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Non-Medical Determinants of Caesarean Deliveries in Ghana: A Logistic Regression Approach

Ernest Yeboah Boateng[1], Senyefia Bosson-Amedenu[2], Ezekiel Nii Noye Nortey[3], Daniel A. Abaye[1*]

[1]Department of Basic Sciences, School of Basic and Biomedical Sciences, University of Health and Allied Sciences, Ho, Ghana
[2]Department of Mathematics and ICT, Holy Child College of Education, Takoradi, Ghana
[3]Department of Statistics and Actuarial Science, University of Ghana, Legon, Accra, Ghana
Email: eyboateng@uhas.edu.gh, sbosson-amedenu@st.ug.edu.gh, ennnortey@ug.edu.gh, *dabaye@uhas.edu.gh

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Abstract

This study examined the non-medical factors that influence expectant mothers to opt for caesarean deliveries in Ghana. Data on 395 expectant mothers across the ten regions of Ghana who were located in urban, semi-rural and rural areas, and spanned a period of five years (from 2012 to 2016) were obtained from the Ghana Health Service. In fitting the logistic regression model, data on 355 expectant mothers (*i.e.* 89.9% of the data) was assigned to the analysis sample while 40 (*i.e.* 10.1%) was assigned to the hold-out sample. The hold-out sample together with other statistical measures of overall model fit, pseudo R^2 measures and classification accuracy were used to validate the results obtained from the analysis sample. Significance was tested at p = 0.05. Determinants including, educational level of expectant mother, parity of expectant mother, baby's birth weight, previous caesarean delivery, location of expectant mother, age of expectant mother and, period within the year of childbirth had a significant effect on caesarean delivery. The study recommended that health practitioners should be able to foretell expectant mothers who are likely to undergo caesarean delivery in order for them to prepare financially and psychologically to avoid further complications. Due to the significant positive attitude of women towards caesarean delivery rather than normal delivery, it is necessary to inform them about the advantages of normal delivery and the health hazards associated with caesarean delivery to the mother and child.

Keywords

Caesarean Deliveries, Non-Medical Determinants, Logistic Regression, Ghana

1. Introduction

An estimated 18.5 million caesarean procedures are carried out annually in the world and 3.6% of the procedures are performed without any medical or surgical indications [1]. With about one in every three babies born surgically, caesarean delivery is the most frequently performed abdominal surgery in recent years mainly to protect the health of the mother [2].

So far, the prevalence of caesarean deliveries in many countries is considerably higher than the acceptable threshold announced by the World Health Organization (WHO), which is 10% - 15% of all births [3]. Studies have revealed that when caesarean section rates rise towards 10% across a population, the number of maternal and newborn deaths decreases but when the rate goes above 10%, there is no evidence that mortality rates improve [4].

The rate of caesarean delivery in the world has increased from less than 7% in 1970 to more than 35% in 2013. In the U.S., the rate of this surgery has increased annually since 1997 and reached 45.9% in 2013. This measure was relatively lower in Africa; that is, around 30% of all deliveries were carried out through caesarean delivery [5]. Caesarean birth rates exceeding the standard 15 per 100 births cost the health care systems of many developed and developing countries. Increased costs due to caesarean surgery are related to surgical costs, longer hospital stays, direct delivery costs and post-surgical complications [6]. In the year 2008 alone, about 6.2 million avoidable caesarean deliveries were performed and the corresponding economic cost associated with such operations was estimated at $2.3 billion [7]. Moreover, high cost of caesarean procedures may result in catastrophic health expenditure for families and exert additional pressure upon overburdened health systems particularly in low and middle income countries [8].

The use of caesarean delivery is limited in the African health facilities probably due to resource constraints, cultural values, fear of suffering and wrong perceptions of womanhood. Spontaneous vaginal delivery is the commonest mode of delivery globally, particularly in remote areas of resource constrained countries like Ghana and other developing countries where modern healthcare is limited. For most expectant mothers, vaginal delivery is viewed as a normal, healthy and a natural mode of delivery, which makes them experience womanhood [9].

Considerable debate has been generated by rising rates of caesarean deliveries and other obstetric interventions. Part of the debate is to try and explain why these changes are occurring. Although caesarean section is the preferred mode of delivery for some mothers, the rate of caesarean section deliveries has increased to more than 50% in some countries, even though the WHO has emphasized that caesarean deliveries be performed only based on the indication. It has been established that serious complications or even deaths are more likely to occur following caesarean delivery compared with spontaneous vaginal deliveries [10].

A review of 79 studies [6] comparing outcomes of elective caesarean sections

with vaginal deliveries, including both observational studies and randomized trials and suggested that caesarean deliveries may have substantially greater risks than vaginal deliveries. Mortality and disability rates were reported to be respectively, 23 and 5 - 10 times higher in caesarean delivery compared with vaginal deliveries. Additionally, the infant mortality rate in caesarean delivery is 4 times higher compared with that in vaginal delivery. Furthermore, the risk of primary pulmonary hypertension was 5 times higher among the infants born through caesarean delivery in comparison to those born through vaginal delivery [11].

Various reasons have been suggested for the increasing rate of caesarean delivery, including the rising maternal age at first pregnancy, technological advances that have improved the safety of the procedure, changes in women's preferences and a growing proportion of women who have previously had a caesarean delivery [10]. One report indicated that maternal age, birth weight and parity are significant predictors of caesarean delivery [12]. Another study employed a stepwise logistic regression to analyze discharge data from three Northeast Tennessee, US, hospitals to ascertain maternal demographic factors that may be linked to higher rates of caesarean deliveries [13]. The study found that there were 1678 (23.3%) singleton live births by caesarean section of which 7.6% were repeat caesarean section deliveries. Less than 1% of the 7181 births were vaginal births after caesarean (VBAC) delivery. The study also revealed that insurance and maternal age were significant predictors of caesarean delivery.

A report revealed that obese patients and those who gain more than 40 pounds (18.2 kg) during pregnancy are less likely to have VBAC delivery [14]. The same study revealed an inversely proportional relationship between VBAC and Body Mass Index (BMI). One-third of women who have a caesarean delivery will undergo a repeat caesarean delivery [15]. Also, mothers who are 40 years old or more are more likely to have a caesarean delivery compared with mothers who are less than 18 years.

Chaillet and Dumont [16] applied a multi-logistic regression model, when the effects of all co-variables were controlled statistically, probability for using caesarean delivery increased with better socio-economic status, higher education of women, increasing age, decreasing birth order, antenatal attendance and, with presence of bad obstetric history. Another study, a stepwise binary logistic regression analysis was employed to identify the most impact factors on caesarean delivery [17]. The study revealed that 13 out of 21 risk factors were statistically associated with caesarean delivery type. These variables were maternal age at birth, baby birth weight, mother's occupation, husband age at birth, husband occupation, order of birth, pregnant before age 18, pregnancy induced swollen of leg, high blood pressure, death of previous children, a balanced diet during pregnancy, breastfeeding and family planning [17].

The Department of Reproductive Health and Research of the WHO in recent times has been stressing on the worrying increase in caesarean delivery globally

and has called for more research on the reasons for expectant mothers voluntarily opting for caesarean delivery as well as the impact of caesarean delivery on women's psychological and social well-being. Due to the increased cost, high rates of unnecessary caesarean delivery could pull resources away from other services in overloaded and weak health systems [4]. Globally, caesarean deliveries that are possibly medically unnecessary appear to command a disproportionate portion of global economic resources [18]. Caesarean delivery arguably is an obstacle to universal coverage with necessary health services. They [18] further argued that "excess" caesarean delivery can have important negative consequences for health equity both within and across countries. It has, therefore, become imperative for researchers to come out with the non-medical determinants for expectant mothers opting for caesarean delivery to help policy makers formulate policies that would help keep caesarean delivery rates within the WHO recommended range of 10% to 15%.

Although maternal request and the rising maternal age at first pregnancy are the most frequently cited non-medical factors related to increasing caesarean delivery rates [19], there might be other important non-medical factors that have not been identified or quantified, in the African and, more especially the Ghanaian setting. The aim of this study is to use logistic regression to determine the non-medical predictors of caesarean deliveries using socioeconomic and demographic factors among antenatal and postnatal attendees across the ten regions of Ghana.

In this study, we developed the logistic regression model which was then scrutinized with the three statistical assessment procedures; validation analysis, regression diagnostics and goodness-of-fit measures.

2. Materials and Methods

2.1. Data

Data for this study was secondary data obtained from the Statistics and Information Department of the Ghana Health Service. The data consist of the demographic and socio-economic records of 395 expectant mothers across the ten regions of Ghana who were located in urban, semi-urban and rural areas and had visited the antenatal and postnatal clinics during the years 2012 to 2016.

The secondary data comprise of vital maternal data of interest including, educational level of expectant mother, parity of the expectant mother, birth weight of baby, insurance status of expectant mother, marital status, religion, previous caesarean delivery by expectant mother, ethnic group of expectant mother, age of expectant mother, location of expectant mother, type of health facility delivery took place, period within the year of childbirth, occupation of expectant mother and that of her partner.

2.2. The Logistic Regression Model

In this study, the response variable, caesarean delivery, is a binary variable, that

is, whether the childbirth was through caesarean or not. Therefore, the logistic regression is a suitable technique to use because it is developed to predict a binary dependent variable as a function of the predictor variables. The logistic regression model is widely used in studies where the dependent variable is binary. Many studies have used logistic regression to estimate the risk of caesarean delivery [7].

The logit, in this model, is the likelihood ratio that the dependent variable, non-caesarean delivery, is one (**1**) as opposed to zero (**0**), caesarean delivery. The probability, *P*, of non-caesarean delivery is given by:

$$\ln\left[\frac{P(Y)}{1-P(Y)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \cdots + \beta_K X_K \quad (1)$$

$$\begin{aligned}&\ln\left[\frac{P(\text{Non}-\text{Caesarean Delivery})}{1-P(\text{Non}-\text{Caesarean Delivery})}\right]\\ &= \beta_0 + \beta_1 \text{Educational Level} + \beta_2 \text{Parity}\\ &\quad + \beta_3 \text{Baby's Birth Weight} + \beta_4 \text{Age of Expectant Mother}\\ &\quad + \beta_5 \text{Loaction of Expectant Mother} + \beta_6 \text{Previous Caesarean Delivery}\\ &\quad + \beta_7 \text{Period of Delivery}\end{aligned} \quad (2)$$

where,

$$\ln\left[\frac{P(Y)}{1-P(Y)}\right] \text{ is the log odds of Caesarean Delivery} \quad (3)$$

$$\beta_0, \beta_1, \beta_3, \beta_4, \cdots, \beta_K \text{ are the regression (model) coefficients}$$

Y is the dichotomous outcome which represents caesarean delivery (whether the childbirth was through caesarean or not). $X_1, X_2, \cdots, X_K$ are the predictor (independent) variables which are educational level of expectant mother, parity of the expectant mother, birth weight of baby, previous caesarean delivery by expectant mother, age of expectant mother, location of expectant mother, and the quarterly period within the year of childbirth.

2.3. Determining the Number of Significant Variables to Retain

Working with α-value of 5%, variables with $p \leq 0.05$ were treated as statistically significant. Thus, the variables listed at Equation (2) were found to have statistical significance on caesarean delivery. Variables including insurance status of expectant mother, marital status, religion, ethnic group of expectant mother, type of health facility where delivery took place (*i.e.* whether it is a regional, teaching, municipal hospital or clinic), occupation of expectant mother and that of her husband were found to have no statistical significance on caesarean delivery and hence were not included in the fitted model.

2.4. Assessing the Goodness-of-Fit of the Estimated Model

The analysis sample was assigned 89.9% of cases in the dataset in order to obtain

a model. The hold-out sample was assigned 10.1% of cases in the dataset to give an "honest" estimate of the ability of the model to predict.

3. Results and Discussions

3.1. Data Handling

Table 1 presents the case processing summary for fitting the model. In fitting the logistic regression model to the data, information on 355 expectant mothers representing 89.9% of the data was assigned to the analysis sample while 40 representing 10.1% was assigned to the hold-out sample. The hold-out sample was used to validate the results obtained from the analysis sample.

The estimated result for the final logistic regression model is reported in Table 2. It can be noticed from the table that baby's birth weight was found to have a significant effect on caesarean delivery. Compared with babies with birth weight above 3.5 kg, babies with birth weight less than 3.5 kg were found to have a decreased probability of caesarean delivery. The negative sign of the estimated coefficients and the sign of the odds ratio being less than 1 ($\beta = -1.5381$, $p < 0.001$ and OR = 0.2148) for babies with birth weight from 2.5 kg to 3.5 kg and ($\beta = -1.6042$, $p < 0.001$ and OR = 0.2010) for babies with birth weight below 2.5 kg show that the probability of caesarean delivery is higher for babies with birth weight above 3.5 kg than babies with birth weights below 3.5 kg. That is, the relative probability of caesarean delivery decreases by 78.52% for babies with birth weight from 2.5 kg to 3.5 kg and 79.9% for babies with birth weight below 2.5 kg.

The location of the expectant mother also influenced the probability of caesarean delivery. The likelihood of caesarean delivery is lower for expectant mothers who live in semi-rural areas (OR = 0.2556, $p < 0.001$) and rural areas (OR = 0.6286, $p < 0.001$) relative to expectant mothers who live in urban centres. That is, the relative probability of caesarean delivery decreases by 74.4% for expectant mothers who live in semi-urban areas and 223.2% for expectant mothers who live in rural areas.

Table 1. Case processing summary.

Unweighted Cases		N	%
Selected Cases	Included in Analysis	355	89.9
	Included in Hold-out	40	10.1
	Missing Cases	0	0.0
	Total	395	100.0
Unselected Cases		0	0.0
Total		395	100.0

Table 2. The fitted logistic regression model.

Explanatory variable	Co-efficient	Standard error	p-value	Z-value	Odds ratio
Baby's Birth Weight (Above 3.5 kg as Reference)					
2.5 - 3.5 kg	−1.5381	0.3988	0.00012*	−3.857	0.2148
Less than 2.5 kg	−1.6042	0.5148	0.00183	−3.116	0.2010
Location of Expectant Mother (Urban as Reference)					
Semi-urban	−1.3641	0.3642	0.00018	−3.746	0.2556
Rural	−0.4643	0.8751	0.00574	−0.531	0.6286
Previous Caesarean Delivery (No as Reference)					
Yes	1.2244	0.3302	0.00021	3.708	3.4021
Age of Expectant Mother (Above 40 Years as Reference)					
30 - 40 years	−1.0432	0.4809	0.03006	−2.169	0.3523
20 - 29 years	−1.1078	0.5612	0.04836	−1.974	0.3302
Below 20 years	−1.2436	0.5402	0.02132	−2.302	0.2883
Parity (None as Reference)					
One	1.1588	0.5700	0.04205	2.033	3.1861
Two	1.0248	0.5063	0.04296	2.024	2.7865
Three	1.1322	0.5273	0.03178	2.147	3.1025
Above Three	1.6898	0.6047	0.0052	2.794	5.4184
Educational level (Tertiary as Reference)					
Secondary	1.4161	0.5771	0.01414	2.4540	4.1210
Middle/Junior High	1.0855	0.5773	0.06006	1.880	2.9609
Primary	2.329	0.6726	0.00053	3.463	10.2677
None	2.425	0.6912	0.35265	0.929	11.302
Period of Delivery (First Quarter as Reference)					
Second Quarter	0.2712	0.3972	0.49481	0.683	1.3115
Third Quarter	0.7173	0.504	0.05464	1.423	2.0489
Fourth Quarter	1.5865	0.5507	0.00396	2.881	4.8867
Constant	−0.4217	0.6943	0.54362	−0.607	0.6559

Null Deviance: 508.44 on 353 degrees of freedom (Dof). Residual Deviance: 273.17 on 343 Dof. AIC: 321.17. Number of Fisher Scoring iterations: 6. *Variables are significant ($p < 0.05$).

Previous caesarean delivery by expectant mother was also identified to have a significant influence on the likelihood of a pregnant woman undergoing another

caesarean delivery or not. The probability of caesarean delivery significantly increases with the expectant mother having a medical history of once undergoing caesarean delivery (OR = 3.4021, $p < 0.001$). That is, the relative probability of caesarean delivery increases by 240.21% for expectant mothers who have once undergone caesarean delivery. All other variables held constant, an expectant mother with history of caesarean delivery is three times more as likely to undergo another caesarean delivery compared to an expectant mother with no history of caesarean delivery.

The age of the pregnant woman was also found to be negatively related to the likelihood of caesarean deliveries. Compared with expectant mothers aged 40 and above, expectant mothers aged 30 to 40 years (OR = 0.3523, $p = 0.05$), expectant mothers aged 20 to 29 years (OR = 0.3302, $p = 0.05$) and expectant mothers below 20 years (OR = 0.2883, $p = 0.05$) are found to have a decreased probability of caesarean delivery. That is the relative probability of caesarean delivery decreases by 64.77% for expectant mothers aged 30 to 40 years, 66.98% for expectant mothers aged 20 to 29 years and 71.17% for expectant mothers below 20 years. This is an indication that the probability of caesarean delivery increases as the age of the expectant mother increases.

The parity of a pregnant woman (**Table 2**) was estimated to have a significant effect on caesarean delivery. Compared with pregnant women with no parity, expectant mothers with one parity (OR = 3.1861, $p = 0.05$), two parities (OR = 2.7865, $p = 0.05$) and three parities (OR = 3.1025, $p = 0.05$) are characterized by significantly higher probability of not undergoing caesarean deliveries. However, expectant mothers with more than three parities, that is, four or more parities (OR = 5.4184, $p < 0.005$) are associated with a very higher probability of not undergoing caesarean delivery. That is, compared with a pregnant woman with no parity and, all other variables held constant, expectant mothers with four or more parities are five times more as likely not to undergo caesarean delivery. The relative probability of not undergoing caesarean delivery increases by 441.84% for expectant mothers with more than four parities and approximately 210.25% for expectant mothers with one to three parities.

Educational level (**Table 2**) has a significant influence on caesarean delivery. Compared with tertiary education and all other variables held constant, a client with secondary education (Odds ratio; OR = 4.121, $p = 0.05$) is four times more as likely not to undergo caesarean delivery while a pregnant woman with primary education (OR = 10.2677, $p < 0.001$) is almost 11 times more as likely not to undergo caesarean delivery. There is an increase of 312.1% in the relative probability of a pregnant woman with secondary education not to undergo caesarean delivery and 926.77% for pregnant women with primary education.

Interestingly, the period within the year of childbirth also had a significant influence on the likelihood of caesarean delivery. The likelihood of caesarean delivery is higher for childbirths during the last quarter of the year (OR = 4.8867, $p < 0.005$) relative to the first quarter of the year. All other variables held constant,

an expectant mother who delivers during the last quarter of the year is almost five times more as likely to undergo a caesarean delivery compared to an expectant mother who delivers during the first quarter of the year. That is the relative probability of caesarean delivery increases by 388.67% for expectant mothers who deliver in the last quarter (October to December) of the year.

These findings confirm an earlier study [16] who applied multi-logistic regression model and concluded that probability for using caesarean delivery increased with higher education of women, increasing age and decreasing birth order. Again, the findings of the study lend support to the results of Nguyen *et al.* [15] that mothers 40 years of age and older are more likely to have a caesarean delivery compared with mothers who are less than 18. Our results showed that insurance status has no bearing on the expectant's mother's decision to opt for caesarean delivery. This is in contrast with earlier findings [13] who concluded that insurance status of the expectant mother (in the UK) was a significant predictor of possible caesarean delivery. This point should be understood in the Ghanaian context, in that, insurance is covered by the National Health Insurance Scheme (NHIS), with the provision that any expectant mother should receive the same care whether or not they are registered on the scheme.

The results of this study also confirms the findings by Wong *et al.* [17] who applied stepwise binary logistic regression analysis to identify the most impact factors on caesarean delivery and concluded that maternal age at birth, baby birth weight and order of birth (parity) were among the most significant contributors to caesarean delivery.

It is not surprising that educational level of expectant mother had a significant influence on caesarean delivery as it is a general perception that educated women are more likely to be informed about the risks and benefits associated with caesarean delivery hence are better positioned to make independent choices compared with those women with a lower level of education whose thoughts are mostly influenced by myths and traditional beliefs surrounding caesarean deliveries. The study authenticated the existing perception in Ghana and most parts of the developing world that caesarean deliveries are for the educated. In these societies, good health care facilities that render the services of caesarean delivery are mostly located in urban centers, so it in line with our findings that the location of expectant mother is a significant contributor to caesarean delivery with more women in urban centres opting for caesarean delivery than their counterparts in the rural centres.

Rising maternal age at first pregnancy is one of the most frequently cited non-medical factor related to increasing caesarean delivery rates globally and this study also confirmed age to have a significant effect on caesarean delivery. This is expected because as an expected mother advances in age her physical and emotional health to undergo vaginal delivery reduces hence the majority of relatively aged pregnant women are likely to opt for caesarean delivery.

Surprisingly, the study found the quarterly period (quarter) within the year of

child delivery to have a significant influence on caesarean delivery. The study revealed that the likelihood of caesarean delivery increases as we move from the first quarter of the year through to the last quarter.

3.2. Assessing the Model Fit

Three approaches were used in assessing the overall fit of the constructed model: the statistical measures of overall model fit, pseudo R^2 measures and classification accuracy.

3.2.1. Statistical Measures of Overall Model Fit

The fitted logistic regression model in Table 2 was the model with the minimum Akaike Information Criterion (AIC). It can be observed from Table 2 that the −2 LL value reduced from the base model value of 508.44 to 273.17 for the fitted model, a decrease of 235.27. This indicates an increase in model fit. Table 3 presents an assessment of the overall model fit, the null hypothesis; the fitted model is not different from the null (base) model was tested against the alternative hypothesis; the fitted model is different from the null model. This followed a *chi*-squared (χ^2) test. From Table 3, since p (0.000) < 0.05, the hull hypothesis is rejected and concludes that the fitted model is significantly different from the null (base) model.

The next statistical measure of overall model fit is the Hosmer and Lemeshow measure. This statistical test measures the correspondence of the actual and predicted values of the dependent variable (caesarean delivery). A better model fit is characterized by a smaller difference between the observed and predicted classification as evident in Table 4. The Hosmer and Lemeshow test shows insignificance for the fitted model (0.650 from Table 5), indicating that insignificant differences remain between the actual and expected values. This is a strong signal of a good model fit (*i.e.* well calibrated).

3.2.2. Pseudo R^2 Measures

From Table 6, it can be observed that the model has a relatively larger pseudo R^2 of 0.723 for the Nagelkerke R^2 and 0.576 for the Cox and Snell R^2. That is, the fitted model can explain or account for 72.3% of the variation in the dependent variable (caesarean delivery). This is an indication of a good model.

3.2.3. Classification Accuracy

This represents the level of predictive accuracy achieved by the fitted model. It can be observed from the classification table in Table 7 (subheading: **Analysis sample**) that the fitted model predicted an overall percentage of 82.9% correctly. That is, 83.6% of the outcome "Yes" of the variable, "Did you undergo caesarean delivery?" is predicted accurately, while 82.2% of the outcome "No" of the variable, "Did you undergo caesarean delivery?" is predicted accurately by the fitted model. Together with the statistically based measures of model fit, the model is deemed acceptable regarding both statistical and practical significance.

Table 3. Omnibus tests of model coefficients.

		Chi-squared (χ^2)	Dof	Significance
Step 1	Step	238.148	25	0.000
	Block	238.148	25	0.000
	Model	238.148	25	0.000

Table 4. Contingency table for Hosmer and Lemeshow test.

	Caesarean Delivery = yes		Caesarean Delivery = no		Total
	Observed	Expected	Observed	Expected	
Step 11	36	36.425	1	0.575	37
22	36	34.788	1	2.212	37
3	30	32.915	7	4.085	37
4	32	29.455	5	7.545	37
5	23	22.726	14	14.274	37
6	15	16.14	22	20.86	37
7	9	9.516	28	27.484	37
8	6	4.682	31	32.318	37
9	1	1.854	36	35.146	37
10	1	0.500	35	35.500	36

Table 5. Hosmer and Lemeshow test.

Step	Chi-squared (χ^2)	Dof	Significance
1	5.975	8	0.65

Table 6. Model summary.

Step	Likelihood	Cox & Snell R^2	Nagelkerke R^2
1	273.175	0.576	0.723

Table 7. Classification table for the analysis sample and hold out sample.

Analysis sample			Predicted		
			Caesarean Delivery		Percentage
	Observed		Yes	No	Correct
Step 1	Caesarean Delivery	Yes	158	31	83.6
		No	32	148	82.2
	Overall Percentage				82.9
Holdout sample					
Step 1	Caesarean Delivery	Yes	19	2	90.4
		No	1	18	94.7
	Overall Percentage				92.5

[a]The cut value is 0.500.

3.3. Results from the Hold-Out Sample

The hold-out sample was used to validate the fitted model in Table 2. It can be observed from Table 7 (subheading: **Holdout sample**) that out of 40 respondents in the holdout sample, three were misclassified by the fitted model. It is also evident from the table that the fitted model achieved an overall classification accuracy of 92.5% in the holdout sample indicating a high practical significance of the model.

4. Conclusions

This study employed the logistic regression model to elucidate the non-medical determinants of caesarean deliveries in Ghana. Educational level of expectant mother, parity of the expectant mother, baby's birth weight, history of previous caesarean deliveries, age of expectant mother, location of expectant mother and period within the year the childbirth occurs were significant determinants of an expectant mother's decision to undergoing caesarean delivery or not.

Existing literature on logistic regression suggests that most studies do not report validation analysis, regression diagnostics or goodness-of-fit measures. But this study assessed the model using all the three statistical assessment procedures which yielded similar and complementary results indicating a strong statistical significance and by extension practical significance.

The following recommendations are suggested; health practitioners should be able to foretell expectant mothers who are likely to undergo caesarean delivery in order for them to prepare financially and psychologically to avoid further complications. Due to the positive attitude of women towards caesarean delivery rather than normal delivery, it is necessary to inform them about the advantages of normal vaginal delivery and, also the health hazards which might be caused by caesarean surgery to the mother and child, and the attendant financial costs.

Authors' Contributions

The idea was developed by EYB, SBA and ENNN. Data was collected and analysed by all authors, manuscript writing was led by EYB and DAA. All authors approve the final document.

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Additional Information

The data for this study are readily available upon request.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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