Horizontal Equity in the Use of Maternal Health Services in Cameroon

By

Saleu Feumeni Josiane

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Saleu Feumeni Josiane
University of Yaoundé II-Soa

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List of abbreviations and acronyms

CARMMA	Campaign for Accelerated Reduction of Maternal Mortality in Africa
DHS	Demographic and Health Surveys
MDGs	Millennium Development Goals
NIS	National Institute of Statistics
SDGs	Sustainable Development Goals
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Abstract

An equitable healthcare system should be the health policy goal of all countries. The objective of this study is to measure horizontal equity in the use of maternal health services in Cameroon from 2004 to 2018. Specifically, it aims to determine the level of inequity in assistance during delivery and in the intake of tetanus vaccine from 2004 to 2018. It identifies sources of inequity in assistance during delivery and at the intake of tetanus vaccine. To accomplish this, we used the indirect standardization of health care method and the 2004, 2011, and 2018 Demographic and Health Surveys. The results show that there are significant inequities in wealth, education, region of residence, and in the access to the nearest health facilities. Furthermore, sociodemographic and economic inequities are associated with health care utilization inequities. A health policy implementation monitoring team is therefore essential if the observed inequities in the use of maternal health services in Cameroon are to be significantly reduced.
Key words: *Horizontal equity; Tetanus vaccine; Assistance during delivery.*
JEL classification codes: *I14; C13; C25.*

1. Introduction

An equitable healthcare system is the health policy objective of most governments in both developed and developing countries. The crucial objectives of health system reforms are usually a means to achieve a level of equity and to equalize the system of health service utilization (Özsoy and Alcan, 2017). According to Whitehead and Dahlgren (2006), equity in health involves the equitable distribution of resources needed at health care, coupled with equitable access to opportunities and support in the event of illness; whereas health inequity occurs when the social, economic, demographic or geographical aspects that characterize health differences between population groups are unjust and avoidable (Whitehead and Dahlgren, 2006). The health status of individuals is important for productivity and economic growth. Maternal health, most especially, is important because of its impact on mortality rates, family, poverty, and maternal labour supply decisions. Maternal health status is an indicator of the level of health development as well as an indicator of health system performance. Maternal health care corresponds to the health care of women of reproductive age (15–49 years). It includes several dimensions: preconception, conception, and family planning used to reduce maternal and neonatal mortality.

Inequity in the utilization of maternal and reproductive health services leads to poor reproductive and maternal health outcomes. One of the most serious consequences is maternal mortality. They can lead to other serious health problems, such as postpartum depression, premature birth, low birth weight, and infant mortality. These problems can have serious consequences for both mother and child, including physical, mental, and emotional health problems (Gandhi et al, 2022). Maternal and reproductive health issues are also a priority for the Sustainable Development Goals (SDGs), which focus on equity. SDG 3 calls for ensuring healthy lives and promoting wellbeing for all. The maternal and reproductive health objectives for 2030 encompass the following: (i) decreasing the worldwide maternal mortality ratio to less than 70 per 100,000 live births; (ii) guaranteeing universal availability of sexual and reproductive health care services; (iii) eradicating avoidable infant deaths, with all countries striving to decrease neonatal mortality to a maximum of 12 per 1,000 live births.

Globally, approximately 830 women died every day due to complications during pregnancy or childbirth in 2015 according to the World Health Organization. Target 3.1 of the Sustainable Development Goals (SDGs) would reduce the global maternal mortality ratio from 216 per 100,000 live births in 2015 to less than 70 per 100,000 live

births by 2030. This will require achieving an overall annual rate of reduction of at least 7.5% (Alkema et al, 2016). Women's deaths occur as a result of complications during or after pregnancy or childbirth that can be prevented or treated. Other complications that existed before become worse at this time, especially if not addressed in a care package.

The main complications, which account for 75% of all maternal deaths include: severe haemorrhage (mostly after delivery); infections (usually after delivery); hypertension during pregnancy (pre-eclampsia and eclampsia); complications from delivery; and unsafe abortion (Alkema et al, 2016). These complications can be better managed if the maternal health professional attending the delivery is skilled. In 2016, millions of births worldwide were not attended by a skilled midwife, doctor or nurse, with only 78% of births attended by a skilled birth attendant (World Health Organization [WHO], 2017). Live births in the five years prior to the survey, 69% were attended by a trained health provider: 16% by a doctor and 53% by a nurse, midwife, or health worker. One in ten (10%) of births were assisted by a traditional birth attendant, and 3% of births were not assisted at all (National Institute of Statistics [NIS] & ICF International, 2020).

To reduce neonatal mortality, it is important that the mother during pregnancy receives multiple doses of tetanus vaccine. Tetanus vaccination during pregnancy is one of the essential interventions recommended by maternal and child health programmes to improve the chances of survival for women and their newborns (National Institute of Statistics [NIS] and ICF International, 2020). Tetanus vaccination is one of the important components of maternal health (WHO, 2017). It is the most effective intervention against neonatal tetanus. It is independent of all other protective approaches, which include hospital care and delivery by trained health professionals (Moniz & Beigi, 2014).

Immunization of pregnant women of childbearing age with two doses of tetanus toxoid vaccine can reduce the risk of infection and neonatal mortality from tetanus. United Nations Children's Fund (UNICEF) and United Nations Population Fund (UNFPA) believe that it is important to give at least two doses of tetanus vaccine to all pregnant women and three doses to all women of childbearing age. Effective surveillance for maternal and neonatal tetanus should be ensured. In most developing countries, the tetanus vaccination programme is implemented as part of the routine immunization programme (Khan and Raza, 2013). It is, therefore, crucial to improve the use of maternal health services and women's access to quality care before, during, and after delivery.

Studies focusing on individual health in general and maternal health in particular in Cameroon have been interested in analysing the determinants of the uses and access to health services (Ndonou, 2016; Tambi, 2015; Saleu, 2020). Inequalities in terms of access and use have hardly been analysed, but not geographical and economic barriers that explain consumers' preferences to seek unskilled care. The relationship between inequalities and needs has not been established. Although measures such as the sectoral health strategy (2016–2027), the national strategic

plan for reproductive health, the CARMMA[1] plan, and the Cheque Santé programme have been developed, it turns out that access to and use of maternal health services are no longer a constraint for certain segment of the population but have certainly made it possible to appreciate changes, but they are still far from the targets expected to bring about a significant reduction in maternal mortality, and consequently have lasting impact on development.

Research on this is, therefore, very relevant in a country like Cameroon, where regions are not equally endowed with health infrastructure and income. It will be an important contribution because many existing articles already analyse the horizontal equity of maternal health service utilization in Cameroon for a specific year, but they have not examined the development over longer periods. The main objective of this study is to measure horizontal equity in the use of maternal health services in Cameroon from 2004 to 2018. More specifically, it aims at determining the level of inequity in the use of maternal health services in Cameroon, and to identify the sources of inequity in the use of maternal health care services in Cameroon from 2004 to 2018.

1 Campaign for Accelerated Reduction of Maternal, Newborn and Child Mortality in Africa.

2. Overview of the use of maternal health services in Cameroon

The use of maternal health services in Cameroon is a major challenge for the achievement of the Sustainable Development Goals (SDGs). Maternal health topics remain a priority for the post-2015 SDGs (Alkema et al, 2016). Unlike the Millennium Development Goals (MDGs), which paid insufficient attention to equity, the SDGs place a strong emphasis on equity. MDG 3 calls for healthy lives and wellbeing for all, while MDG 10 calls for reducing inequalities within and between countries to promote inclusion and empowerment for all (Tangcharoensathien et al, 2015). Countries commit to achieving the SDGs with every individual in mind. The issue of maternal health is the first target of the MDG number 3. Several programmes have been set up by the Cameroonian Government, such as the National Multisectoral Programme for the fight against maternal and infant mortality in Cameroon, the 2016–2027 Health Sector Strategy, just to name a few, with the aim of evaluating public policies on maternal health. These programmes, as a whole, aim to improve the supply and quality of health care, facilitate access to health services for the poor and align with the Sustainable Development Goals by accelerating the implementation of universal health coverage (Ministry of Health, 2015).

In Cameroon, the achievement of public health policies requires the identification of factors that influence the use of health services. It is observed that the level of use of maternal health services has declined. Indeed, assisted delivery by trained personnel is one of the four pillars of maternal mortality reduction. Only 67% of births took place in a health facility (45% in public facilities remaining the most frequent), and 33% of births took place at home (National Institute of Statistics [NIS] and ICF International, 2020). Thus, from 1991 to 2004, the percentage of births in a health facility varied irregularly from 62% to 59%. This percentage increased slightly from 2011 to 2018 from 61% to 67% (National Institute of Statistics [NIS] and ICF International, 2020). The maternal mortality rate has fallen from 782 deaths to 467 deaths per 100,000 live births. This rate is still considered high insofar as the SDG target for 2030, which is to achieve a ratio of less than 140 maternal deaths per 100,000 live births, considering the fact that Cameroon achieves an annual reduction rate of about 9.8% (National Institute of Statistics [NIS] and ICF International, 2020).

During the prenatal care, the World Health Organization recommends that, if a woman has received one to four doses of tetanus toxoid-containing vaccine in the past, she should receive a further dose with each subsequent pregnancy up to a total of five doses (five doses for the entire childbearing period), and delivery should be assisted by a trained attendant. About 71% of women have received the required doses of tetanus vaccine. The National Institute of Statistics of Cameroon confirms that from 2011 to 2018, the percentage of women who received the tetanus vaccine was high (73%) on the one hand, and on the other hand 69% of pregnant women were assisted by a trained provider, i.e., 16% by doctors, 33% by midwives and nurses, 10% by traditional birth attendants, and 3% received no assistance (National Institute of Statistics [NIS] & ICF International, 2020).

Theoretical approaches to health equity

This research is based on the theory of social determinants of health. Marmot's theory of social determinants of health argues that social and economic conditions are key drivers of health outcomes and health inequalities (Marmot, 2005). Marmot's theory emphasizes that the conditions in which people are born, grow, live, work, and age are influenced by the distribution of money, power, and resources at global, national, and local levels. This distribution is, in turn, influenced by social and economic policies that also define and influence the social determinants of health.

Social determinants include income, education, ethnicity, gender, housing, and social support. These determinants affect access to and utilization of health services and are often linked to inequities. Health inequities arise from an unequal distribution of these social determinants; this leads to unequal access to necessary resources, and thus to good health. For example, people with lower incomes and education levels are more likely to experience poor health due to limited access to good nutrition, acceptable living environments, and quality health care (Marmot and Wilkinson, 1999).

It is, therefore, important to address the fundamental causes of health inequities through policy measures and improvements in health systems rather than focusing solely on individual behaviour and health care interventions. Policies and practices that promote social justice and equity can improve health outcomes for all individuals, while policies that increase social inequalities can lead to health disparities.

The behavioural model of health care utilization proposed by Andersen (1995) posits that, access to and utilization of health care services is influenced by social determinants of health, which are shaped by societal structures, policies, and practices, and are often linked to inequities in health outcomes. These social determinants can be grouped into three sets: predisposing, enabling, and need factors. (i) Predisposing factors are related to the pre-existing socio-cultural characteristics of individuals, which includes their social structure, before the onset of their illness (education, occupation, ethnicity, social networks, social interactions, and culture), health beliefs (attitudes, values, and knowledge that people have about and towards the healthcare system), and demographics (age and gender). (ii) Enabling factors refer to the logistical

aspects of obtaining care. They can be related to personal characteristics (means and skills to access health services, income, health insurance, and quality of social relationships), community (availability of staff and facilities, waiting time), genetic factors, and psychological characteristics. (iii) Need factors refer to the most immediate cause of health service use, starting from the functional and health problems that generate the need for health services that can be perceived or assessed. Perceived needs can assist in comprehending health care seeking behaviour and adherence to medical treatment, whereas evaluated needs are more relevant to the type and quantity of treatment offered to a patient following their visit to a healthcare facility.

4. Methodology

Analytical framework

The analytical framework for this study is based on social welfare theory. It expresses equity as the wellbeing that optimizes the policy maker's objective. This framework is close to the egalitarian criterion of health equity, which argues that individuals should have the same opportunity to acquire care. The health system should present no barriers to the acquisition of care. People should receive the same care when they have the same needs.

Social welfare maximization: *A framework for equity analysis*

Every policy maker's purpose is to maximize the total welfare of society's citizens. The goal of this paper is to depict a scenario in which social welfare maximization leads to horizontal and vertical equity as a required condition for efficient healthcare resource allocation. The theoretical model used in this study is comparable to the theorical welfare maximization model of Gravelle et al (2006).

The following is the welfare maximization model:

$$V_i = V(I_i, X_i, C_i) = (\delta_0^0 + \delta_1^0 x_{1i} + \delta_2^0 x_{2i} - \delta_3^0 C_i)I_i - \frac{1}{2}\theta I_i^2 \quad (1)$$

Where: V_i is the maximum wellbeing achievable by an individual given her income I_i, her cost of care C_i, and her socio-demographic characteristics X_i. V_i is also equal to the direct utility that an individual derives from good health upon consuming the amount of health care purchased with income Ii at prevailing prices. This model is based on the fact that the use of health services by individuals affects individual wellbeing and V_i has the same functional form across individuals. It reflects the value judgment. The wellbeing of individuals depends only on their characteristics and not on their identities. Thus, two people with the same characteristics I_i, X_i, C_i generate the same welfare.

The analysis of the model is based on the assumption that the health policy problem is to choose the levels of use of health services by an individual and to maximize an aggregate welfare function subject to the constraint that total use does not exceed supply (S):

$$W = \sum V(I_i, X_i, C_i) \text{ Subject to the constraint of } \sum I_i \leq S \quad (2)$$

With: W the welfare function and S the total supply function. The additive form of the welfare function reflects a judgement that the marginal welfare of an individual resulting from increased use is independent of the level of use or welfare of other individuals. The welfare function is also neutral between individuals: the welfare of each individual is given equal weight.

Empirical framework

We use the concentration index method proposed by Wagstaff and van Doorslaer (2000a) to measure inequity in the Cameroonian health system. This method quantifies the degree of inequity caused by socioeconomic factors (Kakwani et al, 1997). Studies on inequity in mental health (Mangalore et al, 2007), malnutrition (Wagstaff et al, 2003), and health service utilization (van Doorslaer et al, 2008) use this method.

As health service utilization is correlated with age, gender, and health status variables, these may be unequally distributed across groups of individuals with different socioeconomic levels. Therefore, the variables must necessarily be standardized. The indirect standardization method proposed by Wagstaff and van Doorlaer (2000b) will be used in this study. Indirect standardization is, however, preferred to direct standardization when dealing with individual level data.

If individuals with the same medical needs are treated in the same way, the amount of treatment an individual receives is determined as follows:

$$Y_i = \alpha + \sum_j \beta_j X_{ji} + \sum_k \gamma_k Z_{ki} + \varepsilon_i \tag{3}$$

Where: i represents the mother; Y_i is the variable that represents health service utilization; X_j the justifiable variables such as age, sex, and health status variables such as the mother's body mass index. These variables are standardized. The non-justifiable variables Z_k include expenditures, education level, employment status, place of residence, social security status, etc. Estimation of the parameters of Equation 3, i.e., $\hat{\alpha}, \hat{\beta}$ and $\hat{\gamma}$, the current values of the justifiable variables (X_{ji}) and the mean of the control or non-justifiable variables ($\bar{Z}_k$) are used to obtain the predicted values of health service utilization as in Equation 4.

$$\hat{Y}_i = \hat{\alpha} + \sum_j \hat{\beta}_j X_{ji} + \sum_k \hat{\gamma}_k \bar{Z}_{ki} \tag{4}$$

The estimate of the standardized health service utilization Y_i^s will then be the difference between the actual health service utilization (Y_i) and the predicted health service utilization ($\hat{Y}_i$) to wich we will add the average sample of mothers who use health services ($\bar{Y}$). We can see from Equation 5.

$$Y_i^s = Y_i - Y_i^s + \bar{Y} \tag{5}$$

Concentration curve

The concentration index is related to the concentration curve (O'Donnell et al, 2008). The concentration curve plots the cumulative percentage of the health care utilization variable against the cumulative percentage of the population ranked from poorest to richest.

If each individual enjoys the same level of health with respect to economic status, the concentration curve should be at 45° to the line called the "equality line". By contrast, if the health care utilization variable has higher (respectively lower) values among the poorest population, the concentration curve should be below (or above) the equality line.

When the curve is further away from the line of equality, the more unequal the distribution of the health care utilization variable is. Also, if the curve is above the line, the inequality in utilization is desirable and vice versa. Therefore, when the concentration curve coincides with the line of equality, the concentration index is zero. However, when the concentration curve is above the equality line, the concentration index takes a negative value (pro-poor) and a positive value when it is below the equality line (pro-rich). Kakwani et al (1997) proposed a practical regression approach to estimating the concentration index. The concentration index and its error term are obtained by estimating the following equation:

$$2\sigma_r^2\left(\frac{Y_i}{\hat{Y}_i}\right) = \alpha + \beta r_i + \varepsilon_i 2\sigma_r^2\left(\frac{Y_i}{\hat{Y}_i}\right) = \alpha + \beta r_i + \varepsilon_i \quad (6)$$

Where: σ_r^2 is the variance of the fractional variable r_i. For mother i, it can be defined as follows:

$$r_i = \frac{1}{N}\sum_{i=-1}\sum_{j=1} r_j + \varepsilon_i \quad (7)$$

Where, N is the sample size.

The decomposition of the concentration index

The elasticities of the variables used in the regression can be predicted from Equation 3. Using the estimated parameter β_j, the elasticities can be defined for each determinant as follows:

$$n_j = \frac{\beta_j \bar{X}_j}{\bar{Y}} \quad (8)$$

Where $\bar{X}_j$is the average of X_j. These elasticities show that the variation in the percentage of Y results from the variation in the percentage of X_j (van Doorslaer et al, 2008). It has been shown by Wagstaff et al (2003) that the concentration index can be calculated as follows:

$$C = nC_{lnexp} + \sum_j n_j C_{Xj} + \sum_k n_k C_{Zk} + \frac{2}{n\bar{Y}}\sum_i \varepsilon_i r_i \quad (9)$$

Where: C_{lnexp} is the concentration index of health expenditure; C_{Xj} and C_{Zk} are the concentration indices of the different variables. Also, n, n_j and n_k can be defined similarly. The first term of Equation 9 shows the partial contribution of income inequality measured by the household standard of living, while the second term of the equation is the partial contribution of the justifiable variables, and the third term is the partial contribution of the non-justifiable variables. The last term is the generalized concentration index of the ε_i term.

Elasticities measure the sensitivity of the variables of interest (dependent variables) to changes in the need variables, coupled with other supply and demand variables. In contrast, concentration indexes measure the degree of inequality of the different variables. The contributions to inequality of the different variables depend on the elasticities and the degree of inequality of each variable. Thus, the need variables as well as the other variables are unevenly distributed, and have a strong influence on the variables of interest which will be the main drivers of health service utilization. Moreover, the purpose of decomposition is to explain inequalities in the use of maternal health services by the degree of involvement of different variables characterizing the population (Allara and Fomba, 2021).

Nevertheless, the positive or negative value of the contribution depends on both the sign of the elasticities and the concentration indices. Allara and Fomba (2021) present in a table the four types of results that we could obtain.

Table 1: Interpretations of the results of the decomposition of the concentration indices

Different Cases	Elasticities	Concentration Index	Value Contributions	Comments
Case 1	-	-	+	Women in this category are less likely to use health care services and the inequality of the determinant, i.e., the characteristic considered, is in favour of poor women.
Case 2	+	+	+	Women in this category are more likely to use health care services and the inequality of this characteristic is in favour of rich women.
Case 3	+	-	-	Women in this category are more likely to use health care services and the inequality of this characteristic is in favour of poor women.
Case 4	-	+	-	Women in this category are likely to make less use of antenatal care services and the inequality of this characteristic is in favour of rich women.

Source: Allara and Fomba (2021).

The Adept software we use here will break down the inequalities into two categories: those that are justifiable and those that are not. It then decomposes the causes of the inequalities so that the contribution of each variable to the inequality of each component of the non-justifiable variables can be quantified. The intermediate results of equations 3, 4, and 5 will not be reported in this work for the simple reason that Adept automatically standardizes the variables and only presents the results related to the concentration indices and the decomposition.

Compared to other software, Adept has the advantage of minimizing human errors in scheduling, and facilitates the interpretation of the results for economic implication. However, the Adept software does not have the capacity to manipulate the data. For this reason, we use Stata 15 software to process the data before using it in Adept.

Data used

Data from the last three Demographic and Health Surveys (DHS) were used in this work: 2004, 2011, and 2018. These samples were designed to estimate a large number of indicators on the situation of children under-5 and women aged 15–49 at the national level. In addition, data disaggregated by quintiles of household socioeconomic wellbeing will allow for the identification of inequalities and the observation of equity issues in social areas in particular. These samples cover all live births that took place in the five years preceding the survey. These surveys are an initiative that has provided recent data, disaggregated by age, gender, and socio-cultural characteristics, to assess progress in implementing strategies and policies, and to report on international goals and commitments. Maternal health service utilization variables will be measured by attendance at delivery and tetanus vaccination. Mothers were asked how many doses of vaccine they received during pregnancy and how much assistance they received during delivery. The latter refers to births where the delivery was assisted by doctors, nurses, and midwives.

5. Results

Descriptive statistics

Table 2 presents the descriptive statistics of the variables we use in this work. The descriptive statistics are for each year of the study, namely, 2004, 2011, and 2018. Each variable has maximal value 1 and minimal value 0. It is the dummy variables. But the maximal and minimal value for popweight are, respectively, 465,670 and 1,905,380 for 2004; 58,792 and 43,9145 for 2011; 25,295 and 5,250,016 for 2018. While the maximal and minimal value for wealth index are, respectively, -125,175 and 320,424 for 2004, -153,536 and 322,002 for 2011, -164,645 and 338,267 for 2018. We also note that variables with two modalities have the same standard deviation.

From Table 2, it can be seen that the percentage of women who seek assistance during childbirth has improved slightly over time, from 61% in 2004 to 70% in 2018. This can be explained by the maternal health awareness that is already attracting the attention of some women. We can see in Table 2 that the proportion of women who have received a tetanus vaccine has rather considerably decreased from 49% in 2004, 53% in 2011, and 51% in 2018, compared to those who have not taken any vaccine. This can be explained by the communication efforts that have been made to motivate women to take the tetanus vaccine.

This table also shows that the percentage of poor women has increased slightly over time from 32% in 2004 to 34% in 2011 and 2018 compared to those with an average standard of living. In general, the standard of living of households did not change significantly between 2004 and 2018. The percentage of women in employment has not changed much over time. Until 2018, only 68% of women had a job, in contrast to those who did not have a job. It is also noticeable that very few women have a higher level of education, increasing slightly between 2004 and 2018 from 0.9% to 5%. Most women have a primary education.

Table 2: Descriptives statistics of 2004, 2011, and 2018

	2004 (8,125 observations)		2011 (11,732 observations)		2018 (9,733 observations)	
Variables	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Dependant variables						
Assistance during delivery	0.61	0.4872821	0.64	0.4805507	0.70	0.4590883
Intake of tetanus vaccine	0.49	0.4999511	0.53	0.3551712	0.51	0.3454396
Justifiables variables						
Mother's age group						
15–19 years (Ref.)	0.09	0.2889568	0.08	0.2779756	0.09	0.281884
20–24 years	0.28	0.4486033	0.26	0.4387313	0.23	0.421735
25–29 years	0.27	0.4427189	0.28	0.4507562	0.28	0.4486061
30–34 years	0.18	0.3843648	0.19	0.3904825	0.21	0.4080639
35–39 years	0.11	0.3127939	0.12	0.3185019	0.13	0.3358351
40–44 years	0.05	0.2270609	0.05	0.2287769	0.05	0.218454
45–49 years	0.02	0.1282977	0.01	0.1184616	0.01	0.1071278
Body Mass Index						
Underweight	0.05	0.1658606	0.07	0.1904165	0.05	0.1636452
Normal	0.67	0.4735505	0.62	0.4678219	0.57	0.4592212
Overweight	0.18	0.2852714	0.18	0.2991927	0.22	0.3203611
Obese (Ref.)	0.09	0.2877049	0.12	0.3205992	0.16	0.370137
Unjustifibles variables						
Household size						
0–5 members (Ref.)	0.32	0.2491025	0.31	0.2378252	0.31	0.2655522
6–10 members	0.47	0.4686503	0.49	0.4639018	0.47	0.4605804
11–15 members	0.14	0.4993202	0.14	0.4999041	0.15	0.4992296
16 members and more	0.07	0.3412345	0.06	0.3441062	0.08	0.3536368
Wealth level						
Poor	0.32	0.4969468	0.34	0.4973282	0.34	0.4936857
Middle (Ref.)	0.23	0.4229915	0.22	0.4113486	0.24	0.4267969
Rich	0.45	0.4673069	0.45	0.47239	0.42	0.4736908
Wealth index	-20973.8	92593.42	-14993.6	92483.77	-23276.5	92439.3
Normalized wealth index	0.23	92593.42	0.29	0.1944824	0.28	0.1838081
Job status						
Employed	0.68	0.46726	0.69	0.4631778	0.68	0.4683519
Unemployed (Ref.)	0.32	0.46726	0.31	0.4631778	0.32	0.4683519
Mother's level of education						

No education (Ref.)	0.26	0.4384253	0.25	0.4322409	0.23	0.4213416
Primary education	0.45	0.4974212	0.42	0.4932798	0.33	0.4424848
Secondary education	0.28	0.4499861	0.31	0.4604898	0.39	0.4522216
Higher education	0.009	0.0968931	0.03	0.1651026	0.05	0.2420159
Partner’s level of education						
No education (Ref.)	0.32	0.4650145	0.30	0.4601645	0.38	0.4863222
Primary education	0.31	0.4620778	0.31	0.4630042	0.27	0.4712711
Secondary education	0.33	0.4716795	0.32	0.4677253	0.29	0.4866153
Higher education	0.04	0.1979816	0.06	0.2397073	0.06	0.2207659
Sex of the head of household						
Male	0.83	0.3784168	0.82	0.3855639	0.80	0.4008964
Female (Ref.)	0.17	0.3784168	0.18	0.3855639	0.20	0.4008964
Marital status						
Married	0.70	0.456409	0.69	0.4638675	0.59	0.492403
Single (Ref.)	0.30	0.456409	0.31	0.4638675	0.41	0.492403
Place of residence						
Rural	0.61	0.4875358	0.60	0.4898875	0.56	0.4968395
Urban (Ref.)	0.39	0.4875358	0.40	0.4898875	0.44	0.4968395
Religion						
Christian	0.67	0.4691064	0.70	0.4597647	0.70	0.4815543
Muslim	0.21	0.4035802	0.24	0.4263893	0.26	0.2771597
Other religions	0.06	0.2322973	0.04	0.1951089	0.02	0.4405182
No religion (Ref.)	0.07	0.2491025	0.03	0.1672796	0.02	0.1332578
Regions						
Adamaoua	0.08	0.2678488	0.09	0.2862086	0.08	0.264071
Centre	0.14	0.3511113	0.15	0.3566851	0.19	0.3916481
East	0.08	0.2730172	0.07	0.255267	0.10	0.3040417
Littoral	0.12	0.32798	0.12	0.3211652	0.12	0.3190017
North	0.12	0.3210547	0.13	0.3406588	0.13	0.3307796
North West	0.08	0.2666811	0.08	0.2774651	0.05	0.2150362
West	0.12	0.3195793	0.09	0.2859642	0.10	0.297075
South	0.07	0.251867	0.06	0.2323853	0.10	0.293707
South West	0.06	0.2449871	0.06	0.2331955	0.02	0.1298671
Far North (Réf.)	0.13	0.3397785	0.15	0.3577704	0.13	0.3400924
Problem to get access to a health facility						
Problem	0.42	0.4937179	0.72	0.3830809	0.44	0.4965658
No problem (Ref.)	0.58	0.4937179	0.28	0.3830809	0.56	0.4965658
Time to get water						
0 minutes–10 minutes (Ref.)	0.35	0.478154	0.34	0.4737036	0.24	0.4247086

11 minutes –20 minutes	0.17	0.3711339	0.18	0.3830809	0.19	0.3910761
21 minutes--45 minutes	0.17	0.3777777	0.20	0.3967586	0.20	0.3777499
More than 45 minutes	0.31	0.4620778	0.29	0.4517732	0.37	0.4905382
Popweight	996,578.3	371,795.7	1,001,392	544,106.4	1,033,717	644,806.6
Source: Author's own construction based on DHS (2004, 2011, 2018), and Stata 15.						

In 2011, 72% of women have difficulties to get to the nearest health centre. But in 2018, only 44% of women have difficulties accessing a health centre. This could probably be achieved through the development of new physical infrastructure and improved communication channels.

Concentration curves and indexes

Figure 1 shows the concentration curves for assistance during childbirth from 2004 to 2018. The concentration curves have been constructed for each year. They show the inequality related to the socioeconomic situation in terms of assistance during delivery. We can observe that the economic situation is better for rich households. The level of inequality has increased between 2004 and 2011, as the concentration curve moves further away from the equality line. But between 2011 and 2018, the level of inequality has decreased; the concentration curve is moving closer to the equality line.

Figure 2 shows the concentration curves for tetanus vaccine intake from 2004 to 2018. The concentration curves have been constructed for each year. They show the inequality related to socioeconomic status in terms of tetanus vaccine uptake. We can observe that tetanus vaccine uptake is more concentrated among wealthy households. Although the concentration curve provides a clear picture of the levels and nature of inequality, the magnitude of this inequality is not shown. To address this, we have calculated the concentration indices that are presented over time. The positive sign of the concentration indices shows that socioeconomic inequality has favoured rich households.

Table 3 presents the different concentration indexes of our variable of interest. It shows that the positive sign of the concentration indexes of assistance during delivery also confirms that mothers with a better economic situation are more assisted during childbirth than women from poor households, and the level of inequality increases between 2004 and 2011 and decreases between 2011 and 2018. So there has been a decrease in inequality. Similarly, with regard to tetanus vaccination, the same analysis can be made insofar as inequality is more observed by the rich women from 2004 to 2018. Between 2004 and 2011, efforts were made to reduce inequality, but between 2011 and 2018, the situation was still the same as 2004.

Table 3: Concentration indices, 2004–2018

Outcomes variables	2004	2011	2018
Assistance during delivery	0.2378 (0.01)	0.2497 (0.01)	0.2119 (0.01)
Intake tetanus vaccine	0.1066 (0.01)	0.1223 (0.01)	0.1178 (0.01)

Notes: Standard deviations are in parentheses.
Source: Author's own construction based on ADEPT 6.

The nature of the concentration curves, the concentration indices, and the levels of inequality were higher for assistance during childbirth than for the vaccine. It can also be noted that, in general, the level of inequality has decreased over time (2004–2018).

Decomposition of concentration indices (contributions of each explanatory variable to the observed inequality)

The results of inequalities in attendance at delivery and tetanus vaccination are given by the contributing factors (Table 4 and Table 5). Columns 2, 5, and 8 represent the elasticities of attendance at delivery for each study year, respectively. Columns 3, 6, and 9) represent the concentration indices of the explanatory variables for each study year. Columns 4, 7, and 10 represent the variables that contribute to the inequity that is the product of the elasticities with the concentration indices. Among the inequity factors, we have the variables not taken into account in the model and the inequities generated by the variables taken into account in the model for 2004, for 2011, and for 2018. The justifiable variables contributed very little to horizontal inequity compared to the non-justifiable variables.

Factors explaining inequities in skilled assistance during delivery

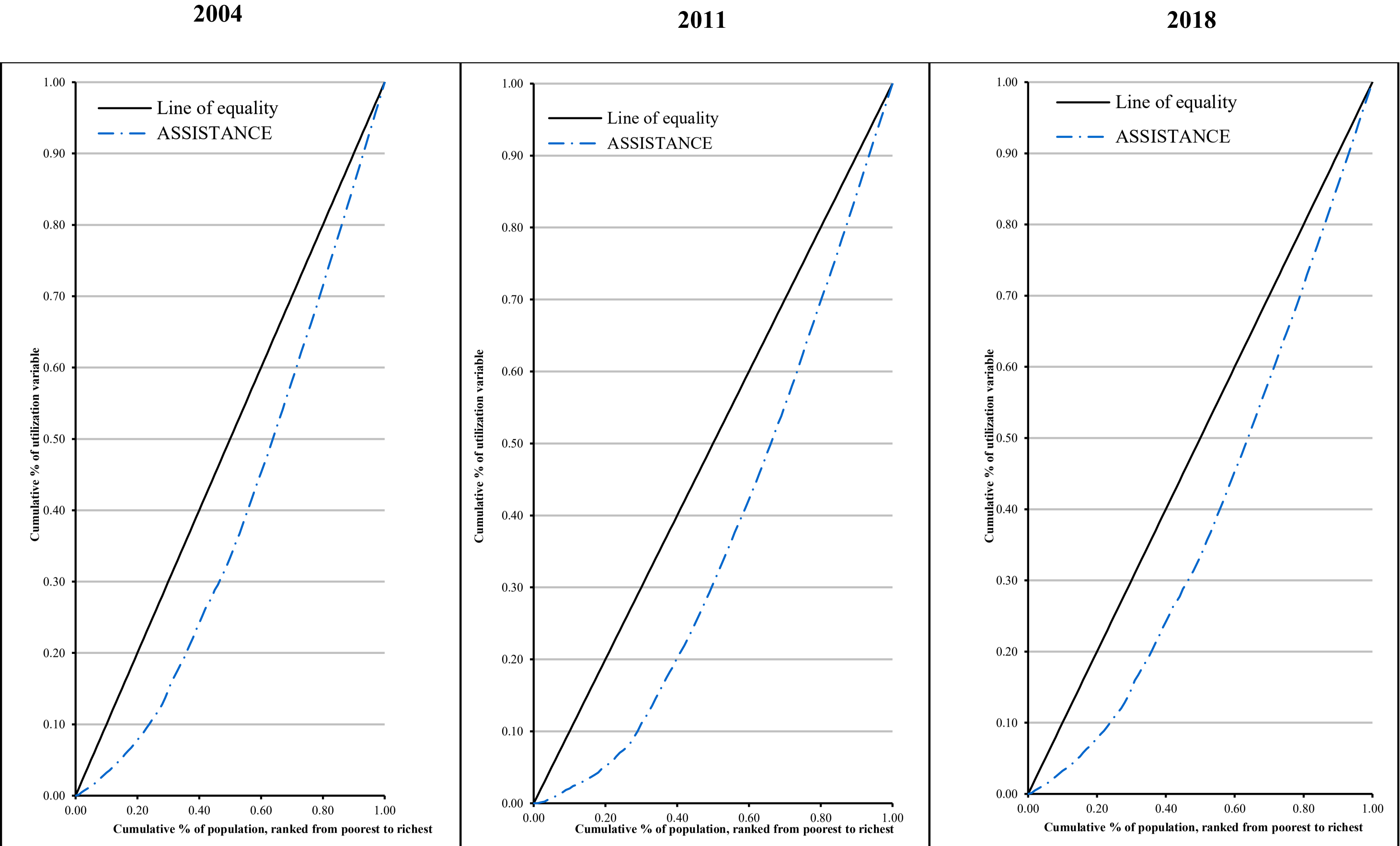
The contributions of the variables in explaining inequities in access to skilled attendance at delivery show that the majority of inequities in access to maternal health services affect the poor women compard to rich women. These inequalities are mostly explained by unjustifiable factors, i.e., inequity variables (0.238, 0.250, and 0.212, respectively, for each year). They increase between 2004 and 2011 and decrease between 2011 and 2018. Among the inequity factors, those provided by the variables not considered in the model are for each year 0.006, 0.015, and 0.013, respectively. On the other hand, the inequalities generated by the variables taken into account in the model are higher in 2011. They increase between 2004 and 2011 and decrease between 2011 and 2018 (0.239, 0.240, and 0.206, respectively). As concerns the level of wealth, the inequity is observed within the poor. It decreases over time

(with a contribution of 0.061, 0.057, and 0.046, respectively, for each year). It is the weight of richer women (with a concentration index of -0.5423, -0.5471, and 0.5479, respectively, for each year). Women from poor households find it difficult to seek the assistance of a health professional. This is because the cost of care increases when the health professional becomes more qualified.

There is the importance of secondary education (with an elasticity of 0.0827, 0.0968, and 0.1483, respectively, for each year) in explaining inequality in skilled assistance during delivery. The disparity observed at the secondary education level is by rich women (with a contribution of 0.037, 0.042, and 0.048), and is clearly evident in the assistance of women during delivery. This inequality increases over time.

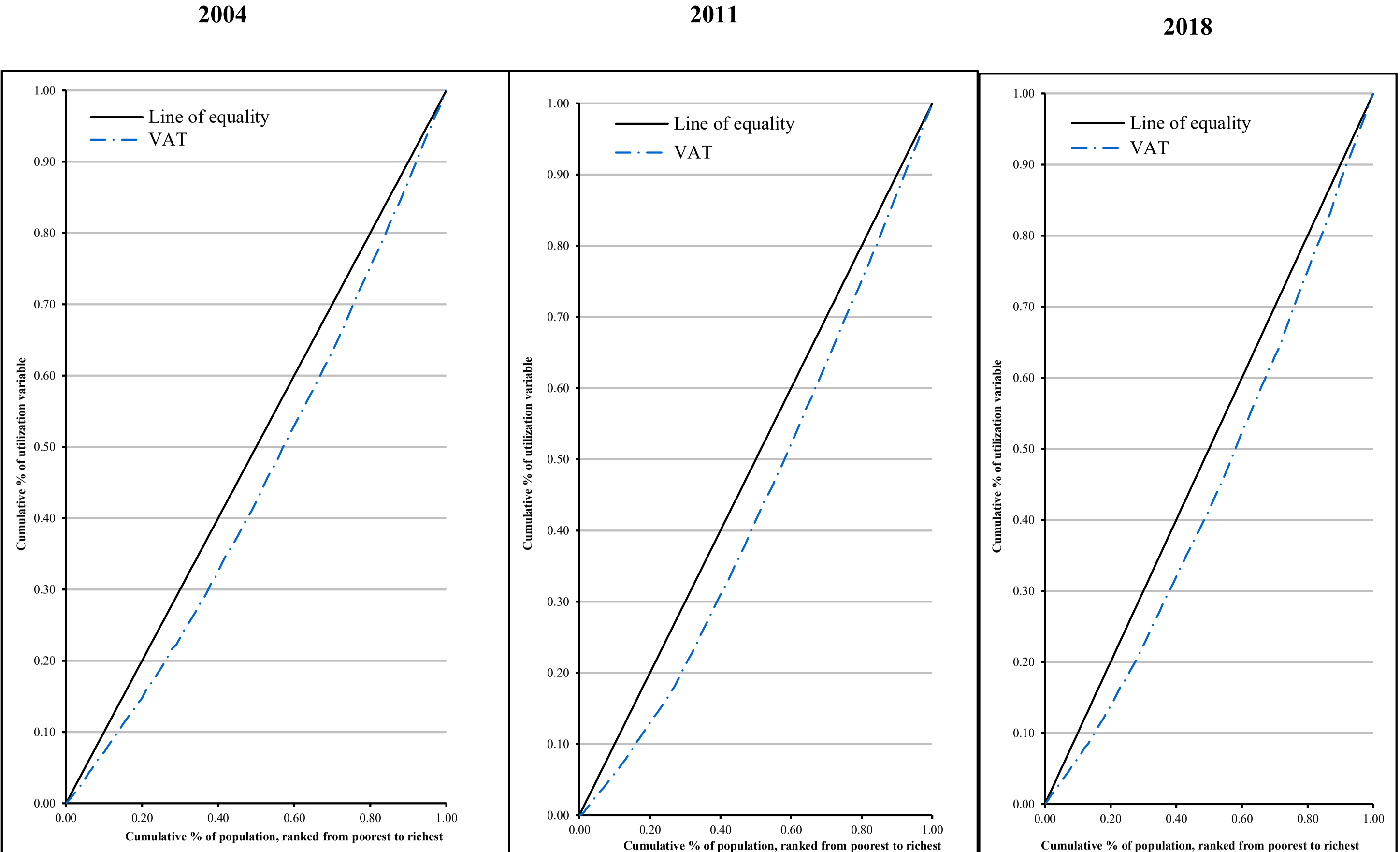
Several studies have identified education as a major determinant of maternal health and health-seeking behaviour (Saleu, 2020; Dimbuene et al, 2018; Hahn and Truman, 2015). Unfortunately, in developing countries such as Cameroon, women from poor households also have lower levels of education than their counterparts from wealthy households. We can also observe that women are less likely to be assisted during delivery by a skilled health professional with regard to the place of residence. The contribution of this variable decreases over time from 2004 to 2018 (0.030, 0.033, 0.025, respectively, for each year). This suggests that the inequity by the poor has gradually decreased. Living in rural areas prevents them from being assisted during delivery by a skilled health professional compared to those who are rich and live in urban areas.

Figure 1: Concentration curves for assistance during delivery by a skilled provider, 2004–2018



Source: Author's own construction based on ADEPT 6.

Figure 2: Concentration curves for intake of tetanus vaccine, 2004–2018



Source: Author's own construction based on ADEPT 6.

The same applies to the region of residence, specifically the Littoral regions where the inequity is observed in the wealthy women (with a contribution of 0.032, 0.032, and 0.015, respectively, for each year) who are more likely to be attended by skilled health professionals. Inequity is also observed in access to the nearest health centre, and affects more the poor. We can observe that this inequity decreased from 2004 to 2011 and is higher from 2011 to 2018. This can be explained by the fact that measures have probably been taken and have reduced the inequity but have not been accentuated.

We find that all factors are in favour of rich women. But for some factors, women are more likely to be assisted during delivery (level of wealth, level of education, region of residence, and access to the nearest health centre); while for other factors, they are less likely to be assisted during childbirth. This reflects an inequitable distribution of health centres throughout the country.

We also observe that wealthy women are more educated and live in the more affluent regions of Cameroon. From 2004 to 2011, inequity in terms of wealth level and area of residence increased. Inequity in terms of educational level increased. Inequity in terms of region of residence decreased between 2011 and 2018, and stable between 2004 and 2011; while inequity in terms of access to the nearest health centre decreased between 2004 and 2011 and increased between 2011 and 2018. This shows that efforts have been made to provide health care by building health centres closer to homes.

Factors explaining inequities in intake of tetanus vaccine during pregnancy

The contributions of variables in explaining inequities in intake of tetanus vaccine during pregnancy are reported in Table 5, and show that rich women use more this service compared to poor women. The inequities are mostly explained by unjustifiable factors, i.e., inequity variables (0.105, 0.125, and 0.116, respectively, for each year). They increased between 2004 and 2011 and decreased between 2011 and 2018. Among the inequity factors, those provided by the variables not considered in the model are, for each year, 0.005, 0.010, and 0.009, respectively. On the other hand, the inequalities generated by the variables taken into account in the model are higher in 2011. They increased between 2004 and 2011 and decreased between 2011 and 2018 (0.103, 0.111, and 0.105, respectively).

With regard to the level of wealth, we have the pro-rich inequity. It increases over time (with a contribution of 0.020, 0.002, and 0.019, respectively, for each year). It is the weight of richer women (with a concentration index of 0.6763, 0.6450, and 0.6551, respectively, for each year). Compared to the other study years, it can be observed that the inequity has increased in 2018. Over time, women from poor households continue to experience difficulties in taking the tetanus vaccine. This may be due to its cost and availability.

There is the importance of secondary education (with an elasticity of 0.0623, 0.0415, and 0.1153, respectively, for each year) in explaining inequality in the intake of tetanus vaccine. The disparity observed at the secondary education level is among rich women (with a contribution of 0.028, 0.018, and 0.037), and is clearly evident in the intake of tetanus vaccine. This inequality decreases between 2004 and 2011 and increases between 2011 and 2018. It is thus evident that there should be emphasis in communication on the importance of tetanus vaccination for the life of mother and her child.

We can also observe the importance of the effect of the place of residence in the explanation of inequality in the intake of tetanus vaccine. We observe that the inequity is evident among poor women with regard to the place of residence. The contribution of this variable increases over time from 2004 to 2018 (0.004, 0.004, 0.012, respectively for each year). This suggests that this inequity has gradually increased. Such a result may be explained by the lack of supply of the vaccine in rural areas compared to urban areas.

Table 4: Contributions of factors explaining inequalities in skilled assistance at delivery in Cameroon, 2004–2018

Assistance During Delivery (1)	2004			2011			2018		
	Elasticities (2)	Concentration Index (3)	Decomposition (4)	Elasticities (5)	Concentration Index (6)	Decomposition (7)	Elasticities (8)	Concentration Index (9)	Decomposition (10)
Justifiable variables									
Mother's age group (Ref.=15–19 years)									
20–24 years	-0.0089	0.0006	0.000	-0.0072	0.0198	0.000	0.0050	0.0129	0.000
25–29 years	-0.0158	0.0319	-0.001	-0.0042	0.0209	0.000	-0.0137	0.0116	0.000
30–34 years	-0.0007	0.0057	0.000	-0.0046	-0.0159	0.000	-0.0041	0.0432	0.000
35–39 years	-0.0039	0.0184	0.000	0.0064	-0.0078	0.000	-0.0031	-0.0269	0.000
40–44 years	0.0033	-0.1276	0.000	0.0039	-0.0329	0.000	-0.0020	-0.0561	0.000
45–49 years	-0.0017	-0.1742	0.000	0.0001	-0.1408	0.000	-0.0005	-0.2366	0.000
Body Mass Index (Ref.= obese)									
Underweight	-0.0110	-0.2693	0.003	-0.0097	-0.3128	0.003	-0.0055	-0.4047	0.002
Normal	-0.0788	-0.0907	0.007	-0.0227	-0.1136	0.003	-0.0511	-0.1693	0.009
Overweight	-0.0121	0.2158	-0.003	-0.0001	0.2217	0.000	-0.0136	0.2527	-0.003
Subtotal 1			**0.007**			**0.005**			**0.007**
Unjustifiable variables (inequity control)									
Household size (Ref.= 0-5 members)									
6–10 members	0.0107	-0.0034	0.000	-0.0016	0.0366	0.000	0.0143	0.0943	0.001
11–15 members	0.0060	0.0117	0.000	-0.0038	-0.0123	0.000	0.0351	-0.0257	-0.001
16 members and more	-0.0062	-0.0616	0.000	-0.0059	-0.0159	0.000	0.0057	-0.0912	-0.001
Wealth level (Ref.=middle)									
Poor	-0.1156	-0.5358	0.062	-0.0956	-0.5504	0.053	-0.0901	-0.5449	0.049
Rich	0.0163	0.6763	0.011	0.0293	0.6450	0.019	0.0195	0.6551	0.013
Job status (Ref.= unemployed)									
Employed	-0.0146	-0.1127	0.002	-0.0169	-0.0424	0.001	0.0457	-0.0616	-0.003
Mother's level of education (Ref.= No education)									
Primary education	0.0818	-0.0215	-0.002	0.1030	-0.0570	-0.006	0.0967	-0.0826	-0.008
Secondary education	0.0827	0.4465	0.037	0.0968	0.4364	0.042	0.1483	0.3205	0.048
Higher education	0.0024	0.8972	0.002	0.0122	0.8052	0.010	0.0205	0.7863	0.016
Partner's education level (Ref.= No education)									
Primary education	0.0125	-0.1001	-0.001	0.0403	-0.1230	-0.005	0.0073	-0.1400	-0.001
Secondary education	0.0221	0.2595	0.006	0.0501	0.2419	0.012	0.0275	0.2102	0.006
Higher education	0.0037	0.7084	0.003	0.0080	0.6839	0.005	0.0029	0.7043	0.002
Sex of the head of household (Ref.= female)									
Male	-0.0079	-0.0181	0.000	-0.0595	-0.0226	0.001	-0.0036	-0.0198	0.000
Marital status (Ref. =single)									
Married	-0.0009	-0.0803	0.000	-0.0333	-0.0830	0.003	-0.0072	-0.0723	0.001

Place of residence (Ref.=urban)									
Rural	-0.0934	-0.3176	0.030	-0.0871	-0.3785	0.033	-0.0685	-0.3634	0.025
Religion (Ref.= No religion)									
Christian	0.0026	0.0919	0.000	0.0848	0.0924	0.008	0.0491	0.0850	0.004
Muslim	-0.0054	-0.0790	0.000	0.0402	-0.1390	-0.006	0.0314	-0.1579	-0.005
Others religion	-0.0044	-0.2654	0.001	-0.0022	-0.4041	0.001	-0.0022	-0.4886	0.001
Region (Ref.=Far west)									
Adamaoua	0.0030	-0.0036	0.000	0.0061	-0.0066	0.000	-0.0024	-0.1261	0.000
Centre	0.0639	0.3978	0.025	0.0513	0.4316	0.022	0.0442	0.2951	0.013
East	0.0013	-0.0142	0.000	-0.0014	-0.0228	0.000	-0.0034	-0.0953	0.000
Littoral	0.0590	0.5494	0.032	0.0548	0.5788	0.032	0.0255	0.5770	0.015
North	0.0148	-0.3842	-0.002	0.0087	-0.3749	-0.006	-0.0010	-0.4078	0.000
North west	0.0795	-0.1004	-0.008	0.0610	-0.0486	-0.003	0.0240	-0.0339	-0.001
West	0.0819	0.0555	0.004	0.0741	0.1120	0.011	0.0380	0.2166	0.009
South	0.0109	0.2084	0.010	0.0084	0.2226	0.007	0.0076	0.2226	0.004
South west	0.0281	0.2633	0.007	0.0205	0.2675	0.005	0.0031	0.6396	0.002
Problem with access to a health facility (Ref.= No problem)									
Problem	-0.0392	-0.2212	0.009	-0.0467	-0.0424	0.002	-0.0395	-0.2062	0.008
Time to get water (Ref. =0 min–10 min)									
11 min–20 min	0.0066	-0.0936	-0.001	-0.0008	-0.1184	0.000	0.0039	-0.2335	-0.001
21 min–45 min	0.0115	-0.1346	-0.002	-0.0023	-0.1336	0.000	0.0043	-0.1552	-0.001
More than 45 min	0.0208	0.2065	0.004	0.0008	0.1653	0.000	0.0170	0.3029	0.005
Subtotal 2			**0.232**			**0.235**			**0.199**
Subtotal (1+2)			**0.239**			**0.240**			**0.206**
Residual: Regression error			0.006			0.015			0.013
Residual: Missing data			-0.006			0.007			-0.004
Inequality (total)			0.239			0.262			0.215
Inequity/Unjustified inequality			0.238			0.250			0.212

Source: Author's own construction based on DHS (2004, 2011, 2018), and ADEPT 6.

Table 5: Contributions of factors explaining inequalities in the intake of tetanus vaccine in Cameroon, 2004-2018

Intake of Tetanus Vaccine (1)	2004 Elasticities (2)	2004 Concentration Index (3)	2004 Decomposition (4)	2011 Elasticities (5)	2011 Concentration Index (6)	2011 Decomposition (7)	2018 Elasticities (8)	2018 Concentration Index (9)	2018 Decomposition (10)
Justifiables variables									
Mother's age group (Ref.=15–19 years)									
20–24 years	-0.0721	0.0006	0.000	-0.0648	0.0198	-0.001	-0.0773	0.0129	-0.001
25–29 years	-0.0803	0.0319	-0.003	-0.0880	0.0209	-0.002	-0.1296	0.0116	-0.002
30–34 years	-0.0436	0.0057	0.000	-0.0623	-0.0159	0.001	-0.0771	0.0432	-0.003
35–39 years	-0.0195	0.0184	0.000	-0.0198	-0.0078	0.000	-0.0493	-0.0269	0.001
40–44 years	-0.0029	-0.1276	0.000	-0.0089	-0.0329	0.000	-0.0145	-0.0561	0.001
45–49 years	0.0004	-0.1742	0.000	0.0005	-0.1408	0.000	-0.0019	-0.2366	0.000
Body Mass Index (Ref.= obese)									
Underweight	-0.0049	-0.2693	0.001	-0.0017	-0.3128	0.001	-0.0025	-0.4047	0.001
Normal	-0.0117	-0.0907	0.001	0.0268	-0.1136	-0.003	-0.0046	-0.1693	0.001
Overweight	-0.0095	0.2158	-0.002	0.0034	0.2217	0.001	-0.0063	0.2527	-0.002
Subtotal 1			**-0.003**			**-0.004**			**-0.003**
Unjustifiable variables (inequity control)									
Household size (Ref.= 0–5 members)									
6–10 members	0.0877	-0.0034	0.000	0.0396	0.0366	0.001	0.0775	0.0943	0.007
11–15 members	0.0475	0.0117	0.001	0.0088	-0.0123	0.000	0.0398	-0.0257	-0.001
16 members and more	0.0102	-0.0616	-0.001	-0.0067	-0.0159	0.000	0.0174	-0.0912	-0.002
Wealth level (Ref.=middle)									
Poor	-0.0165	-0.5358	0.009	-0.0788	-0.5504	0.043	-0.0434	-0.5449	0.024
Rich	0.0289	0.6763	0.020	0.0036	0.6450	0.002	0.0283	0.6551	0.019
Job status (Ref.= unemployed)									
Employed	-0.0275	-0.1127	0.003	0.0385	-0.0424	-0.002	0.0613	-0.0616	-0.004
Mother's level of education (Ref.= No education)									
Primary education	0.0410	-0.0215	-0.001	0.0187	-0.0570	-0.001	0.0620	-0.0826	-0.005
Secondary education	0.0623	0.4465	0.028	0.0415	0.4364	0.018	0.1153	0.3205	0.037
Higher education	0.0031	0.8972	0.003	0.0051	0.8052	0.004	0.0152	0.7863	0.012
Partner's education level (Ref.= No education)									
Primary education	-0.0060	-0.1001	0.001	-0.0075	-0.1230	0.001	-0.0182	-0.1400	0.003
Secondary education	-0.0095	0.2595	-0.002	-0.0043	0.2419	-0.001	-0.0187	0.2102	-0.004
Higher education	0.0025	0.7084	0.002	0.0029	0.6839	0.002	-0.0045	0.7043	-0.003
Sex of the head of household (Ref.= female)									

Male	0.0377	-0.0181	-0.001	0.0004	-0.0226	0.000	-0.0143	-0.0198	0.000
Marital status (Ref. =single)									
Married	-0.1156	-0.0803	0.009	-0.1605	-0.0830	0.013	-0.0652	-0.0723	0.005
Place of residence (Ref.=urban)									
Rural	-0.0119	-0.3176	0.004	-0.0095	-0.3785	0.004	-0.0317	-0.3634	0.012
Religion (Ref.= No religion)									
Christian	0.0739	0.0919	0.007	-0.0288	0.0924	-0.003	0.0804	0.0850	0.007
Muslim	0.0111	-0.0790	-0.001	-0.0073	-0.1390	0.001	0.0449	-0.1579	-0.007
Others religion	0.0025	-0.2654	-0.001	-0.0087	-0.4041	0.004	0.0014	-0.4886	-0.001
Region (Ref. =Far west)									
Adamaoua	-0.0052	-0.0036	0.000	0.0111	-0.0066	0.000	-0.0059	-0.1261	0.001
Centre	0.0023	0.3978	0.001	0.0181	0.4316	0.008	-0.0180	0.2951	-0.005
East	0.0004	-0.0142	0.000	0.0106	-0.0228	0.000	-0.0099	-0.0953	0.001
Littoral	0.0075	0.5494	0.004	0.0316	0.5788	0.018	0.0054	0.5770	0.003
North	-0.0157	-0.3842	0.003	0.0211	-0.3749	-0.009	0.0002	-0.4078	-0.001
North west	0.0254	-0.1004	-0.003	0.0328	-0.0486	-0.002	0.0171	-0.0339	-0.001
West	0.0090	0.0555	0.000	0.0281	0.1120	0.005	0.0000	0.2166	0.001
South	-0.0002	0.2084	0.002	0.0040	0.2226	0.005	0.0006	0.2226	0.002
South west	0.0061	0.2633	0.002	0.0138	0.2675	0.004	0.0030	0.6396	0.002
Problem with access to a health facility (Ref.= No problem)									
Problem	-0.0506	-0.2212	0.011	-0.0557	-0.0424	0.002	-0.0289	-0.2062	0.006
Time to get water (Ref. =0 min–10 min)									
11 min–20 min	-0.0045	-0.0936	0.000	0.0004	-0.1184	0.000	0.0076	-0.2335	-0.002
21 min–45 min	0.0089	-0.1346	-0.001	-0.0032	-0.1336	0.000	0.0115	-0.1552	-0.002
More than 45 min	0.0104	0.2065	0.002	0.0095	0.1653	0.002	0.0283	0.3029	0.009
Subtotal 2			**0.101**			**0.113**			**0.110**
Subtotal (1+2)			**0.098**			**0.109**			**0.107**
Residual: Regression error			0.005			0.009			0.008
Residual: Missing data			-0.001			0.002			-0.001
Inequality (total)			0.103			0.121			0.114
Inequity/Unjustified inequality			0.107			0.122			0.118

Source: Author's own contruction based on DHS (2004, 2011, 2018), and ADEPT 6.

At the level of region of residence, specifically the Littoral regions, the inequity is observed among wealthy women (with a contribution of 0.004, 0.004, and 0.012, respectively, for each year) who are more likely to take up tetanus vaccine. Inequity in access to the nearest health centre is evident among the poor (with an elasticity of -0.00434, -0.0557, -0.0240). With the contribution of 0.004, 0.018, and 0.004, respectively, we can observe that this inequity is more apparent in 2004, but in other years there are almost no inequities. Such a result is normal and can be explained by the fact that the health programmes set up to improve the use of antenatal care offer available and accessible health services at a lower cost, so this shows that efforts have been made to educate women, enabling them to acquire more knowledge.

All these factors are in favour of rich women. While for some factors, women are more likely to take up the tetanus vaccine (place of residence), for others, women are less likely to utilize the tetanus vaccine (due to factors such as level of education, level of wealth, region of residence, and nature of accessibility to the nearest health facility). We can say that the inequality in the distribution of wealth level works against vaccination of women from the poorest households.

Overall, policy makers must make efforts to reduce socioeconomic inequalities, particularly in household living standards and education, if significant progress is to be made in reducing maternal mortality. In order to reduce these inequalities in wealth, the income gaps of households or women of childbearing age could be reduced over time by promoting equal opportunities in access to sources of income. Cameroon has certainly put in place documents to reduce poverty, such as the Poverty Reduction Strategy Document, the Growth and Employment Strategy Document and the Health Sector Strategy (2016-2027), just to list a few. These documents make certain propositions that make it possible to improve the living conditions of the most vulnerable groups.

On the one hand, specific programmes to promote employment for the most disadvantaged groups (young people, women, the disabled, indigenous minorities, etc.) and to rejuvenate the workforce in the public service have been implemented in terms of job opportunities. On the other hand, targeted prenatal consultations and skilled assistance during delivery by trained attendants are encouraged by public decision-makers through the pre-positioning of obstetric kits in health facilities and the health voucher project with a single rate for the entire package of obstetric services (childbirth, blood transfusion, other complications, etc). Unfortunately, it is only the northern part of Cameroon that benefits from these kits. This is why inequity in this area is almost non-existent. We could also consider extending these programmes to the Littoral region where there is still inequity in the use of maternal health services, whether in terms of assistance during delivery or in terms of taking vaccines.

However, the rate of professionally assisted deliveries has stagnated, rising from 63.3% to 64.7% between 2011 and 2014 (Ministry of Health, 2015). Teams could be set up to monitor the application of these decisions in health facilities, and also the availability and effective provision of all the necessary equipment and their

distribution throughout the country so that all women can benefit. These attempts to improve the supply of care are little known by the public and must be accompanied by major information and awareness campaigns through the media, brochures, and social networks.

To reduce adverse effects of poor access to health centres, we could encourage the redeployment of health professionals to rural populations who suffer more from the remoteness of health services compared to their sisters who live in urban areas. To this end, the necessary means could be provided (means of transport, better income, etc.) to enable them to go about their business. Moreover, the construction of integrated health centres in rural areas, their physical and material equipment will also reduce the distances to the places of residence and thus allow all women to have access without any difficulty. In Cameroon, it can be observed that access to a health centre is on average 44%, a problem for pregnant women. The achievement of the MDGs undoubtedly aims to reduce these distances, but it would be urgent, in the short term, to prioritize rural areas which suffer more from this mobility problem.

Reducing inequalities in educational attainment will require increasing educational attainment among poor women and women of reproductive age. Thus, the promotion of equality and access to education between rich and poor women must be encouraged to make it real over time. Education allows access to all services and is therefore effective in combating inequality. In Cameroon, women are less likely than men to have reached secondary level without completing it (incomplete secondary). The percentage of women who have no education is 36% in rural areas compared to 8% in urban areas (National Institute of Statistics [NIS] and ICF International, 2020). The implementation of a strategy to promote education for all women must be targeted. In other words, the focus must be on rural areas. In Cameroon, free primary education is already in place, but is not fully implemented.

As with the distribution of maternal health kits, a team to monitor the implementation of these measures must be set up to ensure the effectiveness of this measure. The provision of minimum materials and better working conditions for teachers must also be effective throughout the country. To improve inequalities in health care, it is also necessary to ensure that educational policies target women from poor and disadvantaged households.

6. Conclusion

The objective of this study was to measure horizontal equity in the use of maternal health services in Cameroon. More specifically, it was to determine the level of inequity in the use of maternal health services in Cameroon, and to identify the sources of inequity in the use of maternal health care services in Cameroon. To do this, we used the indirect standardization method. This decomposition method allowed us to identify sources of inequity by including explanatory variables in the model and also to conduct our own analysis of the inequity of maternal health care distribution. We used the 2004, 2011, and 2018 Demographic and Health Surveys as our database. This study shows that the main sources of inequity include level of wealth, level of education, area of residence, region of residence, and access to the nearest health facility. These factors contribute to inequities, and have almost equal influence on both delivery assistance and tetanus vaccination. The problem of accessibility is a great risk for women. They are exposed to infectious diseases, prolonged labour, haemorrhage, and death due to complications in childbirth. Another justification is the cost differential. The cost of having a trained health professional to assist you is enormous, especially if you have to do a caesarean section. The inequity is lower for tetanus vaccination than for skilled attendance because of strategies developed by policy makers to encourage women to seek health care during pregnancy. This includes the "health voucher" and "performance-based funding" programmes developed in the northern region, which offer low-cost antenatal and postnatal services.

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African Economic Research Consortium
Consortium pour la Recherche Economique en Afrique
Middle East Bank Towers,
3rd Floor, Jakaya Kikwete Road
Nairobi 00200, Kenya
Tel: +254 (0) 20 273 4150
communications@aercafrica.org