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HOUSEHOLD POVERTY AND CHILD HEALTH IN CAMEROON: AN ANALYSIS INTEGRATING SOCIO-ECONOMIC AND GEOGRAPHIC VARIABLES

PAUVRETÉ DES MÉNAGES ET SANTÉ DES ENFANTS AU CAMEROUN: UNE ANALYSE INTÉGRANT LES VARIABLES SOCIO-ÉCONOMIQUES ET GÉOGRAPHIQUES

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Résumé

L'objectif du présent article est de mesurer l'impact de la pauvreté des ménages sur la santé infantile en fonction de la localisation géographique, de la religion et de la position sociale du ménage au Cameroun. Il utilise les données des enquêtes par grappes à indicateurs MICS-5 réalisé en 2014 par le gouvernement Camerounais et mobilise une régression logistique estimée par la Méthode du maximum de vraisemblance ajusté avec le test de Mantel-Hanzel, puis une régression linéaire simple pour mesurer l'effet des conditions de vie des ménages sur la croissance des enfants en les discriminant en fonction des variables socioéconomiques et géographiques. Les résultats obtenus dans les deux approches montrent qu'un niveau de vie faible a un impact négatif sur l'état de santé des enfants au Cameroun, mais aussi, les facteurs culturels tels que la religion et la localisation géographique ont un impact certain sur l'état de santé infantile.

Mots clés : pauvreté ; ménages, santé infantile ; bien-être ;logit multivarié.

JEL: I_1,I_2,I_3,H_{51},H_{52},H_{53},

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Abstract

The objective of this article is to measure the impact of household poverty on child health based on geographic location, religion and social position in Cameroon. It uses data from the MICS-5 in 2014 and mobilizes a logistic regression estimated by the Maximum Likelihood Method adjusted with the Mantel-Hanzel test, then a simple linear regression to measure the effect of household living conditions on the growth of children by discriminating them on the basis of socioeconomic and geographic variables. The results obtained in the two approaches show that a low standard of living has a negative impact on the health status of children in Cameroon, but also cultural factors such as religion and geographical location have a certain impact on infant health.

Keywords: poverty; households, childhealth; well-being; multivariatelogit

JEL: I_1,I_2,I_3,H_{51},H_{52},H_{53},

1. Introduction

The analysis of the impact of household poverty on health in general and child health in particular is central to the empirical work of Health Economics. Indeed, as a major element in the formation of human capital, the contribution of health in strategies for the emergence of developing economies is well known. From this point of view, Cameroon which has set itself the target date of emergence in 2035, must monitor the health status of the various strata of its population, particularly that of child health.

It can be recognized that despite the many development strategies implemented, the child mortality rate in these sub-Saharan African countries still remain high (Dackam, 1990). While there have been serious improvements in most of these countries after independence, the state of child health has become a matter of concern over the past three decades. The United Nations statistics reveal that in most African countries, the infant mortality rate is on average below 100%, whereas the average level of this indicator was over 150% in the 1970s. In Cameroon, the infant and child mortality rate is as high as 74% (DHS, 2004) and as high as 75% (DHS, 2005).

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Knowledge of this state is quite important, but identifying disaster areas according to the intensity of concern for children's health seems even more interesting if we want to implement targeted policies to remedy the situation.

According to Grossman (2000), health is a sustainable capital stock that can deteriorate, be preserved or increased through investments in health care or virtuous behaviors to prevent disease. Individuals are then expected to make more investments using not only medical care and disease prevention techniques but also their own time as an input to the household production function. It is understood that they themselves must make efforts to be able to maintain a better state of health.

Health can then be associated with a state of poverty or well-being of individuals. But while the concept of poverty has long remained dominated by a monetary approach, it has also been the subject of numerous amendments. Today, it is almost universally accepted that poverty results from a lack of access to assets, insufficient or inappropriate economic growth, and poor governance. It is therefore a multidimensional phenomenon, one of the most worrying aspects of which poverty is in general and child poverty in particular (UNDP, 2000). This is associated with food poverty in that the lack of food security makes children and young children particularly vulnerable to epidemics, endemics and other diseases to which they are exposed. However, if there is one thing to note, as in most of the work, the link between household poverty and child health, it is quite vital to identify the pockets, sectors or areas in which this link is most pronounced. Indeed, due to beliefs or social position, the impact of household poverty on child health is more or less marked. This hypothesis means that beyond the negative impact recognized in most works, geographical location, religion and social position may vary this impact.

The objective of this study is to measure the impact of household poverty on child health according to geographic location, religion and social position in Cameroon. It uses data from the MICS-5 realized in 2014 by the Cameroonian government and mobilizes a logistic regression, estimated by the Maximum Likelihood Method adjusted with the Mantel-Hanzel test, followed by a simple linear regression to measure the effect of household living conditions on child growth. The rest of the paper is organized as follows. In Section 2, we briefly present a selective review of empirical

literature on the link between poverty and health in both developed and developing countries. Section 3 presents the methodology for estimating the impact of household poverty on child health. Section 4 presents the empirical results and discussion. And finally, section 5 concludes the paper and makes policy recommendations.

2. The Link between Household Poverty and Child Health: A Review of the empirical literature

The relationship between household poverty and child health seems to have been seriously investigated in the economic literature, although the question of the distribution of this relationship according to socio-economic considerations has not received particular attention.

2.1 Household poverty and child health in developed countries

Most countries in the world recognize that as poverty level rises, children's chances of survival diminish. Studies from the Department for work and pensions, 2015, reveal that between 2013-2014, 3.7 million children lived in poverty. Living in poor households, these children are likely to experience a wide range of adverse health effects and develop chronic diseases in childhood, unlike those living in rich households. A study conducted in Haiti to assess the effect of poor living conditions on child mortality uses general functional forms of a linear maximum likelihood model with multiplicative heteroscedasticity (Beaulière, 2004). The estimation results show that housing and household assets are important determinants of children's health (Beaulière and Flori, 2008). This precariousness in terms of durable goods and housing location leads to an increase of 0.036 points and 0.017 points respectively in child mortality. Poverty expressed in terms of durable goods linked to a household's economic activity has the greatest effect on the infant and child mortality rate. Furthermore, the results indicate that the education of mothers reduces the infant mortality rate by -0.013 points.

In order to identify the variables that most influence the health of Canadian children, Mamodrane (2013) uses Chamberlain's (1980) logit fixed effects model to make the estimates. The results show that being a boy increases the probability of being in poor health by about 2.8%. Boys are in poorer

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health than girls. Similarly, the child's chances of survival are likely to increase by 9% if the child lives with both parents. In fact, parents use their income jointly to provide better health for their offspring. This result is corroborated in the studies ledby Maera, Curie and Moretti (2003). Moreover, the variables that most influence the child's health status are specific to the mother. Indeed, an educated mother positively influences her child's health by about 7%. Similarly, a healthy woman has a 10% influence on her child's health status. The mother's behavior during pregnancy has the greatest influence on the health of her child. However, increasing the real household income simply decreases the fact of being in poor health by 0.5%. It therefore has only a slight impact on the child mortality rate.

2.2 Household poverty and child health in developing countries

Third world countries face enormous difficulties in their health situation. However, these difficulties are the result of many factors, one of which is the level of poverty contained in households. Indeed, the study carried out in 15 countries in Sub-Saharan Africa focuses on the differences observed in urban and rural areas. Using a DHS database for these different countries and the logistic regression method, the author finds that children from poor households are at significantly higher risk of malnutrition than children living in better-off households (Fotso, 2006). According to a study conducted in Central Africa specifically in Cameroon and Congo, the author uses multivariate logistic regression analysis to assess the effect of relative household poverty on under-five mortality. Mboko (2010) uses the EDS-2004 and EDS-2005 bases for the case of Cameroon and Congo respectively and finds first of all that there are more poor people in Congo than in Cameroon. However, the infant mortality rate is higher in Cameroon than in Congo. He finds that the environment of residence has an impact on children's health. In Cameroon, it is the rural area that has the most deaths with 10% in urban areas, while in Congo, the urban area has a high death rate. In Cameroon, household poverty affects child mortality at a rate of 8.6% for the country as a whole. In contrast, in Congo, the impact of poverty on the child mortality rate rose from 11.5% to 22%.

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Similarly, according to a study carried out in Côte d'Ivoire on the determinants of infant mortality, the author uses logistic regression models to make the estimates. For the author, the birth interval plays an important role in child health. Children born less than two years after their predecessors run almost twice the risk of dying, unlike children who benefit from birth spacing. Furthermore, the mother's education level and place of residence do not seem to have a great influence on their health status. In the end, using the DHS (1994) and EIS (2005) bases, the results of logistic regressions reveal that children born in the first row or at a high rank, those with a reproductive interval of less than 2 years, or those whose mothers have not had any prenatal consultations reduce their chances of survival (Esso Lasme, 2013). To address our concern, we will then present the methodology adopted.

3. Methodology

In this framework, we assumed that the child's health demand function depends not only on the child's own characteristics, but also on the standard of living of the household in which he or she lives.The dependent variable used in our analysis is dichotomous in nature. This means that it takes the value yes or no as a respond to our research question. It is the reason while the estimation of our model can be done using logistic regression. Indeed, logistic regression is the appropriate model to use when we are interested in the probability of occurrence of the event we wish to study. Its purpose is to determine which of the different explicative variables strongly influence the occurrence of the event and which hardly influence it at all (Gani Lou, 2002). In addition, it should be noted that the aim of this technique is to measure the relative net impact of an explanatory variable. As such, it allows the estimation of the relative risk of a child being malnourished. It can then be written as follows:

$$\textbf{Health} = \begin{cases} \textbf{1} If the child is well nourished \\ \textbf{0} if not \end{cases} \quad (1)$$

The Logit equation is presented in the form:

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$$\log\left(\frac{P}{1-P}\right) = a + bX(2)$$

Where, a is a constant, p is the probability and b is the coefficient to be estimated.

If P represents the probability that the event studied[1] (growth retardation) will occur; then $(1 - P)$ is the probability of result that this event will not occur (normal nutritional state).

As such, the logistic regression model is as follows:

$$L = \log(\frac{p}{1-P}) \qquad (3)$$

Where, L represents the dependent variable with its linear form which is translated as follows:

$$L = b_0 + b_1X_1 + b_2X_2 + \cdots + b_PX_P \qquad (4)$$

WhereX_1, X_2 , …, $X_P$are the independent variables and, b_0, b_1 ,b_2,…, $b_P$represent the regression coefficients of the model.

After transformation of the dependent variable (4), we obtain a non-linear form of the probability P which is as follows:

$$P = 1/(1 + \exp(-L)) \qquad (5)$$

Therefore, this equation then estimates the probability that the child will not suffer from any growth retardation.

The significance of the coefficients of the parameters to be estimated are interpreted in this framework according to their sign, and are then processed to give the odds ratios (Tinkew and Dejang, 2005). This demonstrates the effects of independent variables on the probability that a child will be well nourished or malnourished. Therefore, according to An (2002) and Cassell (2006), it is important to take into account a complex survey such as MICS in the analysis of the data. This is because it makes it possible to estimate precise standard errors taking into account the framework in which the sample was established, in particular using clusters, stratification, etc.

[1] That is, an abnormal nutritional state.

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The model is written as follow:

$$Health = b_0 + b_1 Povertylevel + b_2 placeofresidence + b_3 sex + b_4 religion + b_5 mothereducation + b_6 ageofthechild + \varepsilon_i (7)$$

The estimation of parameters by a logistic regression is often done by the maximum likelihood method. Due to the non-linearity of the model, these parameters are estimated by iteration. So it's essentially a probabilistic method. As such, it provides "bi" regression coefficients from which relative risks are calculated. However, before proceeding to the estimation of the parameters themselves through the odds ratio (OR) adjusted with the Mantel-Hanzel test, it is first necessary to apply the Pearson Chi-square test.

Two types of variables are retained in our study. The dependent variable, which is the health status of children under the age of five. In children, it is presented as a multidimensional phenomenon, which makes it difficult to capture it as a single indicator. However, it is not easy to reconcile these different measures to find a synthetic index for specific reasons including the nature of the data and the heterogeneity of living conditions. The poverty level of households in terms of household standard of living is captured here as the variable of interest and is one of the most significant variables in the child health function (Behrman and Wolfe, 1982; Strauss, Thomas and Henriques, 1991; Pal, 1999). It determines to some extent the quantity of other inputs in the household, such as food quality, housing, clothing, health care, etc.

In addition, the relationship between children's health captured by nutritional status (height for age) or children's immunization with income levels due to poverty has been the subject of much work that has led to mixed results (Gibson, 2000). Because of the lack of information[2] on household income and consumption expenditure, we use a wealth index as a proxy for long-term household income (Gwatkin et al, 2000; Filmer and Pritchett, 2001). This economic well-being

[2]Questionnaire on household expenditure and income during MICS surveys.

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index is constructed using data on housing characteristics and household possessions[3] and then broken down into five socio-economic classes according to the assets owned by the household. It is presented as follows: the poorest, the poor, the medium, the rich and the richest, corresponding respectively to the first, second, third, fourth and fifth quintile.

To characterize children's health status, a variable usually used in previous anthropometric data work is the height and weight of children (Behrman and Deolikar, 1988; Gibson, 2000; Strauss and Thomas, 1995). In fact, these data are simple, accurate and have been the subject of a consensus to estimate child malnutrition. They are therefore considered as objective indicators of health (Waterlow et al, 1997). As such, it is recognized that malnutrition is the underlying cause of death for one-third of children under five each year (Gross, 2004). In addition, the data obtained on these malnutrition indicators are specific to each individual and provide us with the opportunity to identify differences between households. These differences can be observed in the level of poverty in households. Indeed, poverty increases children's malnutrition by reducing their access to food and increasing their exposure to disease (Marini and Gragnolati, 2003). Based on the fact that malnutrition is fundamentally perceived as a phenomenon that is difficult to conceptualize, there are several anthropometric indicators in this regard.

The following table defines the main variables used in the model and their sources.

[3]The aggregation methodology is based on the non-linear Main Component Analysis approach taking into account the presence/non-precariousness or absence/precariousness of assets in the household (Ambapour, 2006).

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Table 1: Definition of the variables used for the model		
Variables	Definitions	source
Socio-economic level or poverty level	It measures the level of household well-being. Here, it is measured by the wealth index. The modalities are: the poorest, the poor, the means, the rich and the richest.	Grira, 2007
Mother'sleveleducation	This is the level of education achieved by the mother in the formal schooling system and is likely to affect the child's health behavior. We have the following modalities: no education, primary, secondary and higher	MICS 2014
Age of the child	It is an important determinant of individual growth. The nutritional status of children in developing countries is continuously deteriorating as age increases.	Horton, 1988
Gender of the Child	It helps to explain differences in parental behavior and family outcomes. Here, we have twomodalities: boys and girls	Lefebvre, 2006
Religion of household head	It is the set of practices and rituals specific to each belief. (Akoto, 1995). We find here Christians, Muslims and others.	Akoto, 1995 ; MICS 2014
Place of residence	Rural or urban areas are variables that can be taken into account when assessing children's health status.	MICS 2014

Source : *Author*

3. Data and Sample

The data used in this study are from the third phase of the Multiple Indicator Cluster Survey (MICS-5), conducted in 2014 by the Cameroonian government. MICS-5 is a national statistical operation as part of a regional program of surveys conducted in several African countries. The survey focuses on household living conditions, chronic diseases, child health and nutrition, child development, education and protection, marriage, fertility, family planning, violence against women, etc. The econometric analysis of the influence of poverty level on children's health status has been the subject of many methods. However, to analyze the effect that household living standards can have on child health in Cameroon, we use the maximum likelihood method. We also have only one model to estimate relating the health status of individuals to the poverty level of the household in which they live. We begin with a descriptive analysis and then present the results of the estimation.

3.1 Descriptive analysis

It is intended to highlight some statistics on variables of access to nutrition for children under five in Cameroon during the survey period. The tables below present descriptive statistics of all our variables for better access to nutrition. This provides a clear picture of the average percentage of children under five years of age who had access to nutrition during this period. To do this, we begin by presenting in the table below the socio-demographic characteristics of the sample.

Table 2: Sociodemographic characteristics of the sample

Variables	Observations	Proportions (in %)
Povertylevel		
Verypoor	1 434	19.67
Poor	1 639	22.47
Average	1 630	22.35
Rich	1 429	19.59
Veryrich	1 159	15.89
Mother'slevel of education		
Sans niveau	1 844	25.29
Primary	3 058	41.94
Secondary	2 123	29.11

Higher	266	3.64
Religion		
Others	2 984	40.92
Musulmans	1 735	23.79
Christians	2 572	35.27
Place of residence		
Rural	3 948	54.14
Urban	3 343	45.86
Gender of the Child		
Feminine	3 710	50.88
Masculin	3 581	49.12
Source: Author, calculated from MICS database data (2014).		

The following observations emerge from this table: poor and middle households are the most dominant in our sample. However, the percentage distribution of modalities by poverty level is not far from each other. Similarly, the distribution of the sample by level of education reveals that mothers with a primary level of education are the most prevalent. On the other hand, mothers with higher education levels represent only about 3.60% in our analysis. It is also noted that households living in rural areas (54.14%) are the most prevalent than in urban areas (45.86%). Better nutrition in early childhood is a key determinant of children's health, well-being and development throughout their lives. In addition, infants must be exclusively breastfed for the first six months of life for good growth, development and health. After six months, in order to meet their changing nutritional needs, safe and nutritionally appropriate complementary foods will be added to their nutrition, while continuing to breastfeed them for up to two years or more. In the following, we present descriptive statistics on all the variables selected.

3.1.1 Descriptive analysis of the study variables

The table below presents the descriptive statistics of the variables selected for our study.

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Table n°3: Results of descriptive statistics of the study variables

	N	mean	Standard deviation	Min	Max
Nutrition	7 291	0.5638458	0.495941	0	1
HAZ (taille pour âge)	7 291	-0.5039761	2.819053	-9.91	9.99
Age of the child	7 291				
0 to 6 months	3 431	0.4705802	0.0058459	0	1
6 to 12 months	1 806	0.2477026	0.0050559	0	1
13 to 18 months	1134	0.1555342	0.0042446	0	1
19 to 24 months	631	0.0865451	0.0032931	0	1
25 to 30 months	261	0.0357976	0.0021759	0	1
31 to36 months	28	0.0038404	0.0007244	0	1
Standard of living	**7 291**	**1.895762**	**1.353793**	**0**	**4**
Verypoor	1 434	0.1966808	0.0046554	0	1
Poor	1 639	0.2247977	0.0048892	0	1
Average	1 630	0.2235633	0.0048797	0	1
Rich	1 429	0.1959951	0.0046493	0	1
Veryrich	1 159	0.1589631	0.0042824	0	1
Religion	**7 291**	**0.943492**	**0.8711753**	**0**	**2**
Others	2 984	0.4092717	0.0057589	0	1
Muslims	1 735	0.2379646	0.0049875	0	1
Christians	2 572	0.3527637	0.0055964	0	1
Gender of child					
Feminin	3 710	0.5088465	0.0058552	0	1
Masculin	3 581	0.4911535	0.0058552		
Level of education	**7 291**			**0**	**3**

No level	1 844	0.2529146	0.0050911	0	1
Primary	3 058	0.4194212	0.0057795	0	1
Secondary	2 123	0.2911809	0.0053209	0	1
tertairy	2 66	0.0364833	0.0021959	0	1
Place of residence	**7 291**	**0.4585105**	**0.4983098**	**0**	**1**
Rural	3 948	0.5414895	0.0058359	0	1
Urban	3 343	0.4585105	0.0058359	0	1

Source: Author's calculation based on MICS data (2014)

Our analyses show that, on average, 56.38% of households had access to nutrition. Although this percentage is above the average, it is clear that this is still not enough. There are 47.05% of children aged 0 to 6 months, 24.77% aged 7 to 12 months, 15.55% aged 13 to 18 months and the rest of the population from 19 to 36 months. In addition, 25.29% of mothers have no level of education, 41.94% have a primary level of education, 29.11% have a secondary level of education and the rest of mothers have a higher level of education (3.64%). The poorest individuals (22.47%) and the mean (22.35%) are the most numerous. They are followed by the poorest (19.66%), the rich (19.59%) and the richest (15.89%). This brings us to an average percentage of 57.85% in favor of the non-poor. However, people living in rural areas (54.14%) are more prevalent than those living in urban areas (45.85%). To reinforce our results, we also presented the table that shows the statistics from the contingency tables.

3.2 Statistical results of the contingency tables

The table below shows the statistics of the contingency analysis for child nutrition.

Table 4: Descriptive statistics of contingency analysis for child nutrition

Variables	Has been well fed	Has not been well fed
Nutrition	4111 (56.38)	3180 (43.62)
Poverty level		
Poor	2 588(35.50)	2 115(29.01)

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Not poor	1 523(20.89)	1 065(14.61)
Niveau de pauvreté		
Verypoor	670(9.19)	764(10.48)
Poor	954(13.08)	685(9.40)
Average	964(13.22)	666(9.13)
Rich	850(11.66)	579(7.94)
Very rich	673(9.23)	486(6.67)
Place of residence		
Rural	2 230(30.59)	1 718(23.56)
Urban	1 881(25.80)	1 462(20.05)
Gender		
Feminine	2 142 (29.38)	1 568 (21.51)
Masculine	1 969 (27.01)	1 612 (22.11)
Religion		
Others	1 691 (23.19)	1293(17.73)
Muslims	959 (13.15)	776(10.64)
Christians	1 461 (20.04)	1111(15.24)
Mother's level of education		
No level	954(13.08)	890(12.21)
Primary	1 745(23.93)	1 313(18.01)
Secondary	1 253(17.19)	870(11.93)
Higher	159(2.18)	107(1.47)
Age of child		
[0-6 [	1 945 (26.68)	1 486 (20.38)
[7-12 [	1 025 (14.06)	781(10.71)
[13-18 [	631 (8.65)	503(6.90)

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[19-24 [	353 (4.84)	278(3.81)
[25-30 [	142 (1.95	119(1.63)
[31-36 [	15 (0.21)	13(0.18)

Source: *Author, calculated from MICS database data (2014).*

Children health care measure is a major problem in developing countries and precisely in countries where birth and death registration is not sufficiently complete (Graham, Stanton et al, 2008). Indeed, not that only some deaths are not recorded, but the cause of these deaths remains unknown (Inoue et al, 2005). For example, it is estimated that 56.38% of children were well fed compared to 43.62% who did not have good nutrition. Of these children who have been well fed, 9.19% are very poor, 13.08% are poor, 13.22% are medium, 11.66% are rich and 9.23% belong to the richest class. As a result, it is observed that the best-nourished children belong to the middle-income and poor population. This can make sense because children from poor families benefit from breast milk because they do not have enough means to obtain others for their children's nutrition. Similarly, children living in rural areas are 30.59% better nourished than those living in urban areas (25.80%); mothers with primary and secondary education level have 23.93% and 17.19% of well-nourished children respectively. In addition, those at a higher level and those without a level have lower percentages. That is 13.08% and 2.18%. In addition, it is observed that good nutrition of children decreases as the child's age increases. Indeed, children aged 0 to 6 months (26.68%) and those aged 7 to 12 months (14.06%) are above 10%. The remainder represents the portion below 10%. Explicitly, we have 8.65% for children aged 13 to 18 months. Also, children aged 25 to 30 months and those aged 30 to 36 months are 1.95% and 0.21% respectively. To better understand the degree of linkage between children's nutritional status and child health indicators in Cameroon, we used the independence test (table in appendix 2). The results reveal that poverty level, maternal education level and child gender are linked to children's nutritional status.

4. Results and discussion

Results here are presented in two stages. First of all, the general results obtained from the estimation of the impact of household poverty on health, then specific results of impact estimation in function of different socioeconomic and geographical variables.

4.1 The general results of household poverty impact on child health

Results are summarized in two phases. The effect of poverty level on child health on one hand and the effect of poverty on children growth on the other hand.

4.1.1 The effect of poverty level on child health

Before commenting econometric results, we present the following table

Table 5: Effect of poverty level on child nutrition

Variables	Coefficients
Poverty level	
Not poor	0.1916841 (2.75) ***
Gender	
masculine	-0.1104305 (-2.33) **
Religion	
Muslims	0.0649102 (0.98)
Christians	-0.0246351 (-0.45)
Place of residence	
Urban	-0.2175757 (-3.44) ***
Mother's level of education	
Primary	0.246032 (3.81) ***
Secondary	0.3320967 (4.11) ***

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Higher	0.3611382 (3.61) **	
Age of child		
7 to 12 months	0.0025711 (0.04)	
13 to 18 months	-0.0397519 (-0.57)	
19 to 24 months	-0.0302578 (-0.34)	
25 to 30 months	-0.0733122 (-0. 57)	
31 to 36 months	-0.1341085 (-0.36)	
Constant 1.152702 (1.77) **		
Some Statistics		
Log pseudo likelihood	-4790.0202	
Wald chi2(17)	51.38	
Pseudo R2	0.0054	

Source: *Author. calculations based on data from the MICS database (2014). In brackets. the t's of Student*

*Notes: *** (p<0.01) significance at 1%. ** (p<0.05) significance at 5%. *(p<0.1) significance at 10%.*

The results obtained through the estimation reveal that poverty has a negative effect on child health in Cameroon. Thus, 35.49% of non-poor individuals increase their chances of being healthy by 19.16% unlike children in poor families. Indeed, this result is confirmed in many studies carried out in developing countries. According to Cissé et al (2004), the poor are those with the lowest ability to pay for access to health inputs. Moreover, when we break down the wealth index, there is no impact on children's health at any level of poverty.

In addition, individuals in the household tend to take more care of their offspring when it is a female child. This is justified by the fact that being a boy reduces the chance of being healthy by 11.04%. The same applies to people living in urban areas. Children living in urban areas have a

21.75% lower chance of being healthy. This result is contrary to the one found by Esso Lasme (2013) when he admits that the level of poverty has no influence other than the health status of children.

As found in many studies, the level of education and mainly that of the mother influences the nutritional status of children (Flori and Beaulière, 2008). The estimated model shows that the more the level of education changes, the more mothers tend to increase their children's chances of survival. To this end, primary school mothers increase their children's chances of survival by 24.6%, secondary school mothers increase by 33.20% and higher education mothers increase by 36.11%. Educated women are more likely to use health care services and to understand the benefits of medical follow-up during pregnancy (Sanou, 2001). It then admits that women's literacy leads to a good state of child health and thus to a reduction in infant mortality.

Although poverty level has an effect on the nutritional status of children; this indicator hides the effect of other variables. The latter being directly related to the woman and children. This leads us to perform regression to assess the effect of poverty level on the child's height for age.

4.1.2 The effect of poverty level on child growth

While acute and chronic malnutrition defined by wasting and stunting respectively are indicators of poor child health status (WHO, 2005), the objective of our analysis focuses on the effect of household poverty level on the height-for-age (HFA) of children in Cameroon.

Table 6: Effect of poverty level on child growth

	Coefficients
Variables	**HAZ (Height-size)**
Standard of living	
Not poor	0,3177163(3,37) ***
Religion	

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Muslim	-0,1660511 (-1,80) **
Christians	0,242716 (3,18) ***
Gender of the child	
Masculine	0,065932(3,30) ***
Place of residence	
Urban	0.3238461 (3.85) ***
Mother's level of education	
Primary	0.3754634 (4.11) ***
Secondary	0.4766404 (4.00) ***
Higher	1.141309 (5.60) ***
Age of child	
7 to 12 months	0.0771792 (0.95)
13 to 18 months	-0.0799038 (-0.83)
19 to 24 months	-0.1370368 (-1.12)
25 to 30 months	-0.207963 (-1.14)
31 to 36 months	-0.1601224 (-0.30)
Constant	
-1.333459 (-13.56) ***	

Few Statistics		
Number of observations	7 291	
R2	0.0346	
Adjusted R^2	0.0329	

Source: *Author, calculation based on data from the MICS database (2014). In brackets, the t's of Student*

*Notes : *** (p<0.01) significance at 1%, ** (p<0.05) significance at 5%, *(p<0.1) significance at 10%*

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The results reported in our table indicate the importance of poverty level on child growth as well as on nutritional status. This growth is measured here by pruning for age. The results obtained reveal that non-poor people are likely to increase their children's chance of good growth by 31.77% compared to children living in poor households. This shows a high rate of well-nourished children in non-poor families. The report by Doak et al (2005) conducted in seven countries with different income levels affirms this result. He acknowledges that household poverty is associated with cumulative overweight and height-for-age abnormalities among mothers and children respectively. Belonging to the Muslim religion reduces the chances of good growth by 16.60% compared to those without religion. A slightly different result is observed among male children. Being a boy takes us 6.59% away from stunted growth. On the other hand, the Christian religion increases by 24.27% the chances that children will not suffer from stunting. The same applies to living in urban areas. As such, children living in urban areas decrease by about one third (1⁄3) that is 32.38% their probability of suffering from stunting.

The mother's level of education has a significant impact on the child's healthy growth. Children of mothers with a level of primary education or higher increase their chances of achieving better growth by at least one-third (1/3) than children whose mothers have no education at all. It is therefore concluded that the level of poverty and the level of education seem to be the two indicators likely to influence the infant mortality rate (Mosley and Chen, 1984; Chou et al, 2007).

The level of poverty in Cameroon is still high among the population. This poverty affects more than half of the population and is the cause of many ills such as low levels of education and poor health among women and children.

4.2 Specific results of socioeconomic and geographic variables

With regard to the specific results to the socio-cultural and geographical variables, three levels of fact can be distinguished, which are represented in the three tables below:

Table n°7: Results of the descriptive statistics of variables

	N	Mean	Standard deviations	Min	Max
Religion	**7 291**	**0.943492**	**0.8711753**	**0**	**2**
Others	2 984	0.4092717	0.0057589	0	1
Muslims	1 735	0.2379646	0.0049875	0	1
Christians	2 572	0.3527637	0.0055964	0	1
Place of residence	**7 291**	**0.4585105**	**0.4983098**	**0**	**1**
Rural	3 948	0.5414895	0.0058359	0	1
Urban	3 343	0.4585105	0.0058359	0	1

Source: Author's calculation based on MICS (2014) data.

These tables show that geographical factors, combined with religious affiliation, influence living conditions as well as other factors. The study shows that on average 40% of households do not belong to any religion, while 35.27% are Christian and 23.79% Muslim. It is also noted that households living in rural areas (54.14%) are more preponderant than in urban areas (45.86%). These proportions determine the level of poverty in children's diet.

Table 8: Effect of poverty level on child nutrition

Variables	Coefficients	
Religion		
Muslim	0.0649102 (0.98)	
Christian	-0.0246351 (-0.45)	
Place of residence		
Urban	-0.2175757 (-3.44) ***	
Some Statistics		
Pseudolikelihood Log	-4790.0202	

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Wald chi2(17)	51.38	
Pseudo R2	0.0054	

Source: Author, calculation from database data *MICS(2014)*. In brackets, Student's t'

*Notes: *** (p<0.01) significance at 1%, ** (p<0.05) significance at 5%, *(p<0.1) significance at 10%.*

Beyond the standard of living of households, place of residence has a significant negative impact in urban areas, unlike a household living in rural areas. This can be understood by the fact that in the city, everything is paid for, and the fact that one is poor will only make the situation worse and children's growth will come at a cost.

Table 9: Effect of poverty level on child growth

Variables	**Coefficients**
	HAZ (Size for age)
Religion	
Muslims	-0.1660511 (-1.80) **
Christian	0.242716 (3.18) ***
Place of residence	
Urban	0.3238461 (3.85) ***
Some statistics	
Number of observations	7 291
R^2	0.0346
Adjusted R^2	0.0329

Source: Author's calculation based on MICS(2014) data. In brackets students' t

*Notes: *** (p<0.01) significance at 1%, ** (p<0.05) significance at 5%, *(p<0.1) significance at 10%.*

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The results recorded in the table above still indicate the importance of the level of poverty on the growth of the child as well as on his or her nutritional status. This growth is measured here by height-for-age. The results show that belonging to the Muslim religion reduces the chances of good growth by 16.60%, unlike those who have no religion. The same is true for living in urban areas. As such, children living in urban areas decrease by about 1⁄3 that is 32.38%, of their probability of suffering from stunted growth.

5. Conclusion and economic policy recommendations

At the end of this analysis, the estimation technique used, it emerges from the various results obtained that the poor living conditions of households have a negative effect on the growth of children and, therefore, on their state of health.

In addition, maternal education is a very effective way to improve the health status of children in Cameroon. However, we face a number of human, economic and administrative limitations. On the human and economic level, it may be difficult to get the basic rule of access to health care for all accepted because households are already struggling to feed themselves. How many times is it a matter of going to health centers to prevent the health status of their offspring? In fact, this problem is very acute because there is a high inequality of assets and income in Cameroon. Administratively, health services must increasingly exist because they are a motivating factor for people living in rural areas. Explicitly, health infrastructures, human resources and other necessary components of health services such as medicines or free consultations must be able to produce appropriate health services in order to motivate individuals increasingly to prevent epidemics and therefore diseases.

The study identifies a number of economic policy recommendations: The extent of poverty by gender, place of residence and child health indicates that this scourge increases as time fades and causes widespread damage. Cameroon's prospects as stated by the Sustainable Development Goals

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(SDGs) through the various national programmes show that the State is the central element for poverty reduction and an improvement in the health status of individuals. The poverty reduction initiative requires national policies in rural areas. Indeed, the strengthening of road infrastructure, rapid access to health and educational facilities and easy access to drinking water would be important elements that would create economic activity and improve the health status of children. These initiatives are most relevant to the problems of households living in rural areas. In addition, given the glaring gender inequality in Cameroon, the government must encourage its process of encouraging women's initiatives. Given that women have an important socio-economic consideration within the family in particular and society in general, policies to combat household poverty could take this particular target into account. For example, the State could focus on its access to credit and access to new technologies for the implementation of successful projects. However, the improvement in the economic status of women has a direct impact on the nutritional status of children and consequently on the decline in the infant mortality rate. To this end, even if the State does not directly undertake productive activities that can improve children's health, it must at least promote them. The involvement of the State in several dimensions of poverty would not only give a higher dimension to the effort to combat multidimensional poverty, but could also improve the nutritional status of children and thus their health status.

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Appendixes

Appendix 1: Summary table of all variables in the study

Table n°1: Summary table of all variables of the study	
Nutrition	1 if the child has been well fed, 0 if not
HAZ	Size for age of child (continuous)
Poverty level	1 if the well-fed child is not poor, 0 if not
Gender of child	1 if the well-fed child is a boy, 0 if not
Mother'slevel of education	
- No level	1 if the mothers have no level of education, 0 if not
- Primary	1 if mothers have a primary education, 0 if not
- Secondary	1 if mothers have a secondary level of education, 0 if not
- Higher	**1** si les mères ont un niveau d'éducation supérieur, **0** sinon
Religion	
- Christians	1 if children in Christian households are well nourished, 0 if not
- Muslims	1 if children in Muslim households are well nourished, 0 if not

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- Others	1 if children in households of other religions are well nourished, 0 if not
Place of residence	1 if the well-fed child lives in an urban environment, 0 if not
Age of child	Age of the child (continuous). It varies from 0 to 36 months

Source : Author

Appendix 2: Results of the independence test between the variables of the study

Table n°2: Results of the independence test between the variables of the study

	nutrition	No	Yes	Chi2
Place of residence	**Rural**	1 718	2 230	0.0348*
	urban	1 462	1 881	
Gender of child	**Feminine**	1 568	2 142	5.6084**
	Masculine	1 612	1 969	
Religion	**Others**	1 293	1,691	1.1526*
	Muslims	776	959	
	Christians	1 111	1 461	
Niveau d'instruction de la mère	**No level**	890	954	24.0207***
	Primary	1 313	1 745	
	Secondary	870	1 253	
	Higher	107	159	
Poverty level	**Very poor**	764	670	68.5947***
	poor	685	954	
	Average	666	964	
	Rich	579	850	

	Very rich	486	673	
Age of child	**0 to 6 months**	1 486	1 945	1.0389*
	7 to 12 months	781	1 025	
	13 to 18 months	503	631	
	19 to 24 months	278	353	
	25 to 30 months	119	142	
	31 to 36 months	13	15	

Source: Author, calculation based on data from the MICS database (2014). In brackets, the t's of Student

Appendix 3: The calculation methods of the different nutritional indices

The objective of our work is to estimate the effects of household poverty on the health status of children. To do this, we focus on the long-term indicator of child height for age (HAZ) instead of other anthropometric indicators because it better captures the long-term impact of past events on the health of individuals (ORC Macro, 2003). Our choice is justified with Delpeuch (1991) because for him, the size for age is the best marker of risks associated with the environment and in general with the socio-economic development of a population. Similarly, Maire (1991) states that the form of malnutrition reported by this index is the most frequent and presents serious risks of morbidity and mortality particularly in developing countries.

The Z score for age is calculated from the expression: $HAZ_i = \frac{h_{ij} - \bar{h}_j}{\sigma_j}$(8)

Where h_{ij} represents the size of child i in group j, the group is defined by sex and age (usually in terms of months) of the child. $\bar{h}_j$ and σ_j represent the median and the deviation standard for group j respectively. In most cases, a child situated at two standard deviations below the median or less than 90% of the median is considered chronically malnourished (HAZ < $-2\sigma_j$). Malnutrition is severe (severe chronic malnutrition) if the calculated value is less than minus 3 standard deviations, median size for age (HAZ < $-3\sigma_j$) in the reference population.

However, we can also capture access to nutrition by the fact that the child was breastfeeding, receiving any liquid or solid food. The measurement of the "nutrition" channel can be done in two ways: considering on the one hand that currently "the child is doing well" because living in a well-off household and on the other hand "the child is doing badly" because living in a poor household

Table 3: Some child health indicators

Variables	Definitions and measures
HAZ (Chronic malnutrition)	Height for age

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WAZ (Acute malnutrition)	Weight for age
WHZ (low weight)	Weight for height
Breastfeeding	1 if the child has been breastfed, 0 if not
Emaciation	1 if the child suffers from wasting; 0 if not
Yellow fever	1 if the child has yellow fever; 0 if not
Cough	1 if the child suffers from coughing; 0 if not
Diarrhea	1 if the child suffers from Diarrhea; 0 if not

Source : From literature