, the smaller sample sizes at the distribution tails (e.g. Q10 and Q90) can reduce the reliability of estimates and make them more sensitive to outliers. Additionally, compared with mean-based analysis, interpreting results from distributional decompositions is more complex, which can pose challenges in communicating findings effectively to policymakers and other nontechnical stakeholders. Moreover, the method requires substantial computational resources, particularly when combined with bootstrapping for uncertainty estimation. Finally, limited variability in key variables may lead to potentially misleading interpretations of their relative importance, as their contributions approach zero when variables

exhibit minimal variation—even if these variables are important determinants of the outcome. Therefore, contributions can vary substantially across different points of the outcome distribution, not necessarily due to true heterogeneous effects, but also owing to differential variability in explanatory variables across quantiles.

To quantify the uncertainty around the decomposition estimates, 95% confidence intervals were calculated by bootstrapping with 1,000 replications for both the mean-based and distributional decompositions. Bootstrapping involves resampling the dataset with replacement to generate a distribution for the contributions for each explanatory variable, from which the 2.5th and 97.5th percentiles are computed to establish the confidence intervals [269].

II.2.5. Use of AI

To enhance the clarity, readability, and grammatical accuracy, I utilized the generative AI tool ChatGPT for language refinement, including sentence structure, coherence, grammar, and overall readability. However, all substantive content, analyses, and interpretations were independently developed by myself. The final thesis was thoroughly reviewed to ensure accuracy, originality, and adherence to academic standards, and I take full responsibility for all included content.

II.3 Findings

This section starts by examining financial hardship due to OOPE in Cambodia from 2009 to 2023, with a focus on uncovered households, followed by an analysis of the determinants of OOPE and the OOPE budget share based on the UPOS 2023.

II.3.1 Trends in OOPE, OOPE budget share, and financial hardship from 2009 to 2023

This section presents empirical work, OOPE and examining financial hardship due to OOPE in Cambodia from 2009 to 2023, with a focus on uncovered households. It aims to address the sub research questions 1, 2 and 3. Understanding trends in these indicators helps contextualize the focus on the determinants of OOPE and the OOPE budget share examined in detail in the next section. By offering background on the scale and trends of OOPE and financial hardship, this section highlights why OOPE remain one of the major challenges facing Cambodia's health system and burdening its population.

The analysis draws on multiple data sources. The trend analysis is based on Study II but incorporates additional results from the 2021 and 2023 CSES, which were

released after the publication of Study II. The second key data source is the 2023 UPOS.

The results for all indicators are presented for two distinct groups. The first group, which is based on CSES data from 2009 to 2023, represents the entire Cambodian population, including both uncovered households and those with access to prepayment schemes. The second group focuses on uncovered households who sought care, with data from both the CSES and the UPOS.[85] The 2009 CSES does not distinguish between uncovered households and those covered by prepayment schemes, so the analysis for uncovered households begins in later years.

OOPE

Figure 13 presents trends in OOPE from 2009 to 2023 for both total households and uncovered households who sought care. All values are adjusted for inflation and presented in constant 2023 US$ to reflect real changes in OOPE over time, following the methods used in Study II. The results indicate that uncovered households who sought care consistently faced higher OOPE than did the total population. From 2009 to 2019, OOPE remained relatively stable for both groups, with a slight peak in 2019. However, a significant decrease occurred between 2019 and 2021, with OOPE decreasing from $438.91 to $285.12 for total households and from $681.16 to $462.56 for uncovered households who sought care. This sharp decline is likely due to the effects of the COVID-19 pandemic, during which the Cambodian government imposed nationwide restrictions such as curfews and stay-at-home orders, which impacted both healthcare utilization and consumption (15). Additionally, reduced healthcare-seeking behavior due to fears of contracting COVID-19 in healthcare settings may have further contributed to this trend as mentioned in section **II.1.1 The Cambodia socioeconomic survey**.

In 2023, data from the CSES revealed that OOPE for uncovered households who sought care remained substantial, averaging $536. In comparison, the estimate based on the UPOS was slightly lower at $475.30. These findings suggest that, even post-pandemic, uncovered households continue to face significant OOPE when accessing healthcare, although at levels below those observed in 2019.

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[85] It is expected that households seeking care will face higher OOPE and a larger financial compared to the total population, which reflects the nationally representative average, including both care-seeking households and those that either did not experience illness or chose not to seek care. However, this comparison remains valuable as it highlights the true financial burden specifically borne by care-seeking households, which otherwise may be masked in national averages.
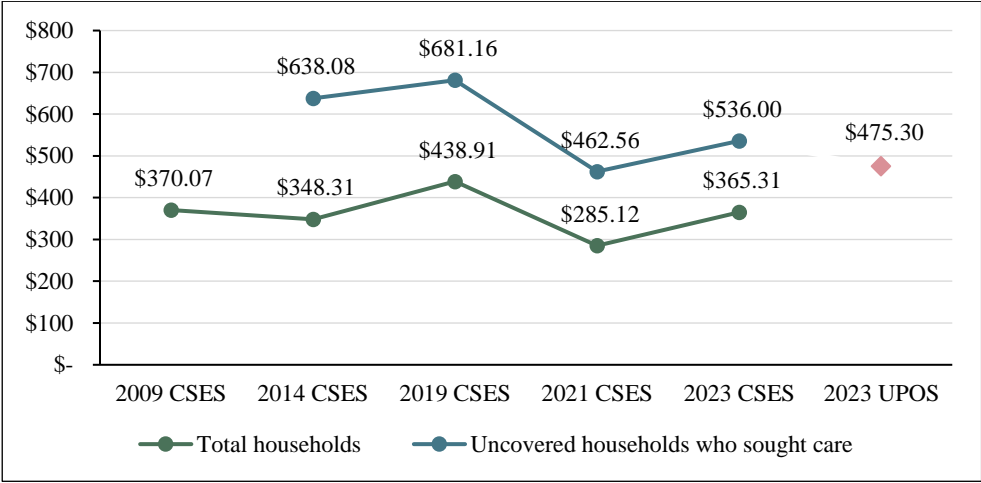
Figure 13. Real OOPE from 2009 to 2023.
Source: Author's deliberation based on the CSES 2009-2023 and the UPOS 2023.

OOPE budget share

The trends in the OOPE budget share closely mirror the patterns observed for OOPE (Figure 14). A decrease between 2009 and 2014 was followed by an increase between 2014 and 2019 for both total households and uncovered households who sought care. Notably, the OOPE budget share also dropped sharply between 2019 and 2021: from 5.42% to 4.07% for total households, and from 8.52% to 7.03% for uncovered households who sought care.

According to Study II, between 2009 and 2017, the growth in THCE outpaced the increase in OOPE, resulting in a declining OOPE budget share. However, from 2017 to 2019, OOPE grew faster than THCE did, leading to a higher budget share. In 2021, during the height of the pandemic, both THCE and OOPE decreased significantly, but the greater decrease in OOPE relative to THCE resulted in a lower overall budget share.

Data from both the CSES and the UPOS for 2023 indicate that the OOPE budget share for uncovered households who sought care has risen again, reaching 7.23% based on the CSES and 7.84% based on the UPOS, although it remained below the levels observed in 2019.
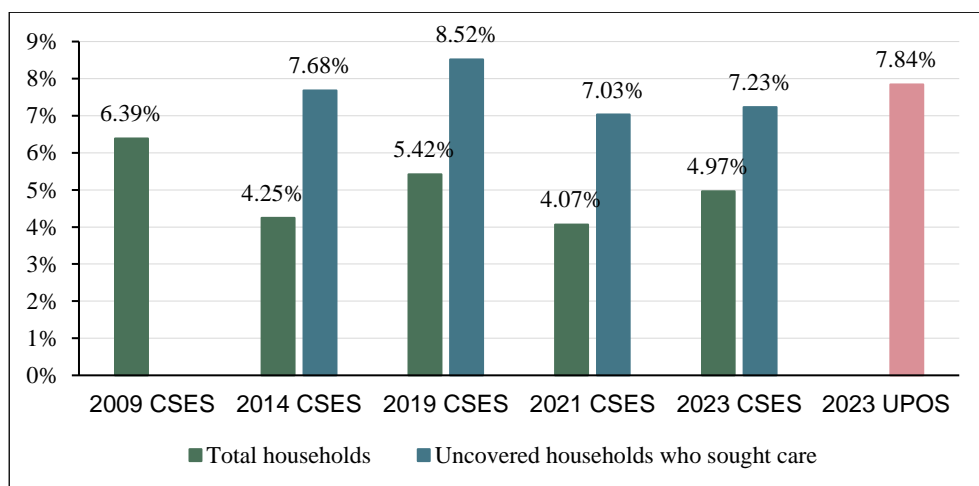
Figure 14. OOPE budget share from 2009 to 2023.
Source: Author's deliberation based on the CSES 2009-2023 and the UPOS 2023.

Catastrophic health expenditure

The trends in the incidence of catastrophic health expenditure aligned closely with the patterns observed in the OOPE budget share, as shown in Figure 15. Across all years, uncovered households who sought care consistently faced higher rates of catastrophic spending compared to the total population, at both the 10% and 25% thresholds of THCE.

Catastrophic OOPE decreased between 2009 and 2014 for the total population but increased again between 2014 and 2019 at both thresholds (as highlighted in Study II). Between 2019 and 2021, the sharp reduction in the OOPE budget share corresponded to a decline in the incidence of catastrophic spending for both groups. In 2021, 20.82% of uncovered households who sought care faced catastrophic health expenditure at the 10% threshold, and 6.20% did so at the 25% threshold, compared with 12.06% and 3.32%, respectively, among total households.

The results from the CSES 2023 and UPOS 2023 indicate a reversal of the previous downward trend, with catastrophic expenditure rising again to 24.24% of uncovered households who sought care at the 10% threshold and 5.98% at the 25% threshold, based on the UPOS, and 23.89% and 5.98%, respectively, based on the CSES.
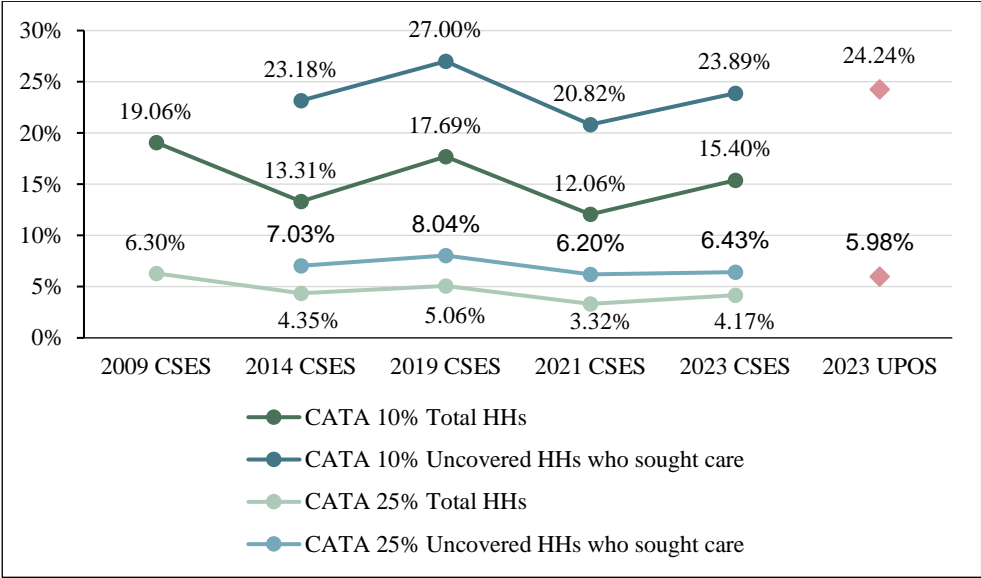
Figure 15. Incidence of catastrophic health expenditure from 2009 to 2023.
Source: Author's deliberation based on the CSES 2009-2021 and the UPOS 2023.
Abbreviations: CATA = catastrophic health expenditure; HHs = households.

Impoverishment

Following a decrease between 2009 and 2014, impoverishment remained relatively stable from 2014 to 2021 for both total households and uncovered households who sought care (Figure 16). In 2021, 5.6% of uncovered households who accessed care fell below the poverty line due to healthcare costs, whereas 3.55% of total households did.

The 2023 CSES and UPOS data indicate a modest rise in the incidence of impoverishment, with 6.67% of uncovered households who sought care experiencing impoverishment according to the UPOS, and 6.03% according to the CSES.
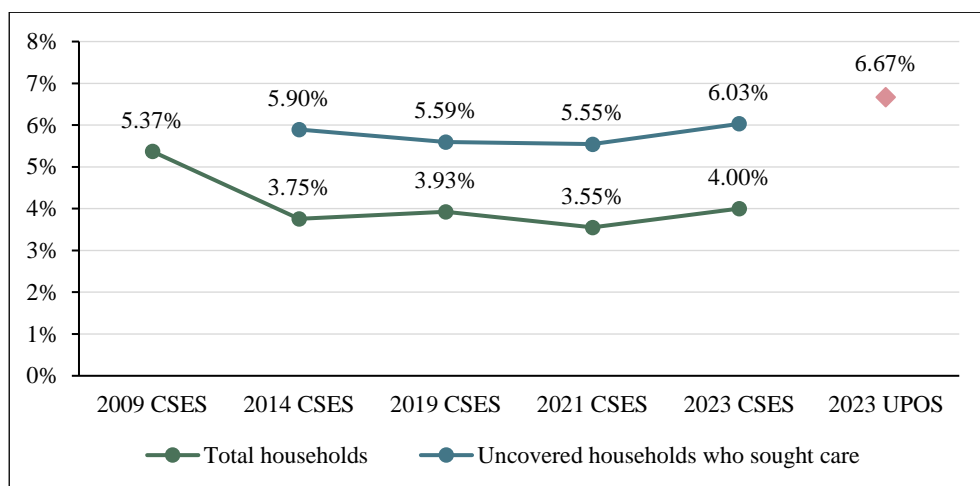
Figure 16. Incidence of impoverishment from 2009 to 2023.
Source: Author's deliberation based on the CSES 2009-2021 and the UPOS 2023.

Coping strategies among uncovered households

This chapter draws solely from the UPOS 2023, which collected detailed data on consumption-based and finance-based coping strategies used by uncovered households. Coping strategies are also briefly mentioned in Studies III and IV. The results are disaggregated for households seeking outpatient care and those seeking inpatient care to account for the potentially differing cost implications associated with each type of care.

Number of coping strategies and underlying factors

Among households in which at least one member sought outpatient care, 62.47% were able to finance their OOPE entirely through household income, while the remaining 37.53% resorted to one or more consumption-based and/or finance-based coping strategies. The proportion of households using coping strategies was notably greater for inpatient care, with 58.78% of households requiring any strategy beyond household income (Table 6).

A more detailed analysis of households resorting to at least one coping strategy reveals valuable insights into the financial strain experienced by different socioeconomic groups. Unsurprisingly, the capacity to finance OOPE entirely through household income was lower among poorer households compared to those in the richest quintile. For instance, only 32.55% of households in quintile 1 managed to cover their inpatient OOPE without using coping strategies, whereas this proportion rose to 47.39% for households in quintile 5. This highlights the greater resilience of wealthier households in absorbing OOPE without needing to compromise essential expenses or relying on finance-based coping mechanisms.

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Table 6. Number of coping strategies adopted for outpatient and inpatient care (UPOS 2023).

Number of coping strategies	Outpatient care		Inpatient care	
	Proportion	Standard error	Proportion	Standard error
0	62.47%	0.017	41.22%	0.487
1	20.56%	0.012	29.47%	0.338
2	12.94%	0.011	20.02%	0.246
3	3.05%	0.010	6.94%	0.097
4	0.92%	0.060	2.15%	0.069
5	0.06%	0.006	0.20%	0.015

Source: Author's calculation based on the UPOS.

Moreover, considering healthcare utilization visits showed that households not resorting to coping strategies for outpatient care averaged 1.55 visits (median 1), while those adopting coping strategies averaged 2.03 visits (median 2). For inpatient care, the difference was less pronounced, with households not using coping strategies averaging 1.03 visits (median 1), and those using coping strategies averaging 1.14 visits (median 1).

Healthcare-seeking behavior also differed between households based on their reliance on coping strategies. Among outpatient care-seeking households that did not rely on any coping strategies, 55.61% sought care at a pharmacy as their highest level of care, followed by 27.14% at primary care, 16.47% at secondary care, and 0.78% at tertiary care. In contrast, households using at least one coping strategy showed a different pattern, with 41.43% seeking pharmacy care, 23.05% primary care, 30.57% secondary care, and 4.76% tertiary care.

The financial burden was notably greater for households that adopted coping strategies. The annualized outpatient OOPE for households not relying on coping strategies averaged $264.31 (median $89.02), compared to $563.21 (median $237.40) for those that adopted at least one coping strategy. Similarly, for inpatient care, households not using coping strategies faced an average annualized OOPE of $358.66 (median $97.56), while those resorting to coping strategies had substantially higher costs, averaging $663.20 (median $195.12).

These findings suggest that households with more frequent visits, those seeking care at higher levels, and those facing higher OOPE are more likely to deplete their regular income and resort to coping strategies.

The majority of households adopted only one coping strategy for both outpatient and inpatient care. However, approximately 17% of households relied on more than one strategy for outpatient care, with this proportion increasing to just over 29% for inpatient care (Table 6). The need for multiple coping strategies likely indicates a more severe financial burden from OOPE, where a single coping strategy is insufficient to cover the costs of care, forcing households to diversify their approach.

A comparison between households using multiple coping strategies and those relying on just one reveals a clear pattern: households employing multiple strategies had more frequent visits, especially at higher levels of care, and faced a substantially greater total OOPE burden. Additionally, households using multiple coping strategies were more likely to manage chronic health conditions than those using only one strategy. On average, 66% of households using multiple coping strategies sought care for NCDs, whereas 56% of households using only one strategy did. In contrast, the difference between the two groups in terms of care-seeking for communicable diseases, MNNDs, or injuries, was minimal.

Types of coping strategies

Among those adopting consumption-based coping strategies, reducing food expenditures was the most common method, used by 28.28% of households for outpatient care and 42.60% for inpatient care. Following this, 18.64% of households seeking outpatient care reduced other essential expenditures, whereas 30.31% of those seeking inpatient care did. A smaller proportion of households had reduced education spending (2.48% for outpatient care and 5.32% for inpatient care), and the proportion of households with increased child labor hours remained below 1%. See Figure 17 for details.
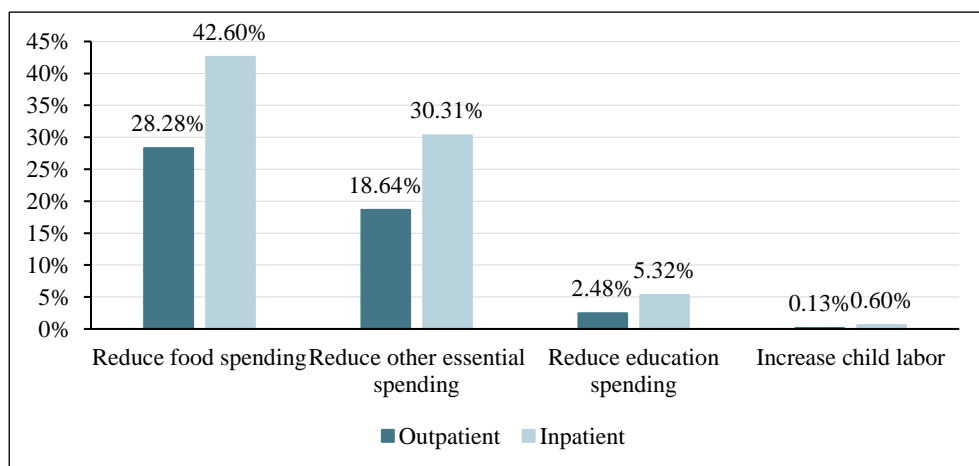
Figure 17. Share of households using consumption-based coping strategies (UPOS 2023).
Source: Author's deliberation based on the UPOS.

Finance-based coping strategies are illustrated in Figure 18. Notably, few households were able to use savings to cover their OOPE—only 0.63% for outpatient care and 1.41% for inpatient care. This low figure reflects the fact that 90.03% of uncovered households reported that they never saved. Remittances, gifts, and donations were the most common finance-based coping strategy, used by 5.12%

of households for outpatient care and 9.37% for inpatient care. Borrowing was the second most prevalent strategy, used by 3.48% of households for outpatient care and 9.03% for inpatient care. Notably, only 8.93% of loans for outpatient care and 26.93% of loans for inpatient care were obtained with interest—mostly from relatives. Together with the reliance on remittances, gifts, and donations, this indicates that finance-based coping strategies among uncovered households largely depend on informal social networks, which can be seen as a form of informal insurance where risks are pooled without formal contracts [21]. The sale of assets was rare, with 0.62% of households selling assets to finance outpatient care and 1.12% doing so for inpatient care. The proportion of households selling future household production was almost negligible.

Despite the considerable prevalence of households resorting to coping strategies, the actual number of households doing so remains relatively small in terms of the overall sample size, particularly for inpatient care and households employing multiple coping strategies. This limitation highlights the need for follow-up analyses with larger sample sizes to gain deeper insights into the patterns and drivers behind these coping strategies, especially among those experiencing the most severe financial strain. Future studies should also explore the long-term consequences of relying on multiple coping mechanisms and assess their longer-term impact on household welfare.
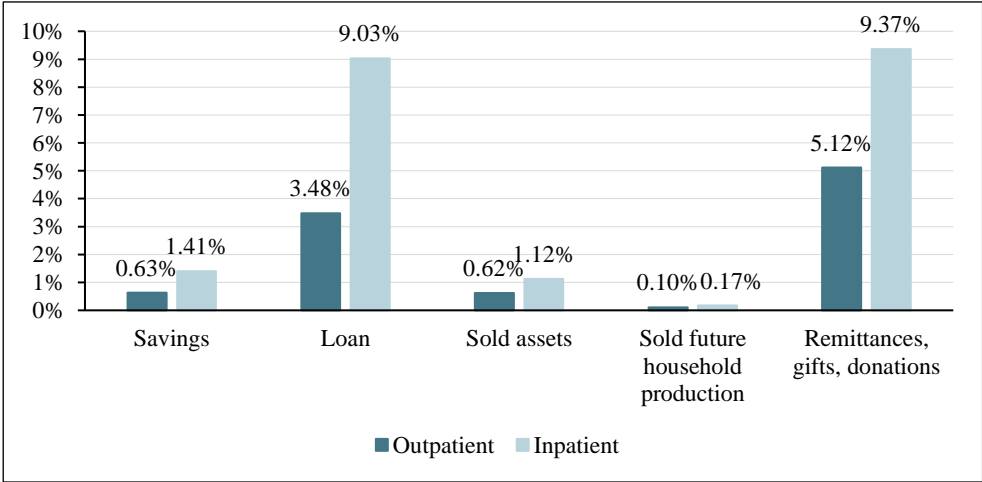
Figure 18. Share of households using finance-based coping strategies (UPOS 2023).
Source: Author's deliberation based on the UPOS.

Financial hardship among uncovered households: the full picture

The previous analyses treated indicators of financial hardship—catastrophic and impoverishing spending and coping strategies—as independent dimensions.

However, it is important to recognize that households can experience multiple forms of financial hardship simultaneously. For example, a household may face both catastrophic health spending and impoverishment or may experience either of the two while also resorting to coping strategies, each compounding the negative impact on their welfare. Understanding this interplay is crucial, as the combined effects of these forms of financial hardship can significantly aggravate the burden that households face due to OOPE. This section moves beyond isolated indicators and examines the overlap between different forms of financial hardship to present a fuller picture of the challenges faced by uncovered households in Cambodia. Using data from the UPOS, the analysis explores the incidence and overlap of catastrophic spending (at 10% of THCE), impoverishment, and coping strategies. The results are again disaggregated into two groups: households seeking outpatient care and households seeking inpatient care.

Figure 19 summarizes the findings, where consumption-based and finance-based coping strategies have been aggregated into a single category (coping) for simplicity. Additionally, Table 7 presents the detailed numbers underlying this analysis, including all 16 mutually exclusive combinations of financial hardships experienced by households. Importantly, the ranking of these categories should not be interpreted as a strict hierarchy of severity, as the nature of (combined) financial hardship is complex and multifaceted. Ranking the categories of financial hardship can be challenging. While it may seem straightforward to rank certain scenarios—such as considering a household experiencing only catastrophic spending to be less severely affected than one facing impoverishment—other comparisons are more complex. For example, is a household that faced catastrophic spending but received remittances to cover healthcare costs better off than one that also experienced catastrophic OOPE but cut their monthly food expenditure by a third? Likewise, is a household that took out a microfinance loan but now struggles with repayments better or worse off than one that sold the productive asset they relied on for their earnings potential? As with many economic questions, the answer depends heavily on the unique circumstances of each household.

For outpatient care, just over half of the households (51.01%) did not experience any form of financial hardship. However, this proportion decreased to 28.18% for inpatient care, highlighting the much greater financial burden associated with inpatient services. The most common form of hardship was the use of consumption-based coping strategies only, affecting 17.27% of households for outpatient care and 16.87% for inpatient care. This suggests that a significant share of households were so financially constrained that they had to reduce essential consumption even for OOPE that did not surpass the catastrophic health expenditure threshold of 10% of THCE. Catastrophic health expenditure alone was notably greater for inpatient care (11.98%) than for outpatient care (8.75%). Conversely, this highlights that while these households incurred catastrophic OOPE, they did not necessarily have to cut back on other essential expenditures.
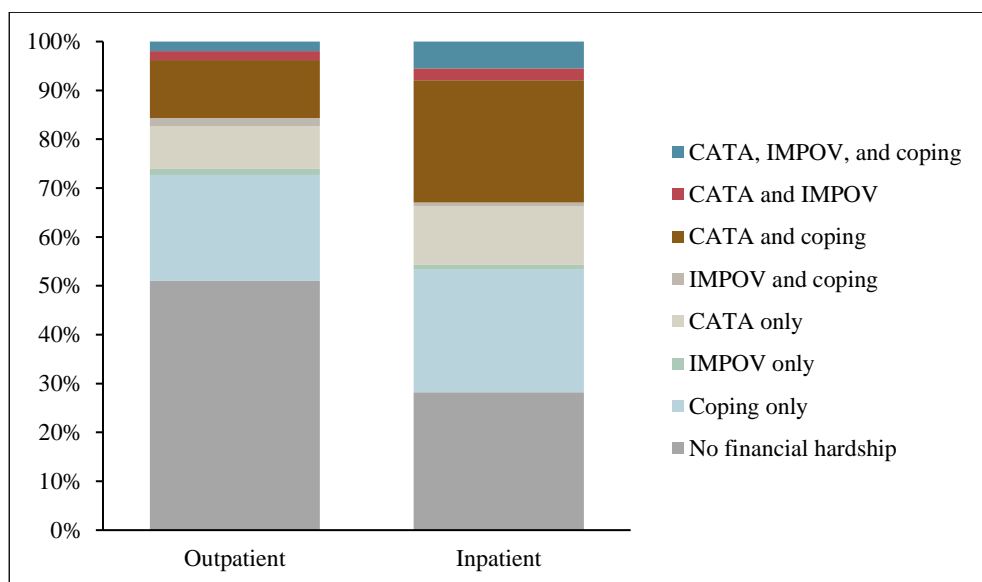
Figure 19. Type(s) of financial hardship experienced by uncovered households (UPOS 2023).
Abbreviations: CATA = catastrophic health expenditure; IMPOV = impoverishing health expenditure.
Source: Author's deliberation based on the UPOS.

Interestingly, 19.60% of outpatient care-seeking households faced multiple dimensions of financial hardship, while this proportion rose to 38.75% for inpatient care-seekers. The combination of catastrophic spending and consumption-based coping was the most prevalent form of overlapping hardship, affecting 16.65% of the inpatient care-seekers and 7.57% of the outpatient care-seekers. This finding indicates that many households experiencing catastrophic health expenditure are also cutting back on essential consumption—aligning with the rationale behind the measurement of catastrophic health expenditure, which is intended to reflect the strain OOPE place on a household's ability to meet other essential needs.

The proportion of households experiencing impoverishment alone was relatively low across all groups, at 1.27% for outpatient care and 0.93% for inpatient care. However, impoverishment becomes more significant when combined with other forms of hardship. For example, the categories of catastrophic and impoverishing spending as well as catastrophic and impoverishing spending with consumption-based coping were relatively common. These combinations affected 1.89% and 1.44% of outpatient care-seekers and 2.43% and 2.76% of inpatient care-seekers, respectively.

At the (inarguably) severest end of financial hardship, combining catastrophic spending, impoverishment, and both finance-based and consumption-based coping affected 0.25% of outpatient care-seekers and 1.28% of inpatient care-seekers.

Table 7. Financial hardship experienced by uncovered households (UPOS 2023).

	Outpatient care		Inpatient care	
	Proportion	SE	Proportion	SE
No financial hardship	51.01%	0.020	28.18%	0.047
Consumption-based coping only	17.27%	0.008	16.87%	0.015
Finance-based coping only	2.10%	0.005	3.28%	0.010
CATA only	8.75%	0.008	11.98%	0.017
IMPOV only	1.27%	0.003	0.93%	0.004
Finance-based and consumption-based coping	2.32%	0.005	5.00%	0.011
CATA and consumption-based coping	7.57%	0.007	16.65%	0.040
CATA and finance-based coping	1.75%	0.003	3.45%	0.010
CATA, finance-based and consumption-based coping	2.51%	0.005	4.92%	0.013
CATA and IMPOV	1.89%	0.004	2.43%	0.007
IMPOV and consumption-based coping	1.09%	0.003	0.71%	0.003
IMPOV and finance-based coping	0.42%	0.003	0.07%	0.001
IMPOV, finance-based and consumption-based coping	0.11%	0.001	0.03%	0.000
CATA, IMPOV, and consumption-based coping	1.44%	0.003	2.76%	0.008
CATA, IMPOV, and finance-based coping	0.24%	0.001	1.45%	0.006
CATA, IMPOV, finance-based and consumption-based coping	0.25%	0.001	1.28%	0.004

Abbreviations: CATA = catastrophic health expenditure; IMPOV = impoverishing health expenditure; SE = standard error.
Source: Author's calculations based on the UPOS.

Summary and key insights

1. Among the general population, catastrophic and impoverishing spending declined between 2009 and 2014, slightly increased between 2014 and 2019, and then sharply decreased in 2021, likely reflecting the effects of the COVID-19 pandemic. By 2023, these indicators had risen again, indicating a reversal of pandemic-related trends.

2. Uncovered households who sought care consistently faced greater financial burdens across all indicators than did the total population, highlighting their financial vulnerability when accessing healthcare.

3. A substantial proportion of uncovered households used coping strategies to finance their OOPE, with 58.78% of inpatient care-seeking households and 37.53% of outpatient care-seeking households resorting to these strategies.

4. Reducing food and essential expenditures was the most common consumption-based coping strategy. Finance-based coping strategies were supported primarily by informal networks, such as remittances, gifts, and loans from relatives.

5. Compared with outpatient care, inpatient care was consistently linked to higher levels of financial hardship, with more households facing multiple, overlapping dimensions of hardship.

6. Consumption-based coping was a major source of financial hardship for uncovered households and was frequently combined with catastrophic spending.

7. Few uncovered households experienced only impoverishment, but when it did occur, it was often combined with other dimensions of financial hardship, especially catastrophic spending and consumption-based coping strategies.

II.3.2 Determinants of OOPE and financial protection

The previous section highlighted the persistent financial burden of OOPE in Cambodia over time, including for uncovered households. As Cambodia aims to progress toward UHC, it is essential to understand the factors driving these findings. Building on the results from Studies III and IV, this section presents an empirical analysis of the determinants of OOPE and the OOPE budget share, along with their relative importance, addressing sub-research questions 4 and 5. Using data from the UPOS, Study III examined these determinants and their relative importance at the mean, while Study IV extended the analysis across the distribution.

This section begins with an overview of group-level contributions—*healthcare*, *health*, and *social*—based on the Shapley decomposition analysis. Each group is then examined in detail, summarizing the determinants at the mean and across quantiles, as identified in the GLM and UQR analyses. This is followed by a presentation of the Shapley decomposition results within each group. For detailed figures supporting this presentation, please refer to Studies III and IV. Given that most uncovered households sought outpatient care only (as shown in Studies III and IV), findings for total OOPE closely reflect those for outpatient OOPE. Therefore, to streamline the presentation, the presentation of Shapley decomposition results within each group focuses on total OOPE and the OOPE budget share only. Individual contributors to inpatient OOPE are not elaborated on, given the limited sample size of inpatient care-seeking households, which resulted in high uncertainty.

Group-level contributions

At the group level, *healthcare* factors dominated the contributions to the explained variance for total OOPE, the OOPE budget share, and outpatient OOPE, particularly at lower quantiles. *Healthcare* factors continued to have a substantial impact at the mean and up to Q90 for total OOPE and outpatient OOPE, although their influence diminished as *health* and *social* factors increased their contributions toward higher quantiles. For the OOPE budget share, *health* factors made a slightly larger contribution than *healthcare* factors by Q90. Across all three outcomes, the results at the mean align closely with those at the median (Q50) and Q75. See Figures 20 to 22 for additional details.
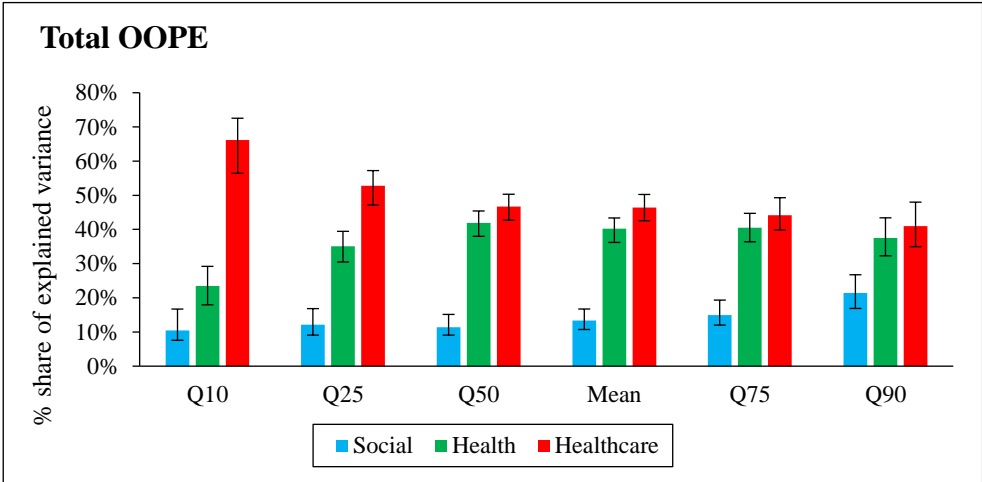
Figure 20. Group contributions to total OOPE (UPOS 2023).
Abbreviations: Q10-90 = 10th quantile to 90th quantile.
Source: Author's deliberation. Detailed figures are available in Study III, Table 4, and Study IV, Table 2.

In contrast, inpatient OOPE showed a distinct pattern, with *social* factors initially contributing the most to the explained variance, while *healthcare* and *health* factors played smaller roles. Toward the mean and higher quantiles, *healthcare* factors strongly increased their contributions, whereas *health* and *social* contributions declined (Figure 23).
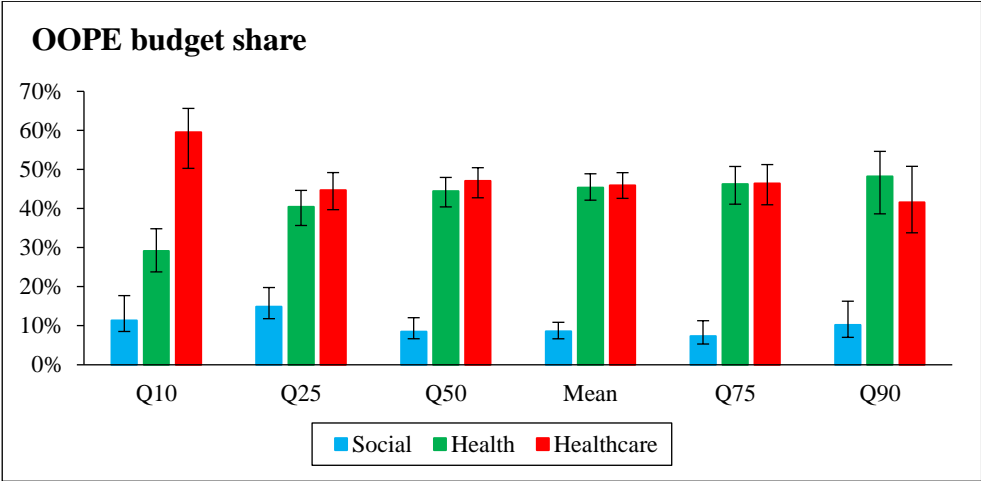
Figure 21. Group contributions to the OOPE budget share (UPOS 2023).
Abbreviations: Q10-90 = 10th quantile to 90th quantile.
Source: Author's deliberation. Detailed figures are available in Study III, Table 4, and Study IV, Table 2.
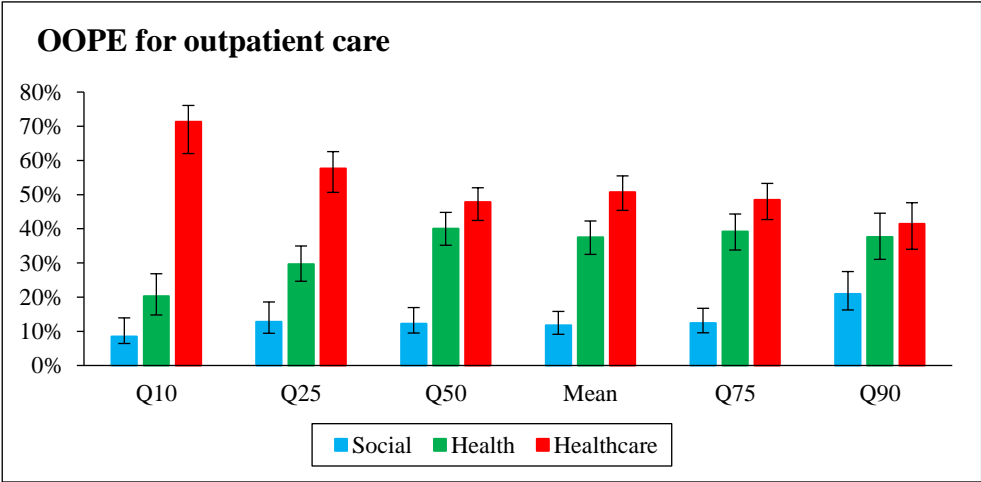
Figure 22. Group contributions to OOPE for outpatient care (UPOS 2023).
Abbreviations: Q10-90 = 10th quantile to 90th quantile.
Source: Author's deliberation. Detailed figures are available in Study III, Table 4, and Study IV, Table 2.

Figure 23. Group contributions to OOPE for inpatient care (UPOS 2023).
Abbreviations: Q10-90 = 10th quantile to 90th quantile.
Source: Author's deliberation. Detailed figures are available in Study III, Table 4, and Study IV, Table 2.

Healthcare determinants and their contributions

Healthcare contributions are illustrated in Figure 24. The analysis of *healthcare* determinants revealed that private outpatient and inpatient care were significant drivers of all outcomes in the GLM analysis, suggesting that households relying on private sector services incur substantially higher OOPE and budget shares than those using public care. This finding was reinforced by the UQR analysis, which revealed that private care remained consistently significant across the distribution of all outcomes. Overseas care was also positively associated with total OOPE, inpatient OOPE, and the OOPE budget share in the GLM, although its significance in the UQR analysis was limited to specific quantiles at the lower and higher ends of the distribution.

In terms of care levels, secondary and tertiary care (compared with pharmacy care) were associated with increases in all outcomes in the GLM and were consistently significant across the distribution in the UQR, particularly at higher quantiles. Additionally, the number of medications was a significant determinant of total OOPE, outpatient OOPE, and the OOPE budget share and remained consistently significant across all quantiles in the UQR analysis. For inpatient OOPE, the number of inpatient nights showed a positive association in the GLM and became significant from Q25 onward in the UQR.

In the Shapley decomposition analysis, private outpatient and inpatient care initially dominated *healthcare* contributions to the explained variance in total OOPE and the OOPE budget share at lower quantiles, with contributions exceeding 25% of the total explained variance. Notably, especially for private outpatient care,

contributions declined sharply toward the mean and higher quantiles, while private inpatient care maintained slightly greater contributions. Overseas care contributed minimally both at the mean and across the quantiles.

Secondary care showed an increasing trend in contributions, peaking at the median with 16.59% for total OOPE and 18.86% for the budget share, followed by a decline to 6.95% and 9.25%, respectively, at Q90, respectively. In contrast, contributions from tertiary care gradually increased across the distribution, reaching approximately 7% for both outcomes at Q90. Similarly, contributions from the number of inpatient nights also increased across the distribution, starting at 0.84% for OOPE at Q10 and reaching 6.82% at Q90.

While not significant in the GLM and UQR analyses, the number of outpatient visits contributed consistently across quantiles, peaking at the mean with 7.53% for total OOPE and 5.70% for the budget share. Similarly, the number of medications maintained stable contributions across the distribution, peaking at the mean with 8.82% for total OOPE and 6.74% for the OOPE budget share.
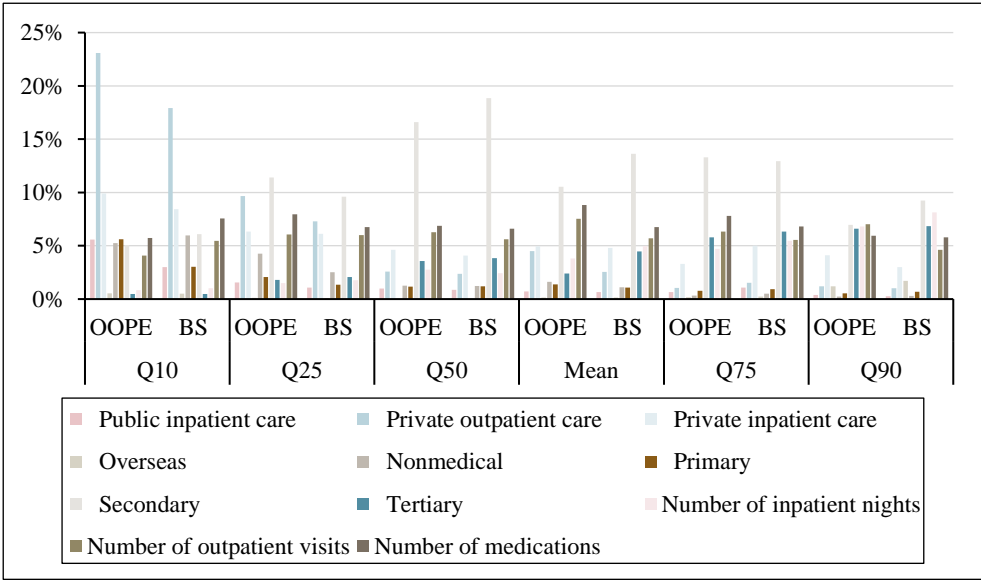
Figure 24. Healthcare contributions to the explained variance (UPOS 2023).
Abbreviations: BS = OOPE budget share; OOPE = out-of-pocket health expenditures; Q10-90 = 10th quantile to 90th quantile.
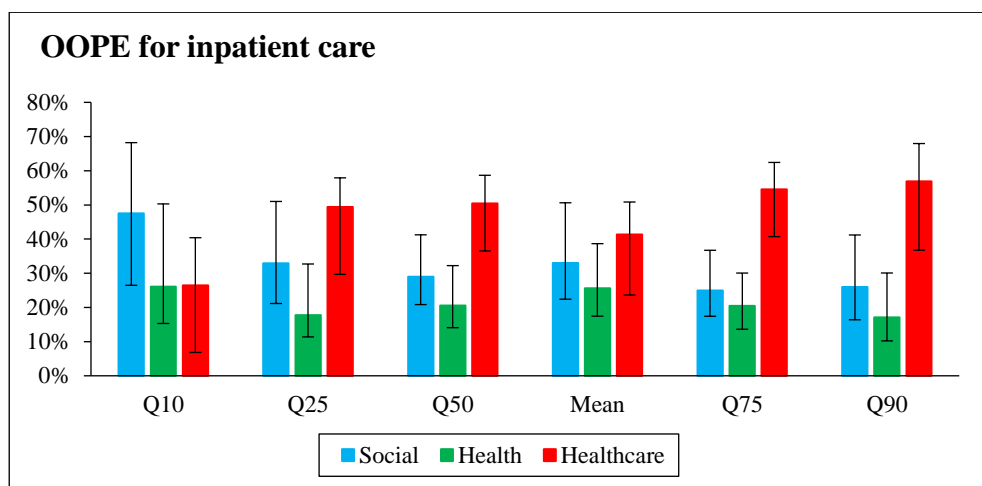**Source**: Author's deliberation. Detailed figures are available in Study III, Additional file 1, Tables 7a and 7b, and Study IV, Table 2.

Health determinants and their contributions

The analysis of *health* determinants revealed distinct patterns across the GLM and UQR models. The share of household members with chronic illness was

significantly associated with higher total OOPE, outpatient OOPE, and the OOPE budget share in the GLM, although it reached significance only at the median quantile in the UQR for these outcomes. The share of household members living with a disability emerged as a significant factor only in the UQR, showing positive associations at higher quantiles for total OOPE and the OOPE budget share.

The severity score was consistently significant across all quantiles for total OOPE, the OOPE budget share, and outpatient OOPE in the UQR, as well as in the GLM; however, for inpatient OOPE, it was significant only at the lowest quantile. Days lost to illness/injury was positively associated with all OOPE categories and the budget share in the GLM. This variable remained significant across all quantiles for total and outpatient OOPE in the UQR and reached significance at specific higher quantiles for the OOPE budget share and inpatient OOPE.

Among disease categories, the number of household members with NCDs was associated with higher total OOPE, outpatient OOPE, and the OOPE budget share in the GLM, while in the UQR, NCDs were significant at lower to median quantiles for total OOPE and the OOPE budget share and up to Q75 for outpatient OOPE. This variable did not show significance for inpatient OOPE in either the GLM or UQR. The number of household members with injuries was positively associated with total OOPE, inpatient OOPE, and the OOPE budget share in the GLM and emerged as significant factor in the UQR, especially at the median and higher quantiles. Injuries were not significant for outpatient OOPE in the GLM and only reached significance at the highest quantile in the UQR. Finally, the number of household members with MNNDs generally showed negative associations with total OOPE, outpatient OOPE, and the budget share in both the GLM and at certain quantiles in the UQR. In contrast, MNNDs were positively associated with inpatient OOPE in the GLM and at median to higher quantiles in the UQR.

In the Shapley decomposition analysis, contributions from *health* factors to the explained variance in both total OOPE and the OOPE budget share were strongly driven by the severity score, which remained a dominant contributor at the mean and across the full distribution of both outcomes at over 20% of the total explained variance. Days lost to illness/injury also made notable contributions, especially from the median quantile onward (including the mean), reaching contributions of 5.3% to the explained variance in total OOPE and 8.3% to the OOPE budget share at the highest quantiles. The contributions from the number of household members with NCDs initially increased and then stabilized across the distribution, maintaining a level of approximately 5% for both total OOPE and the OOPE budget share. The number of household members with injuries, while contributing less than 1% at the lowest quantiles, showed a notable increase to 2.68% and 3.66% at the mean for total OOPE and the OOPE budget share, respectively, and exceeded 6% at the highest quantile for both outcomes. Additionally, the share of household members with chronic illness contributed more substantially to the OOPE budget share,

particularly around the middle quantiles and at the mean. Additional details are shown in Figure 25.
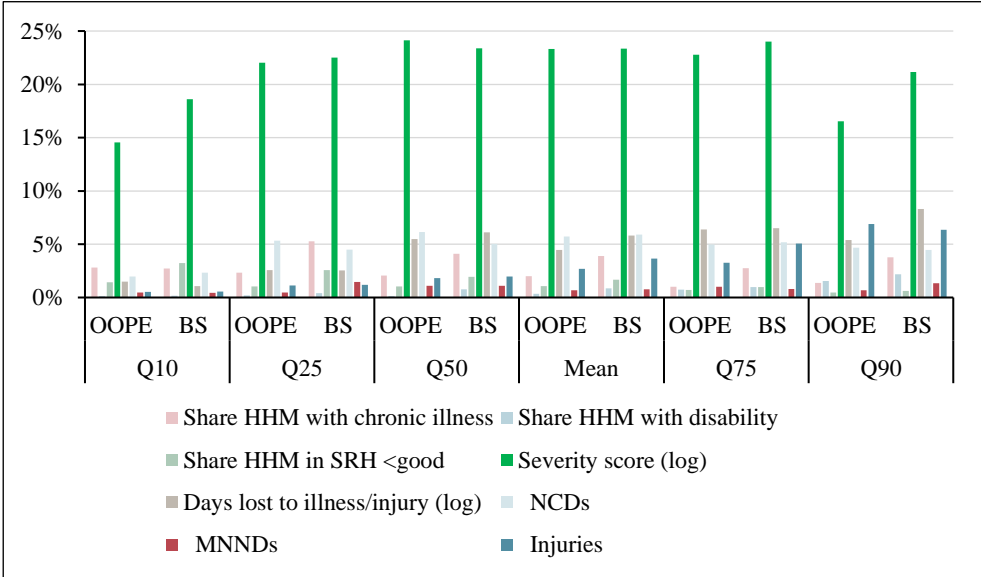
Figure 25. Health contributions to the explained variance (UPOS 2023).
Abbreviations: BS = OOPE budget share; OOPE = out-of-pocket health expenditures; Q10-90 = 10th quantile to 90th quantile.
Source: Author's deliberation. Detailed figures are available in Study III, Additional file 1, Tables 7a and 7b, and Study IV, Table 2.

Social determinants and their contributions

The wealth quintile emerged as a consistent determinant across all four outcome measures in both GLM and UQR models. Wealthier households presented higher total, outpatient, and inpatient OOPE, with a reverse trend in the OOPE budget share, which was significant up to Q50. This suggests a socioeconomic gradient, where wealthier quintiles experience higher absolute expenditure but lower relative OOPE burdens.

Several head of household characteristics also showed significance in the GLM, including positive associations with increasing age for total OOPE, outpatient OOPE, and the OOPE budget share, as well as primary education, which was positively associated with all outcomes compared with no education. Household size was negatively associated with the OOPE budget share and inpatient OOPE, while the employment ratio was negatively associated with total OOPE and the OOPE budget share. The geographic domain was positively associated with all outcomes except inpatient OOPE in the GLM. In the UQR, the effects of these variables varied across quantiles, showing significance only at specific quantiles in the distribution.

Moreover, several variables emerged as significant exclusively in the UQR analysis. For instance, the share of household members under five was positively associated with total OOPE, outpatient OOPE, and the OOPE budget share at lower quantiles, while at higher quantiles, it was negatively associated with inpatient OOPE.

The Shapley decomposition analysis offered a clear picture of the *social* contributions to the explained variance in total OOPE, both at the mean and across the distribution. In alignment with the GLM and UQR results, the wealth quintile emerged as the primary *social* contributor for total OOPE both at the mean and across all quantiles, with its influence increasing at higher quantiles—from 4.22% at Q10 to 10.04% at the mean—and reaching 16.04% at Q90, where it accounted for 75% of the total *social* contributions. This underscores that the rising *social* contributions to the explained variance in total OOPE across the distribution were largely driven by the increasing influence of the wealth quintile. Conversely, for the OOPE budget share, the contribution of the wealth quintile diminished sharply after Q25, falling below 1% by Q90. This aligns with the lack of significance observed for the wealth quintile at higher quantiles in the UQR analysis and reflects the socioeconomic gradient reversal seen in the budget share. Despite their significance in the GLM and certain UQR quantiles, all other *social* variables contributed less than 2% in the Shapley decomposition, as shown in Figure 26.

Figure 26. Social contributions to the explained variance (UPOS 2023).
Abbreviations: BS = OOPE budget share; OOPE = out-of-pocket health expenditures; Q10-90 = 10th quantile to 90th quantile.
Source: Author's deliberation. Detailed figures are available in Study III, Additional file 1, Tables 7a and 7b, and Study IV, Table 2.
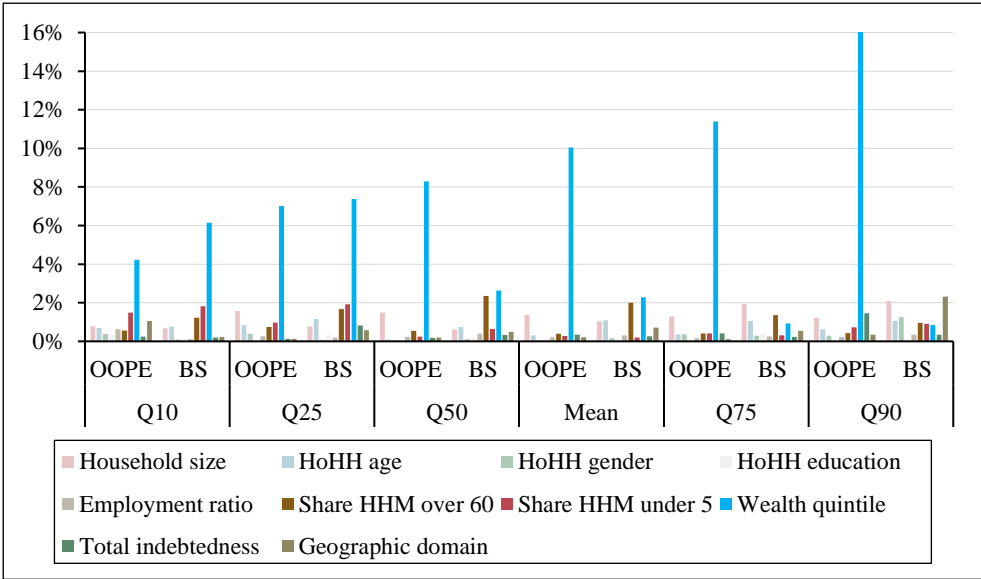
Summary and key insights

1. *Healthcare* factors were the primary contributors to the explained variance in total OOPE, outpatient OOPE, and the OOPE budget share, especially at lower quantiles. They maintained their dominance through the mean and up to Q90 for total and outpatient OOPE, although *health* and *social* factors made increasing contributions at higher quantiles. Inpatient OOPE showed a distinct pattern, with *social* factors initially leading the group contributions to the explained variance, while *healthcare* and *health* factors became more dominant at higher quantiles.

2. Among *healthcare* factors, the sector of care—particularly the private sector—and higher levels of care, notably secondary and tertiary care, were associated with significant increases in all outcomes both at the mean and across their distribution. Similarly, the number of medications was significantly associated with increases in total and outpatient OOPE as well as the budget share, while the number of inpatient nights significantly increased inpatient OOPE at the mean and across the distribution.

3. *Healthcare* contributions were driven by the private sector, higher levels of care, the number of medications, outpatient visits, and inpatient nights. However, these contributions varied across the distribution: measures of utilization intensity, such as visits, nights, and medications, showed increasing contributions toward higher quantiles, while contributions from the sector and level of care decreased at higher quantiles.

4. Among the *health* factors, the share of household members with chronic illness, severity score, days lost to illness/injury, and the number of household members with NCDs and injuries were all associated with significant increases in several or all outcomes in both the GLM and the UQR analyses. The UQR results revealed variation in the significance and of these factors across different points in the distribution.

5. *Health* contributions to the explained variance in total OOPE and the OOPE budget share were driven primarily by the severity score. Other important *health* contributors included days lost to illness/injury and the number of household members with NCDs and injuries.

6. The wealth quintile, head of household characteristics (age, gender, education), employment ratio, geographic domain, and household composition were significant *social* determinants in both the GLM and UQR models; however, as with the *health* factors, their significance varied across quantiles.

7. The Shapley decomposition analysis highlighted the wealth quintile as the primary social contributor to the explained variance in total OOPE, with its influence increasing strongly from lower to higher quantiles. In contrast, wealth quintile contributions to the OOPE budget share became minimal at higher

quantiles. Other social variables contributed minimally (under 2%) to the explained variance in total OOPE and the OOPE budget share in the Shapley analysis, despite some significance in the GLM and UQR models.

Part III: Discussion

This section begins with reflections on the key findings of the thesis. It then introduces a proposed toolbox of policies and interventions aimed at reducing OOPE and enhancing financial protection. The implications for the Cambodian context are subsequently discussed, linking strategies from the proposed toolbox with specific findings from the empirical analysis. The section concludes with suggestions for further research and overarching conclusions.

III.1 Reflections on key findings

Uncovered households are lacking financial protection

Uncovered households, by definition, lack access to any prepayment scheme in Cambodia that could cover part or all of their healthcare expenses in the event of illness or injury. The findings from both the CSES and UPOS revealed that this leaves them vulnerable to high OOPE, resulting in widespread financial hardship. This includes catastrophic and impoverishing health expenditures as well as reliance on consumption- and finance-based coping strategies, underscoring the health-related risks faced by uncovered households in the absence of prepayment mechanisms.

Importantly, the term "uncovered households" obscures a critical fact: members of these households are predominantly engaged in informal employment. Although classified as nonpoor, with expenditures above the threshold for government social assistance for poor and At-risk households (Figure 7), many have not attained financial security, hovering just above the national poverty line. This precarious position leaves them highly susceptible to economic shocks and uncertainties (Study I) [11]. Their vulnerability is further exacerbated by gaps in decent work protection. Informal workers typically lack access to employment benefits and social protection, including education, skill development, childcare, and healthcare, as they operate outside the scope of labor legislation and regulatory frameworks [7,8]. While the disadvantages and their intensity faced by informal workers are highly heterogeneous, they thus share a common lack of legal protection, rights, and commonly, representation, leaving them vulnerable across multiple dimensions and often socially excluded [7,8]. In this context, the lack of prepayment coverage and

financial protection among uncovered households shown in this thesis becomes even more concerning, with uncovered households risking being trapped in cycles of vulnerability and, potentially, falling into poverty. Moreover, nonpoor informal workers who constitute uncovered households represent a large portion of Cambodia's small but growing middle class. The substantial burden of OOPE borne by these households not only threatens their financial stability but also has broader implications for Cambodia's economic development and sustainable growth—both of which are central to the country's highest development strategy [273].

The importance of coping strategies in financial protection analysis

The findings of this thesis reveal a high prevalence of consumption-based coping strategies and, to a lesser extent, finance-based strategies among households seeking care in Cambodia, particularly those accessing inpatient care. Excluding these coping strategies from the analysis would have led to an underestimation of financial hardship—by approximately 22% for outpatient care-seekers and over 25% for inpatient care-seekers—obscuring the full extent of financial hardship faced by households. Previous research has noted that coping strategies receive insufficient recognition and analysis in financial protection research [3]. Therefore, the findings of this thesis underscore the importance of incorporating coping strategies in their analyses to better capture the true financial burden of OOPE, both in Cambodia and other LMICs.

Moving beyond considering financial hardship indicators in isolation is critical

The findings of this thesis revealed notable overlap between financial hardship indicators, with approximately 20% of outpatient care-seeking households and nearly 40% of inpatient care-seeking households experiencing two or more dimensions of financial hardship simultaneously. Recognizing this overlap is essential, as it may indicate a compounding effect that exacerbates household vulnerability. Notably, the intersection between catastrophic OOPE and consumption-based coping strategies raises questions about the effectiveness of catastrophic health expenditure as an indicator. While catastrophic spending is intended to identify households at risk of compromising essential consumption due to OOPE [23,24], the findings revealed a more complex relationship. Although catastrophic spending and consumption-based coping had the largest overlap (7.57% for outpatient care and 16.65% for inpatient care), 8.75% of outpatient care-seekers and 11.98% of inpatient care-seekers who faced catastrophic spending reported no use of consumption-based coping strategies. Conversely, approximately 17% of both groups reported employed consumption-based coping without reaching the catastrophic spending threshold. These discrepancies warrant further investigation to better understand the underlying factors and inform potential refinements to catastrophic spending methodologies and thresholds, ensuring they are better suited to the Cambodian context. A recent study from China examined

discrepancies between objective measurements of catastrophic health expenditure and self-rated assessments, finding that commonly used indicators did not align with self-rated catastrophic spending in a substantial share of cases, particularly among poorer households [274]. These findings further emphasize the need to critically assess current catastrophic health expenditure methodologies and explore complementary approaches that better capture the lived burden of OOPE for households.

Omitting foregone care provides only an incomplete picture of financial protection

Despite the comprehensive analysis of financial hardship in this thesis, it provides only a partial view of financial protection in Cambodia—capturing the financial consequences for households that have accessed care and have OOPE above zero but not considering an equally important dimension of financial protection: care foregone due to financial barriers. Previous studies suggest that low OOPE and low financial hardship can mask the underlying lack of access to essential services; measuring financial hardship only may therefore be misleading [251,275]. In addition to fully foregone care, another manifestation of financial barriers might be "incomplete" care. For example, data from the UPOS indicated that nearly 60% of uncovered households sought pharmacy care due to illness or injury, often as their only source of care, while the CSES 2021 reported a similar reliance on pharmacies among the general population at approximately 40% (Figure 8). Although community pharmacies play an essential role in health systems [276], this pattern may suggest limited access to care beyond pharmacies and medications in Cambodia's health system.

A complex set of factors influences OOPE and financial protection, led by healthcare factors

The findings support the conceptual framework's premise, revealing that a diverse range of *healthcare*, *health*, and *social* factors significantly affect OOPE and the OOPE budget share. The Shapley decomposition analysis at the group level indicated that *healthcare* factors contribute the most to the explained variance across all outcomes. This is encouraging, as *healthcare* factors are among the most directly modifiable through targeted health policy measures [56]. While addressing broader public health and social contexts is important, the analysis suggests the substantial potential of *healthcare*-focused policies and interventions aimed at reducing OOPE and enhancing financial protection. Within each group, a few key variables emerged as primary contributors. Specifically, the severity score and wealth quintile dominated the contributions within the *health* and *social* factor groups, respectively. Among *healthcare* factors, contributions were more distributed but still concentrated around a few variables: secondary care, private sector utilization, and the number of medications, which collectively accounted for the largest portion of *healthcare* contributions at both the mean and across most quantiles. Although

further research is warranted to substantiate these findings, this analysis suggests that these factors present important avenues for strategies aimed at reducing OOPE and improving financial protection for uncovered households.

The value and limitations of a distributional perspective

The UQR analysis revealed important heterogeneity in determinants of all outcomes across the distribution that would have been missed by the GLM mean-based analysis alone. While certain variables, such as the severity score, maintained consistent significance and large contributions throughout the distribution, others demonstrated distinct patterns that were only visible through the distributional analysis. For instance, the share of household members with disability emerged as significant only at the highest quantiles for total OOPE and the OOPE budget share. Similarly, while the share of household members under five was not significant in the GLM, the UQR showed that this variable significantly increased both outcomes at lower quantiles while showing negative (although insignificant) associations at higher quantiles. The wealth quintile provides another example: while this variable showed significance for both total OOPE and the OOPE budget share in the GLM analysis, the UQR uncovered opposing patterns in its significance and contribution to explained variance between these two outcomes through the distributional perspective.

However, the results also highlighted important limitations of applying variance decomposition methods. As explained in **II.2.4 Statistical methods**, Shapley decomposition quantifies how much additional variance a variable explains when added to different combinations of other variables. When a variable has little to no variability (i.e. is nearly constant), its contribution to the explained variance diminishes. This limitation is evident in the declining contributions of private sector care toward higher quantiles. At Q10, the private sector made a substantial contribution because the few households using public sector services systematically reported lower total OOPE. Thus, the private sector acted as a key differentiator between households with very low total OOPE and those with moderate total OOPE. Conversely, at Q90, the private sector's contribution diminished because nearly all high spenders utilized private care. At this quantile, other factors drive the differences between high and very high total OOPE. It is therefore important to exercise caution when interpreting contributions to explained variance across the distribution and to carefully consider the underlying patterns in the data at different quantiles. A variable's declining contribution does not necessarily indicate reduced importance but potentially a shift in its variability relative to other factors. In this case, the GLM and UQR coefficients may offer a more accurate reflection of private care on total OOPE and the OOPE budget share.

The wealth gradients in OOPE and financial protection

The analysis demonstrated a wealth gradient in both OOPE and health service utilization, with wealthier households incurring higher absolute expenditures and utilizing more health services, including outpatient visits, inpatient nights, and medications. However, the OOPE budget share showed an inverted wealth gradient in the GLM and UQR analyses, with richer households facing a comparatively lower relative burden of OOPE. Interestingly, poorer households were less likely to experience catastrophic spending than richer households were, which may indicate barriers to essential services and medications due to budget constraints and thus foregone care, rather than improved financial protection. This finding underscores the importance of further investigating foregone and "incomplete" care across wealth quintiles. Alternatively, higher spending among richer households could reflect more discretionary healthcare spending, as seen in other contexts [2].

High fees, high demand: the private sector conundrum

The significance of the private sector in the GLM analysis and its substantial contributions to the explained variance in the Shapley decomposition are not surprising but align with existing evidence from Cambodia. In 2016, nearly 80% of Cambodia's OOPE was directed to private providers [277], a trend that has continued alongside the rapid expansion of private healthcare providers. By 2019, Cambodia's 1,474 public facilities were outnumbered by 16,190 private providers and 3,747 private pharmacies [192]. In the absence of any price regulation, the private sector typically charges higher fees for both healthcare services and medical commodities. Despite ongoing concerns about the quality of care at many private providers, they offer several (perceived) advantages to clients, including increased geographic accessibility, consistent availability of essential medicines, shorter waiting times, improved responsiveness, and more favorable staff attitudes than the public sector does [178,218,278]. These factors are particularly critical for informal workers but are also highly valued by other population groups, as reflected by the high private sector utilization rates among HEF and NSSF beneficiaries [195]. These patterns are consistent with global findings [35,36,59,60]. Pharmacies are particularly noteworthy, with nearly 60% of uncovered households in the UPOS reporting a visit, a trend consistent with the CSES findings. This underscores the important role that pharmacies play as a primary point of contact with the health system for many Cambodians—often the *only* point of contact. However, in the absence of robust enforcement of regulations surrounding pharmacy operations and medication dispensing, this reliance may inadvertently contribute to unnecessary or excessive medication use, potentially exacerbating financial burdens without improving health outcomes [279].

Medications as a determinant: are they masking deeper health system issues?

Medication consumption among uncovered households was substantial, and spending on medications represented the largest component of both outpatient (83.38%) and inpatient (73.41%) OOPE (Study III). Furthermore, the number of medications purchased emerged as a significant driver in both the GLM and UQR models, while also contributing notably to the explained variance in the Shapley decomposition. This pattern is neither new nor surprising, as similar trends have been observed in other LMICs [2,56,77,151]. However, these findings raise deeper questions beyond the established conclusion that medicines are important determinants of OOPE and financial protection. To fully understand the implications of this spending, it is essential to look beyond spending patterns and consider *why* households allocate so much of their health budget to medications. What roles do they play in the care-seeking behaviors of uncovered households, particularly within the private sector? Are they filling gaps left by unavailable or inadequate (public) primary healthcare, substituting for services that lack accessibility or quality? Or does this spending suggest a deeper reliance on self-medication owing to barriers in accessing professional care? Examining these questions may reveal potential underlying systemic factors driving medication consumption that high medication OOPE might be concealing—such as gaps in quality primary healthcare, geographic barriers, or even a lack of trust in other health services. Gathering data for such insights would be essential for designing strategies aimed at enhancing access to affordable essential services, including medicines, addressing not only *what* households spend on but also the *why* behind it.

The role of (perceived) severity of illness

The consistently high contributions of the severity score suggest that more severe health conditions increase OOPE and the OOPE budget share. While this seems intuitive, it is crucial to note that the severity score is based on the *perceived* severity of illness or injury, reflecting personal beliefs about the seriousness of a condition and its potential medical or social consequences if left untreated.[86] However, perceptions of severity can vary widely and are influenced by factors such as pain levels, fear, or the unavailability or ineffectiveness of self-medication [280]. To gain a more comprehensive understanding and refine the analysis of the contributions of severity to OOPE and the OOPE budget share, future studies should prioritize the collection of objective measures of illness or injury severity to complement subjective data.

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[86] The Health Belief Model suggests that a health behavior (e.g. healthcare utilization) is influenced by four individual perceptions, including perceived severity, perceived susceptibility, perceived benefits, and perceived barriers to a health behavior such as healthcare utilization. Perceived severity was shown to be strongly associated with health behavior in case of illness including, for example, seeking hospital-based care [280].

Unseen factors influencing OOPE and financial protection: what household surveys miss

Many factors influencing OOPE and financial protection are important but either not measurable or not regularly captured in household surveys. These include quality of care, informal payments and other forms of corruption, trust in the health system, health literacy, awareness, or cultural beliefs and norms, among others. Consider the example of quality of care: in Cambodia, there are serious concerns about care quality in both the public and private sectors [178,203], yet data on this issue are scarce, with no government household survey—and neither the UPOS—collecting data on quality of care. This raises important questions about the nature and value of OOPE. On the one hand, households may be spending money out-of-pocket to access higher-quality care and achieve better health outcomes. On the other hand, they may be paying for care that offers no real improvement in quality or outcomes, which would be even more concerning. For instance, Banerjee et al. showed that 70% to 90% of OOPE in a wide range of LMICs were medically unnecessary, stemming from deficits in care quality, misdiagnosis, and incorrect care across a range of LMICs [281]. Understanding these dynamics within the Cambodian context is essential for designing policies that improve not only financial protection but also health outcomes.

III.2 Implications

The conceptual framework presented in section **0.6 Conceptual framework** highlights the multifaceted origins and dynamics of OOPE and financial protection, showing diverse modulating and contextual factors that influence these outcomes. Consistent with this framework, the empirical findings in section **II.3.2 Determinants of OOPE and financial protection** revealed that a range of healthcare, health, and—albeit to a limited extent—social factors influenced OOPE and the OOPE budget share among Cambodia's uncovered households, both at the mean and across the distribution. These findings underscore the necessity for a multifaceted approach, as no single intervention or policy can address the complexity of OOPE and financial protection challenges comprehensively. Building on these insights, the following section proposes a toolbox of policies and interventions aimed at reducing OOPE and enhancing financial protection. This toolbox is informed by global evidence and serves as a practical extension of the conceptual framework. This section is followed by a discussion on how specific strategies from the toolbox could be adapted and implemented to support Cambodian uncovered households, guided by the findings of this thesis.

III.2.1 Proposing a toolbox to address OOPE and financial protection

Figure 27 presents a proposed toolbox, synthesizing policies and interventions that have been implemented globally—with a focus on LMICs—to address OOPE and enhance financial protection. The structure of the toolbox aligns with the conceptual framework, focusing on the three modulators: financial protection policies, health system policies and interventions, and patient and household-level interventions.[87]

The development of the proposed toolbox followed a systematic and iterative process. The first step involved creating a broad classification framework to organize a wide range of policies and interventions with plausible causal pathways to reducing OOPE and financial hardship. The classification framework was refined iteratively through preliminary literature searches and consultations with experts in the field. For each policy or intervention included, I considered the pathway(s) through which it could reduce OOPE and financial hardship. The second step entailed a literature review to identify policies and interventions that have been studied and their effects, guided by systematic review principles but without formal quality assessment. This process included systematic searches in academic databases, snowballing techniques, and targeted searches of organizational websites. The identified studies were synthesized and categorized within the established classification framework.

The following section provides an overview of each area within the proposed toolbox, illustrating specific examples of policies and interventions supported by evidence of their effectiveness. To maintain conciseness, only a selection of examples are discussed, and only select references are cited.

SUPPLY SIDE	**FINANCIAL PROTECTION POLICIES** • Expand population coverage (breadth of coverage) • Extend service coverage (depth of coverage) • Increase cost coverage (height of coverage)
	HEALTH SYSTEM POLICIES & INTERVENTIONS **Governance** • Strengthen regulatory frameworks, guidelines, enforcement & stewardship across sectors • Implement decentralization reforms and increase provider autonomy • Foster effective public-private engagement

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[87] Contextual factors were not included in the toolbox as they often lie beyond the immediate scope of health and financial protection policy. While these factors play an essential role in shaping the broader landscape in which policies and interventions operate and influence financial protection directly, the toolbox concentrates on elements that can be modified from a health and financial protection perspective.

	Health financing
SUPPLY SIDE	• **Revenue raising:** Increase public funding for health (government allocations, new revenue streams & better coordination) • **Risk pooling:** Expand, defragment & harmonize pools • **Strategic purchasing:** Optimize payment system (structure, modalities & volume), contracting of providers, and benefit packages • **Public financial management:** Improve budget planning, allocation & execution **Human resources for health** • Optimize workforce regulation, management, availability, & distribution • Improve skills & emphasize continuous professional development (clinical & interpersonal skills) • Implement task-shifting & empower community health workers **Service delivery** • Invest in infrastructure & equipment • Strengthen preventive & primary healthcare • Implement effective referral & gatekeeping systems • Enhance & standardize quality of care, including care coordination • Strengthen licensing, accreditation & monitoring of providers across sectors **Essential medicines** **Extensive margin (access & rational use)** • Strengthen public supply chain management • Improve regulation of the private supply chain (market conduct & structure) • Regular review of essential medicines list • Foster public-private engagement for access • Establish & manage revolving drug funds • Implement volume controls (rational prescribing & dispensing policies, prior authorization policies, utilization review) **Intensive margin (costs & prices)** • Strengthen public procurement • Implement price controls (reference pricing, price negotiations, price setting, generic prescription & substitution) and additional pricing measures (tax measures, special entry agreements) • Foster public-private engagement for affordability • Encourage local production **Health information** • Implement telemedicine services • Expand electronic health records • Promote digital health financing solutions • Enhance health data analytics for country-level UHC monitoring

	PATIENT AND HOUSEHOLD INTERVENTIONS
DEMAND SIDE	**Price interventions** • Provide vouchers, conditional cash transfers & financial assistance (for healthcare seeking) • Integrate complementary social protection programs & interventions **Nonprice interventions** • Promote health education programs • Expand literacy programs (insurance literacy & understanding entitlements, digital health literacy, financial literacy) • Foster social and behavior change

Figure 27. Toolbox of policies and interventions to address OOPE and improve financial protection.

Financial protection policies

Financial protection policies are the most targeted approach for reducing OOPE and enhancing financial protection. These policies primarily aim to establish and expand prepayment schemes but also include additional policies targeting three core dimensions: population coverage, service coverage, and cost coverage.

Expanding *population coverage* (breadth of coverage) is the most frequently applied and evaluated financial protection strategy. It involves broadening eligibility under prepayment schemes or introducing targeted exemptions for vulnerable groups who are most at risk for financial hardship due to OOPE. The effects of expanding population coverage on OOPE and financial protection are mixed, with variations both within and across countries and studies. While several studies have documented reductions in OOPE and catastrophic spending following the expansion of insurance schemes—including publicly-funded insurance, social health insurance, voluntary health insurance, and national health insurance—others have found no significant changes or even increases in OOPE and financial hardship after such expansions [110,282–306]. Importantly, research suggests that expanding population coverage alone may be insufficient to reduce OOPE and improve financial protection effectively. Without addressing service coverage, cost coverage, and implementation challenges, the OOPE and financial protection benefits of insurance expansions may remain limited [298,299]. In this context, a study in Nigeria assessed the impact of a voluntary health insurance program combined with facility infrastructure upgrades and found that it led to increased healthcare utilization and reduced OOPE among the insured [307].

Expansions of *service coverage* (depth of coverage) focus on adding essential services to benefit packages or including broader provider networks, such as private facilities. The evidence on this approach is limited, but studies report positive effects when private providers are included effectively in service delivery networks [308,309]. Additionally, providing a comprehensive package of services during

inpatient stays helped reduce OOPE for the poor in India by minimizing the need to seek additional services outside the hospital [310]. In Kenya, the inclusion of NCD services in the National Health Insurance Fund benefit package led to a reduction in the proportion of THCE allocated to healthcare. However, it did not result in a significant decrease in catastrophic health expenditure [311].

Increasing *cost coverage* (height of coverage) focuses on reducing direct patient costs, such as user fees, co-payments, balance billing, or informal payments. Effective cost coverage strategies include eliminating co-payments for high-cost illnesses within insurance systems [312]. Additionally, a medicine subsidization program providing free essential medicines at public hospitals for India's poor individuals has shown both positive and negative effects, while equity funds in Madagascar did not find any effect on medicine OOPE [310,313]. In the public sector, general user fee removals or targeted subsidies for specific services, often related to maternal and child health, are widely adopted strategies, especially in LMICs. However, their impact on OOPE varies: while several studies show reductions in OOPE and financial hardship due to fee removal, others report no change or even adverse effects due to increased indirect costs such as transport expenditure and inadequate supply-side readiness [314–322]. Additional interventions to enhance cost coverage include the establishment of catastrophic health expenditure funds for high-cost conditions, such as cancer and other NCDs, which have proven effective in reducing OOPE in Mexico [323]. Similarly, China implemented several measures to expand cost coverage, including catastrophic medical insurance and critical illness insurance, with studies reporting mixed outcomes—some showing reductions in OOPE and improvements in financial protection, while others found no significant effects or even increases [98,324–327]. Consistent with these mixed findings, a recent study from China found that while prioritizing financial protection for inpatient services reduces OOPE burdens for hospitalizations, it may increase OOPE for outpatient care [328].

Overall, the evidence on financial protection policies underscores that their success often depends on the strength and readiness of the broader health system. Effective financial protection policies require prior or parallel reforms across health system building blocks [307,308,315].

Health system policies and interventions

Health system policies and interventions aim to strengthen the health system across all its building blocks, creating a more effective foundation for financial protection.

While direct evidence linking *governance* specifically to reductions in OOPE or improvements in financial protection is limited, robust governance and leadership functions—such as enhancing regulatory frameworks, enforcement, and stewardship across the health system—are essential for its overall effectiveness. One study underscores governance as a critical factor in reducing OOPE,

highlighting the importance of effective legislation, implementation, and monitoring to support financial protection initiatives [308].

In *health financing*, all three core functions—resource allocation, pooling, and purchasing—as well as the efficiency and effectiveness of public financial management, are acknowledged as crucial for addressing OOPE and enhancing financial protection. The evidence suggests that increased public health allocations, either through a greater proportion of government spending or through new revenue streams such as indirect taxes, can significantly contribute to improved financial protection [4,329]. In settings where increasing public funding is challenging, optimizing the efficiency of current spending becomes essential, with strengthened public financial management as an important lever [4]. Provider payment reforms present a mixed picture regarding their impact on OOPE and financial protection. In China, capitation and certain case-based and diagnosis-related group payment reforms were associated with reductions in OOPE [330–334]. Similarly, performance-based payment schemes in the Philippines and Tanzania lowered OOPE, though the Tanzanian scheme also increased the likelihood of paying out-of-pocket for other services [335–337]. In Myanmar, a capitation-based health financing scheme reduced both OOPE and impoverishment, but had no effect on catastrophic spending [338]. Conversely, global budget reforms, along with other case-based and diagnosis-related group payment reforms in China, led to increased OOPE [333,339,340]. Moreover, increasing payment volume for a voluntary community-based insurance program for the poor in China did not improve financial protection [341]. In Ghana, capitation reform resulted in higher OOPE, likely due to informal co-payments arising from design limitations in the capitation system [342,343]. Evidence on policies targeting pooling mechanisms or public financial management remains scarce.

Global health system strengthening efforts consistently emphasize optimizing *human resources for health*—focusing on workforce availability, distribution, skills, training, and regulation [344]. However, evidence directly linking workforce policies or interventions to reductions in OOPE and improvements in financial protection is limited. Similar to leadership and governance, a well-optimized health workforce is nonetheless essential to the effective functioning of the health system as a whole and plays a foundational role in supporting broader financial protection efforts [345]. Two studies reported that physicians actively adopted strategies to support patients in reducing OOPE and enhancing their financial protection [346,347].

Several *service delivery* policies and interventions have been explored to reduce OOPE and enhance financial protection. These include strengthening preventive and primary healthcare, implementing referral and gatekeeping systems, enhancing and standardizing the quality of care, and bolstering provider licensing, accreditation, and monitoring. Ample evidence underscores the benefits of shifting from curative to preventive care (including early screening) and from hospital-based

to primary healthcare. Such shifts can lead to cost savings for both patients and the broader health system. For example, investments in primary healthcare in China led to reductions in both OOPE and catastrophic health expenditure [348]. Similarly, Turkey's family medicine program, which assigned general practitioners as family doctors, lowered monthly OOPE for doctor visits, although medication expenditures remained unchanged [349]. Iran's urban family physician program had no significant impact on overall OOPE, primarily due to insufficient infrastructure and budget constraints [350]. Similarly, studies have shown that in many contexts, preventive and primary healthcare services remain underprioritized, contributing to persistently high OOPE [351–354]. One study reported reduced OOPE due to improved service availability in the public sector [310]. While the review revealed limited direct links between the quality of care and OOPE or financial protection— other than one study showing reduced OOPE through a quality-focused, performance-based payment reform [335]—quality is widely regarded as a key factor in global health system strengthening efforts. It is seen as an essential tool for advancing UHC and was therefore included in the toolbox [355].

Strategies concerning *essential medicines* focus on both the extensive and intensive margins to address OOPE and financial protection. While numerous policies have been implemented globally, only a few have been evaluated in terms of their effects on OOPE and financial protection. Among strategies targeting the extensive margin, one study highlighted the effectiveness of regularly updating essential medicine lists based on patient needs, particularly emphasizing the inclusion of NCD medicines [310]. Additionally, several studies evaluating the expansion of reimbursement lists to include medications for cancer and Hepatitis C found that these policy changes led to reductions in OOPE [356–358]. Other studies highlighted the benefits of volume controls, such as prior authorization reviews [359]. The establishment of revolving drug funds has also shown positive effects on availability and reduced OOPE in Kenya and Cambodia [360–362].

For the intensive margin, policies such as promoting generic prescriptions and contracting with pharmacies have been associated with reductions in OOPE [347,363–365]. Conversely, the impact of price regulation policies has been mixed, with effectiveness often hindered by challenges in enforcement [366–368]. Additionally, China's Essential Medicine Policy has been widely studied, with some research indicating positive effects, including reductions in OOPE and impoverishment [369–372]. However, other studies found no significant impact, and some even reported negative effects, with increased OOPE in certain cases [373–375].

With respect to *health information*, digital health financing solutions have been explored as potential tools for enhancing financial protection. While evidence of their direct impact remains inconclusive, these solutions have demonstrated value in increasing financial transparency, which can help curb informal payments [376]. Telemedicine services, by contrast, have shown promise in reducing OOPE,

particularly for patients in remote or underserved areas [377]. Additionally, the use of electronic health records and advanced data analytics could improve health service coordination and monitoring, although evidence of their direct effectiveness in reducing OOPE and enhancing financial protection is still limited.

Patient and household interventions

On the demand side, patient and household interventions encompass both price and nonprice approaches, each targeting some of the multidimensional pathways through which patient and household characteristics influence OOPE and financial protection [312]. *Price interventions* are primarily direct financial support aimed at reducing OOPE and increasing healthcare accessibility. Examples include vouchers for specific health services and conditional cash transfers linked to health-seeking behavior, which incentivize access while offsetting costs. For instance, vouchers for maternal health services have shown promise in reducing OOPE [378–381]. Moreover, China has implemented medical financial (cash) assistance for low-income households, though this decreased neither OOPE nor the incidence of catastrophic or impoverishing expenditure [382–384]. Finally, there are linkages to broader social protection programs and interventions [23]. Complementary social protection interventions, such as unconditional cash transfers or income support in times of illness, potentially offer additional support for financial protection by directly influencing the denominator in financial protection metrics. However, evidence of their direct effects in reducing OOPE or improving financial protection remains limited. Two studies assessing cash transfer programs in Zambia and Mexico found no significant impact on OOPE or financial hardship [385,386].

Nonprice interventions focus on education, literacy, and behavior change, which, although they may not be primary determinants as indicated in the empirical analysis, can enhance the effectiveness of financial protection policies. Health education programs, literacy initiatives—including insurance literacy (understanding and utilizing entitlements effectively), digital health literacy, and financial literacy—along with social and behavior change activities, play essential roles in building awareness and promoting early care-seeking behavior. However, evidence remains limited. One study in Nepal found that health education for chronic disease management reduced OOPE [387], while another reported that a behavior change intervention for maternal health lowered OOPE and the risk of impoverishment but had no significant effect on catastrophic health expenditure [388]. In contrast, other studies found no significant impact of patient education and support on OOPE [312]. Finally, access to digital platforms has been shown to facilitate enrollment in prepayment schemes, which may improve access to entitlements [376].

III.2.2 Applying the toolbox to the Cambodian context

The empirical findings of this thesis reveal several avenues for policies and interventions that align with the toolbox, offering insights into how it can be adapted and prioritized to reduce OOPE and improve financial protection for uncovered Cambodian households. This section outlines considerations for such policies and interventions, while recognizing the need for further research to fully substantiate these strategies. Although the focus is primarily on financial protection policies, a comprehensive approach that also includes health system policies and interventions, as well as patient and household-level measures, is essential to ensure that financial protection policies translate into effective outcomes.

Financial protection policies

Expanding population coverage to uncovered households: The high levels of financial hardship experienced by uncovered households emphasize the importance of extending prepayment schemes to this group. Study I systematically reviewed approaches adopted by Southeast Asian LMICs to expand coverage for informal workers, highlighting noncontributory schemes financed primarily through general government revenues with mandatory enrollment as a promising direction for reform.

Ensuring that service coverage aligns with population health needs: Extending coverage is not an end in itself—the goal is to improve financial protection and health outcomes. This requires that the health benefit package under any expanded prepayment scheme comprehensively addresses the population's health needs and, where possible, reflects patient preferences.

The findings of this thesis revealed a strong reliance on private sector services among uncovered households, suggesting that expanded schemes should consider integrating private providers and pharmacies. This could be facilitated through clearly defined contractual arrangements. The Cambodian government's ongoing efforts to establish a healthcare accreditation commission present an opportunity to assess and certify quality private providers for inclusion in expanded schemes. Notably, the NSSF health insurance scheme for formal workers and civil servants already contracts with 130 private providers in addition to the 1,474 public facilities. In 2022, the vast majority of utilization cases under NSSF occurred in private facilities, illustrating not only that the preference for private care extends beyond uncovered households, but also the feasibility of integrating private providers into prepayment schemes.

Comprehensive outpatient and inpatient services should also be prioritized in alignment with population health needs. The findings highlight the importance of covering services for NCDs and injuries, alongside maintaining focus on communicable and MNNDs, which have been central to Cambodian health system strengthening efforts in recent decades [178,179]. Furthermore, the inclusion of

essential medications in the health benefit package is particularly critical, given their large share of OOPE. Progressive expansion of benefit packages may be needed to ensure that prioritized services can be reliably delivered, fostering population trust [389].

Prioritize preventive services: Preventive services should also be prioritized to address the current trend of medicalization and ensure the scheme's long-term sustainability [178,193]. Early interventions, particularly for NCD prevention, can substantially reduce future healthcare costs while improving population health outcomes [390,391].

Health system policies and interventions

Implementing health system policies and interventions is essential to ensure that financial protection policies translate into effective outcomes, as highlighted in the toolbox. This section outlines several strategies from the toolbox that are particularly relevant to the empirical findings. However, section **I.2 Cambodia's health and social health protection system** identified challenges across all six building blocks, highlighting the need for broader reforms, although recommendations for these extend beyond the scope of this thesis.

Strengthening primary healthcare and implementing a referral system: The findings demonstrated that treatment at higher levels of care leads to significantly higher OOPE, which is with prior evidence showing that higher-level services are more costly for both patients and health systems [392]. This highlights the need to strengthen Cambodia's primary healthcare system across sectors to provide accessible, high-quality health services closer to communities and reduce higher-level, higher-cost care. This objective aligns with Cambodia's recently endorsed Primary Healthcare Booster Framework and UHC Roadmap, which aim to reorient the health system toward stronger primary healthcare [179,393]. The implementation of a referral or gatekeeping system could further encourage appropriate utilization of lower-level services. However, it is essential that such reforms go hand-in-hand with the progressive expansion of health benefit packages to ensure that necessary services are reliably available at the lower levels of care.

Address both the extensive and intensive margins of medication use: Medications were identified as the major component of OOPE and key determinants in all analyses. Addressing this issue comprehensively requires a dual focus on the extensive and intensive margins of medication use. While making specific recommendations on policies and interventions falls beyond the scope of this thesis, prior research and the brief analysis of essential medicines in **section I.2 Cambodia's health and social health protection system** highlight the importance of reducing medication costs while promoting rational use [279]. Efforts in this regard should extend beyond including essential medications in health benefit

packages to address broader systemic challenges in terms of medication use and cost.

Strengthening regulation and enforcement across all levels: Although not directly explored in this thesis, robust governance and leadership are fundamental to the success of financial protection and health system policies [308]. Effective regulatory frameworks and enforcement mechanisms ensure that these policies translate into tangible outcomes. The earlier analysis in section **I.2 Cambodia's health and social health protection system** identified several gaps in Cambodia's regulatory environment, for example in private sector oversight and pharmaceutical regulation. Addressing these gaps is critical to the effective implementation of proposed strategies, including expanding the breadth and depth of coverage under prepayment schemes.

Patient and household interventions

Empowering patients to effectively navigate prepayment schemes and the health system is crucial. Interventions aimed at improving health education and insurance literacy, for example, can help households understand and better utilize their entitlements. These measures complement the proposed financial protection and health system policies by ensuring that legal coverage translates into effective utilization on the demand side. While this topic was not explored in this thesis, it represents an important area for further research and intervention development.

III.3 Directions for future research

In addition to the ones already mentioned, several avenues for future research emerge from this thesis. First, follow-up analyses are needed to monitor trends in financial hardship among uncovered households over time, utilizing forthcoming rounds of the CSES from 2025 and beyond. Cross-sectional data should be complemented by higher-frequency, longitudinal methods such as phone surveys, which would enable tracking the same households over time. For example, this approach could provide insight into the extent and speed of household recovery from impoverishment or into the longer-term consequences of adopting coping mechanisms. In addition, access to longitudinal data could help refine and adapt common assumptions used in measuring financial protection.

Expanding the analysis of the determinants and their relative importance to other population groups—such as those covered under Cambodia's existing SHP schemes, HEF and NSSF—would enable comparison across groups.

Further research should also explore the strong preferences for private care, particularly pharmacies, among uncovered households. Following the UPOS, focus group discussions were conducted with sampled households in October 2023,

investigating these preferences along with their motivations, reasons, and sources for high medicine consumption. Analyzing these qualitative data will provide valuable context for the quantitative findings presented in this thesis, offering a richer understanding of healthcare decision-making in uncovered households.

Given that the UPOS is one of the few surveys capturing comprehensive data on coping strategies—including savings withdrawals, remittances, and asset sales—an analysis similar to the approach of Flores et al. [28] would be beneficial. Such an analysis could assess how accounting for different coping mechanisms influences common financial protection measures, such as catastrophic and impoverishing spending. Moreover, future studies investigating the observed discrepancies between catastrophic spending and consumption-based coping strategies would be valuable. Additionally, research that integrates both objective and subjective measurements of catastrophic health expenditure, similar to the analysis by Guo et al. [274], could provide deeper insights into the financial burden of OOPE in the Cambodian context.

Future research should also investigate the prevalence of foregone care among uncovered households to generate a complete picture of financial protection. Complementary studies on the 'completeness' or 'adequacy' of care received could add nuance to the discourse on foregone care in Cambodia.

Moreover, future studies should assess the effectiveness of less commonly evaluated interventions from the toolbox, such as policies to expand service coverage, health system reforms targeting various building blocks, and interventions aimed at improving household literacy. Assessing their impact on OOPE and financial protection would generate valuable evidence to inform policymaking efforts in Cambodia and other contexts. Additionally, qualitative research could provide deeper insights into the factors that influence the success of various policies and interventions—examining why and under what conditions they effectively reduce OOPE and financial hardship.

Finally, advancing technology brings increasingly rich data sources, such as health insurance claims data and facility-level financial information, complementing household surveys. These sources enable verification and cross-validation of self-reported data, while also offering new opportunities for measuring OOPE and financial protection.

III.4 Conclusion

Despite global commitments to UHC, financial protection remains a neglected dimension in both global and country-level efforts. The worsening trends in financial protection observed in many LMICs highlight the need to address this

important gap [2]. Additionally, one demographic that has often been left behind in UHC efforts is nonpoor informal workers and their dependents, referred to in this thesis as uncovered households. This thesis aimed to to assess the extent to which OOPE lead to financial hardship among uncovered households in Cambodia and to identify the determinants of these expenditures. By focusing on the demographic of nonpoor informal workers, this thesis not only provides new evidence for Cambodia but also contributes to the global discourse on the financial protection challenges faced by this group as countries move toward UHC.

In the absence of any prepayment coverage, the empirical findings reveal widespread financial hardship among uncovered households, with high incidences of catastrophic and impoverishing health expenditures and many households resorting to consumption-based and finance-based coping strategies to manage OOPE. The analysis identified *healthcare* factors—including higher levels of care, private sector utilization, and medications—as the most important determinants of both OOPE and the OOPE budget share. These factors, which consistently emerged as significant and important across various analytical approaches, provide a direct entry point for public policies and interventions, underscoring the important role of the government in reducing OOPE and improving financial protection. Additionally, *health* factors such as perceived disease severity, days lost to illness/injury, and the presence of NCDs, also emerged as important factors driving OOPE and the OOPE budget share, highlighting the importance of considering the public health context in addressing population health needs.

These findings underscore the urgent need for efforts to reduce OOPE and enhance financial protection for uncovered households in Cambodia. This thesis proposed a toolbox encompassing financial protection policies, health system policies and interventions, and patient and household-level measures. On the basis of the empirical findings, specific recommendations for policies and interventions are proposed to address the financial burden of OOPE among uncovered households across the three dimensions of the toolbox, including policies to strengthen the breadth and depth of coverage, and measures to strengthen the health system across its building blocks.

Several avenues for research are also identified, aimed at substantiating these recommendations and addressing areas outside the scope of this thesis. Importantly, future studies should examine foregone care to provide a more holistic view of financial hardship among uncovered households in Cambodia. Additionally, exploring new strategies to reduce OOPE and improve financial protection, along with evaluating their effectiveness, will be crucial for guiding evidence-informed policymaking and strengthening Cambodia's progress toward UHC, while complementing the broader evidence base on these topics.

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