The influence of mother's education and households' wealth on the use of prenatal health services in Cameroon

L'influence de l'éducation de la mère et du niveau de richesse du ménage sur l'utilisation des services de santé prénatale au Cameroun

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Abstract: This paper investigates the role of mother's education and wealth index on antenatal healthcare use - appealing to the 2004, 2011 and 2018 Cameroon Demographic and Health Surveys. Results show that maternal education at both individual and neighborhood levels increase the likelihood of participating in prenatal healthcare. Specifically, mothers with primary education are more inclined to choose nursing-aiders, while those with secondary level of education are more likely to choose a midwife or a doctor relative to their counterparts with no education. Socio-economic status also significantly influences the mother's participation in antenatal care and the choice of an antenatal health professional. The households' standard of living does not allow the mother, regardless of her level of education, to use a doctor for her prenatal care. These findings suggest that public interventions that improve the education of the girl child, and

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access to health services and potable water would promote prenatal healthcare participation and choice of qualified healthcare providers among pregnant women. It would be important to really implement health policies offering financial support to pregnant women throughout the country.

Keywords: mother's education, antenatal healthcare, wealth index, Heckman two-step approach, Cameroon.

Résumé : *Cet article analyse le rôle de l'éducation de la mère et de l'indice de richesse du ménage sur l'utilisation des services de santé prénatale en utilisant les Enquêtes Démographiques et de Santé du Cameroun de 2004, 2011 et 2018. Les résultats montrent que l'éducation de la mère, tant au niveau individuel que de la communauté, augmente la probabilité de participer aux soins de santé prénataux. De manière spécifique, les mères ayant un niveau d'éducation primaire sont plus enclines à choisir des aides-soignantes, tandis que celles ayant un niveau d'éducation secondaire sont plus susceptibles de choisir une sage-femme ou un médecin par rapport à celles qui n'ont aucun niveau d'éducation. Le statut socio-économique influence également de manière significative la participation de la mère aux soins prénataux et le choix d'un professionnel de santé prénatale. Le niveau de vie du ménage ne permet pas à la mère quel que soit son niveau d'éducation, de recourir au médecin pour ses soins prénataux. Les interventions publiques devraient être en faveur de l'éducation des filles et l'accès aux services de santé et à l'eau potable ; ceci favoriserait la participation aux soins prénataux et le choix de prestataires de soins qualifiés chez les femmes enceintes. Il serait important de vraiment exécuter des politiques des santé offrant des soutiens financiers aux femmes enceintes sur toute l'étendue du territoire national.*

Mots clés : *éducation de la mère, soins prénataux, indice de richesse, approche de Heckman en deux étapes, Cameroun.*

JEL Code: *I12 ; I26 ; O10 ; O53 ; I10 ; C25.*

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1. INTRODUCTION

Prenatal care has always been an important topic on the public health agenda of any country. The outcome of a pregnancy is most often related to the sum of the quantity and quality of care a pregnant woman receives during her pregnancy (Goel, 2015). Despite the progress made in expanding the global coverage of basic primary healthcare services to women internationally, pregnancy and childbirth remain a high-risk period for both mother and child, especially in developing countries. Indeed, one of the key goals of worldwide development policy is to reduce maternal and early childhood morbidity and mortality. It's the third goal in the United Nations Sustainable Development Goals (United Nations, 2017).

Antenatal care is a key component of basic primary healthcare during pregnancy and provides a package of services that can prevent, identify and early treat pregnancy risk factors. Several infections detectable during prenatal healthcare utilization pose a non-negligible risk to the mother and child. Typical among such infections are malaria, tuberculosis, syphilis, tetanus or HIV/AIDS, as well as hypertension, diabetes and other pre-existing health conditions that complicate pregnancy. In addition, antenatal care programs also provide care and information that is not directly related to pregnancy, but may reduce maternal risk factors by promoting healthy lifestyles, combating malnutrition, and mitigating gender-based violence. In this context, as reiterated by Kuhnt and Vollmer (2017), antenatal care utilization is a potentially important process in reducing maternal and infant morbidity and mortality.

Better use of antenatal care services is achievable by focusing on factors such as mother's education – including health education and knowledge generally and the socio-economic status of the household. The

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survival and well-being of a pregnant woman depends on several larger socio-economic factors. According to the United Nations (2015), these factors include economic conditions, education, culture, religion among others. This article focuses on the mother's level of education and economic conditions, so the causal link has not been studied widely enough in Cameroon.

Maternal education appears to be an important predictor of prenatal healthcare consumption behaviour. Several studies report that education is the most important factor explaining differences in the mother's behaviour in caring for her health and that of her child (Caldwell, 1979; Cleland and Van Ginneken, 1988; Chakrabarti and Chaudhuri, 2007). Education conveys skills and competencies that are key to human development. According to the World Bank (2002), each year of additional schooling helps prevent possible maternal deaths. Investment in the education of girls/women would likely produce outstanding economic and social returns. Such investments empower women to be able to make independent and informed decisions that affect their own health. Thus, they are more able to detach themselves from traditional practices and use modern means to safeguard their health and that of their offspring (Cleland, 1990).

The level of education of the mother has a significant effect on the use of maternal healthcare services (Bbaale and Guloba, 2011; Elo, 1992). In this regard, education improves the empowerment of women and helps them to develop greater confidence and ability to make decisions about their own well-being (Raghupathy, 1996). It is also expected that educated women will seek better quality services and have greater ability to use healthcare inputs to produce better care. The mother's education, therefore, influences her healthcare seeking behaviour. As

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reported by Rahman et al. (2008), education provides women with knowledge about the long-term effects of poor health *in utero* and improves their awareness of the demand for and use of prenatal healthcare services.

The socio-economic status of the household is also an important determinant of the use of maternal health care services (Arthur, 2012). Socio-economic status at the individual level has been associated with maternal care coverage in developed (Kim et al, 2018) and developing countries (Makate and Makate, 2017). It is expected to have a positive relationship with antenatal care since health service utilization is associated with the cost of consultation and purchase of recommended drugs as well as other indirect costs such as transportation costs (Arthur, 2012). Thus, it is expected that the wealthier the woman is, the more likely she is to be able to use antenatal care services because she may be able to afford the cost and other expenses associated with the use of health services (Arthur, 2012).

As health care costs continue to rise, particularly from the perspective of social financing of health, economic constraints are increasingly cited as a prohibitive factor for the use of health care services (Goel et al, 2015). Individuals with higher socio-economic status, including greater wealth and education, are generally considered to have better access to maternal health services in developing countries (Kim et al, 2018; Pathak et al., 2010). Educational attainment is an important social determinant of maternal health service use. As one of the key indicators of socio-economic status, it is known to have a positive impact on health service utilisation (Bbaale and Guloba, 2011).

Three reasons justify the relevance of this paper. Firstly, the therapeutic route of the pregnant woman has not been adequately addressed. Existing studies

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that attempt to explain the utilization of prenatal healthcare services in Cameroon are limited in that they consider modern healthcare providers as a homogeneous group (Anya and Yene, 2016; Rwengue and Ngueumaleu, 2011; Kamgnia, 2006).This study analyze the choice of health professionals as an important aspect in the process of prenatal care. The World Health Organization (WHO) recognizes the doctor, the midwife or nurse and the assistant aider as qualified health professionals. Among these three trained professionals, the capacity to manage pregnancy-related risks is not similar in terms of the length and content of their training.

Then, the factors that drive the decision of a pregnant woman to consult a doctor for example may not necessarily be the same as that of consulting a midwife or a nurse. In addition, there is a cost to be paid for consultations with these health professionals, and this cost differs depending on the choice made. This choice may be a function of the education of the pregnant woman and the level of wealth of the household to which she belongs. Moreover, since health services can exist without qualified health professionals, this study goes beyond that of Anya and Yene (2016) to investigate potential heterogeneities when pregnant women choose among qualified prenatal heathcare providers. In this context, we specifically profile the role of mother's education at both individual and community levels in the choice of prenatal healthcare professionals.

Finally, studies have so far focused on maternal immunization (Mwabu, 2009, Tambi, 2015) and the number of antenatal visits (Jayaraman et al., 2008; Greenaway et al 2012) as a measure of prenatal care. il n'existe presue pas d'études auyant mesuré les soins prénataux par le type de professionnels de santé

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The rest of the paper is organized as follows. Section 2 focuses on overview of maternal and child health policy in Cameroon. Section 3 presents methodology and data. The empirical results, the conclusion and policy guidelines are summarized in section 4 and section 5 respectively.

2. OVERVIEW OF MATERNAL AND CHILD HEALTH POLICY IN CAMEROON

In order to reduce the maternal and infant mortality rate in Cameroon, the government of Cameroon, since 1970, has adopted several maternal health policies and programs through the Ministry of Public Health and other international organizations. Discussions by policymakers and development partners are indicative of the observation that even though the health of the mother has received abundant attention, efforts still need to be made to improve such outcomes. In Cameroon, the maternal mortality rate increased from 430‰ (between 1991 and 1998) to 669‰ (in 2004), and from 690‰ (in 2010) to 782‰ (2011) and to 467‰ (2018); which is far from the global and national targets estimated at 108‰ and 350‰, respectively.

To improve the health of mothers, several measures have been taken such as: subsidizing several components of prenatal consultation like HIV testing, antiretroviral medication, tetanus vaccination, vitamin A supplementation, intermittent preventive treatment of malaria, insecticide-treated mosquito nets, strengthening the provision of emergency obstetric and neonatal care including caesarean section kits (MINSANTÉ[3], 2010). The purpose of maternity programs is to improve the health of the mother and the

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[3] MINSANTE is the ministry in charge of public health in Cameroon

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child in general and specifically, to reduce maternal morbidity and mortality.

3. MODEL SPECIFICATION, ECONOMETRIC METHODS AND DATA

3.1. Model specification

The model of Gertler et al. (1987) is employed to model the use of prenatal healthcare services. The choice of the health provider is assumed rational and autonomously made by the mother. In this set up, choices are presumed to be made in a situation of complete information with a view to maximizing the utility function of the mother who seeks prenatal care. Every mother will make the choice that gives her maximum utility. It is important to note, however, that the mother maximizes her utility function subject to her budget constraint. On the other hand, the mother's income is also influenced by non-medical goods that the mother can consume after having paid for the care recommended by the health provider.

$$P_{ij} = (PH = j/j = 4, X) = F(\alpha_0 + \alpha_1 W + \alpha_2 W^2 + \sum_{r=3}^{5} \alpha_r E_r +$$
$$\sum_{r=6}^{8} \alpha_r E_r \times W + \sum_{r=9}^{m} \alpha_r Z_r) \qquad (1)$$

Where E_r is the vector of the different levels of education of mother, W is the wealth index of the household in which mother lives, W^2 is the squared wealth index of mother , $E_r \times W$ is the interactive effect between the vector of different levels of education of mother and the wealth level of the household of mother, and Z_r is the vector of the exogenous variables, and α is the set of the parameters to estimate.

The corresponding econometric specification is the multinomial Probit model which avoid the shortcomings of the multinomial Logit model related to the undesirable assumption of the independence from

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irrelevant alternatives (IIA). Equation 1 is estimated by maximum likelihood.

3.2. Econometric methods

The model presented in (1) can only be estimated directly if the pregnant woman has used a skilled health centre where she can meet qualified health professionals. Mothers who have used a skilled health professional can be identified through the birth weights of their children. The recorded weights reflect the mother's participation in antenatal care or use of antenatal health services. However, for some mothers surveyed, children were not weighed at birth. This explains the fact that in the database, there is missing information on the birth weights of children.

This study considers prenatal care to include all mothers who registered the birthweight of their child. In practice, mothers who participate in prenatal care are more likely to get birthweights than those who do not participate. Moreover, the decision to participate in antenatal care is unlikely to be a random process. Women who self-medicate or are referred by a traditional attendant can also give birth in a health center and get the weight of their child at birth. Nevertheless, in general, this category of women prefers to give birth with their traditional birth attendant and therefore, may not give the true weight of the child

A problem of sample selection therefore arises. Castell and Sillard (2021) obviously state that in a certain number of household surveys, one can suspect an endogenous selection phenomenon leading to an unavoidable selection bias. To correct this selection problem, we use the two-stage Heckman model, which is a semi-parametric selection bias correction method developed by Heckman in 1979. The Heckman two-step

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selection method provides a means of correcting for non-randomly selected samples. The first stage performs a probit analysis on a selection equation. The second stage analyzes an outcome equation based on the first-stage binary probit model.

The selection equation is estimated by maximum likelihood as an independent probit model for the decision to participate in antenatal care from the entire sample. The inverse of the Mills ratio (estimated expected error) will then be generated from the parameter estimates (Greene, 1993). The selection equation is:

$$S = \beta_0 + \beta_1 W + \beta_2 W^2 + \sum_{r=3}^{5} \beta_r E_r + \sum_{r=6}^{8} \beta_r \ E_r \ \times \ W + \sum_{r=9}^{m} \beta_r Z_r + \varepsilon_1) > 0 \ (2)$$

Where S is a sample selection indicator that is set to 1 if the child's weight is recorded and 0 otherwise; and the weight of the child is recorded if the mother gives birth in a health center Z_r, is the vector of the exogenous variables approving the selection of the children in the estimate of the sample and β the vector of the parameters of the variables explanatory exogenous and ε_1 is the error term that captures the random effects and unobservable characteristics of the selection.

Therefore, the second stage reruns the regression with the estimated expected error included as an extra explanatory variable, removing the part of the error term correlated with the explanatory variable and avoiding the bias. Sample selection bias has been corrected by the selection equation, which determines whether an observation makes it into the non-random sample. estimating the sample selection equation, generating an inverse Mills ratio (IMR) and including it as an additional variable in the structural equation.
The augmented structural equation that accounts sample selection biases is given by equation (3):

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$$P_{ij} = (PH = j/j = 4, X) = F(\alpha_0 + \alpha_1 W + \alpha_2 W^2 + \sum_{r=3}^{5} \alpha_r EM_r + \sum_{k=6}^{8} \alpha_r EM_r \times W + \sum_{r=9}^{m} \alpha_r Z_r) + \lambda IMR \qquad (3)$$

Where, IMR is the inverse of the Mills ratio. α and λ are parameters to be estimated.

-Identification strategy

To interpret the estimated parameters of our model, it is important that the effects of endogenous ariables and selection problem are identified (Mwabu, 2009). In this study, we use two instruments: the mother's age at first marriage and the household's access to land. These instruments are used to identify the factors that influence maternal decision to participate in prenatal care.

The mother's age at first marriage can explain the mother's level of education, since once married, it is difficult for the mother to reconcile her family life with her studies. Age at first marriage as an instrument is based on the assumption that it is indirectly correlated with prenatal care and directly correlated with the mother's level of education. It is justified by the intuition that early marriage reduces a woman's education, as many women drop out of school upon marriage (Christiaensen and Alderman 2004). Field and Ambrus (2008) find that each additional year of delayed marriage results in 0.22 additional years of schooling. This in turn can affect household outcomes by affecting women's knowledge, preferences, bargaining power and decision-making (Christiaensen and Alderman, 2004). In other words, younger women may be less able to defend their preferences in the household. This is important as women and men have different preferences for investment in children's health and education (Majlesi, 2014).

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Access to land indicates that the household owns land, which can enable each household to exploit it to generate income that will improve the household's standard of living and to escape poverty and to have an important impact on their living conditions through its different uses. And being landless increases the likelihood of being poor and vulnerable. Land produces food that can not only address food security issues but also be marketed. Land plays a fundamental role for development and social inclusion in a country (Pamen and Djofang, 2019).

3.3. Data presentation

Our data come from the Cameroon Demographic and Health Surveys of 2004, 2011, 2018. Combining the databases will allow us to increase our sample and to see the evolution over time of the different variables used in this study. These surveys were conducted by the National Institute of Statistics (NIS). The last survey was carried out in 2018 after those of 1991, 1998, 2004 and 2011. The survey was conducted among mothers of children aged 0-59 months. Our unit of measurement is a mother aged 15-49 years. They responded to both issues affecting them as well as those on their children.

3.3.1. Dependant variables

The selection equation has as a dependent variable participation in antenatal care (S), which is measured by the child's birth weight. Any mother whose child's birth weight was recorded at birth is considered to have participated in antenatal care, and otherwise not. As noted, not all children were weighed at birth. The structural equation has as a dependent variable the type of health professionals consulted by the mother during pregnancy: the doctor, the midwife or nurse, the health assistant, the traditional birth attendant, the community worker and others. This variable has

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several modalities. Mothers have the possibility to use and choose one health professional among many others. In this paper we consider only those health professionals recognized as qualified by the WHO.

3.3.2. Interest variables

• Maternal Education (EM_r): It is also noticed that the educational level of the mother can be a determinant of the choice of the healthcare service insofar as when one is educated, one is supposed have more information on the importance of visiting a healthcare establishment or consulting a health personnel in case of disease than a person who is less educated (Becker et al, 1993). Education changes the behavior and attitude of expecting mothers towards utilization of maternal healthcare services.

• Index of wealth of households (W): It called the wealth index, is based on household asset holdings an housing characteristics. The index is constructed from household asset data, which consist of a television, bicycle or car, as well as characteristics, such as source of drinking water, sanitation facilities and type of flooring material (CDHS, 2020). Wealth is used in Demographic and Health Surveys (DHS) primarily because of the absence of information on household incomes and expenditures. It is also widely used across the world as a statistic, which is consistent with the expenditure levels of households (Rutstein and Johnson, 2004). In this regard, the differentials in household wealth have spillover effects on health care service utilization (Osei et al. 2020).

• Interaction between maternal education and wealth index ($EM_r * W$). The mothers with higher socioeconomic status, including more wealth and better education, are generally considered to have higher

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access to maternal health services in developing countries (Kim et al, 2018; Pathak et al, 2010). Education level is an important and unique social determinant of maternal health service utilization. It is one of the key indicators of socioeconomic status (Cutler et Lleras-Muney, 2010)

3.3.3. Control variables

- Partner education: husbands are expected to have knowledge and understanding regarding antenatal care, emergency obstetric gynecology services, availability of transportation access to reach referral health services, and costs for accessing services (Shefner-Rogers and Sood, 2004). Another study explained that the husband's knowledge regarding the process of preparing for childbirth was related to frequent access to information from the internet (Mullany et al, 2007). Not only that, but the husband's high education also has implications for promotion to access ANC services (Agushybana, 2016).

- Sex of the head of household: Heads of households, who in most contexts tend to be predominantly male (Kishor and Neitzel, 1996), often act as key decision makers in accessing skilled healthcare at the time of delivery and recent research suggests that husband-only decision making is negatively associated with skilled delivery care (Story and Burgard, 2012). Specifically, men often provide the financial means, transport, and sometimes the permission for women to attend a health centre (Waiswa, 2008; Amooti-Kaguna and Nuwaha, 2000).

- Ethnicity: All African societies possessed and many of them are far from having lost them specific

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models and practices relating to pregnancy and childbirth. These traditional models and practices give an explanation of conception, the evolution of pregnancy and childbirth, which is consistent with the life representations of the ethnic group. TThe pregnant woman observed alimentary and behavioural prohibitions and prescriptions gave birth at home, alone or with the help of a traditional birth attendant or a relative (Beninguisse et Debrouwere, 2005).

- Mother age: Age has an impact on the choice of health provider. Older mothers are more likely to choose skilled health workers because of the experience they may have accumulated over time (Fosu, 1994).

- Place of residence Those who reside in urban environments are closer to healthcare services than those who reside in rural areas (Duchesne, 1998).

4. RESULTS AND DISCUSSIONS

All the regressions in this paper are made from the combined databases of the Demographic and Health Surveys carried out in 2004, 2011 and 2018.

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4.1. Descriptive statistics

Table 1a shows the descriptive statistics from the 2004, 2011 and 2018 Health Surveys combined databases. On average, 43.1% of mothers completed primary school, while 29.6% of mothers have a secondary level of education; 2% of mothers have a higher level of education. Looking at these education-related statistics, we note that overall, partners of the women are more educated than the women.

Table 1a: *Descriptive Statistics*

Variable	Observations	Mean	Std. Dev	Min	Max
Registred birthweight	29590	0.61	0.49	0	1
Professional healthcare					
Doctor	29590	0.088	0.28	0	1
Midwife	29590	0.40	0.49	0	1
Nursing_aider	29590	0.074	0.26	0	1
Characteristics of the mother					
Primary education	29590	0.40	0.49	0	1
Secondary education	29590	0.33	0.47	0	1
Higher Education	29590	0.031	0.17	0	1
Mother's age	29590	27.97	6.78	15	49
Characteristics of the partner					

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Primary education	29590	0.30	0.46	0	1
Secondary education	29590	0.31	0.46	0	1
Higher Education	29590	0.056	0.23	0	1
Household demographic characteristics					
Household is male headed	29590	0.81	0.39	0	1
Rural area	29590	0.59	0.49	0	1
Normalised weatlh index	29590	0.29	0.18	0	1
Normalised weatlh index 2	29590	0.12	0.14	0	1
Primary education × normalised weatlh index	29590	0.10	0.15	0	0.9676583
Secondary education × normalised weatlh index	29590	0.13	0.21	0	1
Higher education × normalised weatlh index	29590	0.02	0.11	0	0.9645206
Christian religion	29590	0.67	0.47	0	1
Muslim religion	29590	0.18	0.38	0	1
Northern	29590	0.29	0.45	0	1

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ethnic group					
Bantu ethnic group	29590	0.37	0.48	0	1
Semibantu ethnic group	29590	0.31	0.46	0	1
Year dummy for 2018	29590	0.33	0.47	0	1
Year dummy for 2011	29590	0.40	0.49	0	1
Distance to health center	29590	0.55	0.50	0	1
Instrumental variables					
Cluster mean age of mother at first marriage	29590	18.85457	1.208452	15.66667	26.16667
Access to land	29590	0.89	0.31	0	1
Sample selection corrector					
IMR for selection bias	29590	0.39	0.18	0.00040	0.6090

Source: *Computed by the authors.*

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Table 1b: *Descriptive Statistics*

Maternal level education	2004		2011		2018	
	Obs	Mean	Obs	Mean	Obs	Mean
None education	8125	0.26	11732	0.249	9733	0.231
Primary education	8125	0.449	11732	0.418	9733	0.333
Secondary education	8125	0.282	11732	0.305	9733	0.385
Higher education	8125	0.009	11732	0.028	9733	0.051

<u>Source:</u> *Computed by the authors.*

This may be justified by the fact that in most families, parents are more likely to encourage male children to go to school than female children. They believe that these are intended for marriage. In this sample, the mothers are on average 27 years old. 55% of mothers thik that the distance to the nearest health facility is a problem. It is therefore important to present the percentages for the mother's education level in order to explain the variations that result. The table below allows us to appreciate this.

The proportion of women with no education decreases over time from 26% in 2004 to 24.9% in 2011 and 23.1% in 2018. The same trend is observed among women with primary education (44.9% in 2004 against 41.8% in 2011 and 33.3% in 2018). Meanwhile, the proportion of women with secondary and tertiary education is increasing over time. This suggests that women are becoming more educated over time. The education of women is increasingly encouraged by parents. This can explain the fact that in Cameroon, there are also many women in positions of responsibility

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4.2. Determinants of mothers' participation in prenatal care

All the estimates presented in this article are made from the combined CDHS 2004, 2011 and 2018 databases. Table 2 presents both the results with the coefficients and the marginal effects. The participation of the woman in prenatal care was measured as 1 if the woman visited a prenatal health care provider and 0 otherwise.

Table 2 shows that mother's level of education at the individual level and at the community level and father's education increase the likelihood of participating in prenatal care – with probabilities generally increasing with the level of education. For the specific case of mothers, the probability increases by 19.9% at the primary level, 33.2% at the secondary level and 35.9% at the higher level compared to their counterparts with no education. These results are in line with those of Rahman et al. (2008) in a study conducted in Bangladesh. The knowledge acquired by mothers during their schooling influences their judgment and decision-making capacity. The higher probabilities of participation observed among mothers with secondary and higher education is attributable to their greater awareness of the importance of the reproductive health services in the prenatal healthcare package for pregnant women.

Partner's level of education is also instrumental for the woman's participation in prenatal healthcare sessions. The likelihood of the mother participating in prenatal care increases as the partner's level of education increases; 6.30% for partners with primary education, 11.3% for those with secondary education and 11.8% for those with higher education compared to partners with no education. The socio-economic status of the household positively influences the mother's

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participation in prenatal care by 149.6%. In other words, the probability of the mother's participation in antenatal care increases with the socio-economic status of the household. The high percentage further demonstrates that socio-economic status is an important factor in household decisions. Mothers are able to bear the direct (consultation, purchase of medicines) and indirect (transport) costs related to their health status. This result was also found by Abor et al (2011) for mothers in Ghana. They find that mothers who belong to the middle wealth quintile are more likely to use antenatal services and deliver in a health facility.

The interaction of education level with socio-economic status negatively influences the mother's participation antenatal care. Socio-economic status can influence significantly the participation of mothers with secondary education in antenatal care by 29.5% compared to those with no education. Although there is a minimum level of knowledge about the importance of antenatal care, if the mother has no financial resources, it will be difficult for her to get close to health facilities as almost all services related to this care are not free of charge. Living in rural areas decreases the likelihood of a woman participating in antenatal care by 11.3% compared to those living in urban areas. These findings can be explain by the absence of healthcare services or by the absence of qualified health professionals. Moreover, mothers living in ares are more likely to prefer traditional birth attendants. Between 2011 and 2018, the probability of mothers attending antenatal care increased by 12%.

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Table 2: *Determinants of mother's decision to participate in prenatal care (probit model)*

Variables	Participation in prenatal care	Marginal effects of participation in prenatal care
Characteristics of the mother		
Mother level education (Ref. no education)		
Primary education	0.546*** (0.0576)	0.199*** (0.0202)
Secondary education	0.998*** (0.0762)	0.332*** (0.0215)
Higher Education	1.664*** (0.455)	0.359*** (0.0311)
Mother age	0.00749*** (0.00178)	0.00282*** (0.000672)
Partner level education (Ref. no education)		
Primary education	0.169*** (0.0299)	0.0630*** (0.0109)
Secondary education	0.322*** (0.0323)	0.118*** (0.0114)
Higher Education	0.556*** (0.0899)	0.185*** (0.0250)
Household demographic characteristics		
Household is male headed (**Ref. female**)	-0.165*** (0.0316)	-0.0609*** (0.0114)

Normalised wealth index	3.970*** (0.319)	1.496*** (0.121)
Normalised wealth index 2	-2.126*** (0.441)	-0.801*** (0.166)
Interaction level of education and wealth index (Ref. no education x wealth index)		
Primary education × normalised wealth index	-0.397 (0.246)	-0.150 (0.0927)
Secondary education × normalised wealth index	-0.783*** (0.279)	-0.295*** (0.105)
Higher education ×normalised wealth index	-0.715 (0.834)	-0.269 (0.314)
Rural area **(Ref. urban)**	-0.304*** (0.0330)	-0.113*** (0.0120)
Ethnicity (Ref. others)		
Northern ethnic group	-0.164*** (0.0582)	-0.0619*** (0.0220)
Bantu ethnic group	0.110* (0.0604)	0.0410* (0.0223)
Semi bantu ethnic group	0.878*** (0.0617)	0.298*** (0.0180)
Yeardummy for each year (Ref. yeardummy for 2004)		
Yeardummy for 2011	0.0804** (0.0353)	0.0302** (0.0132)
Yeardummy for 2018	0.325*** (0.0368)	0.120*** (0.0131)
Distance to health center **(Ref. no problem)**	-0.219*** (0.0253)	-0.0821*** (0.00941)
Instrumental variables		

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Access to land	-0.185*** (0.0439)	-0.0711*** (0.0172)
Cluster mean age of mother at first marriage	0.0577*** (0.0108)	0.0217*** (0.00409)
Constant	-2.275*** (0.223)	
Observations	29,590	29,590

Source: *Computed by the authors.*

Notes: *Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.*

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The fact that the head of the household is male negatively influences mothers' participation in prenatal care by 6.09% compared to female-headed households. This can be explained by the fact that the head of the household is not sufficiently educated and does not appreciate the importance of getting close to health facilities during pregnancy. This finding is consistent with demand for normal goods and services. Distance to health facility increase the opportunity cost of participating in prenatal healthcare sessions. Distance to health facility correlated strongly and negatively with a woman's participation in prenatal healthcare. The distance to the nearest health centre reduces the probability of the mother participating in antenatal care by 8.2% compared to mothers who find the distance to the health centre from home not to be a problem. This further confirms the poor distribution of health infrastructures throughout the country. Women travel long distances to get to the nearest health centre.

As for the instruments we used in this study, they are significant. The household that owns a piece of plot is less likely to participate in antenatal care compared to those who do not own land at 7.11%. The household is concerned about the welfare of the family and prefers to spend a lot of time in agricultural activities to improve their income. The average age of the mother at first marriage increases the probability of the mother participating in antenatal care by 21.7%. The average age of the mother at first marriage increases the likelihood of the mother participating in antenatal care by 21.7%. If the mother's age of cohabitation is high, then the mother is more likely to participate in antenatal care because she has enough experiences related to the environment in which she has evolved.

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4.3. Determinants of the choice of health professionals

The estimation of the choice of health provider was done using the multinomial probit model. The study considered four choices: doctor, midwife, nursing-aider and others providers. The latter category is used as the reference category. All the estimates are made from the combined DHS 2004, 2011 and 2018 databases. The raw table which presents the coefficients is in the appendix (table 3a). Table 3 presents the marginal effects of multinomial probit estimates of the determinants of the choice of prenatal healthcare providers. The results show that the level of education of the mother and the socio-economic status of household are instrumental in determining choice of healthcare providers. In general, levels of education correlate strongly with the probability of choosing one health professional over another.

We can observe that the probability of seeking a doctor's consultation increases with the level of education compared to those with no education at all. It is 5.69%, 10.2% and 20.8% respectively for primary, secondary and higher education levels. The reason for this is that reproductive health education programmes would be more accentuated from secondary and tertiary levels onwards. Mothers with these levels of education are more inclined to approach doctors than other qualified health professionals. Similarly, with a primary level of education, their partners' decision-making influences negatively the choice of a doctor and a midwife by 1.48% and 2.46% respectively and compared to partners with no education at all. Education plays an important role in household decisions about health. A minimum level of knowledge is required for rational choices in the household. The socio-economic status of the household

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positively influences the choice to consult doctors and midwives by 23.2% and 34.8% respectively. As the services offered by these health professionals are not free of charge, the availability of financial resources is an asset for mothers to benefit from the expertise of doctors and midwives and to ensure good pregnancy outcomes.

The interaction of education levels with socio-economic status negatively and significantly influences the use of doctors. Socio-economic status influences the choice of doctors regardless of their level of education, i.e. 12.8%, 12.9% and 15.7% respectively for primary, secondary and tertiary levels compared to those with no education at all. Seeking medical counselling is not easy for most mothers, although they are aware of its importance. As the cost of the consultation is not free, many mothers can do without the doctor and turn to other health care providers who are more accessible in terms of cost. In essence, mothers with primary education are most likely to choose nursing aiders, those with secondary education are most likely to choose midwifes, and those with higher education are most likely to choose doctors compared to their counterparts with no education. These results may find an explanation in the configuration of the school curricula in different levels of education in Cameroon. To better raise awareness on healthcare services and providers, these programs should include reproductive healthcare aspects, at least from post primary levels.

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Table 3: *Determinants of health professional choice (multinomial probit model)*

Variables	Marginal effects (Doctor)	Marginal effects (Midwife)	Marginal effects (Nursing-aide)
Characteristics of the mother			
Mother level education (Ref. no education)			
Primary education	0.0569*** (0.0136)	0.00118 (0.0196)	0.00952 (0.0106)
Secondary education	0.102*** (0.0172)	0.0854*** (0.0232)	0.0110 (0.0128)
Higher Education	0.208*** (0.0656)	0.0968 (0.0721)	0.00920 (0.0419)
Mother age	0.000721*** (0.000200)	0.000408 (0.000440)	-0.000436* (0.000239)
Characteristics of the partner			
Partner level education (Ref. no education)			
Primary education	-0.0144*** (0.00368)	-0.0247*** (0.00801)	0.00398 (0.00429)

Secondary education	-0.0119*** (0.00432)	-0.00855 (0.00826)	-0.00162 (0.00365)
Higher Education	-0.0144* (0.00822)	-0.00500 (0.0158)	-0.00508 (0.00546)
Household characteristics			
Household is male headed **(Ref. female)**	-0.00695 (0.00442)	-0.0379*** (0.00783)	-0.0175*** (0.00363)
Normalised wealth index	0.0580 (0.0492)	0.348*** (0.0866)	0.232*** (0.0406)
Normalised weatlh index 2	-0.149** (0.0606)	-0.267*** (0.100)	0.0781** (0.0384)
Interaction level of education and wealth index (Ref. no education x wealth index)			
Primary education × normalised weatlh index	0.0444 (0.0417)	0.106 (0.0746)	-0.128*** (0.0360)
Secondary education × normalised weatlh index	0.00821 (0.0461)	0.0318 (0.0805)	-0.129*** (0.0361)
Higher education × normalised weatlh index	0.0163 (0.0780)	-0.170 (0.135)	-0.157*** (0.0482)
Rural area **(Ref. urban)**	0.0177*** (0.00452)	-0.0429*** (0.00859)	-0.0133*** (0.00403)

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Ethnicity (Ref. others)			
Northern ethnic group	-0.0356*** (0.00669)	-0.00448 (0.0155)	0.0315*** (0.00943)
Bantu ethnic group	0.0180** (0.00801)	0.0235 (0.0160)	-0.00674 (0.00878)
Semi bantu ethnic group	0.0255*** (0.00892)	0.0901*** (0.0170)	0.0102 (0.00980)
Yeardummy for each year (Ref. yeardummy for 2004)			
Yeardummy for 2011	0.0333*** (0.00396)	-0.0285*** (0.00759)	0.0132*** (0.00429)
Yeardummy for 2018	0.0250*** (0.00425)	-0.0147* (0.00778)	0.00992** (0.00445)
Distance to health center **(Ref. no problem)**	-0.00244 (0.00294)	-0.0302*** (0.00637)	-0.00209 (0.00346)
Sample selection corrector			
IMR for selection bias	0.0422** (0.0173)	0.278*** (0.0320)	-0.00943 (0.0173)
Observations	29,590	29,590	29,590

Source: Computed by the authors.

Notes: Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.

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Moreover, as expected, rural areas are generally deprived of qualified health professionals like nursing aiders, midwives and doctors (1.33%, 4.29% and 1.77% respectively). This finding can be explained by the unequal distribution of healthcare providers in the national territory and preference by health personnel for localities with adequate social anminities. Since access to healthcare can be expensive, some mothers may be discouraged and would prefer not to see any health professional, even those who are in their place of residence.

The inverse Mills ratio relates positively and significantly with the choice of doctors and midwives. Specifically, because the sample mean of Inverse Mills Ratio is 0.3871 (table 1), mothers captured in the estimation sample are 1.63% (0.3873*4.22) and 10.76% (0.3873*27.8) more likely to see doctors and midwives respectively than their counterparts randomly drawn from the general population.

5. CONCLUSION AND RECOMMENDATIONS

This paper analyzed the influence of mother's education and households' wealth on the use of antenatal care services in Cameroon. It recognized that before choosing the type of prenatal healthcare provider, the expectant mother must first decide to participate in prenatal care. Results showed that the mother's level of education as well as partner's level of education and socio-economic status, strongly correlates with the decision to participate in prenatal care. When the mother chooses to participate in prenatal care, she then has to choose the type of healthcare provider who will consult her. It follows from this analysis that the education of the mother and the socio-economic status

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of the household influence the mother's choice. Thus, we can say that education of the mother and socio-economic status are very important in making prenatal healthcare provider choice.

Results showed that expectant women with primary education have a higher likelihood of choosing a nursing-aider those with secondary education more likely to choose a midwife and those with higher education more likely to choose a doctor to monitor their pregnancy, compared to those with no education. In addition, more educated women could easily search for information in newspapers, brochures, the internet and other media - thus informing themselves of the need for professional caregivers.We observe also that socio-economic status of the household positively influences the choice to consult doctors and midwives. As the services offered by these health professionals are not free of charge, the availability of financial resources is an asset for mothers to benefit from the expertise of doctors and midwives and to ensure good pregnancy outcomes. Efforts have already been made by decision-makers to reduce the costs of caring for a pregnant woman in order to improve the monitoring of mothers during pregnancy. But they should ensure that these measures are actually applied in the health structures, and also provide enough minimum equipment to health providers to enable them to offer better care.

Other results indicate that the rural woman is less likely to participate in prenatal care and will more likely choose less skilled providers compared to the urban woman. The typical absence of health professionals in rural areas also justifies the absence of formal antenatal care and thus the low probability that the child is eventually be weighed at birth. It would

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therefore be useful for public policy to focus on the training and deployment or redeployment of qualified health professionals. These measures would be effective if incentives such as special allowances and/or free accommodation are used to entice them to accept working and living in rural areas. The presence of qualified caregivers in rural areas would provide more assurance to mothers, compensate for poor education and contribute to the reduction of maternal and infant mortality. Improving the education of the girl child, and access to health services are key policy interventions for promoting antenatal healthcare participation and choice of qualified healthcare providers by pregnant women.

The mother's level of education alone does not guarantee optimal participation in antenatal care and a rational choice of health professionals. Mothers make choices that are affordable in terms of both direct and indirect costs. To improve the use of antenatal care, it would be important to focus on making antenatal care free and to find ways to support expectant mothers. The use of professionals could be almost free of charge to ensure the quality of care received by mothers, but the working conditions and remuneration of these professionals would need to be improved in advance. Mothers could also be provided with tests and medicines on the premises of health facilities to prevent them from having to go to private facilities to obtain them and incur high costs.

For some mothers, these costs lead to discouragement or the use of traditional medicine. Most pregnant women incur indirect costs due to the distance between their homes and health facilities for consultations. Some women end up spending the whole day travelling.

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However, most of them work in the informal sector to earn a living. It may therefore be necessary to increase the number of antenatal health professionals who can reach mothers. These findings are essential for policies to address the challenges Cameroon faces in its attempt to ensure improved maternal health through better use of maternal health services.

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Table 3a: *Determinants of the choice of prenatal health profesionals (multinomial probit model): Table of coefficients*

Variables	(1) Doctor	(2) Midwife	(3) Nursing-aider
Characteristics of the motherL			
Primary education	0.655*** (0.132)	0.133* (0.0700)	0.211** (0.0955)
Secondary education	1.220*** (0.136)	0.572*** (0.0830)	0.501*** (0.116)
Higher Education	1.886*** (0.303)	1.041*** (0.266)	0.937** (0.367)
Mother age	0.00852*** (0.00237)	0.00213 (0.00163)	-0.00196 (0.00223)
Characteristics of the partner			
Primary education	-0.218*** (0.0465)	-0.116*** (0.0296)	-0.0376 (0.0395)
Secondary education	-0.0598 (0.0438)	-0.0587*(0.0307)	-0.137*** (0.0424)

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Higher Education	-0.101 (0.0723)	-0.0557 (0.0594)	-0.167* (0.0881)
Household characteristics			
Household is male headed	-0.287*** (0.0383)	-0.196*** (0.0290)	-0.177*** (0.0399)
Normalised weatlh index	3.560*** (0.486)	1.902*** (0.317)	1.695*** (0.455)
Normalised weatlh index 2	0.123 (0.467)	-1.171*** (0.372)	-1.789*** (0.563)
Primary education*normalised weatlh index	-1.242*** (0.421)	0.252 (0.272)	0.369 (0.385)
Secondary education*normalised weatlh index	-1.468*** (0.428)	-0.106 (0.296)	-0.124 (0.427)
Higher education*normalised weatlh index	-2.170*** (0.600)	-0.927* (0.504)	-0.486 (0.729)
Rural area	-0.203*** (0.0463)	-0.158*** (0.0317)	0.0644 (0.0437)
Christian religion	-0.396*** (0.0883)	-0.0252 (0.0565)	0.213*** (0.0805)

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Muslim religion	0.238*** (0.0849)	0.113* (0.0580)	0.0161 (0.0834)
Northern ethnic group	0.491*** (0.0922)	0.424*** (0.0613)	0.331*** (0.0875)
Yeardummy for 2011	0.354*** (0.0422)	-0.0225 (0.0280)	0.140*** (0.0388)
Yeardummy for 2018	0.276*** (0.0447)	0.00909 (0.0286)	0.117*** (0.0400)
Distance to health center	-0.0911*** (0.0346)	-0.126*** (0.0234)	-0.0828** (0.0322)
Sample selection corrector			
IMR for selection bias	1.014*** (0.201)	1.142***(0.116)	0.523***(0.160)
Constant	-3.259*** (0.181)	-1.001***(0.104)	-2.011***(0.144)
Observations	29,590	29,590	29,590

Source: *Computed by the author using the pooled 2004 and 2011 Cameroon Demographics health Surveys and Stata 12.*

Notes: *Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.*