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Research Article

Influences of Pregnancy Outcome, Child's Weight Recall, and Size at Birth on Caesarean Delivery among Women in Ghana

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Abstract

Background: Of late, Ghana has enjoyed improved access to skilled maternal care. Yet, disparities in delivery outcomes still exist.

Objective: It is against this assertion that the study attempted to examine the extent to which pregnancy outcome, child's weight recall, and size at birth influence caesarean delivery among women in Ghana.

Methods: The study used the 2022 GDHS data. SPSS version 27 was used to process the data. Data were analyzed with descriptive statistics, cross tabulation, and binary logistic regression. The descriptive analysis was performed with frequency and percentages. The cross tabulation was performed with Pearson's chi-squared test to assess the association between the explanatory variables and the outcome variable. However, multivariate analysis was performed with the binary logistic regression to determine the predictors of women's delivery by caesarean section.

Results: The study found that recall of child's weight at birth was positively associated with women's delivery by caesarean section while size of child at birth was negatively correlated with women's delivery by caesarean section.

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Conclusion: Therefore, the study recommends that healthcare systems could be strengthened to ensure that all newborns are weighed at birth and recorded using standardized health cards. Hence, this can possibly reduce reliance on maternal recall and the "do not know" category, which was significantly associated with higher caesarean section rates.

Introduction

Caesarean delivery, a surgical operation that is used to deliver a baby through an incision in the abdomen and uterus [1-3]. This procedure may be planned or performed during labour if unexpected complications such as preeclampsia, placenta previa, baby's position, prolonged labour (if the baby is not tolerating the labour process), or issues with the umbilical cord, and history of cesarean deliveries that put the life of the mother or the baby at risk [1,4-6]. Globally, the number of women who give birth by caesarean delivery has steadily increased from 6% in 1990 to 21% in 2018 and it is estimated to reach 30% in 2030 [7]. Further, projections indicate that 38 million women will give birth by caesarean delivery in 2030, and 88% of these operations will occur in low- and middle-income countries [7].

In Ghana, evidence suggests that the prevalence of caesarean delivery stands at 21% [8], higher than the WHO's recommended 15% benchmark [8,9]. The rising rates suggest that one in every five births end up in caesarean delivery [8], hence, raising notable public health concerns [10]. Of late, Ghana has enjoyed improved access to skilled maternal care [11-13]. Yet, disparities in delivery outcomes still exist [14,15]. Therefore, an understanding of the underlying factors influencing caesarean delivery remains essential. One of the emerging areas of interest is the role of perceived and recorded characteristics of the newborn-particularly birthweight and size-as well as the mother's perception or recall of these attributes, in influencing decisions around caesarean delivery [9,16,17].

Child's birthweight and perceived size at birth are often used as proxy determinants for foetal health and are recognised to influence clinical decisions regarding the mode of delivery [16,18-21]. Also, pregnancy outcomes-whether successful, complicated, or resulting in loss-may also shape the likelihood of a caesarean delivery in subsequent deliveries [22-25]. Further, out of caution, adverse pregnancy outcomes history might also prompt healthcare providers or expectant mothers to opt for caesarean delivery [26-29].

Regarding the increasing caesarean delivery rates and growing concerns over its appropriate use [30-32], there remains limited empirical evidence on how maternal perception of birthweight, child size at birth, and pregnancy outcomes influence the likelihood of caesarean delivery among women in Ghana [10,33]. The limited studies available failed to explore all the four variables (pregnancy outcome, child's weight recall, size at birth, and caesarean delivery) combined. For instance, Adu-Bonsaffoh, Ntumy, Obed and Seffah [34], and

Wuni, Turpin and Dassah [35], explored how previous maternal complications or delivery outcomes (e.g., stillbirth, hemorrhage) affect the likelihood of caesarean delivery. However, they did not include birthweight recall or perceived size at birth in their analysis [34,35]; Dickson, Adde and Amu [36], examined maternal-reported birth size (average, small, large) as a predictor of caesarean delivery. But, pregnancy history (e.g., previous losses or complications) was not a central focus, and actual birthweight was often missing or recalled, not measured [36]; Ampofo, Tagoe-Danso, Asare, Adade and Agyemang [37], used clinical records in Northern Ghana to look at actual birthweight and caesarean section rates, but they did not include maternal perception or recall, nor previous pregnancy outcomes in depth [37]. It is against this assertion that the study attempted to examine the extent to which pregnancy outcome, child's weight recall, and size at birth influence caesarean delivery among women in Ghana.

The Study is Guided by the Following Objectives:

1. Analyse if pregnancy outcome influences caesarean delivery among women in Ghana;

2. Ascertain whether child's birthweight recall predicts caesarean delivery among women in Ghana;

3. Examine whether child size at birth influences caesarean delivery among women in Ghana.

The study further hypothesized that women's caesarean delivery in Ghana is not significantly related with pregnancy outcome, child's weight recall, and size at birth.

Methods

Data Source

The study made used of data extracted from the 2022 GDHS which was provided by Measure DHS initiative. The data extracted revolved pregnancy outcome, child's weight recall, size at birth, and caesarean delivery.

Sample and Sampling Procedure

A sample of 18,450 households were enrolled in the survey. These sample were selected from 618 clusters, which resulted in 15,014 women age 15-49 years, and 7,044 men age 15-59 years [38]. To reach the participants, the survey employed a two-stage stratified cluster sampling approach, where a probability proportional to size was employed to select 618 target clusters from the sampling frame for both urban and rural areas in each region in the first stage. Further, the targeted number of clusters needed were chosen with equal probability. Furthermore, a systematic random sampling of the clusters chosen was also carried out in the stage 1 for the urban and rural areas in each region [38]. Then, listing and map updating operation of households were also carried out in all the chosen clusters, to advance a list of all the households in the cluster. The list eventually became the sampling frame for selection of the household sample [38].

Measures

In the study, pregnancy outcome, child's birthweight recall, and child's size at birth were the explanatory variables while caesarean delivery was the outcome variable. The variables were carefully chosen based on the assumption that studying them might help in identifying risk factors responsible for poor maternal or child health, guide health policies and interventions, and to improve healthcare delivery and equity, especially in vulnerable populations [39-43].

Data Collection Instruments and Fieldwork

The 2022 DHS made used of four separate questionnaires which include (Household, Woman, Man, and the Biomarker) [38]. These questionnaires reflected the specific context of Ghana, and were adapted from The DHS Program's model questionnaires. Fieldwork begun on 2022, October 17, and ended on 2023, January 14. In all, data collection lasted for three months. In the field, data collectors were assisted with tablet computers to collect the data [38].

Data Processing and Analysis

SPSS version 27 was used to process the data. Further, three levels of analysis were conducted which include descriptive statistics, bivariate, and multivariate. The descriptive statistics analysis was performed with frequency and percentages. This analysis was used to aggregate respondents' responses into proportions. The bivariate analysis was performed with Pearson's chi-squared test. This analysis was also used to assess the association between the explanatory variables and the outcome variable. With the bivariate analysis, significant was set at three different levels (p=0.001, p=0.05, & p=0.10). However, the multivariate analysis was also performed with the binary logistic regression with significant level at 0.05 with 95 confidence intervals. This analysis was conducted to determine the predictors of women's caesarean section delivery.

Ethical Consideration

To ensure that the survey adheres to ethical standards, ethical approval was sought from both Ghana Health Service Ethical Review Committee and the ICF Institutional Review Board [38].

Results

Descriptive Statistics

Whereas 4763 (83%) of women never had their birth by caesarean section, 1005 (17%) had their birth by caesarean section. On pregnancy outcome, overwhelming majority 5218 (90.5%) had their most recent live birth by caesarean section, while 550 (9.5%) had prior live birth by caesarean section. Concerning child's birthweight recall, the dominant category was 3758 (65.2%) a written card followed by not weighed 950 (16.5%), from mother's recall 738 (12.8%), while the least was do not know 322 (5.6%). Regarding the size of a child at birth, average scored the highest 2329 (40.4%), larger than average 1829 (31.7%), very large 818 (14.2%), smaller than average 534 (9.3%), very small 228 (4.0%), while the least was do not know 30 (0.5%).

Table 1 presents bivariate results on recall of child's weight at birth and women's caesarean delivery. This analysis was performed to ascertain the association between recall of child's weight at birth and women's caesarean delivery. Association was observed between recall of child's weight at birth [χ^2=175.763, p<0.001] and women's caesarean delivery.

Table 2 shows multivariate analysis results on recall of child's weight at birth and women's caesarean delivery. This analysis was done to ascertain the effect of recall of child's weight at birth on

Variable	No (%)	Yes (%)	Total n (%)	χ^2	P-value
Weight at Birth/Recall				175.763	**<0.001**
Not weighed	96.6	3.4	950(100.0)		
From written card	80.5	19.5	3758(100.0)		
From mother's recall	74.4	25.6	738(100.0)		
Do not know	83.5	16.5	322(100.0)		

Table 1: Bivariate results on recall of child's weight at birth and women's caesarean delivery.

Note: Row percentages in parenthesis, χ^2 significant at (0.001), (0.05), (0.10)

No: did not deliver by caesarean section; Yes: delivered by caesarean section

Source: GDHS (2022).

caesarean delivery among women in Ghana. After analysis, the logistic regression model was significant at -2LogL=5110.869; Nagelkerke R^2 of 0.063; χ^2=225.011; $p<0.001$ with correct prediction rate of 82.6%. Meaningfully, the Model Summary which reveals a Nagelkerke R^2 of 0.063 submits that the model describes 6.3% of variance in the probability that women will deliver by caesarean section in Ghana. This significant contribution to the entire model confirms that the entire model significantly influences women's caesarean delivery in Ghana.

It emerged in table 2, that information from written record was significantly related to women's caesarean delivery at $p<0.001$, (OR=6.928, 95%CI ([4.826-9.946]). This variable tag those women to have 6.9 times more likely to deliver by caesarean section compared with their counterparts who reported child was not weighed (Table 2). Further, from mother's recall was significantly related to women's caesarean delivery at $p<0.001$, (OR=9.876, 95%CI ([6.691-14.576]). This factor identifies those women to have 9.9 times more likely to deliver by caesarean section compared with their counterparts who reported child was not weighed (Table 2). Furthermore, do not know was significantly related to women's caesarean delivery at $p<0.001$, (OR=5.652, 95%CI ([3.570-8.948]). This variable reveals those women to have 5.7 times more likely to deliver by caesarean section compared with their counterparts who reported child was not weighed (Table 2).

Variable	B	Wald	Sig.	Exp(B)	95CI	
Weight at Birth/Recall (Not weighed=1.0)						
From written card	1.936	110.065	0.000	6.928	4.826	9.946
From mother's recall	2.290	132.937	0.000	9.876	6.691	14.576
Do not know	1.732	54.620	0.000	5.652	3.570	8.948
Constant	**-3.356**	**348.363**	**0.000**	**0.035**		

Table 2: Binary logistic regression results on recall of child's weight at birth and caesarean delivery among women in Ghana.

Note: Source: GDHS (2022). Significant at 0.05.

Table 3 presents bivariate analysis results on size of a child at birth and women's caesarean section delivery. This analysis was performed to determine whether there existed an association between the size of a child at birth and women's caesarean section delivery. Association

was found between the size of a child at birth [χ^2=19.376, p=0.002] and women's caesarean section delivery.

Variable	No (%)	Yes (%)	Total n (%)	χ^2	P-value
Size of Child at Birth				19.376	0.002
Very large	78.7	21.3	818(100.0)		
Larger than average	83.0	17.0	1829(100.0)		
Average	83.9	16.1	2329(100.0)		
Smaller than average	83.1	16.9	534(100.0)		
Very small	76.8	23.2	228(100.0)		
Do not know	93.3	6.7	30(100.0)		

Table 3: Bivariate analysis results on the size of a child at birth and women's caesarean section delivery.

Note: Row percentages in parenthesis, χ^2 significant at (0.001), (0.05), (0.10)

No: did not deliver by caesarean section; Yes: delivered by caesarean section

Source: GDHS (2022).

Table 4 presents the results of multivariate analysis on the size of a child at birth and women's caesarean section delivery. Based on this multivariate analysis, the influence that the size of a child at birth exerts on women's caesarean section delivery was obtained (Table 4). The results found demonstrates that the logistic regression model was significant at -2LogL=5316.681; Nagelkerke R^2 of 0.006; χ^2= 19.199; p=0.002 with correct prediction rate of 82.6%. Meaningfully, the Model Summary which reveals a Nagelkerke R^2 of 0.006 recommends that the model describes 0.6% of variance in the possibility that women will deliver by caesarean section. Based on this entire model contribution, the outcome established that the whole model significantly determines women's caesarean section delivery.

It emerged in table 4, that larger than average was significantly related to women's caesarean delivery at p=0.009, (OR=0.758, 95%CI ([0.616-9.0.933]). This variable tag those women to have 0.8times less likely to deliver by caesarean section compared with their counterparts who reported child was very large (Table 4). Further, average was significantly related to women's caesarean delivery at $p<0.001$, (OR=0.710, 95%CI ([0.581-0.868]). This variable classifies those women to have 0.7times less likely to deliver by caesarean section compared with their counterparts who reported child was very large (Table 4). Furthermore, smaller than average was significantly related to women's caesarean delivery at p=0.046, (OR=0.750, 95%CI ([0.566-8.0.994]). This variable reveals those women to have 0.8times less likely to deliver by caesarean section compared with their counterparts who reported child was very large (Table 4). However, the rest of the variables (very small, and do not know) were not significant which could be as a result of chance. This suggests caesarean delivery among women in Ghana is not dependent on them (Table 4).

Discussion

The current study aimed to investigate how maternal perception of birthweight, child size at birth, and pregnancy outcomes influence the likelihood of caesarean delivery among women in Ghana. The findings reveal a positive correlation between child's birthweight recall and caesarean delivery among women in Ghana. This finding corroborated with previous studies conducted in Ghana which found that

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Variable	B	Wald	Sig.	Exp (B)	95CI	
Size of Child at Birth (Very large=1.0)						
Larger than average	-0.277	6.852	0.009	0.758	0.616	0.933
Average	-0.342	11.167	0.001	0.710	0.581	0.868
Smaller than average	-0.287	3.997	0.046	0.750	0.566	0.994
Very small	0.114	0.409	0.523	1.121	0.790	1.591
Do not know	-1.330	3.260	0.071	0.264	0.062	1.121
Constant	**-1.309**	**234.598**	**0.000**	**0.270**		

Table 4: Binary logistic regression on size of child at birth and women's caesarean delivery in Ghana.

Note: Source: GDHS (2022). Significant at 0.05.

higher birthweight babies (4-6kg) were significantly associated with caesarean delivery (adjusted odds ratio ~2.13 for that weight range) [9,10]. On the contrary, the finding disagrees with a previous study conducted in Japan which found that no association existed between cesarean delivery and greater child weight or BMI [44]. This finding suggests that as the likelihood of having a caesarean delivery increases, so does the likelihood or accuracy of recalling the child's birthweight [45-47]. The plausible explanation to this finding could probably be influenced by factors such as health facility delivery, maternal education, socioeconomic status, birthweight salience, and access to medical records [46-49].

The study found that child size at birth was negatively correlated with caesarean delivery. This finding agrees with a previous study which found that babies with smaller birth sizes have lower odds of being delivered via cesarean section [50,51]. On the contrary, the finding disagrees with previous studies which found that caesarean delivery operation was more common among women whose baby's birth weight was less than 2.5kg, compared to babies of weight at least 2.5kg [10,52,54]. This finding suggests that larger infant size increases the likelihood of caesarean delivery, hence, likely due to clinical complications, while smaller infants are more often delivered vaginally, highlighting fetal size as a key determinant in delivery method decisions [55-59].

The study did not find relationship between pregnancy outcome and caesarean delivery among women in Ghana. Therefore, null hypothesis was accepted. This finding suggests that women's caesarean delivery in Ghana is not dependent on pregnancy outcome. However, the study found that relationship exists between child's birthweight recall and caesarean delivery among women in Ghana. Therefore, the null hypothesis was not confirmed. A p-value of <0.001 found is an indication that both the explanatory and the outcome variables are not independence of each other and that they are interdependence. Further, the relationship revealed that child's birthweight recall is a stronger predictor of caesarean delivery among women in Ghana. This finding corroborated with previous studies conducted in Taiwan and Canada which found that maternal recall of birthweight is highly accurate and strongly associated with caesarean delivery, supporting the finding that the two variables are interdependent and that birthweight recall can be a strong predictor of caesarean delivery [60,61].

The study found that relationship exists between size of child at birth and caesarean delivery among women in Ghana due to this, the null hypothesis was ignored. A p value of =0.002 found indicates that child's size at birth is a determinant of caesarean delivery among

women in Ghana. This finding is consistent with previous studies conducted in Ghana which also found that larger infant size at birth is associated with significantly higher odds of caesarean delivery, while smaller infants correspond to lower odds [9,10,33].

The study found that overwhelming majority of the women sampled had their most recent live birth by caesarean section. The finding is in line with previous studies which also found that overwhelming majority of women who had caesarean sections were performed [62-66]. On the contrary, the finding contradicted a previous study conducted in Nepal which found only 17.03% caesarean delivery rate [67]. This finding suggests that there is a high rate of cesarean deliveries in Ghana [10]. The plausible explanation to this finding could probably be that these women have an increased access to healthcare, socioeconomic and demographic trends, and regional disparities in healthcare access and quality. Further, it could be due to individual factors like advanced maternal age, higher education, and formal employment [10]. The few that had their prior live birth by caesarean delivery reason could be complications during labor which made vaginal delivery risky [10].

The research found 65.2% of women reporting child's birth size from a written card, 16.5% had children being not weighed, 12.8% from mother's recall, and 5.6% did not know. Concerning the size of child at birth, 40.4% of the women indicated average size while 0.5% of them did not know. The study also found that majority (83%) of the women sampled never had caesarean delivery while 7% had. These findings reflect moderate institutional delivery coverage and record-keeping, hence, improving the reliability of reported birth data [69]. However, equity issues remain uneven, particularly, regarding birthweight tracking and caesarean section access [48]. Most mothers were able to recall or reference birthweight, and a growing proportion are delivering via caesarean section-likely shaped by a mix of socioeconomic factors, health system access, and clinical need [68,70]. The findings infer that while most women in the study had access to written records for reporting their child's birthweight and could assess the size of their newborns, there are still gaps in birthweight documentation and knowledge among a minority [71-75]. Further, the caesarean section rate of 17% indicates increasing access to surgical delivery, suggesting improvements in maternal healthcare services in Ghana [66,76]. However, this also highlights potential disparities in access and utilization, as well as the need for continued investment in record-keeping, maternal education, and equitable obstetric care [11]. Furthermore, the high percentage of women reporting birthweight from written cards (65.2%) reflects increased facility-based deliveries where birth details are recorded by health professionals [20,71]. Moreover, the 17% caesarean delivery rate may be due to factors such as urbanization, older maternal age, higher parity, and increased healthcare-seeking behaviors, which are linked to both elective and emergency caesareans [10,11,68,77-79]. Additionally, regional differences in the availability of obstetric services may explain why some women still rely on recall (12.8%) or report that the child was not weighed (16.5%), indicating gaps in health facility access or postnatal care [71,77,80]. Also, women who delivered outside of formal healthcare settings or who faced barriers such as cost, distance, or traditional beliefs may be less likely to have babies weighed or recorded, contributing to the "don't know" (5.6%) and "not weighed" categories [68,81,82].

Conclusion

In essence, these findings suggest that both documented and perceived indicators of birthweight and size are significantly associated with the likelihood of caesarean section delivery among women in Ghana. Therefore, the study recommends that healthcare systems could be strengthened to ensure that all newborns are weighed at birth and recorded using standardized health cards. Hence, it might reduce reliance on maternal recall and the "do not know" category, which was significantly associated with higher caesarean section rates. Further, healthcare providers should endeavor to educate women during antenatal visits about the need of knowing and retaining information on their child's birthweight and size. One weakness of the study is that the DHS relied on self-reported information therefore, the possibility of recall bias is high and this can affect the results of the study. So, the findings should be interpreted with caution. Further, the DHS was conducted cross-sectionally and since it is not a census, generalizability is not possible.

Declaration

Abbreviations

DHS: Demographic and Health Survey

GDHS: Ghana Demographic and Health Survey

ICF: International Coaching Federation

IVs: Independent Variables

SPSS: Statistical Package for the Social Sciences

US: United States

Ethics Approval and Consent to Participate

The GDHS Program obtained ethical approval from both The Ghana Health Service's Ethics Review Committee and The ICF The Institutional Review Board for ethical review. This dual approval process assure that the survey adheres to ethical guidelines and protects the rights of participants.

Consent for publication

Not applicable.

Availability of Data and Materials

The study made used of the 2022 GDHS data. Therefore, it is publicly available online at https://dhsprogram.com/data. This is Measure DHS Initiative or Program.

Competing Interests

Authors did not register any conflict of interest.

Funding

The study received no fund.

Author's Contribution

Rita Tekpertey: Conceptualise the study, Methodology, Formal analysis, Data curation, and Writing - original draft.

Anthony Edward Boakye: Software, Formal analysis, Writing – original draft, Writing - review & editing.

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