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Factors Explaining Catastrophic Health Expenditure and HouseholdImpoverishment in Cameroon

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ABSTRACT: The objective of this article is to study the exposure of Cameroonian households to the financial risk linked to catastrophic health expenditure. The study population is made up of households and the data used come from the fourth Cameroon Household Survey conducted in 2014. The statistical and econometric methods deployed are essentially descriptive statistics, hypothesis tests and logistic regression. Analyzes show that Cameroonian households spend an average of 5% of their total expenditure on health. Medication, used primarily by poor households, represents the first health service, followed by consultation and hospitalization, much more used by rich households. A significant proportion of Cameroonian households (10.33%) devote at least 10% of their income to direct payment for health care and services. The incidence of impoverishment due to these direct payments is 1.29%. The socioeconomic characteristics of Cameroonian households are the main determinants of their catastrophic health expenditures and their impoverishment due to direct payments for health care and services.

KEYWORDS: Financial risk in health; out-of-pocket payments for health care and services; catastrophic health expenditure; impoverishment.

1. INTRODUCTION

When populations need care, a large part of them must pay a financial contribution that is often very high in relation to their income. These costs borne by users at the point of service are for some the cause of catastrophic health expenditure (*Xu et al., 2007*). They result in reduced spending on basic necessities such as food, clothing, children's schooling, among others. Financial risk protection in health is simply all about alleviating the financial burden on households when using health services. This burden translates into the sums they must pay out of their own pockets to acquire health care, these sums which are generally considered excessive in relation to the contribution of the State and other health partners (*Houcine El Akhnif & Bruno Meessen, 2014*). The aim is to avoid the impoverishment of households when a fairly serious illness or accident pushes them to spend a fairly large part of their income. Financial risk protection in health is achieved when out-of-pocket health expenditures are not catastrophic (household health expenditures greater than 10% of total expenditure or income, SDG 3.8.2). Direct health expenditure refers to all expenditure incurred by a household when one of its members uses a health product or service to receive any type of care (preventive, curative, rehabilitation, long-term) provided by care providers, for any type of illness, condition or health problem and in any setting (outpatient, hospital, home). They include formal and informal expenditure directly related to the cost of care, including expenditure on drugs and medical products, outpatient care services, inpatient care services, diagnostic imaging services and medical laboratory, as well as transportation and emergency rescue services. They do not include advance payments (taxes, contributions, premiums, etc.) and sums reimbursed to the household by a third party entity such as the State, a health insurance fund or a private insurance company (*WHO, 2015*).

Health systems produce goods and services to improve the health status of individuals. However, since access to these services is not always free and in the absence of demand-side support mechanisms, households can devote very large proportions of their disposable income to them, at the risk of falling into poverty. Each year, about 44 million households or 150 million people face these catastrophic health expenses and 100 million people sink into poverty because of the high cost of this care. In addition, many individuals forgo healthcare because of the direct (consultations, analyses, drugs, etc.) or indirect (transport costs) cost of health services. This situation can accentuate the precariousness of the poor because of the loss of income caused by illness and its effects on their well-being (*Xu et al., 2007*). In addition, 930 million people (nearly 12% of the world's population) devote at least 10% of their budget to health care and services and, each year, around 6% of people fall into extreme poverty due to payment for health care and services (*WHO, 2014*). Yet every individual should be covered by a financial protection mechanism in the event of illness, and no one should suffer financial hardship or fall into poverty as a result of out-of-pocket payments for health care and services. The need for easy access to health care for all is an important aspect of universal health coverage.

In Africa, accessibility and coverage of essential health services are particularly low. Indeed, only 43% of pregnant women attended the four recommended prenatal visits, compared to a global average of 55% in 2014. Only 49% of births are attended by skilled health personnel, compared to a global average of 70%. Out-of-pocket payments have been identified as a major cause of this situation across the continent, with several studies showing that out-of-pocket payments provide limited access to care for the disadvantaged and women in particular (*WHO, 2014*).

In Cameroon, much effort is still needed to protect against financial risk in health. Indeed, 37.5% of the population lives below the poverty line (ECAM, 2014). In addition, households contribute nearly 70% of their health expenditure, while the State only contributes 13% (*WHO, 2019*). Only 6.4% of the Cameroonian population is covered by a prepayment mechanism and the pooling rate is 2% (*OASIS Report, 2016*). Furthermore, the share of the state budget allocated to health fluctuates between 3.8% and 6% between 2008 and 2018, whereas at the Abuja summit in 2001, African leaders committed to allocating to minus 15%. Universal Health Coverage (UHC) is promoted as the hope of people around the world who are trapped in a poverty trap due to out-of-pocket payments often due to a lack of protection against disease risk in low- and middle-income countries including Cameroon is one of them (*WHO, 2010*).

2. SELECTIVE LITERATURE REVIEW

2.1 Care costs

Costs can be divided into three broad categories: direct, indirect and opportunity costs. Direct costs include official medical fees and charges, hospitalization, the cost of drugs purchased in and out of hospital, and diagnostic tests, i.e. any payments for medical reasons. Direct costs also include informal payments sometimes required by health personnel. Indirect costs include transport, food and accommodation costs for the patient and accompanying persons. Opportunity costs represent the time lost by the patient and his companions (*Nahar and Costello, 1998*).

2.2 Catastrophic health expenditures

Lorsque des paiements directs sont imposés en santé, ceux-ci peuvent s'avérer élevés par rapport au revenu des ménages. Cependant, même des dépenses relativement basses peuvent être désastreuses pour un ménage pauvre pour qui la totalité des ressources est utilisée pour leurs besoins essentiels. En effet, une dépense de santé catastrophique n'est pas toujours synonyme de coût des soins de santé élevé et pour certains ménages payer, même une faible somme, peut le conduire à la pauvreté (*Xu et al, 2003*).

In fact, any expense that threatens a household's ability to meet basic needs is qualified as catastrophic (*WHO, 2005*). These expenses can lead households to deprive themselves of essential goods such as food, clothing or children's education. A health expenditure will be catastrophic if a household has to reduce its basic consumption expenditure in order to be able to meet health costs (*Xu et al, 2003*). For Russel (*2004*), an expenditure will be catastrophic if it forces the household to reduce its usual consumption, to sell goods or to contract debts and leads to impoverishment.

Some studies assume that spending more than between 5% and 20% of income will be catastrophic (Xu et al, 2003). According to McIntyre et al (2006), this threshold is too arbitrary since much lower expenditure could be catastrophic for extremely poor households. According to Kawabata et al (2002), certain other socio-economic characteristics determine the catastrophic impact or not of expenditure. These include the level of household income, but also the age of the members, whether they are employed and the presence of elderly, disabled or chronically ill people. Conversely, a young and healthy household may not be affected in the same way by the same level of expenditure.

Similarly to Wagstaff & Van Doorslaer (2003), Barros et al., (2011) considered spending above between 10% and 20% of total household expenditure. The study by Su et al, (*2007*), carried out in the district of Nouna in Burkina Faso using socioeconomic and health data from 774 households revealed that 6.46% of households incurred health expenditure above 60 % of their income and 15.12% of expenses above 20% of their income. Barros et al., (2011) conclude that it would be more appropriate to directly estimate whether the household has become impoverished or indebted in order to assess the presence of financial catastrophe.

2.3 Determinants of Catastrophic Spending and Impoverishment

Denis Raynaud (2005) estimated the influence of the characteristics of households in France and of the individuals to which they belong on their health expenditure. The analysis of health care consumption has shown that hospital expenditure accounts for the largest share in total health expenditure. In addition, individual expenditure increases with age, and in an accelerated manner from the age of 50.

Eiko Saito et al., (2014), analyzed the incidence of catastrophic health expenditures and associated illnesses. Compared to health expenditure, the share of direct household payments in total health expenditure varies between 48% and 69%. In addition, hospitalization accounts for the largest share of household health expenditure, followed by outpatient care.

At the 10% threshold, 13.8% of households in Nepal faced catastrophic health expenditures. As for the determinants, the risk of incurring catastrophic health expenditure varies according to the disease and the level of household wealth.

Abdeljaouad Ezzrari & L. Asma EL Alami El Fellousse (2007) studied the catastrophic health expenditures of Moroccan households, and their impact on their impoverishment. It emerged that Moroccan households devote nearly 5.1% of their budget to

health care, a proportion that differs according to place of residence and region. In addition, the share of households in health care payments represents nearly 85.5%, payments which are higher in urban areas than in rural areas. In addition, the purchase of drugs represents the largest share (53%) of direct payments for care, followed by consultations and radiological examinations with 17% and 14% respectively. During this same period, the incidence of catastrophic health expenditure was 7.08% and the rate of impoverishment due to direct health payments was 1.36%. The main determinants of catastrophic health expenditure were: the place of residence, the occupation of the head of household, his sex, his educational level, the existence within the household of persons aged 65 and over, of those under 15 years, the standard of living of households. Indeed, rural households were most at risk of incurring catastrophic health expenditures than their urban counterparts. In addition, households with at least one person aged 65 and over are also highly exposed to the risk of incurring these expenses. The sex of the household head also influences the probability that a household will incur catastrophic health expenditure: households headed by men are more likely to protect themselves against this risk. In addition, the more the standard of living improves, the more likely one is to protect oneself against the risk of incurring catastrophic health expenditures. The coverage of the head of household by a health insurance system is a protective factor against the risk of catastrophic expenses.

In the DRC, Eloko Eya Matangelo.G et al., (2018) analyzed the protection against financial risk in household health between 2005 and 2012. From the outset, no progress was recorded in the reduction of the number of households making in the face of catastrophic health expenditure. At the national level, the proportion of households facing these expenses rose from 3.9% in 2005 to 4.8% in 2012, an increase of 0.9%. In 2005, this proportion was higher in urban areas, and vice versa in 2012. At the 10% threshold, we observe a higher proportion among the poorest quintiles. The authors concluded with the influence of certain variables on catastrophic health expenditure by means of a logistic regression. To this end, a household living in a rural environment, headed by a woman or with a level of education equivalent to higher education, has less risk of incurring catastrophic health expenditure. In addition, the effect of belonging to rich and richer consumption quintiles decreases the risk of meeting these expenses.

In Burkina Faso, Tin Tin Su et al., (2006), studied the catastrophic health expenditures (and the factors responsible) of households in the district of Nouna, a low-income region. It found that out-of-pocket health care payments by households account for more than 50% of total health care expenditure. Household health expenditure accounted for 5.8% of their total expenditure. At the 10% threshold, 8.66% of households faced catastrophic health expenditure. Overall, the incidence of catastrophic health expenditure decreases as household income increases. As for the factors that influence catastrophic health expenditures, it appears that households headed by women are less likely to fall into catastrophic health expenditures, as are households in rural areas and those with higher incomes.

3. MATERIAL AND METHODS

3.1 The model

The statistical method used in this study is essentially based on logistic regression. It is used for classification and is very efficient, in the sense that it does not require additional conditions and/or information. It is widely used in many fields including medicine, insurance, banking and economics (F. DUYME et al, 2005). It makes it possible to find the factors relating to the group of healthy subjects in order to distinguish them from the groups of sick subjects, for example. On the other hand, in the banking field for example, logistic regression gives the ability to target a fraction of the clientele who will be sensitive to an insurance policy on such and such a particular risk and to detect groups at risk when taking out a loan.

Logistic regression is similar to multiple linear regression. Indeed, it is a question of predicting or explaining a dependent variable Y using one or more predictive variables X. These predictive variables X1, X2, X3…, Xn participate in an additive way in the equation regression model and the weight of each predictor variable is assessed by its regression coefficient. Furthermore, there are several features that distinguish logistic regression from conventional multiple regression. The most obvious is of course the fact that the variable Y to be predicted is dichotomous rather than continuous. In this sense, it is a technique that falls into the same category as discriminant analysis (Amemiya T., 1981). As long as the dependent variable is dichotomous, the logistic model corresponds to a situation where one seeks to predict to which group (zero or one) a subject belongs. Moreover, the relation between the predictor variables X1, X2, X3…, Xn and the criterion variable Y, can be considered as another distinctive point of the logistic regression. Therefore, the dependent variable Y is assumed to be nonlinear with respect to the logistic regression.

Logistic regression makes it possible to measure the association between the occurrence of an event (qualitative explained variable) and the factors likely to influence it (*M. El Sanharawi and F. Naudet, 2013*). A very interesting property of logistic regression is that it makes it possible to estimate an odd ratio (OR) which provides information on the strength and direction of the association between the explanatory variables (X_i) and the variable to be explained (Y). It therefore constitutes a method of choice for researching and determining the risk factors or the protective factors of an incident (*Amemiya T., 1981*). In the context of this study, the incidents are catastrophic expenditure and household impoverishment. The factors likely to explain them are the socio-economic characteristics of the households. This regression will therefore be used to identify and explain these factors. It is binary because the variables of interest (catastrophic expenditure and impoverishment) are binary, that is to say taking two modalities: “1=yes” and “0=no”.

The trick of logistic regression is not to model the qualitative variable Y but the probability p that it occurs (*Amemiya T., 1981*). The logistic model (formula below) allows a non-linear expression, varying monotonically between 0 and 1, of this probability as a function of the explanatory variables (X_i).

$$\boxed{Ln\left(\frac{p}{1-p}\right) = logit(p) = \beta_0 + \beta_1 X_1 + \cdots + \beta_n X_n + \varepsilon}$$

The logit of the probability (p) of the realization of the variable to be explained Y (catastrophic health expenditure/impoverishment, taking the values "yes" and "no") is expressed according to an intercept (or ordered at the origin)β_0, explanatory variables X_i (characteristics of households: region, environment, characteristics of the head of household, etc.) attached to their coefficientsβ_i and a noise term ε.

3.2 Estimation issues

In order to use the model for the description of relationships between variables, it would be necessary to first estimate the parameters β0, β1, β2, β3…, βn relating to the appropriate model. In this perspective, statistical software uses the maximum likelihood method. This is the equivalent of the least squares method for linear regression. The main idea of this method is to calculate the probabilities and to observe the values X1, X2, X3…, Xn of the function with unknown parameters and known data. The best way to estimate the parameters is to determine the maximum likelihood estimator, the one that will maximize the considered probability (*Amemiya T., 1981*). Obviously, this will be very close to reality.

Two models will be estimated: one model for the determinants of catastrophic health expenditure and another for the determinants of impoverishment. The model parameters are estimated using the maximum probability method. Furthermore, due to the large volume of data, two separate samples will be used in the implementation of the logistic regression: the first, the training sample will be used to estimate the logistic regression model and the second, the validation, will make it possible to assess the quality of the model estimated on the first sample. In general, the training sample represents 50% to 75% of the data set (*M. El Sanharawi and F. Naudet, 2013*).

3.3 Data

The data used in this study come from the fourth Cameroon household survey (ECAM 4) conducted in 2014 by the National Institute of Statistics (INS). Data collection took place from October to December 2014, using the CAPI method: this is a face-to-face questionnaire administration mode where the interviewer uses an electronic terminal to carry out the interview and record the data of the respondents. The general objective of this survey is to produce indicators on the living conditions of the Cameroonian populations to allow the updating of the indicators of the poverty profile, the monitoring of the evolution of the National Development Strategy (SND30) and the progress towards achieving the Sustainable Development Goals (SDGs). They also make it possible to assess the effects of macroeconomic programs and policies implemented in Cameroon on the living conditions of households in the years prior to 2014. The target population includes the entire population of Cameroon living in ordinary households. To cover this population, interviews are conducted at the household level. The operation concerns all ordinary households (as opposed to collective households: boarding schools, barracks, hospitals, convents, etc.) residing throughout the national territory, excluding members of the diplomatic corps and their households.

The ECAM 4 sample was drawn using an area sampling plan, stratified at two stages. The strata were formed by combining the 12 survey regions with the place of residence (urban, semi-urban, and rural). A total of 32 survey strata were formed, including 12 urban (Yaoundé, Douala, and the urban stratum of each of the 10 regions of the country), 10 semi-urban strata and 10 rural strata with one stratum per region. At the first stage, the enumeration areas (EAs) are selected independently in each stratum with a probability proportional to their size in number of households. At the second stage, in each of the EAs drawn at the first stage, a sample of households is selected by the procedure of systematic drawing with equal probability, from the lists of households drawn up at the time of the count. A total of 12,847 households were surveyed. From the information collected during this survey, the socio-demographic characteristics of households (composition, place of residence, health, health, education, employment) and household consumption expenditure (taking into account the 12 functions of COICOP) will be retained.).

4. RESULTS AND DISCUSSION

The measure of financial risk in health will be highlighted using the incidences of catastrophic health expenditures and impoverishment due to out-of-pocket health care payments.

4.1 Preliminary results

The preliminary results relate to the weight of expenditure on the various health care services and services (medication, consultation, hospitalization, other) in total health expenditure and the impact of catastrophic household health expenditure and impoverishment.

4.1.1 Structure of household health expenditure

In the structure of health expenditure, pharmaceutical expenditure is the most important. Indeed, the acquisition of medicines (traditional or modern) is higher than that of other services. Households devote annually and on average 67,382 FCFA, 21,812 FCFA, and 17,781 FCFA respectively to the cost of drugs, consultation and hospitalization, i.e. respective weights of 59.67%,

19.32% and 15.75 %. More specifically, the weight of drug expenditure is higher in the Far North and North regions with values of 76.96% and 73.84% respectively, while those of the other two services are lower. This can be partly explained by self-medication, which is very common in these two regions, and the very culture of the populations which pushes them more to consume traditional medicine to the detriment of visits and hospital care. On the other hand, the share of drug expenditure in health expenditure is lower in the cities of Yaoundé and Douala (49.44% and 52.83% respectively) while those of other services (consultation and hospitalization) are higher. In addition, the weight of drug expenditure is higher in rural areas, while that of other services is higher in urban areas. In addition, the more the level of household wealth increases, the more the share of medicine in health expenditure decreases, and conversely for the share of other benefits. This would reflect that the drug is mainly used by poor households while consultation and hospitalization by rich households, since the costs of consultations or hospitalization are generally higher than those of drugs.

Table 1: Annual health expenditure by type of service (in % and in FCFA)

		Drugs		Consultations		Hospitalizations		Others		Together	
		%	Average	%	Average	%	Average	%	Average	%	Average
National	Cameroon	59,67	67 382	19,32	21 812	15,75	17 781	5,27	5 949	100,00	112 924
Region	Douala	52,83	89 124	27,69	46 710	14,78	24 928	4,70	7 927	100,00	168 689
	Yaounde	49,44	77 329	25,10	39 260	19,78	30 936	5,68	8 881	100,00	156 406
	Adamawa	67,54	81 713	17,22	20 836	11,94	14 447	3,30	3 992	100,00	120 987
	Centre	55,67	66 998	16,28	19 594	22,78	27 414	5,27	6 339	100,00	120 345
	East	56,60	57 877	15,41	15 756	20,70	21 168	7,30	7 464	100,00	102 265
	Far North	76,96	64 381	11,35	9 498	9,19	7 688	2,50	2 093	100,00	83 660
	Littoral	62,82	61 059	16,82	16 351	14,91	14 493	5,45	5 299	100,00	97 202
	North	73,84	78 738	14,20	15 145	8,82	9 401	3,15	3 355	100,00	106 639
	Northwest	60,26	43 714	18,79	13 628	15,71	11 401	5,24	3 804	100,00	72 546
	West	58,99	77 244	18,94	24 797	16,94	22 188	5,13	6 713	100,00	130 943
	South	54,31	49 228	19,50	17 671	18,12	16 420	8,07	7 316	100,00	90 635
	South-West	59,03	42 608	13,38	9 658	14,94	10 784	12,65	9127	100,00	72 176
Environment	Urban	56,61	78 429	22,05	30 543	16,29	22 568	5,05	6 999	100,00	138 540
	Rural	65,38	54 895	14,22	11 943	14,73	12 369	5,67	4 762	100,00	83 969
Expenditure quintiles	Q1 (the poorer	71,23	23 110	11,44	3 712	10,87	3 525	6,46	2 097	100,00	32 444
	Q2	65,49	35 009	12,63	6 750	14,25	7 621	7,63	4 081	100,00	53 460
	Q3 (the	60,54	45 950	16,61	12 605	16,01	12 148	6,84	5 194	100,00	75 897
	Q4	61,31	73 851	18,79	22 628	15,19	18 298	4,71	5 673	100,00	120 450
	Q5 (the richest	56,40	147 119	22,45	58 573	16,68	43 505	4,47	11 671	100,00	260 868

Source: Authors' construction.

The health expenditure of Cameroonian households represents nearly one twentieth of their total consumption expenditure and food expenditure a little more than 3 tenths. The wealthier a household becomes, the more it spends on health care, and less on food needs. Among health care expenditures, it is those on medicines that occupy the largest place, which decreases when the level of household expenditure improves in favor of services such as consultation and hospitalization. However, what about the financial risk incurred by these households when they have to acquire health care and services?

4.1.2 Incidence of catastrophic household health expenditure and impoverishment

- **Incidence of catastrophic health expenditure**

In Cameroon, just over one household in 10 incurs health expenses that compromise their well-being and financial health at the 10% threshold. In other words, about 10.33% of Cameroonian households incur health expenses whose cost is more than one tenth of their total expenses. However, it is in the West, Adamawa and Littoral regions that this incidence is higher with values of 12.87%, 12.70% and 12.39% respectively. This could be partly explained by the fact that households in these regions devote more of their expenditure to health care, as shown in Table 1. On the other hand, it is households in the South and South-West regions that are less affected by catastrophic expenditure with incidences of 5.30% and 7.88% respectively. Households in these two regions also spend the least on health care and services (Table 1). By taking a look at the area of residence of households, we realize that the incidence of catastrophic expenditure is higher in rural areas, an area where household health expenditure accounts for a larger share

of their total expenditure (cf. table 1). And generally speaking, when a household's income improves, the risk of facing catastrophic expenses also increases.

Table 2: Incidence of catastrophic health expenditure

		Catastrophic expenditures		Incidence (%)
		No	**Yes**	**%**
National	Cameroon	9 234	1 064	**10,33**
Region	Douala	1 018	119	**10,47**
	Yaounde	955	108	**10,16**
	Adamawa	639	93	**12,70**
	Centre	735	84	**10,26**
	East	570	56	**8,95**
	Far North	1 004	94	**8,56**
	Littoral	580	82	**12,39**
	North	855	111	**11,49**
	Northwest	832	108	**11,49**
	West	792	117	**12,87**
	South	518	29	**5,30**
	South West	736	63	**7,88**
Environment	Urban	4 926	538	**9,85**
	Rural	4 308	526	**10,88**
Expenditure quintiles	Q1 (Poorer 20%)	1 423	146	**9,31**
	Q2	1 907	200	**9,49**
	Q3 (Modests)	2 041	198	**8,84**
	Q4	1 987	249	**11,14**
	Q5 (Richest 20%)	1 876	271	**12,62**

Source: Authors' construction.

- **Incidence of impoverishment due to catastrophic health expenditure**

Nearly 13 out of 1,000 households have fallen into poverty as a result of out-of-pocket payments for health care and services. However, it is in the Far North (Adamawa, Far North and North) and North West regions that this proportion is higher. This could be partly explained by the fact that households in these regions generally have low consumption expenditure (see Table 1), and therefore the smallest penny spent on health care could drain them of all their financial resources. But on the other hand, the incidence of impoverishment is lower in the cities of Douala and Yaoundé (0.18% and 0.38% respectively). Moreover, rural households are the most impoverished. In addition, impoverishing households almost all belong to the first expenditure quintile.

Table 3: Incidence of impoverishment due to health expenditure

		Before health expenditure			After health expenditure			Incidence
		Non pauvres	**Pauvres**	**Pauvreté (%)**	**Non pauvres**	**Pauvres**	**Pauvreté (%)**	**%**
National	Cameroon	9 316	982	**9,54**	9 183	1 115	**10,83**	**1,29**
Survey region	Douala	1 136	1	**0,09**	1 134	3	**0,26**	**0,18**
	Yaounde	1 058	5	**0,47**	1 054	9	**0,85**	**0,38**
	Adamawa	636	96	**13,11**	621	111	**15,16**	**2,05**

		Before health expenditure			After health expenditure			Incidence
		Non pauvres	**Pauvres**	**Pauvreté (%)**	**Non pauvres**	**Pauvres**	**Pauvreté (%)**	**%**
	Centre	798	21	**2,56**	790	29	**3,54**	**0,98**
	East	598	28	**4,47**	592	34	**5,43**	**0,96**
	Far North	759	339	**30,87**	736	362	**32,97**	**2,09**
	Littoral	626	36	**5,44**	618	44	**6,65**	**1,21**
	North	779	187	**19,36**	748	218	**22,57**	**3,21**
	NorthWest	722	218	**23,19**	698	242	**25,74**	**2,55**
	West	890	19	**2,09**	886	23	**2,53**	**0,44**
	South	540	7	**1,28**	538	9	**1,65**	**0,37**
	SouthWest	774	25	**3,13**	768	31	**3,88**	**0,75**
Environment	Urban	5 387	77	**1,41**	5 367	97	**1,78**	**0,37**
	Rural	3 929	905	**18,72**	3 816	1 018	**21,06**	**2,34**
Expenditure quintiles	Q1 (Poorer	587	982	**62,59**	468	1 101	**70,17**	**7,58**
	Q2	2 107	0	**0,00**	2 094	13	**0,62**	**0,62**
	Q3	2 239	0	**0,00**	2 239	0	**0,00**	**0,00**
	Q4	2 236	0	**0,00**	2 236	0	**0,00**	**0,00**
	Q5 (Richest	2 147	0	**0,00**	2 146	1	**0,05**	**0,05**

Source: Authors' construction.

As a result of the above analyses, the incidences of catastrophic expenditure on health and impoverishment differ according to the region, the place of residence, and the level of wealth of the household.

4.2 The determinants of catastrophic health expenditures and impoverishment due to these expenditures

The aim is to determine the factors that influence catastrophic health expenditures and the impoverishment caused by these expenditures. It will also be a question of describing the influence of these factors on the risk for a household to face catastrophic health expenses or to become impoverished because of these expenses. In the following, the terms "catastrophic expenditures" and "impoverishment" will refer respectively to catastrophic health expenditures and the impoverishment due to these expenditures.

4.2.1 Construction of training and validation samples

The learning samples where the modalities of the dependent variables are in equivalent proportions are constituted so that for each learning sample, the individuals with the "yes" modality represent 75% of those in the overall sample; then we balance with as many individuals having the "no" modality. The validation samples that represent the rest of the database consist of the difference between the global sample and the corresponding training sample. The following table represents for each model the numbers and the proportions of the modalities of the dependent variable in each sample.

Table 4: Distribution of training and validation samples

		Total sample		Learning		Validation	
Model 1	**Catastrophic expenditure**	Number	%	Number	%	Number	%
	Yes	1 064	10,33%	798	50,00%	266	3,06%
	No	9 234	89,67%	798	50,00%	8 436	96,94%
	Total	10 298	100,00%	1 596	100,00%	8 702	100,00%
Model 2	**Impoverishment**	Number	%	Number	%	Number	%
	Yes	133	1,29%	100	50,00%	33	0,33%
	No	10 165	98,71%	100	50,00%	10 065	99,67%
	Total	10 298	100,00%	200	100,00%	10 098	100,00%

Source: Authors' construction.

4.2.2 Estimation and validation of the different models

- **Overall significance of the models**

The estimated models are all globally significant at the 5% level ($p - valeur < 5\%$, appendix 1). In other words, the socioeconomic characteristics of Cameroonian households explain overall catastrophic spending and impoverishment. But the variables that really play a role in this meaning have yet to be determined.

- **Signifiance of the coefficients**

The following table presents the significance of the variables at the 5% level.

Table 5: Significance of the variables in the two models

Variables	Model 1	Model 2
Survey region	No	No
Environment	Yes	No
Gender of head of household	Yes	No
Age of head of household	Yes	No
Level of education of the head of household	No	No
Activity status of the head of household	Yes	Yes
Quintiles de dépenses	Yes	Yes
Type de ménage	Yes	**No**

Source: Authors' construction.

Before interpreting the influence of these variables on catastrophic spending and household impoverishment, it would be appropriate to measure the performance of these models through the following steps.

- **Mc Fadden's Pseudo-R^2**

The model on catastrophic expenditure stands out quite well from the trivial model with regard to appendix 1. In other words, the socioeconomic characteristics of Cameroonian households contribute to the explanation of their risk of facing or not facing catastrophic health expenditure. . Indeed, this model explains 57.52% of the total variability. The same is true for the impoverishment model. This last model explains 61.74% of the total variability.

- **Hosmer–Lemeshow test**

The achievements of the Hosmer-Lemeshow test (appendix 1) show that each model is compatible with the data. In other words, these models fit quite well to the data used for their estimation.

- **Confusion Matrix**

For each model, a confusion matrix is built on its validation sample. For each model, the following indicators are provided:

Table 6: Ranking indicators of the two models

Indicators (%)	Model 1	Model 2
Good classification rate	76%	82%
Sensitivity	88%	94%
Specificity	76%	82%
Error rate	24%	18%

Source: Authors' construction.

The first model has a good classification rate of 62%, an ability to predict individuals who face catastrophic expenses (sensitivity) of 63%, a specificity of 62% and an error rate of 38%. Concerning the second model, the confusion matrix built on the validation sample makes it possible to obtain a good classification rate of 82%, a sensitivity of 94%, a specificity of 82%. In addition, this model makes it possible to classify households with an error rate of 18.22%, representing the probability that a household is misclassified. Moreover, when the model predicts a "positive" household (falling into impoverishment due to catastrophic health expenditure), this household actually has nearly 94 chances out of 100 of actually being so: this model is therefore a very good identifier of "positive" households.

- **The ROC Curve**

The ROC curve represents sensitivity versus specificity. Appendix 1 shows that the area under the curve is 0.818 for catastrophic health expenditure, thus reflecting good discrimination. In terms of depletion, the model has excellent discrimination with a value of 0.929.

4.2.3 Results interpretation

First of all, it should be recalled that since the incidences of catastrophic expenditure on health and impoverishment are quite low (10.33% and 1.29% respectively), the odds ratios (ORs) can be interpreted as risks relative (appendix 1).

The place of residence of the household influences the risk for the latter of being confronted with catastrophic expenditure. Indeed, a household living in a rural environment runs 5 times more risk of facing catastrophic expenses. The same is true for the sex of the head of household, because households headed by a woman are 4 times more likely to incur health expenses likely to compromise their financial health. In addition, the age of the head of household is a risk factor insofar as the more it increases, the more the risk for his household of facing catastrophic expenses also increases. In addition, households headed by a person who does not work run 3 to 6 times more risk of falling into catastrophic expenditure: we can therefore say that the work of a household head protects the latter against these health expenditures. . One-person households run less risk of catastrophic spending compared to other types of households, with the exception of single-parent households. Finally, it appears that the higher the level of wealth, the greater the risk of making catastrophic expenses. This result is consistent with that where the incidence of catastrophic health expenditure increased from one expenditure quintile to a higher one.

The main determinants of the impoverishment of a household due to health expenditure are: its level of expenditure, the age of the head of the household and the activity status of the latter. The age of the head of household is a risk factor for impoverishment. Indeed, the older the latter, the higher the risk of becoming impoverished. To this end, compared to a household whose head is between 12 and 24 years old, one whose head is at least 60 years old runs 25 times more risk of falling into poverty because of health care expenditures. The work of the head of household rather protects the latter against impoverishment, because households whose heads do not work (inactive and unemployed) run 14 to 38 times more risk of falling into poverty. The situation is worse for households whose head is unemployed. And finally, unlike catastrophic health expenditures, the risk of becoming impoverished is reduced when moving towards households with higher levels of wealth.

4.2.4 Discussion

The purpose of this section is to provide further reflection and interpretation of the results of the study. This is undoubtedly going to make a link between the results obtained, the hypothesis put forward in the introduction and the literature.

- **Structure of household health expenditure**

The results of this study revealed that in the health expenditure of Cameroonian households, the acquisition of drugs represents the largest share (59.67%). In 2014, 37.5% of the Cameroonian population lived below the monetary poverty line (ECAM 4), and therefore was likely to resort to self-medication in the event of illness. In addition, this share is higher among the poorest households (71.23%), and lower among the richest households (56.40%), and vice versa for the other types of service (consultations and hospitalizations). This result made it possible to make the first observation that in Cameroon, the use of drugs is accentuated among the poor, while that of consultations and hospitalizations is accentuated among the rich. This result seems to be in line with the reality of the country because the last two services are generally more expensive.

In Morocco also, the purchase of drugs represents the largest share (53%) of health care payments, followed by consultations with 17% in the period of January 2000 (*Abdeljaouad and L. Fellousse 2007*): a result which is not very far from that of Cameroonian households (59.67% drugs, 19.32% consultations). And similarly, the share of medicine in total health expenditure continues to decrease in favor of consultation, hospitalization and radiological examinations as the level of expenditure increases. You would think that in 2000 Morocco had a monetary poverty rate similar to that of Cameroon in 2014 (37.5%), but in 2000 only 6.3% of the Moroccan population lived below the poverty line, which in this case does not explain the weight of the drug in the total health expenditure of Moroccan households. But looking at the most common pathologies in Africa, which are mainly diseases such as Malaria, Typhoid Fever, HIV/AIDS, Tuberculosis, Cholera, and which are generally treated through the use of drugs (traditional or modern), it is understandable why expenditure on drugs represents such a large share of total health expenditure. Thus, in addition to the level of wealth, the type of pathology encountered in a region could also explain the structure of health expenditure.

In France, on the other hand, hospital expenditure represents the largest share of total health expenditure (*Denis Raynaud 2005*), a share which gradually increased from 1950 to 2015, rising from 40% to 55% (*Pierre-Yves Cusset 2017*). This is explained by the very moderate use of prevention, which induces more serious pathologies and resulting in higher hospital expenditure (*Denis Raynaud 2005*). Indeed, these pathologies which are very frequent in French patients are generally linked to alcoholism (inducing cirrhosis, cancers, suicides, accidents, etc.), smoking (cancers, respiratory pathology, myocardial infarction), lifestyle differences concerning nutrition (diabetes, colon cancer), and physical inactivity (myocardial infarction) or the adoption of risky behaviors (road accidents, attempted suicide), and which require long hospital stays. In addition, medicine occupies only the third share in the health expenditure of French households, because it is preceded by outpatient care or city care.

This difference in the structure of health expenditure of African and French households (Europeans in general) could therefore be explained by the type of pathologies encountered, the way of life, the level of development. At first glance, the way of life of the French, which exposes them to the various pathologies mentioned above, largely explains the fact that they spend more on hospital care. The analysis according to which the drug is generally used by the poor would largely explain the fact that drug expenditure occupies the first place in the health expenditure of Cameroonian households, because a good part of the latter still remain poor (37,

5% of the population lives below the poverty line according to ECAM 4). And even if non-poor households had the means to resort to hospital care or consultation, there is still a problem of qualified personnel, the lack of health infrastructure and an adequate technical platform. In addition, the epidemiological profile of African countries further encourages households on this continent to use drugs to regain health.

- **Impacts of catastrophic spending on health and impoverishment**

According to the WHO, the incidence of catastrophic health expenditure in 2014 in Cameroon is 10.9% (at the 10% threshold). This result is very close to the value obtained in this study (10.33%). The WHO estimates this incidence at 12% worldwide. It therefore appears that Cameroonian households run less risk of facing catastrophic health expenses than those in the rest of the world, although there is still a lot of effort to be made in terms of financial protection in health.

Regarding the incidence of impoverishment, the WHO estimates that in 2014, 1.87% of Cameroonian households became impoverished because of the payment of their health care. The analyzes of this study revealed that this incidence in 2014 was 1.29%. These two results are not very far apart. In terms of impoverishment, Cameroon does not stand out from the rest of the world, because according to the main facts revealed by the WHO, about 100 million people (or 1.3% of the world's population) are falling into poverty. Extreme because of the health expenses left to them, an incidence which is equal to that of Cameroon.

In a study conducted in Nepal by Eiko Saito et al, 13.8% of households in the Kathmandu locality faced catastrophic expenditure at the 10% threshold between November 2011 and January 2012, an incidence not very far from that of Cameroonian households (10.33%). In 2011, out-of-pocket payments from households in Nepal accounted for almost 67.4% of health financing, which is almost in the same proportions as those in Cameroon in 2014 (70%). Eloko G. et al, also showed that in 2012, 4.8% of Congolese households (DRC) suffered catastrophic health expenditure at the 10% threshold. This incidence is on the other hand lower than those of Cameroon and Nepal mentioned above. This can be explained by the fact that direct payments from households in the DRC represented 39.6% of health financing, much lower than the proportions of direct payments from Cameroonian and Nepalese households in said financing (70% and 67.4 % respectively). It should also be noted that this year (2012), the GDP/Inhab and the poverty rate in the DRC were respectively $671 and 76.6%, respectively much lower and higher than those of Cameroon ($3,187 and 37.5% in 2014) and Nepal ($2,002 and 6.3% in 2011), and that despite this, the incidence of catastrophic expenditure is much lower in the DRC. Thus, this analysis shows that the main determinant of the incidence of catastrophic spending in a country is the share of out-of-pocket payments by households in that country in health financing. The more the health expenses of households are left to their own expenses, the more they spend more to acquire care, and run the greater the risk of incurring catastrophic expenses, or even becoming impoverished. On the other hand, when the State bears a good part, households spend less on their health care and run less risk.

- **Determinants of catastrophic health expenditure and impoverishment**

The results of this study showed that the socioeconomic characteristics of Cameroonian households are the main factors that determine whether they suffer catastrophic health expenditures and become impoverished due to out-of-pocket health care payments. Indeed, it emerged that: households in rural areas are more exposed; single-parent and/or extended households are more exposed; female-headed households are more at risk; the older the household head, the greater the risk; and the fact that the head of the household has a job reduces the risk. These results are in agreement with those of the study by Abdeljaouad and Fellousse, carried out in Morocco in 2000. On the other hand, the result according to which the risk of being confronted with catastrophic health expenses would increase with income is a situation which seems paradoxical. Indeed, the richer a household, the more it has sufficient means to pay for health care. Moreover, the previously cited study revealed that the more the standard of living of a household improves, the more likely it is to protect itself from financial risk.

Moreover, in the study by Eloko Eya et al, carried out in the DRC in 2012, it emerged that a household headed by a woman is less likely to incur catastrophic health expenditure, which contradicts the results of this study and the previously cited study. This protection from risk in households headed by women in the DRC is explained by the fact that in this country, the illiteracy rate is higher among men (70.82% among men against 62.91% among women in 2012), since our results show that the level of education of the household head reduces the risk. In addition, the unemployment rate is higher among men (5.31% among men against 3.61% among women), and the possession of a job by a head of household reduces the risk of facing catastrophic spending, as the results of this study and previous studies have shown.

However, taking into account the presence of certain diseases (Diabetes, HIV/AIDS, Viral Hepatitis, Hypertension, Malaria, etc.) within Cameroonian households would have made it possible to better explain the determinants of catastrophic expenditure, when we know that the households confronted with this type of disease spend significant amounts to maintain the health of their members. This is what the authors Eiko Saito et al did by analyzing the incidence of catastrophic health expenditure and associated diseases (diabetes, heart disease, asthma, etc.). The same is true for Tin Tin Su et al who showed that the average number of cases of adult illness increases the probability for a household to be faced with catastrophic expenditure. In addition, the presence of a person with a chronic illness multiplies by 3.3 the probability of his household falling into catastrophic expenses.

5. CONCLUSION

Ultimately, this article aimed to study the financial risk of Cameroonian households that arises when they make health expenditures, in particular for those qualified as catastrophic, that is to say likely to compromise their well-being or their financial health. To achieve this, an analysis was made first of all on the structure of the health expenditure of these households. Then another analysis was conducted on the incidence of catastrophic health expenditure and impoverishment due to health care payments. Finally an analysis focused on the socio-economic factors or characteristics that explain the catastrophic expenditures and the impoverishment because of these expenditures.

The structure of health expenditure revealed that medicine is the main health service, because it represents almost 60% of the budget allocated to health for a household: this proportion is higher among poor households and lower among wealthy households. The consultation and the hospitalization represent respectively 19.32% and 15.75%: proportions which increase with the level of wealth of a household. The analysis of the incidence of catastrophic health expenditure revealed that 10.33% of Cameroonian households devote at least 10% of their income to payment for health care. This incidence is higher in rural than urban areas and increases with the level of wealth of a household. With regard to poverty, about 1.3% of households in Cameroon fall into poverty due to health care payments: this incidence is also higher in rural areas. Moreover, these households almost all belong to the first expenditure quintile. As for the factors influencing catastrophic health expenditure, it emerges that large families are more likely to meet these expenditures, as well as those headed by a woman, or by a head who does not work, who is more older or less educated or at higher level of spending. Moreover, the determinants of the impoverishment of a household are mainly its level of expenditure, the age and the activity status of its head. In addition, a household whose head is older or who does not work is more likely to become impoverished due to health care payments, and households with higher levels of expenditure are less at risk.

These socioeconomic characteristics of Cameroonian households, which fairly well explain their risk of suffering catastrophic health expenditure or becoming impoverished, should be taken into account in order to target priority households in the implementation of Universal Health Coverage. Indeed, a global coverage of the population could be considered as a utopia with regard to the current situation and all the more so as the question of the financing of this policy remains.

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APPENDIX : Significance, explanatory powers, adjustment, discriminating power and odds ratio of regression models of catastrophic health expenditure and impoverishment

		Model 1 : Catastrophic expenditures		**Model 2 : Impoverishment**	
Overall significance		p_value = 1,930e-13		p_value = 1,049e-21	
McFadden's Pseudo-R2		0,5752		0,6174	
Hosmer–Lemeshow test		p_value = 0,468		p_value = 0,513	
ROC curve		0,818		0,929	
Variables	**Modalities**	**OR**	**Pr(>|z|)**	**OR**	**Pr(>|z|)**
Constant	(Intercept)	0	**0**	0,52	**0**
Survey region (reference: Douala)	Yaounde	/	/	/	/
	Adamawa	/	/	/	/
	Centre	/	/	/	/
	East	/	/	/	/
	Far North	/	/	/	/
	Littoral	/	/	/	/
	North	/	/	/	/
	NorthWest	/	/	/	/
	West	/	/	/	/
	South	/	/	/	/
	SouthWest	/	/	/	/
Place of residence (*reference : urbain*)	Rural	5,35	**0**	/	/
Household type (*reference: single-person household)*	Monoparental	0,69	0,54	/	/
	Extended single-parent strict	4,29	**0,03**	/	/
	Strict nuclear	4,85	**0**	/	/
	Expanded nuclear	1,88	0,25	/	/
	Other expanded	0,36	**0,05**	/	/
Chief gender (*reference: male*)	Female	4,25	**0**	/	/
Age of head of household (*reference: 12-24 years)*	25-39 years	10,79	**0,02**	10,2	0,07
	40-59 years	7,85	**0,05**	17,73	**0,01**
	60 years and +	22,24	**0**	25,47	**0,02**
Level of education of the head of household (*reference: no schooling*)	Primary	/	/	/	/
	Secondary	/	/	/	/
	Superior	/	/	/	/
Activity status of the head of reference (*reference: active occ*)	Unemployed	6,21	**0,03**	38,45	0,29
	Inactive	2,97	**0,02**	12,93	**0,02**
Expenditure quintiles (*reference: Q1/the poorest 20%)*	Q2	1,09	0,88	0,05	**0**
	Q3	3,98	**0,01**	0	0,9
	Q4	3,92	**0,01**	0	0,99
	Q5 (richest 20%)	12,64	**0**	0	**0**

Source: Authors' construction.