



Research Article

Factors Associated with Catastrophic Health Expenditure Among Households in Côte d'Ivoire

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Abstract

Protection against financial risk is an essential pillar of Universal Health Coverage (UHC), particularly through the reduction of out-of-pocket payments that can lead to catastrophic health expenditure (CHE). This study aims to identify the determinants of CHE among households in Côte d'Ivoire. We conducted a cross-sectional analytical study using data from the 2021 Harmonized Household Living Conditions Survey (HLCS) (secondary analysis). The survey is based on a two-stage probability sampling method; 1,084 clusters and 13,008 households were initially selected, and 12,965 households were retained after validation. CHE was defined according to the "ability to pay" approach: a dichotomous variable (CHE=1) when OOPCAP = OOP/CAP $\geq$ 40%, otherwise CHE=0. Descriptive statistics, a bivariate Chi² test and binary logistic regression were used (Stata 17). Households spend more than half of their consumption expenditure on food (52.2%). The frequency of CHE is low: 0.11% in the total sample (14 households) and 0.35% among those who received direct payments. The concentration curve indicates a relatively homogeneous distribution (Gini = 0.187). The logistic model is significant (Chi² = 38.38; $p < 0.001$; pseudo-R² = 0.094). The risk of CHE decreases significantly with household size (OR = 0.07 for 6–7 members; OR = 0.03 for >7). Conversely, households headed by a married person have an increased risk (OR = 5.27), as do those residing in rural areas (OR = 4.72). With regard to standard of living, the upper quintiles show odds ratios below 1 (Q2 to Q5), suggesting better financial protection, although some associations are of marginal significance. No significant link is observed for the gender of the head of household or for residence in Abidjan. CHE are rare, but their distribution remains socially differentiated: increased risk in rural areas, increased vulnerability when the head of household is married, and a protective effect of household size, linked to intra-family mutualization. A socioeconomic gradient also appears, with wealthier households being less exposed, but the significance is marginal. These results call for strengthening financial protection, especially in rural areas, and interpreting CHE with caution, given their rarity and sensitivity to methodological choices.

Keywords

Catastrophic Health Expenditure, Financial Protection, Universal Health Coverage, Côte d'Ivoire

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1. Introduction

Protection against financial risk is an essential pillar of universal health coverage (UHC), as is access to quality services. In this sense, social protection systems in health aim to reduce financial barriers to the use of health services and prevent impoverishment associated with direct out-of-pocket payments [1, 2]. This approach is supported by Resolution WHA58.33, which calls on States to strengthen financing mechanisms that ensure access to necessary services while protecting households from financial risk [3-5]. The benefits of expanding social protection in health include reducing financial barriers to accessing health care services and protecting against financial catastrophe and impoverishment related to health expenditure [6].

In many low- and middle-income countries, however, continued heavy reliance on out-of-pocket (OOP) payments remains a marker of vulnerability, particularly for poor households and those in the informal economy, where formal pooling remains insufficient [2, 7].

Among the indicators used to assess protection against financial risk, catastrophic health expenditure (CHE) plays an important role, as it reflects the crossing of a threshold beyond which direct payments threaten the satisfaction of basic needs [8]. The most commonly used definition considers a health expenditure to be "catastrophic" when it exceeds a given proportion of household resources, with two main approaches: the share of out-of-pocket payments in total consumption/income and the share of out-of-pocket payments relative to ability to pay (non-subsistence expenditure), with a threshold of 40% accepted based on the work of Xu et al. [8, 9]. The latter approach, which is common in the literature, is also discussed in recent work on measuring financial protection and estimating financial risk within UHC [8, 7]. Nevertheless, there is no absolute reference point for estimates, and rankings vary according to thresholds and the definition of resources, which makes international comparisons difficult and poses a challenge for harmonization in global monitoring [8, 10].

Global trend analyses show that progress in UHC does not systematically imply an improvement in financial protection. Multi-country estimates indicate that millions of people continue to face high health expenditures relative to their resources, and that the proportion of populations exposed to catastrophic levels of OOP has, in several contexts, increased in recent years [2]. This potential disconnect between service coverage and financial protection reinforces the value of empirical approaches focused on the determinants of OOP, in order to identify at-risk groups and inform public policy trade-offs (extension of mutualization, targeted exemptions, subsidies, etc.) [1-3, 11].

From this perspective, Côte d'Ivoire is a particularly relevant case study, given the reforms undertaken towards UHC and the challenges of healthcare financing [12]. This study is based on a secondary analysis of data from the 2021 Household Living Conditions Survey (HCLS) 2021, conducted by the National Statistics Agency (ANStat) with technical and financial support

from the World Bank and West African Economic and Monetary Union (WAEMU), and designed to be representative at the national and subnational levels.

The objective was to identify the determinants of catastrophic health expenditure among households in Côte d'Ivoire.

2. Methods

2.1. Data Source and Sampling Design

This study is based on a secondary analysis of data from the 2021 Harmonized Household Living Conditions Survey (HCLS), conducted in Côte d'Ivoire by the National Statistics Agency (ANStat). Technical and financial support for this household survey was provided by the World Bank and the West African Economic and Monetary Union (WAEMU). Conducted in all WAEMU member countries, the HCLS aims to produce harmonized data on household living conditions by collecting information on health, education, social protection, the environment, and the socio-demographic and socio-economic characteristics of households. The survey covers all households residing in Côte d'Ivoire. The sampling frame used for sample selection is extracted from the 2014 General Population and Housing Census (RGPH) file, which provides an updated spatial distribution of households across the national territory.

The Household Living Conditions Survey (HCLS) uses a two-stage probability sampling plan to establish a representative sample of households at the national and subnational levels (31 regions or 2 autonomous districts).

The sampling plan is stratified according to the country's administrative entities. In the first stage, a defined number of enumeration areas (ZD) were selected in proportion to the population in each stratum (region or autonomous district) using random sampling. In the second stage, an exhaustive list of households was drawn up in each selected area (cluster), from which 12 households were randomly and systematically selected. In total, 1,084 clusters and 13,008 households were surveyed, representing 64,491 individuals in 12,965 households.

Data collection took place in two waves, each lasting three months: the first between November 2021 and February 2022, and the second from April to July 2022. This two-wave organisation of the survey makes it possible to capture seasonal variations in consumption, covering both the lean season and the period of abundance.

2.2. Target Population

The target population consisted of all households residing in Côte d'Ivoire.

2.3. Study Participants

The survey was conducted through face-to-face interviews, using standardized questionnaires administered to household respondents. Information was collected from individuals likely to provide data on living conditions, including, particularly information relating to health, education, social protection, the environment, and the socio-demographic and socio-economic characteristics of households. In total, the teams interviewed 12 households in each of the 1,081 clusters covered by the enumeration and mapping teams, representing 12,972 households. Ultimately, data from 12,965 households were validated after removing seven (07) households either for lack of food consumption or for lack of non-food consumption (excluding imputed rent and durable goods).

The approach adopted was that of a cross-sectional analytical study designed to measure the frequency and analyse the determinants of catastrophic health expenditure.

The questionnaires were designed to collect information on household characteristics (age of the head of household, level of education of the head of household, occupation of the head of household, household size, consumption quintile, etc.). For this study, only responses relating to consumption expenditure and the socio-demographic and economic characteristics of households were analysed.

2.4. Study Variables

2.4.1. Dependent Variable

The dependent variable was "catastrophic health expenditure".

The measure of the frequency of CHE is the proportion of households experiencing CHE. In this study, we used the WHO-recommended ability-to-pay method [3] as it is a good estimate of financial protection [8].

A health expenditure was considered catastrophic when it reached or exceeded the threshold of 40% of household capacity [3, 7]. Monthly household expenditure data were extracted to estimate CHE.

Out-of-Pocket Payments as a share of Capacity to Pay (OOPCAP) is defined as follows: $OOPCAP = OOP / CAP$.

Where OOP is the monthly average of direct payments to the household and CAP is the household's non-subsistence expenditure.

If $SE > MHFE$ then $CAP = MTE - MHFE$

If $SE \leq MHFE$, then $CAP = MTE - SE$

SE = Subsistence Expenditure

MHFE (Monthly Household Food Expenditure)

MTE (Monthly Total Expenditure)

We constructed a dichotomous variable CHE that took the value "1" if OOPCAP was equal to or exceeded the threshold of 40% and the value "0" otherwise.

2.4.2. Independent Variables

Independent variables included socio-demographic characteristics of the household (age of the head of household, gender of the head of household, marital status of the head of household, place of residence) and socio-economic characteristics (level of education of the head of household, socio-professional category of the head of household, consumption quintiles, household size).

2.5. Analytical Methods

Descriptive statistics: Frequencies and percentages were used to describe the distribution of household characteristics.

Bivariate analysis: use of the Chi-square test (X^2) to explore associations between catastrophic health expenditure and explanatory variables.

A binary logistic regression model (catastrophic health expenditure yes/no) was applied to identify the determinants of CHE: variables deemed significant ($p < 0.05$) and/or relevant were included in the model in order to control for confounding effects and estimate the strength of associations.

The analysis was conducted using STATA® software version 17.

2.6. Ethical Considerations

This study was conducted in compliance with health research ethics standards. The use of data from the Household Living Conditions Survey (HCLS) 2021 within a legal framework following a letter addressed to the National Statistics Agency (ANstat) which gave its authorization.

The study was carried out using anonymized secondary data, which guarantees the confidentiality and privacy of the households surveyed.

3. Results

3.1. Socio-demographic, Socio-economic and Health Data on Households

The Table 1 shows significant differences in household characteristics according to area of residence ($p < 0.05$ for all variables).

The majority of heads of household are men, especially in rural areas (85.6%), with a high sex ratio (5.93 in rural areas compared to 3.23 in Abidjan).

The average age is similar (≈ 45 –46 years), but the age structure varies slightly, with more 15–24-year-olds in urban areas. Rural households are more often married (78.1%) and much more likely to have no education (64.3%), while Abidjan has a significant proportion of households with higher education (23.2%).

Economically, rural households are overrepresented in the poorest quintiles (Q1–Q2), while Abidjan has the majority of

households in the richest quintile (Q5: 55.3%). Finally, employment is more common in rural areas (92.5%) than in Abidjan (80.6%), but occupational status reflects a strong

dominance of self-employment, especially in rural areas (85.4%), while skilled workers and managers are more prevalent in Abidjan.

Table 1. Socio-demographic and socio-economic characteristics of households by area of residence.

Features		Rural (n=7722) (n,%)	Urban (n=4296) (n,%)	Abidjan (n=947) (n,%)	Total (n=12, 965) (n,%)	P
Sex	Male	6608 (85.6)	3358 (78.2)	723 (76.3)	10689 (82.5)	0.027
	Female	1114 (14.4)	938 (21.8)	224 (23.7)	2276 (17.6)	
	Sex ratio	5.93	3.58	3.23	4.70	
Age (Year)	15–24	235 (3)	220 (5.1)	33 (3.5)	488 (3, 8)	0.0001
	25–34	1512 (19.6)	889 (20.7)	153 (16.2)	2554 (19, 7)	
	35–44	2235 (28.9)	1228 (28.6)	279 (29.5)	3742 (28, 9)	
	45–54	1670 (21.6)	919 (21.4)	249 (26.3)	2838 (21, 9)	
	55–64	1167 (15.1)	620 (14.4)	146 (15.4)	1933 (14, 9)	
	65 and over	903 (11.7)	420 (9.8)	87 (9.2)	1410 (10.9)	
	Average age Standard deviation	46 (14.1)	44.8 (14)	45.9 (12.7)	45.6 (14)	
	Median [Min - Max]	44 [15-102]	43 [15-100]	45 [17-88]	44 [15-102]	
Marital status	Bachelor	851 (11)	831 (19.3)	225 (23.8)	1907 (14.7)	0.0001
	Married)	6034 (78.1)	2990 (69.6)	614 (64.8)	9638 (74.3)	
	Widowed/Divorced	837 (10.8)	475 (11.1)	108 (11.4)	1420 (11)	
	None	4967 (64.3)	2199 (51.2)	281 (29.7)	7447 (57, 4)	
Schooling level	Primary	1582 (20.5)	809 (18.8)	153 (16.2)	2544 (19, 6)	0.0001
	Secondary 1	706 (9.1)	574 (13.4)	165 (17.4)	1445 (11, 2)	
	Secondary 2	324 (4.2)	412 (9.6)	128 (13.5)	864 (6, 7)	
	Superior	142 (1.8)	302 (7)	220 (23.2)	664 (5, 1)	
Household spending quintile	Q1	2025 (26.2)	540 (12.6)	28 (3)	2593 (20)	0.0001
	Q2	1825 (23.6)	718 (16.7)	50 (5.3)	2593 (20)	
	Q3	1600 (20.7)	878 (20.4)	115 (12.1)	2593 (20)	
	Q4	1340 (17.4)	1023 (23.8)	230 (24.3)	2593 (20)	
	Q5	932 (12.1)	1137 (26.5)	524 (55.3)	2593 (20)	
Employment situation (n=54924)	In employment	7146 (92.5)	3735 (86.9)	763 (80.6)	11644 (89, 8)	0.0001
	Unemployed	576 (7.5)	561 (13.1)	184 (19.4)	1321 (10, 2)	
	Senior executive	14 (0.2)	33 (0.9)	37 (4.8)	84 (0.7)	
	Middle management	119 (1.6)	204 (5.4)	76 (9.8)	399 (3, 4)	
CSP (n=11834)	Worker or employee qualified	158 (2.2)	368 (9.7)	170 (22)	696 (5, 9)	0.0001
	Worker or employee simple	326 (4.5)	461 (12.2)	147 (19)	934 (7, 9)	
	Laborer	208 (2.9)	135 (3.6)	5 (0.6)	348 (2, 9)	

Features	Rural (n=7722) (n,%)	Urban (n=4296) (n,%)	Abidjan (n=947) (n,%)	Total (n=12, 965) (n,%)	P
Boss	87 (1, 2)	114 (3)	28 (3.6)	229 (1, 9)	
Self-employed	6219 (85.4)	2336 (61.8)	283 (36.6)	8838 (74.7)	

3.2. Incidence of Catastrophic Health Expenditure Among Households

Table 2 shows that more than half of household consumption expenditure is allocated to food (52.2%).

The frequency of catastrophic health expenditure is slightly

higher (0.35%) among households that have made direct payments (OOP) (Table 4) than in the overall sample (0.11%) (Table 3).

Furthermore, the concentration curve shows a relatively homogeneous distribution of catastrophic health expenditure (Figure 1) within households. The associated Gini coefficient is 0.187, indicating low asymmetry in the distribution.

Table 2. Share of food expenditure in total consumption.

Variables	Mean	Standard deviation	Median
DACT	0.5221288	0.1307095	0.5253643

Table 3. Frequency of CHEs in the overall sample global.

Variables	Number	Standard error	Percentage (%)
Presence of CHE	14	0.0002884	0.11
Absence of CHE	12951	0.0002884	99.89

Table 4. Frequency of CHEs in the event of OOP.

Variables	Number	Standard error	Percentage (%)
Presence of CHE	14	0.0009291	0.35
Absence of CHE	4006	0.0009291	99.65

Table 5. Predictive factors for CHE: logistic regression.

DSC	Odds-ratios.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Taille	1	.	.	.	.	.	.
2 à 3	0.237	0.189	-1.81	0.071	0.05	1.129	*
4 à 5	0.119	0.102	-2.49	0.013	0.022	0.637	**
6 à 7	0.066	0.063	-2.87	0.004	0.01	0.424	***
>7	0.025	0.027	-3.39	0.001	0.003	0.21	***
Situation Matrimoniale	1	.	.	.	.	.	.

DSC	Odds-ratios.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Marié (e)	5.27	3.388	2.59	0.01	1.495	18.58	***
Veuf (ve)/Divorcé	4.066	3.497	1.63	0.103	0.753	21.938	
Q1	1	.	.	.	.	.	
Q2	0.303	0.211	-1.72	0.086	0.077	1.185	*
Q3	0.351	0.227	-1.62	0.105	0.099	1.245	
Q4	0.35	0.22	-1.67	0.095	0.102	1.201	*
Q5	0.257	0.188	-1.86	0.063	0.061	1.076	*
: base Urbain	1	.	.	.	.	.	
Rural	4.718	3.537	2.07	0.039	1.086	20.509	**
Abidjan	2.657	3.297	0.79	0.431	0.233	30.239	
Sexe	1	.	.	.	.	.	
Feminin	1.083	0.462	0.19	0.851	0.469	2.499	
Constant	0.001	0.001	-5.59	0	0	0.012	***
Mean dependent var		0.001	SD dependent var			0.023	
Pseudo r-squared		0.094	Number of obs			44422	
Chi-square		38.382	Prob > chi2			0.000	
Akaike crit. (AIC)		398.730	Bayesian crit. (BIC)			520.550	

*** p<0.01, ** p<0.05, * p<0.1

3.3. Factors Associated with Catastrophic Health Expenditure

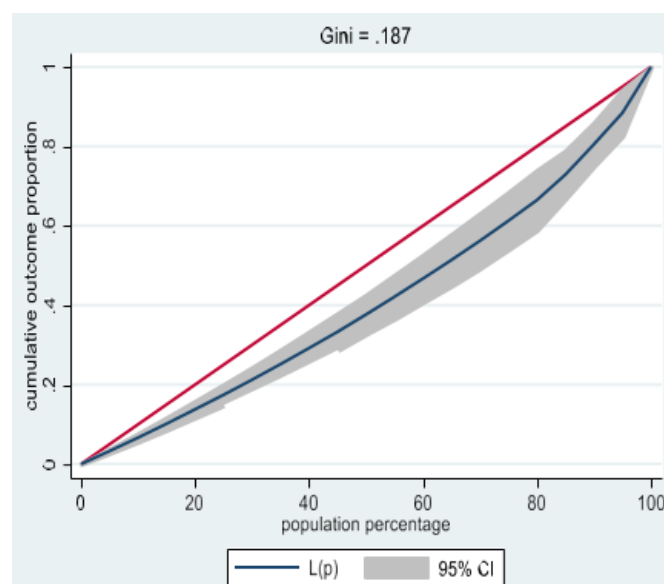


Figure 1. Concentration curve for catastrophic health expenditure (CHE).

Logistic regression (Table 5) shows that several factors are associated with the occurrence of catastrophic health expenditure (CHE) ($\chi^2 = 38.38$; $p < 0.001$; pseudo $R^2 =$

0.094). Compared to single-person households, larger households have a significantly lower risk of CAT, particularly households with 6 to 7 members ($OR = 0.07$; $p = 0.004$) and

those with more than 7 members (OR = 0.03; $p = 0.001$). Married heads of household are more exposed than single heads of household (OR = 5.27; $p = 0.01$). Households in the richest quintiles have a lower risk of DSC, although some associations are marginally significant (e.g. Q5: OR = 0.26; $p = 0.063$). In rural areas, the risk is significantly higher than in urban areas outside Abidjan (OR = 4.72; $p = 0.039$). However, no significant association is observed for the gender of the head of household ($p = 0.851$) or for residence in Abidjan.

4. Discussion

The analysis of the determinants of catastrophic health expenditure (CHE) highlights structural vulnerabilities in households' financial risk protection. Although the overall prevalence of CHE appears low—0.11% in the full sample (14 households) and 0.35% among households that incurred direct payments (OOP)—its distribution is not random. Large households (more than five members) [12] are significantly less exposed to CHE, confirming the protective role of intra-household risk pooling [9, 13, 14]. The most robust effect in our model was household size: compared with single-person households, odds ratios decrease sharply and monotonically (e.g., OR = 0.119 for 4–5 members; OR = 0.066 for 6–7 members; OR = 0.025 for >7 members). This relationship is consistent with a health economics interpretation based on informal insurance: larger households are more able to pool resources, diversify income sources (with more potential assets), and rely on internal support networks that facilitate transfers and consumption adjustments. As a result, crossing the catastrophic threshold is less likely when risk can be shared within a collective unit. This finding reinforces the idea that when formal risk-sharing mechanisms remain incomplete, financial protection partly depends on private arrangements, whose effectiveness strongly relies on family structure.

Methodological studies specifically recommend cross-referencing CHE with indicators of unmet need in order to distinguish genuine financial protection from expenditure avoidance behaviors—such as foregoing or postponing care [8]. Married household heads are at higher risk, possibly due to greater health burdens or increased economic responsibilities [15]. Consumption levels also influence the likelihood of experiencing CHE, although the observed associations are only marginally significant. This is consistent with previous research showing that poorer households spend a larger share of their income on health, making unexpected expenditures potentially catastrophic [2].

The rarity of CHE in our data should be interpreted in light of the methodological choices used to define and measure “catastrophic” expenditure. The main approaches rely either on the share of out-of-pocket (OOP) payments in total consumption/income (using thresholds of 10% and 25%), or on the share of OOP payments relative to a measure of “ability to pay,” with a 40% threshold (9, 2). In this context, international

comparisons remain challenging: incidence varies substantially depending on the chosen threshold and the definition of available resources, and harmonization continues to be a major issue for global monitoring (8).

From an economic perspective, a low incidence of CHE may reflect some ability to smooth consumption (through savings, transfers, and mutual aid), but it may also conceal behaviors such as foregoing care, resorting to informal care, or underreporting health spending—mechanisms that reduce observed expenditure without eliminating underlying health needs [8]. Thus, out-of-pocket spending captures an important dimension of vulnerability, but it does not fully summarize the magnitude of financial risk associated with illness. Universal health coverage monitoring reports also emphasize that financial protection can deteriorate even as access to services improves, and that recent trends show persistent—or even worsening—financial hardship related to out-of-pocket payments in many contexts [2, 11, 16].

The occurrence of out-of-pocket expenditure is shaped by sociodemographic and economic factors, as well as by the functioning of the social protection system. Poverty, rural residence, and lack of health coverage are major risk factors. These findings underscore the need to strengthen health coverage and financial inclusion mechanisms—namely, expanding access to basic financial services for groups excluded from the formal financial system—in order to accelerate progress toward universal health coverage [17].

5. Conclusion

The analysis highlights three main findings. First, the larger the household, the lower the risk of catastrophic health expenditure (CHE), indicating a protective effect of household size through informal resource pooling. Second, households headed by a married individual face a higher risk of CHE, likely reflecting greater economic responsibilities and health-related costs. In addition, rural residence is associated with a significantly elevated risk, pointing to structural constraints in healthcare access and service delivery. Finally, despite only marginal statistical significance, a socioeconomic gradient emerges: wealthier households are generally less exposed.

Abbreviations

ANstat	National Statistics Agency
CAP	Capacity to Pay
CHE	Catastrophic Health Expenditure
HCLS	Household Living Conditions Survey
MHFE	Monthly Household Food Expenditure
MTE	Monthly Total Expenditure
OOP	Out-of-Pocket
OOPCAP	Out-of-Pocket Payments as a Share of Capacity to Pay
RGPH	General Population and Housing Census

ZD Enumeration Areas

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Author Contributions

Koffi Kouame: Conceptualization, Formal Analysis, Methodology, Software, Visualization, Writing – original draft

Attia-Konan Akissi Regine: Supervision, Validation, Writing – review & editing

Kouame Jerome: Methodology, validation, Writing – original draft

Sangare Abou Dramane: Methodology, Writing – review & editing

Oga Stephane Serge: Supervision, Writing – review & editing

Kouadio Luc: Supervision

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Data Availability Statement

The data supporting the results of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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Research Field

Koffi Kouame: Healthcare funding and financial protection 1-1, Health Technology Assessment (HTA) 1-2, Request for care, access, and use of services 1-3

Attia-Konan Akissi Regine: Request for care, access, and use of services 2-1, Healthcare funding and financial protection 2-2, Equity, inequality and social justice in health 2-3

Kouame Jerome: Healthcare funding and financial protection 3-1, Request for care, access, and use of services 3-2