



Does Safe Delivery Depend on Antenatal Care in Cameroon?

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Abstract

BACKGROUND

Cameroon had 529 maternal deaths per 100,000 live births in 2017. This high maternal mortality rate (MMR) is likely to reduce if the health system identifies earlier the complications related to pregnancy and provides an adequate response. The perinatal period is appropriate to identify some of these complications through antenatal care (ANC). However, little is known about the contribution of the ANC consultation in the improvement of safe delivery. This study, therefore, aimed to determine the effect of ANC on the probability of safe delivery in Cameroon.

MATERIALS AND METHODS

The study used a cross-sectional Cameroon Demographic Health Survey (CDHS, 2018). This survey comprised women who gave birth in the 5 years preceding the survey aged 15 to 49 years (N = 6463). Women's ANC compliance was assessed by at least one clinic. Safe delivery was measured as whether the woman gave birth at a health facility or home attended to by a skilled health worker or not. The association between women's ANC and safe delivery was analysed using a probit regression model.

RESULTS

The results show that women of favoured regions have a comparative advantage to safe delivery compared to the North and extreme North regions of Cameroon. Among women who did not carry out ANC consultation, 81.24% did not use a Safe delivery mode whereas 79.67% of women who carried out ANC consultation used the Safe delivery mode. Finally, the econometrics estimations indicate a positive and significant effect of ANC consultation on the probability safe of delivery.

CONCLUSION

The study confirms a positive and significant dependence of safe delivery on ANC in Cameroon. The main control variables such as education, income levels, living environment and region of residence are also expected to affect the likelihood of safe delivery.

RECOMMENDATION

To increase safe delivery in Cameroon, public policymakers could put in place policies encouraging ANC consultation among pregnant women. These policies could include, improving maternal education and reducing the distance to health facilities.

Keywords: Safe delivery, Antenatal care, Cameroon

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Introduction

In the world, every day 808 women die from pregnancy-related causes and two-thirds of these deaths occur in Sub-Saharan Africa (1). In 2015, nearly 303,000 women died of pregnancy-related causes, 2.6 million children were stillbirths and 2.7 million newborns died in the first months of birth (2). These statistics show that the risk of a woman dying during childbirth has declined but remains high. This high level needs more knowledge on the causes of maternal deaths and evidence-based interventions to address the factors. One of the important components of the maternity initiative is the provision of good antenatal care for all pregnant women. This ANC is one of the basic components of maternal care on which the life of mothers and babies depend (3). Indeed, there is a positive relationship between the follow-up of antenatal care and Safe delivery (4). The goals of good antenatal care are to ensure that the pregnancy does no harm to the mother and keeps the fetus healthy during the antenatal period and at birth. According to WHO recommendations on antenatal coverage in developed countries, 98% of all pregnant women attend antenatal care and 94% give birth under the supervision of skilled health professionals with prompt access to appropriate emergency treatment in the event of a complication. By contrast, in Africa and Asia, less than 70% of pregnant women receive antenatal care. In sub-Saharan Africa, 66% of maternal mortality is due to pregnancy and childbirth complications (5). In reality, these women do not receive adequate antenatal care and lack skilled attendance during childbirth. This explains the fact that the maternal and newborn mortality rate is high in these regions.

In Cameroon, the maternal mortality rate was estimated at 529 deaths per 100,000 births in 2017(6). Similarly, pregnant women have nearly universal access to a skilled ANC professional

(7), with a lower percentage to have their first ANC visit in the first quarter. In the town of Buea for example, only 27,7% of pregnant women begin antenatal consultations in the first quarter of pregnancy (8). This is due to factors such as poor access to health centres, financial problems and lack of information. Nevertheless, to secure childbirth, and reduce maternal and newborn mortality, Cameroon adopted the Sustainable Development Goals in 2015. The third objective focuses on reducing the maternal mortality rate to 70 deaths per 100,000 births by 2030 (9) and a reduction in the number of newborn deaths. In reality, these progressions will make it possible to increase the number of women who follow antenatal care, thus starting these antenatal consultations in the first quarter, thus inducing a safe delivery.

However, given the current stage of development of Cameroon's economic model, the commitment to reducing maternal and perinatal mortality with an emphasis on antenatal care is inevitable. Therefore, it is both important and urgent for Cameroon to find ways to improve antenatal care. In this light, a study on the relationship between antenatal consultation and Safe delivery in Cameroon could provide empirical information for the formulation of appropriate public policies aimed at reducing maternal and newborn mortality.

Other studies, which have estimated the level of antenatal care obtained using the interquartile range difference, do not claim to be exhaustive (10). On the other hand, to the best of our knowledge, the previous empirical studies regarding antenatal health care in Cameroon did not assess the clear relationship between antenatal health care and safe delivery. In this light and considering the particular situation in Cameroon, the present study aimed to estimate the effect of antenatal care (ANC) consultation on the probability of safe delivery in Cameroon.



Methodology

The data used in the study comes from the Demographic and Health Surveys (DHS) carried out in Cameroon in 2018 by the National Institute of Statistics. The sample consists of 16,101 women aged 15-49 and 15,677 were successfully interviewed. However, given the missing data for certain indicators, the numbers of observations after estimation are not the same in the different tables and equations.

Dependence of safe delivery on antenatal care consultation

The relationship between Safe delivery and antenatal consultation is obtained via the Chi2 independence test. The different steps of this Chi2 test are as follows:

Step 1. The level of the test is $\alpha = 5\%$ and the null hypothesis suggests the independence of Safe delivery and antenatal care consultation while the alternative hypothesis suggests the dependence between the two characteristics.

Step 2. The study has a sample size of $n = 15677$ and the 2 matched samples of measurements will be summarized by the distribution of observed joint counts (N_{lc}).

Step 3. The Chi2 statistic is obtained from the empirical chi-square coefficient, noted χ^2 and defined by the following formulation:

$$\chi^2 = \sum \frac{(N_{lc} - f_{lc})^2}{f_{lc}} \quad (1)$$

With (N_{lc}), the joint numbers of the contingency table are associated jointly with the Safe delivery modality in line and the antenatal care modality in the column. And, f_{lc} , the joint frequency, i.e. the joint number in relation to the total sample.

Step 4. Under conditions $n \geq 30$ and all $f_{lc} \geq 5$, the χ^2 statistic approximately follows the Chi-2 distribution at $(L - 1)(C - 1) = 1$ dof.

Step 5. Under the null hypothesis, the study expects to observe a χ^2 value close to 0 and under the alternative hypothesis, it expects to observe a larger χ^2 value.

Step 6. The P-value α_{obs} is the probability under the null hypothesis of observing a value of χ^2 at least as large as its χ^2_{obs} value: $\alpha_{obs} = \text{Probability of the null hypothesis } (\chi^2 \geq \chi^2_{obs})$.

Step 7. Rule based on the P-value: if $\alpha_{obs} \leq \alpha$, we reject the null hypothesis at the risk of error α . On the other hand, if the P-value (largely) exceeds the level of 5% chosen, we fail to reject the null hypothesis. At the 5% level and with an unknown β error risk, we cannot conclude that there is a link between Safe delivery and antenatal care.

The different test steps presented above represent a presumptive association between Safe delivery and antenatal care. To determine a causal relationship, an econometric model is important.

Probit model

To estimate the predicted value of a Safe delivery, one should keep in mind the behaviour of the woman under the two alternatives (had a Safe delivery or not) according to the Probit model. In this model, the dependent variables are binary and given by:

$$\begin{cases} 1 & \text{if Woman had the safe delivery} \\ 0 & \text{Otherwise} \end{cases} \quad (2)$$

Thus, the probability distribution of Safe delivery care Y_i conditional on the explanatory variables X_i is described as follows:

$$(Y, B) = [(X_i B)] [1 - F(X_i B)]^{(1-Y_i)}, Y = 0, 1 \quad (3)$$

After making all development (log likelihood logarithm, maximization of function with respect to β and the inverse of the Hessian

matrix evaluated in $\hat{\beta}_{MV}$) the estimated probability for each woman is given by:

$$P_i = \Phi(x_i' \beta_{probit}) \quad (4)$$

Data and variables

Women who had a safe delivery were considered as the outcome variable, recorded as a binary variable (yes/no) in the dataset. Table 1 describes the variables and their definitions.

Results

Socio-demographic characteristics

Figures (1 & 2) present the descriptive statistics of the key characteristics of women aged 15-49. These are Safe delivery and the region of residence. The pie chart reveals that 69% of women had a safe delivery meanwhile 31% did not have a safe delivery.

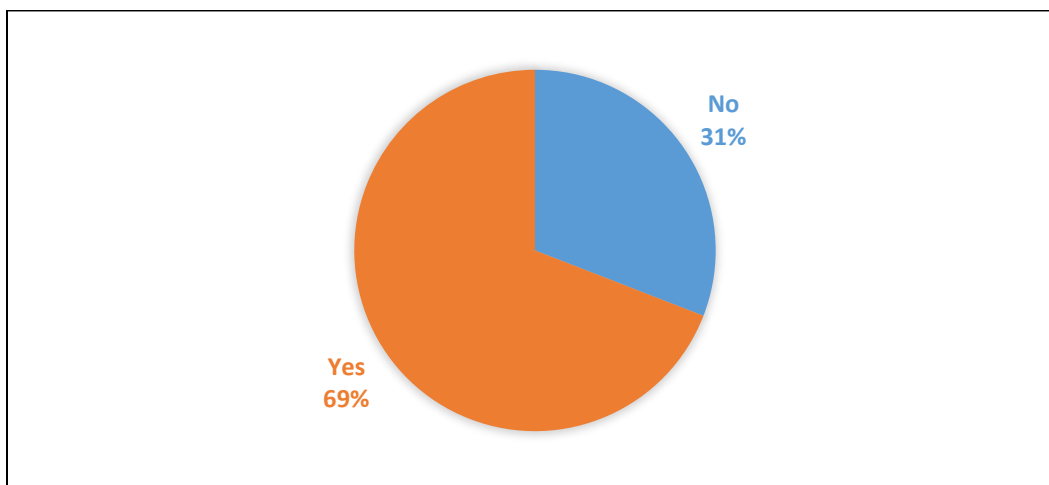


Figure 1:
Distribution of Safe delivery

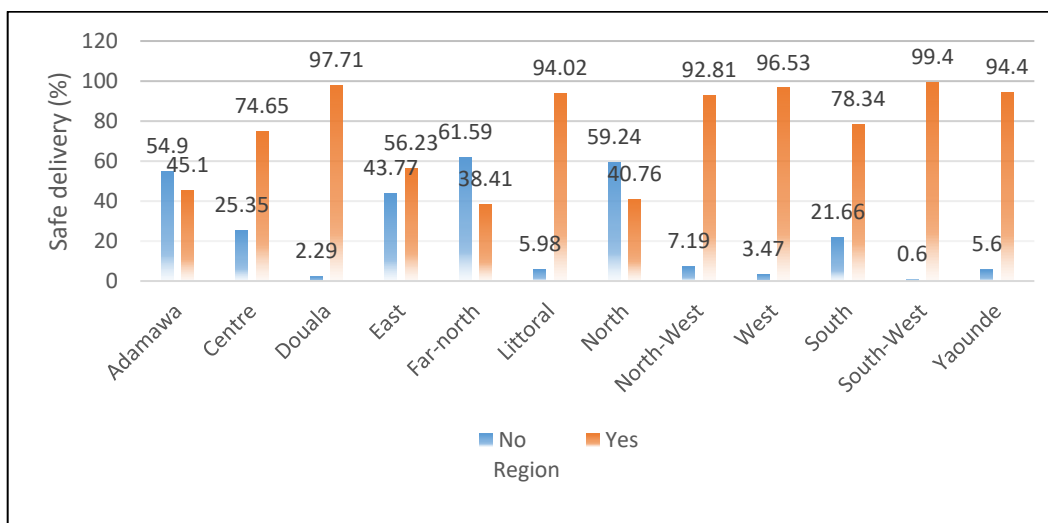


Figure 2:
Safe delivery according to the region



This underlines the importance that women attach to their health and especially when it comes to their health during the perinatal period. However, this interest in safe delivery is disproportionately distributed according to the ten (10) regions of Cameroon (Figure 2). Figure 2 reveals two trends, namely regions with more safe deliveries and regions with fewer safe deliveries.

Regions such as Adamawa, Far-north, and North are those with lower proportions of Safe deliveries. On the other hand, regions such as Centre, Douala, East, Littoral, North-West, West, South, South-West and Yaoundé have the largest shares of Safe deliveries. This clearly illustrates the fact that the favoured regions are those located around the centre. The proximity effect with the centre gives them a comparative advantage compared to the northern and extreme northern regions in particular.

Distribution of safe delivery based on antenatal care

Among 890 women who do not have access to prenatal consultation, 723 did not have access to safe delivery either, and 167 had access to safe delivery, i.e. a rate of non-access to safe delivery of 81.24%. In addition, of the 5,573 women with access to prenatal consultation,

1,134 had no safe delivery, while 4,439 had safe delivery, an access rate of 79.65%.

The Chi2 test at a 5% risk of error indicates that safe delivery is statically linked to antenatal care. There is indeed a link between prenatal consultation and safe childbirth. This means that women of childbearing age do not behave in the same way with regard to their childbirth depending on whether they have received a prenatal consultation or not. The contingency table indicates significant differences between the observed frequencies and the theoretical frequencies. For example, the intersection between having access to prenatal consultation and not having access to safe childbirth counts 1134 women of childbearing age when it should only have... if the two characters were independent. Similarly, at the intersection between access to prenatal consultation and access to safe childbirth, there are 4,606 women of childbearing age when they should not.

Effect of antenatal care consultation on safe delivery

The results of the probit model are presented in Table 3. Indeed, five separate equations were estimated. The first equation (column 1) takes into account only antenatal consultations.

Table 2:
Association between Safe delivery and Antenatal care consultation

ANC	Safe delivery		Total
	No	Yes	
No	723	167	890
%	81.24	18.76	100.00
Yes	1134	4439	5573
%	20.35	79.65	100.00
Total	1857	4606	6463
%	28.73	71.27	100.00

$$\chi^2_{0.05} = \frac{1}{4} < 3.841$$

Pearson Chi2 (1) = 1.4e+03 Pr = 0.000

The Chi2 value with $\alpha = 0.05$ and one degree of freedom is 3.841



The second and third (columns 2 and 3) integrate the geographic and sociodemographic factors in addition to antenatal consultations. One takes into account geographical location (column 2) while the other considers education and religion (column 3). Finally, while starting from the previous equations, models four and five (columns 4 and 5) take into account characteristics such as media exposure and socioeconomic characteristics (well-being quintile and financial autonomy). For each equation, the results of the Chi2 test of the likelihood ratio (LR), the Pseudo R-squares and the number of observations included in the model are given at the end of Table 3.

It is observed that antenatal consultations significantly determine Safe deliveries in Cameroon. Indeed, the equations show the

existence of a positive and significant relationship between the antenatal consultations of Cameroonian women and their Safe deliveries. The fact that Cameroonian women consulted health personnel during their pregnancy is significantly and positively correlated with safe delivery. These results are robust whatever the equation considered (from column 1 to column 5).

Regarding the geographical characteristics, it is found that the region of residence of women affects their Safe delivery. Even if the fact of belonging to certain given regions does not significantly increase the probability of having a safe delivery, it nevertheless seems that other regions increase this probability.

Table 3:

The outcome of the effects of antenatal care and other characteristics of the woman on Safe Delivery

	(1) Safe delivery	(2) Safe delivery	(3) Safe delivery	(4) Safe delivery	(5) Safe delivery
m14anc	1.716*** (32.87)	1.506*** (25.39)	1.396*** (22.77)	1.355*** (22.06)	1.402*** (19.60)
A18_34		0.00510 (0.11)	-0.0640 (-1.32)	-0.0744 (-1.53)	-0.105 (-1.94)
Adamawa		-1.293*** (-7.42)	-0.935*** (-5.02)	-0.772*** (-4.09)	-0.288 (-1.37)
Centrewithoutyaounde		-0.690*** (-3.94)	-0.697*** (-3.83)	-0.588** (-3.21)	-0.227 (-1.10)
East		-1.224*** (-7.12)	-1.142*** (-6.37)	-0.986*** (-5.41)	-0.603** (-2.93)
Farnorth		-1.706*** (-10.00)	-1.262*** (-6.94)	-1.020*** (-5.52)	-0.534** (-2.62)
Littoralwithoutdouala		-0.0277 (-0.14)	-0.0292 (-0.14)	0.0906 (0.44)	0.467 (1.90)
North		-1.474*** (-8.61)	-1.085*** (-5.97)	-0.878*** (-4.76)	-0.436* (-2.14)
Northwest		-0.0178 (-0.09)	0.0643 (0.31)	0.215 (1.03)	0.512* (2.19)
West		0.206 (1.04)	0.261 (1.27)	0.296 (1.43)	0.670** (2.90)
bothSouth		-0.589*** (-3.40)	-0.633*** (-3.52)	-0.547** (-3.01)	-0.247 (-1.19)



In other words, there are regions whose effect is negative and significant and regions whose effect is positive and not significant. Living in an urban environment seems to increase the probability of Cameroonian women having a Safe delivery. Moreover, being educated positively and significantly influences the decision to have a Safe delivery. Since education opens the mind and provides access to all basic

rights, having a high level of education increases exposure to health needs and therefore increases the likelihood of access to Safe delivery (11).

Regarding religion, the results show that the Cameroonian woman's religion does not significantly affect Safe delivery. However, the probability of safe delivery of an animist woman is negatively correlated with safe delivery.

Table (continued) 3:

	(1) Safe delivery	(2) Safe delivery	(3) Safe delivery	(4) Safe delivery	(5) Safe delivery
Yaounde		-0.255 (-1.29)	-0.287 (-1.40)	-0.263 (-1.28)	-0.100 (-0.42)
Urban		0.867*** (18.30)	0.751*** (15.30)	0.599*** (11.53)	0.395*** (5.82)
Noeducation			-1.367*** (-6.29)	-1.053*** (-4.72)	-0.900** (-2.76)
Primary			-0.981*** (-4.60)	-0.720*** (-3.31)	-0.598 (-1.86)
Secondary			-0.629** (-2.94)	-0.470* (-2.19)	-0.401 (-1.26)
Christ			0.0656 (0.50)	0.0306 (0.23)	0.132 (0.91)
Muslim			0.00748 (0.06)	-0.0228 (-0.16)	0.0392 (0.26)
Animist			-0.511* (-2.26)	-0.549* (-2.37)	-0.394 (-1.63)
Female			0.122* (2.19)	0.141* (2.49)	0.0822 (1.06)
Notatall				0.0598 (0.38)	0.102 (0.51)
Lessthanonceaweek				0.194 (1.15)	0.326 (1.51)
Notatallradio				-0.254*** (-3.41)	-0.237** (-2.77)
Lesthnonceaweekradio				-0.183* (-2.19)	-0.134 (-1.36)

The values in parentheses are the t-statistics: *** p<0.01; ** p<0.05; * p<0.1.



Discussion

The objective of this study is to estimate the effect of antenatal consultation on Safe delivery in Cameroon. The results show that there is a positive and significant relationship between antenatal consultation and Safe delivery as well as certain variables such as region, living environment, mother's level of education, gender of the head of household, media exposure, wealth quintile, distance from the health centre, and the person who decides on the use of money in the couple. This result means that women who attend

at least one consultation have a higher probability of having a birth in a health centre or with qualified personnel than women who do not attend antenatal consultations. Women's first contact with health personnel is therefore decisive for the continuation of the antenatal consultation and possibly the delivery at the place of consultation or with qualified personnel. It appears that a relationship of trust is created and established between pregnant women and the healthcare structures. This smoothes out the unspoken and the intimacy to facilitate the flow of information and take appropriate measures.

Table (continued)3:

	(1) Safe delivery	(2) Safe delivery	(3) Safe delivery	(4) Safe delivery	(5) Safe delivery
Notatalltv				-0.479*** (-7.55)	-0.368*** (-4.39)
Lessthanonceaweektv				-0.268*** (-3.34)	-0.210* (-2.12)
Poorest					-0.750*** (-4.87)
Poorer					-0.662*** (-4.52)
Middle					-0.527*** (-3.79)
Richer					-0.279* (-2.01)
Bigproblemdistance					-0.170*** (-3.38)
Respdtonemoney					-1.032 (-1.41)
Respdandhusbpmoney					-0.930 (-1.28)
Husbandpalonemoney					-1.068 (-1.47)
_cons	-0.887*** (-18.24)	-0.146 (-0.83)	0.752* (2.36)	0.960** (2.89)	1.917* (2.31)
N	6463	6463	6463	6463	4968
Pseudo R ²	0.1628	0.3779	0.4011	0.4137	0.4324
Wald Chi ²	1080.13	1710.51	1721.72	1792.70	1440.59
Prob>Chi ²	0.0000	0.0000	0.0000	0.0000	0.0000
Log pseudolikelihood	-3245.104	-2411.2219	-2321.5513	-2272.3831	-1765.5375

The values in parentheses are the t-statistics: *** p<0.01; ** p<0.05; * p<0.1.



Our result is consistent with various studies where ANC was reported to increase the use of safe delivery. Indeed, a study on the impact of antenatal care on maternal and perinatal outcomes in Nepal indicates that 87% of women who delivered within four months had more than four antenatal visits compared to only 6.5% who had only one antenatal visit. Of the women who received assisted delivery, most had a high level of education, high economic status, owned a business, were in the 20-29 age group, etc. (12). A similar study shows that access to comprehensive antenatal care in rural Uganda negatively affects stillbirths (13). Concerning education level, another study shows that educated women have a higher number of antenatal visits and institutional deliveries than uneducated women living in a similar context and economic status (14). In our study, we found a positive relationship between safe delivery and the level of education of women of childbearing age. Women with a high level of education know the importance of antenatal consultations for safe delivery. The more they participate in antenatal care, the higher the chances of having a Safe delivery. In the same perspective, in South Sudan's East Mundri region, a study indicates that health education on childbirth preparedness and complications significantly affects the use of skilled attendance at delivery (15). This result improved significantly in a propensity score-matched analysis, which is consistent with and reinforces our findings. These studies suggest that pregnant women with full antenatal care are expected to deliver in a health facility or with skilled attendants. However, some studies in Ethiopia show that some women, despite having antenatal care, give birth at home because of household decision-making power, the husband's preference for the place of delivery, the woman's professional status (16) and other socio-economic, cultural and health system reasons

(17). Similar findings report that increased education does not necessarily translate into greater use of health services, as educated people tend to practice self-treatment and do not adhere to the current treatment schedule (18).

Another study shows that women's autonomy is a major determinant of maternal healthcare utilisation (19). This is consistent with our study, which found a positive and significant relationship between women's participation in decision-making and follow-up antenatal care. However, a study in Nepal found that the influence of women's participation in decision-making about their health or major purchases on antenatal care attendance was weak (20).

Regarding media exposure an indirect effect of information on complications during pregnancy is conclusive. A study in sub-Saharan Africa assessing the impact of information about pregnancy complications during antenatal care on the likelihood of institutional delivery supports our findings associating antenatal care with safe delivery. This study shows a positive relationship between ANC's complication information, ANC's number and institutional delivery (21). The recalling information about complications increased with the number of antenatal care and also the likelihood of institutional delivery in most sub-Saharan African countries. However, the overall rate of institutional deliveries among antenatal care users varied widely across countries. Furthermore, it has been estimated that between 13% and 33% of maternal deaths could be prevented by the presence of a skilled birth attendant (22). However, other major factors such as delay in recognising complications and deciding to seek care, delay in reaching a health facility, and delay in receiving adequate care and treatment at the health facility providing care need to be taken seriously during the perinatal period if pregnancy is to be a truly positive experience. This implies the serenity and



diligence of qualified personnel throughout the pregnancy period. All pregnant women should therefore, in principle, go for an antenatal visit to receive appropriate and adequate knowledge about their health and their fetus and to give birth safely.

Study limitations

This study faces some limitations in its design and implementation. It does not include World Health Organization (WHO) recommendations, ANC numbers and postnatal care. Considering the WHO recommendations regarding the ideal number of antenatal care (four or eight) will refine the analysis of safe childbirth. Then, the integration of postnatal care will make an in-depth analysis taking into account the comprehensive model of maternal health. Finally, constructing the prenatal consultation index based on the United Nations Development Program's method for determining the human development index will make it possible to distinguish the effect of low, medium and high levels of prenatal consultation on safe childbirth.

Conclusion

The study concludes that Safe delivery is positively and significantly dependent upon ANC consultation in Cameroon even after taking into account several explanatory variables. The main control variables such as education, income levels, living environment and region of residence also correlate with safe delivery.

Recommendations

To increase safe delivery in Cameroon, Government must improve ANC consultation, improve maternal education, and reduce poverty and distance to reach the health facility. A serious policy of free care for women during the maternity period targeting indigent women and those in rural areas would stimulate Safe delivery. Furthermore, promoting the policy of health decentralization oriented towards maternal

health, the education of women of childbearing age and their empowerment is an excellent way of stimulating the demand for ANC to guarantee their access to all Cameroonian women, following objective number 3 of the Sustainable Development Goals (SDGs) which aims for equitable access to health care services in case of need by 2030.

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Availability of data and materials

The supporting data for this article is available free of charge from the Demographic Health Survey website (https://dhsprogram.com/data/dataset_admin/index.cfm).

Conflict of interest

No conflict of interest.

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Author contributions

Issac Danadji conceived the topic for the study, provided relevant revisions of the background literature review and substantive input to the discussion and reviewed the methodology, and discussed the results. Eric Allara Ngaba developed the methodology of the study and treated and analysed the data. He also drafted the manuscript for publication. Christel Mapa conducted the background literature review and compiled the references for the study. All authors read and approved the final manuscript.

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Appendix 1:

Description of Variables

Variables' names	Definition / Measurement
Safe delivery	Safe delivery is defined as delivery carried out either in a health facility or at home, attended by a qualified person (Doctor, Nurse, Midwife, Matron, hospital worker and health centre worker) during the last 5 years preceding the survey. Its measurement is obtained by asking women to know where their children were born and who attended the birth of these children.
First antenatal care (ANC 1+)	(ANC 1+) Per cent of women aged 15–49 with a live birth in five years period preceding the survey received antenatal care one time or more. The indicator is based on standard questions to know, "have you seen someone for antenatal care about this pregnancy?"
Age	Age is a factor in the deterioration of health status. In the context of maternal health, it is a vector of degradation other than that of procreation. It is obtained from the answer to the questions "In what month and in what year were you born?" "And" How old were you on your last birthday?"
Region	Cameroon was devised by ten regions as follows: Adamawa, Centre, East, far north, North, Northwest, West, Littoral, South and Southwest. However, taking into account the particular status of the political city and business city, the study increases the level of the region by introducing Yaounde and Douala.
Place of residence	Place of residence measures the administrative subdivision of a country in which the individual resides. It is traditionally distinguished in urban and rural areas.
Literacy/ Mother's Educational Status	A woman's level of education is classified according to whether she has "no education" or a "primary" level or a "secondary" or "higher" level. Literacy corresponds in this case to all women who do not belong to the "no education" category.
Religion	Religion is subdivided into Christianity, Islam, Animist and Without religion.
Sex of household head	The sex of the household head was used as a proxy for assessing decision-making within a household. Usually, the oldest individual in the household is designated the head. Typically, the identified head is male. However, in this study, the household head is described by the responsibility sense the head has.
Media exposure	Media exposure was regarded as the frequency of reading newspapers or magazines, the frequency of listening to the radio and the frequency of watching tv. Each section includes the specific modality as not at all, less than once a week and at least once a week.
Wealth status	Wealth status was calculated using data on household assets collected from MICS surveys (2018) and is classified into 5 wealth quantiles: lowest, second, middle, fourth and higher.
Getting medical help for self: distance to a health facility	This variable was devised by two indicators as a big problem the issue of the distance or not.
The person who usually decides what to do with the money the husband earns	The person who usually decides what to do with the money husband earns indicates whether the wife decides or his husband or both.