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Prevalence of Cesarean Section at Georgetown Public Hospital Corporation, Guyana: An Institution-Based Cross-Sectional Study

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Abstract

The International Healthcare Community recommends that countries do not exceed a 15% rate for cesarean section (CS). Our objective was to determine the prevalence and factors associated with CS at GPHC from July to September 2022. **Methods:** A cross-sectional study was carried out and data were collected from 1296 mothers, who met the inclusion criteria, through face-to-face interviews after obtaining prior informed consent. We performed descriptive analyses both for the outcome and independent variables. Bivariate and multiple logistic regression were used to identify factors associated with CS with a p-value < 5%. **Results:** The prevalence of CS at GPHC was 28.9% (95%CI: 26.5-31.5). Factors associated factors with CS were mothers aged 20 to 34 years (AOR: 1.56, 95%CI: 1.02 - 2.39, P = 0.039); mothers who received more than three minimum wages (AOR: 1.95, 95%CI: 1.29 - 2.97, P = 0.002) and who attended prenatal care at both public and private health facilities (AOR: 2.49, 95% CI: 1.19 - 5.22, P = 0.022). Likewise, the highest Odds of CS were observed in mothers with gestational hypertension (AOR: 2.00, 95%CI: 1.35 - 2.96, P < 0.001), gestational diabetes (AOR: 3.22, 95%CI: 1.65 - 6.30, P = 0.001), and admitted to the hospital for any sickness during pregnancy (AOR: 1.82, 95%CI: 1.24 - 2.67, P = 0.002). Mothers who gave birth with less than 37 weeks of gestation (AOR: 1.52, 95%CI: 1.01 - 2.28, P = 0.046) were also associated with the highest odds of CS. Conversely, mothers who lived without a partner/unmarried (AOR: 0.68, 95%CI: 0.47 - 0.99, P = 0.044), who lived at least 5 km from any public health facility (AOR: 0.63, 95%CI: 0.47 - 0.85, P = 0.003) were associated with lower odds of CS. **Conclusion:** The prevalence of CS is higher than the ideal rate recommended by the International Healthcare Community. More studies are needed to understand the reasons for such high prevalence at GPHC.

Keywords

Cesarean Section, Delivery, Georgetown Public Hospital Corporation, Guyana

1. Introduction

The cesarean section or C-section (CS) is a surgical intervention by which one or more babies are delivered through an open abdominal incision (laparotomy) and an incision in the uterus (hysterotomy) of the mothers [1]. CS is highly effective in saving the life of both mother and baby but is only recommended when vaginal delivery might pose a risk to the mother or baby [2]. Since 1985, the International Healthcare Community has recommended countries not exceed 15% of the cesarean rate, as the excessive use of CS can create harm and waste of human and financial resources [2] [3] [4]. However, this remains inconclusive as other studies have indicated that CS rates exceeding 10% across a particular population show an inverse relationship to maternal and newborn mortality [5]. Recent studies have shown that the global rate of CS is higher than the ideal trends, as well as the projection of CS by 2030 [6] [7]. A study carried out by Betran *et al.*, in 2021, with data from 154 countries, showed that, globally, 21% of women gave birth by CS. It was also demonstrated that the rate of CS varied widely from 5% in sub-Saharan Africa to 42.8% in Latin America and the Caribbean [6]. It was projected that by 2030, 28.5% of women worldwide will give birth by CS, representing 38 million CS, of which 33.5 million will occur in low and middle-income countries (LMIC) annually [6]. However, a report published in 2017 by the Countdown working groups using data from 57 LMICs showed a median national coverage of CS of 6% [7].

In Guyana, the CS rate in 2014 was estimated at 17% [7]. A study by Vansell *et al.* (2015), with data from three regional public hospitals showed a similar CS rate of 16.1% [8]. However, in a report by Kaiteur News in 2020, it was estimated that 25% of all births at the Georgetown Public Hospital Corporation (GPHC) in the last three years were by CS, while in private hospitals, it was over 50% [9].

Although the number in various regions of the world is alarming and should be cause for concern, it should be noted that an internationally accepted standardized classification system is still lacking to adequately monitor and compare CS rates in a consistent and action-oriented manner [5].

Additionally, several factors are known to be associated with CS, including but not limited to maternal age [10], socioeconomic status [11], parity [11], gestational hypertension [10], gestational diabetes [12], and gestational age at birth [10], among others.

In Guyana, there is a paucity of published data on factors associated with CS. Estimating the prevalence of CS and its associated factors at the only tertiary referral hospital in Guyana will help policymakers understand the subgroups that most request CS and adopt strategies to reduce unnecessary CS at GPHC. This

study aimed to determine the prevalence and factors associated with CS at GPHC from July to September 2022.

2. Materials and Methods

2.1. Design and Settings

An institution-based cross-sectional study was conducted from July to September 2022 to assess the prevalence of CS at GPHC. GPHC is the largest teaching hospital in Guyana and serves as both a regional and national public referral hospital [13]. GPHC provides the widest range of healthcare services, including maternity services. People are referred to the GPHC from all ten regions for health service, which is offered free of charge. About 6000 babies are born every year at GPHC, which represents 40% of all births in the country. The maternity unit is open 24 hours and has 102 beds for both prenatal and postnatal care [14].

2.2. Study Population and Procedures

We collected data from all pregnant women as of 28 weeks of gestational age who were admitted and delivered a single live baby at GPHC from July to September 2022. Based on the number of women who give birth each year at GPHC, it was estimated that a minimum of 307 women would be necessary to conduct the study, with a prevalence rate of 30% and a 95% confidence interval. We decided to sample all women who gave birth at GPHC during that period to achieve the study objectives and have greater precision in the estimates. Daily, before 8:00 am, the main researcher obtained, in the delivery room, the list of all pregnant women who gave birth at the GPHC, and handed it to the interviewers for identification of the mothers for the interview. Upon receiving the list, the interviewers contacted the mothers in the puerperium room, explained the study, and invited them to participate.

Free and informed consent was obtained from each mother who agreed to participate in the study. For adolescent mothers, informed consent was obtained from their relatives and assent from the adolescents. Mothers who suspected or tested positive for COVID-19 post-delivery or who were unable to communicate in English or in Spanish were excluded from the study. Likewise, mothers who delivered a stillbirth baby, twin babies, or who gave birth outside the study site were excluded from the study. For data collection, a pre-tested questionnaire developed by the research team was used (see **Web Appendix Questionnaire**). One interviewer was available each day from 8:00 am to 6:00 pm at the maternity unit to collect the data. The mothers were interviewed in the first 48 hours post-delivery through face-to-face interviews. Mothers who could not be interviewed within 48 hours due to pregnancy or delivery-related complications had their names recorded by the interviewers and were before hospital discharge. We collected data on several factors, including sociodemographic and pregnancy history, prenatal care, medical conditions of mothers, and mode of delivery. Permission to conduct the study was obtained from the Ministry of Health-Insti-

tutional Review Board (MOH-IRB), and the research committee team at GPHC.

2.3. Independent and Dependent Variables

Three groups of variables were assessed based on their relationships with the prevalence of CS [12] [15] [16] [17] [18]. These variables were organized as follows: 1) sociodemographic characteristics and pregnancy history; 2) prenatal care during pregnancy and, 3) medical conditions of the mothers during pregnancy. Sociodemographic characteristics included: maternal age (<20, 20 - 35, ≥ 35), self-declaration of ethnicity (African, Amerindian, East Indian, Mixed, White), marital status (living with husband or partner, living without husband or partner), family income in minimum wages (<1 minimum wage, 1 - 3 minimum wage, >3 minimum wages), and distance from home to any public health facility (<5 km, ≥5 km). The current minimum wage in Guyana is GYD 60,147/USD 284.96 [19]. Pregnancy history included first-time pregnancy (Yes/No). For prenatal care during pregnancy, we included the number of antenatal care visits (<4 visits, ≥4 visits), the health sector where mother attended antenatal care (public, private, both). Medical conditions of mothers included gestational hypertension (Yes/No), gestational diabetes (Yes/No), admission to hospital during pregnancy for any sickness or pregnancy-related issue (Yes/No), and gestational age at birth (<37 weeks, ≥37 weeks). The dependent variable of the study was the mode of delivery and categorized as vaginal delivery versus CS. All this information was obtained from a face-to-face interview with the mothers. However, data for the number of antenatal care visits were obtained from the mother's charts and for gestational age at birth from the newborn's medical charts.

2.4. Statistical Analyses

Descriptive analyses were carried out for each variable. The chi-square test (X^2) was used to calculate the prevalence of C-section according to each independent variable and to assess the association between CS and the independent variables. Logistic regression was used to determine factors associated with CS using a conceptual framework (See **Web Appendix** Figure S1), and backward selection procedure. Variables were manually inserted into the model according to the hierarchical organization of the variables by the conceptual structure. For each level of the conceptual framework, starting with level 1, we run a model with all variables in the level and remove those with a p-value > 0.2, starting with the variable with the highest p-value. Variables with a p-value lower than 0.2 were retained and added up to the next level (level 2). The same procedure was repeated for level 2 and level 3. Variables that were already retained from levels 1 and 2 were kept in the model independently of changes in their p-values at the next level. The variables considered associated with the outcome were those with a p-value < 0.05 in the final model (after the inclusion of the variables of the 3 levels). The model's explanatory power at each level was assessed by measuring the increase in the value of the −2 log likelihood (−2LL) with the X^2 of the mod-

el. We tested for multicollinearity between the explanatory variables using the variance inflation factor (VIF), which was less than five. All the analyses were conducted using Stata (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC).

3. Results

From July to September 2022, 1407 pregnant women gave birth at GPHC. Of these, we excluded mothers who delivered a stillborn baby (0.9%) and twin babies (1.1%). We also excluded mothers who were not able to communicate in English or Spanish (0.5%) and those suspected of COVID-19 infections (0.1%). Besides, 4.6% of mothers refused to participate in the study and were excluded.

The total number of mothers who delivered a single live baby from July to September 2022 included in the study was 1296. Of them, 37 were CS, which account for 28.9% (95%CI: 26.5 - 31.5). Most of the mothers were between 20 to 34 years old (71.3%), self-identified as African descent (34.5%), living with a husband or partner (77.6%), homemaker (48.2%) and received from one to three minimum wage (54.3%). Likewise, 59.0% of the mothers lived less than 5km from any public health facility and 34.8% were primipara. Besides, 8.3% received less than four prenatal visits, 93.4% attended prenatal care in the public sector only, 13.5% had gestational hypertension, and 4.5% had gestational diabetes. 92.2% of the mothers used iron/folic acid supplements at any time during pregnancy, 10.4% were admitted to the hospital at any time during their pregnancy for any sickness or pregnancy-related issue, and 12.5% of the babies were born before 37 weeks of gestation (Table 1).

The prevalence of CS was higher among mothers 35 years old or older (33.0%), of African descent (31.8%), living with a partner/married (30.7%), who received more than three minimum wages (38.6%) and living less than 5km from any public health facility (31.9%). Similarly, cesarean was more prevalent among mothers who delivered more than once (31.3%), who received four or more prenatal visits (29.2%), and who had prenatal at both public and private facilities (58.8%). CS was also more common in mothers with gestational hypertension (51.4%), gestational diabetes (60.4%), those who were admitted to the hospital for any sickness or pregnancy-related issue (46.0%), and who gave birth before 37 weeks of gestation (38.7%) (Table 1).

Table 2 provided findings from both crude and adjusted logistic regression analyses. In crude regression analyses, maternal age from 20 to 34 years old (COR: 1.77, 95%CI: 1.25 - 2.51, P = 0.001), or 35 years or older (COR: 1.94, 95%CI: 1.19 - 3.18, P = 0.008) had higher odds of CS.

Likewise, family income more than three minimum wages (COR: 2.10, 95%CI: 1.44 - 3.05, P < 0.001), mothers with antenatal care visits at both private and public hospitals (COR: 3.65, 95%CI: 1.82 - 7.30, P < 0.001) were associated with higher odds of CS. Gestational hypertension (COR: 3.11, 95%CI: 2.25 - 4.31, P < 0.001), gestational diabetes (COR: 4.02, 95%CI: 2.34 - 6.90, P < 0.001), admission to hospital for any sickness during pregnancy (COR: 2.41, 95%CI: 1.76 - 3.31, P

Table 1. Characteristics of the population studied and prevalence of C-section according to the main exposure variables of the study.

Variables	Description N (%)	Prevalence of CS N (%)
Maternal age		P = 0.004
<20	232 (18.6)	47 (20.3)
20 - 34	888 (71.3)	274 (31.0)
≥35	126 (10.1)	41 (33.0)
Maternal ethnicity		P = 0.031
African	446 (34.5)	140 (31.8)
Amerindian	237 (18.3)	52 (21.9)
East Indian	209 (16.2)	54 (25.9)
Mixed	402 (31.1)	123 (30.8)
Marital status		P = 0.013
Living with husband/partner	1009 (77.6)	308 (30.7)
Living without husband/partner	291 (22.4)	67 (23.2)
Family income		P < 0.001
<1 minimum wage	291 (24.6)	67 (23.0)
1 - 3 minimum wage	644 (54.3)	182 (28.3)
>3 minimum wage	250 (21.1)	96 (38.6)
Distance from health facility		P = 0.007
<5 km	758 (59.0)	241 (31.9)
≥5 km	526 (41.0)	130 (24.8)
First-time pregnancy		P = 0.012
Yes	453 (34.8)	111 (24.6)
No	848 (65.2)	264 (31.3)
Number of antenatal care visits		P = 0.370
<4 visits	106 (8.3)	26 (24.8)
≥4 visits	1167 (91.7)	339 (29.2)
Sector of antenatal care visits		P < 0.001
Public	1195 (93.4)	335 (28.2)
Private	51 (4.0)	18 (35.3)
Both	34 (2.6)	20 (58.8)
Gestational hypertension		P < 0.001
Yes	175 (13.5)	90 (51.4)
No	1124 (86.5)	284 (25.4)
Gestational diabetes		P < 0.001
Yes	58 (4.5)	35 (60.3)
No	1239 (95.5)	339 (27.5)

Continued

Use of iron/folic acid during pregnancy		P = 0.110
Yes	1191 (92.2)	352 (29.6)
No	101 (7.8)	22 (21.8)
Admission to hospital for any sickness during pregnancy		P < 0.001
Yes	187 (10.4)	86 (46.0)
No	1109 (85.6)	288 (26.1)
Gestational age		P = 0.003
<37 weeks	155 (12.5)	60 (38.7)
≥37 weeks	1090 (87.5)	293 (27.0)

Table 2. Logistic regression odds ratio (OR) for factors associated with C-section at GPHC.

Variables	COR (95%CI)	p-value	AOR (95%CI)	p-value
Maternal age				
<20	ref		ref	
20 - 34	1.77 (1.25 - 2.51)	0.003	1.56 (1.02 - 2.39)	0.111
≥35	1.94 (1.19 - 3.18)		1.61 (0.89 - 2.90)	
Maternal ethnicity				
African	ref			
Amerindian	0.60 (0.42 - 0.87)	0.028	-	-
East Indian	0.75 (0.52 - 1.09)			
Mixed	0.95 (0.71 - 1.28)			
Marital status				
Living with husband/partner	ref	0.013	ref	0.044
Living without husband/partner	0.68 (0.50 - 0.92)		0.68 (0.67 - 0.99)	
Family income				
<1 minimum wage	ref		ref	
1 - 3 minimum wage	1.32 (0.96 - 1.82)	<0.001	1.18 (0.82 - 1.70)	0.003
>3 minimum wage	2.10 (1.44 - 3.05)		1.95 (1.29 - 2.97)	
Distance from health facility				
<5 km	ref	0.006	ref	0.002
≥5 km	0.71 (0.55 - 0.91)		0.63 (0.47 - 0.85)	
First-time pregnancy				
Yes	0.71 (0.55 - 0.92)	0.011	-	-
No	ref			
Number of antenatal care visits				
<4 visits	0.80 (0.50 - 1.27)	0.340	-	-
≥4 visits	ref			

Continued

Sector of antenatal care visits				
Public	ref		ref	
Private	1.39 (0.77 - 2.51)	0.000	1.29 (0.63 - 2.62)	0.046
Both	3.65 (1.82 - 7.30)		2.49 (1.19 - 5.22)	
Gestational hypertension				
Yes	3.11 (2.25 - 4.31)	<0.001	2.00 (1.35 - 2.96)	0.001
No	ref		ref	
Gestational diabetes				
Yes	4.02 (2.34 - 6.90)	<0.001	3.22 (1.65 - 6.30)	0.001
No	ref		ref	
Use of iron/folic acid during pregnancy				
Yes	1.51 (0.93 - 2.46)	0.098	-	-
No	ref			
Admission to hospital for any sickness during pregnancy				
Yes	2.41 (1.76 - 3.31)	<0.001	1.82 (1.24 - 2.67)	0.002
No	ref		ref	
Gestational age				
<37 weeks	1.71 (1.21 - 2.43)	0.003	1.51 (1.01 - 2.28)	0.046
≥37 weeks	ref		ref	

AOR: Adjusted Odds Ratio, COR: Crude Odds Ratio.

< 0.001), and gestational age < 37 weeks (COR: 1.71, 95%CI: 1.21 - 2.43, P = 0.003) were associated with higher odds of CS. In contrast, Amerindian mothers (COR: 0.60, 95%CI: 0.42 - 0.87, P = 0.007), mothers who lived without partner/unmarried (COR: 0.68, 95%CI: 0.50 - 0.92, P = 0.013), who lived 5 km or more from any public health facility (COR: 0.71, 95%CI: 0.55 - 0.91, P = 0.006), and in their first pregnancy (COR: 0.71, 95%CI: 0.55 - 0.92, P = 0.011) had lower odds of CS.

In the adjusted regression analysis, mothers aged 20 to 34 years (AOR: 1.56, 95%CI: 1.02 - 2.39, P = 0.039), who received more than three minimum wages (AOR: 1.95, 95%CI: 1.29 - 2.97, P = 0.002) and who attended prenatal care at both public and private health facilities (AOR: 2.49, 95%CI: 1.19 - 5.22, P = 0.022) were statistically associated with the highest odds of CS.

Equally, mothers with gestational hypertension (AOR: 2.00, 95%CI: 1.35 - 2.96, P < 0.001), gestational diabetes (AOR: 3.22, 95%CI: 1.65 - 6.30, P = 0.001), admitted to the hospital for any sickness during pregnancy (AOR: 1.82, 95%CI: 1.24 - 2.67, P = 0.002) had the highest odds of CS. Besides, mothers who gave birth with less than 37 weeks of gestation (AOR: 1.52, 95%CI: 1.01 - 2.28, P = 0.046) were associated with higher odds of CS. However, mothers who lived without a partner/unmarried (AOR: 0.68, 95%CI: 0.47 - 0.99, P = 0.044), who

lived at least 5 km from any public health facility (AOR: 0.63, 95%CI: 0.47 - 0.85, P = 0.003) were associated with lower odds of CS. The final model explained 8.3% of the total variability of CS at GPHC. Both maternal ethnicity and first - time pregnancy were statistically associated with CS in the crude analyses but lost the statistical significance after adjusting for the other covariates.

4. Discussion

This study showed that almost one for every three mothers that gave birth at GPHC from July to September 2022 were by CS, which is similar to the findings from previous studies [15] [20]. A cross-sectional study carried out in Brazil by Padua *et al.* (2010), with data from a Brazilian hospital found a prevalence of CS of 30.1% [15]. Moges *et al.* (2015) in a cross-sectional study at Atat Hospital in Ethiopia found a prevalence of CS of 27.6% [20]. However, Manyeh *et al.* (2018) analyzing data from the Dodowa Health and Demographic Surveillance System in Ghana, showed that the overall C-section rate for the study period was 6.59% [21]. In contrast, Nedberg *et al.* (2020) in a registry-based study in Georgia using data from primiparous women found a proportion of cesarean section of 37.1% [17].

Our findings also showed the main factors that were associated with CS were the mother's age (20 to 34 years old), marital status, family income, distance from home to any public health facility, health sector where the mothers attended antenatal care, gestational hypertension, and diabetes, admission during pregnancy for any sickness or pregnancy-related complications and gestational age at birth. Such findings are consistent with other previous publications. Several studies have shown that an increase in maternal age is associated with CS [10] [17] [20] [22]. However, in our study, we found no association between mothers aged 35 years or older and CS. Likewise, some studies showed that higher monthly family income [11] [23], mothers who had prenatal care at private facilities [24], gestational hypertension [10] [25], gestational diabetes [26], hospital admission during pregnancy for any sickness [27] and preterm delivery [28] were statistically associated with higher odds of CS, which are consistent with findings from our study.

We also showed that mothers who lived without a partner/unmarried were associated with lower odds of CS. This finding is not consistent with other previous analyses [21] [29]. Manyeh *et al.* (2018) in Ghana found no association between CS rate and marital status [21]. Likewise, Cecatti *et al.* (2005) found no association between CS and marital status [29].

Furthermore, mothers who lived 5 km or more from any public health facilities were associated with lower odds of CS, which is consistent with findings by Tegegne *et al.* [30]. The reason for the reduced chance of CS among unmarried women is unknown. However, the unmarried women could be those in their first-time pregnancy, less than 18 years old, with fewer complications during pregnancy, and opted for vaginal delivery instead of CS. Similarly, mothers liv-

ing 5 km or more from any public health facility might be those who lived outside Georgetown, the capital city in Guyana, which concentrates most of both public and private health facilities that provide delivery care by CS. In contrast, the older pregnant women could be those with a previous CS or who had a higher probability of complications during pregnancy and who opted for CS.

This study has some advantages and limitations. This is the first study carried out at GPHC that assessed factors associated with CS. In this study, we collected data on more than 90% of the total births that occurred at GPHC from July to September 2022. Even though our findings are not nationally representative, it should be noted that since GPHC is the largest regional and referral hospital in Guyana representing 40% of the total births in the country, these figures are indicative of the national rate of CS [14]. We also showed the subcategories of women that requested the most CS, which can guide stakeholders for policy actions to reduce unnecessary CS at GPHC. However, we were not able to assess several factors such as previous mode of delivery, history of abortion or stillbirths, patient preference and decision for CS, characteristics of hospital admission such as cervical dilatation and status of membranes, which are known to be associated with CS [10] [11].

5. Conclusion

This study showed that the prevalence of CS is higher than the ideal rate recommended by International Healthcare Community. It also demonstrated the main factors that are associated with CS at GPHC. Such findings are of utmost importance as it is the first study of its kind conducted at the GPHC and may help policymakers to better understand and address the CS rate at GPHC. More studies are needed to understand the reasons for such a high prevalence of CS in GPHC.

Authorship

GJ conceived and planned the work that led to the paper or interpreted the evidence it presents, wrote the manuscript and approved the final version. MH reviewed the manuscript and approved the final version. CB reviewed the manuscript and approved the final version.

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Conflicts of Interest

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

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Appendixes

Web Appendix Questionnaire

I-Identification

Name of the interviewer: ……

Date of the interview (Day/month/year): ……./……./…….

Complete name of the mother of the newborn (Capital letter): ……..

Telephone number of the mother: ……

Date of delivery (day/month/year): ……...

Time of birth of the newborn (HR:MN): ……..

Number of babies born in this birth: …….

If multiple births (two or more), record and move to the next mother with a single birth.

II. Socioeconomic and demographic factors

1. Where are you from? □ Guyana (1) □ Other country (2) (specify) …….

2. How old are you? Age in years: ……

3. Place of residence: □In town (1) □ Country side (2)

4. How do you classify yourself in term of ethnicity? □ East Indian (1) □ African (2) □ Amerindian (3) □ White (4) □ Mixed race (5) □ other (6) (specify) ……

5. What is your current marital status? □ Living with husband or partner (1) □ Living without husband or partner (2)

6. Have you ever attended school? □ Yes (1) □ No (0)

If no, move to question 8.

7. What is the highest level of school you reached? □ Never attended school (0) □ Nursery (1) □ Primary (2) □ Secondary (3) □ University (4)

8. What is your current employment status? □ Housewife (1) □ Full time employment (2) □ Part time employment (3) □ Self-employed (4) □ Student (5) □ Other (6) …….

9. What is your monthly family income in Guyanese dollars (G$)?

…….

10. How many individuals live in your house including adults and kids?

…….

11. What type of house do you live in? □ Rented (1) □ Owned (2) □ Family house (3) □ Government house (4)

12. How many children do you have alive? ……..

III. Gestational characteristics and health care factors

13. Mother's height: ___, ___cm

14. What was your weight at the beginning of the pregnancy (see mother's card? ___, ___Kg

15. What was your weight before the delivery of this baby (see mother's card)? ___, ___Kg

16. Do you smoke cigarette? □ Yes (1) □ No (0)

If no, move to question 18.

17. If yes, how many cigarette you smoked in a day?

□ None (0) □ < 1 (1) □ 1 to 3 (2) □ 4 to 7 (3) □ >7 (4)

18. Did you smoke cigarette during this pregnancy? □ Yes (1) □ No (0)

19. Do you use drug like cocaine/marijuana? □ Yes (1) □ No (0)

20. Did you use drug like cocaine/marijuana during this pregnancy? □ Yes (1) □ No (0)

21. If yes, what type of drug you used? □ Marijuana (1) □ Cocaine (3) □ Other (3) (Specify)……..

22. Is this your first pregnancy? □ Yes (1) □ No (0)

23. How many times did you get pregnant?

□ 1 time (1) □ 2 times (2) □ 3 times (3) □ 4 times or more (4)

24. Did you plan for this pregnancy? □ Yes (1) □ No (0)

25. Did you have any antenatal visit during this pregnancy? □ Yes (1) □ No (0)

If no, move to question 29.

26. If yes, how many visits did you have during this pregnancy? Number of visits: ……

Number of antenatal care visits according to antenatal card (Check antenatal card): ……

27. How many weeks pregnant were you when you first received antenatal care for this pregnancy? □ Less than 14 weeks (1) □ 14 to 20 weeks (2) □ Over than 20 weeks (3)

28. Where did you attend antenatal care? □ Public sector (1) □ Private sector (2) □ Other (3)…….

29. How do you consider your distance from the nearest (any) public health facility?

□ Less than 5 Km (1) □ 5 to 10 Km (2) □ Over than 10 Km (3)

30. Number of previous deliveries after 20 weeks of gestation: ……...

IV. Maternal health condition and nutritional status

31. Did you have any of the following before this pregnancy?

Diagnosis before this pregnancy	Yes (1)	No (0)
Hypertension		
Diabetes		
Asthma		
Sickle cell		
Depression		

32. Were you diagnosed with any of the following during this pregnancy?

Diagnosis during this pregnancy	Yes (1)	No (0)
Hypertension		
Diabetes		

Continued

Asthma
Sickle cell
Depression
Pre-eclampsia
Eclampsia
Anemia
Malaria
Dengue
Urinary tract infection

If no for all items from question 33, move to question 41.

33. At what stage of the pregnancy were you diagnosed with hypertension?

□ I have not been diagnosed with hypertension (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

34. At what stage of the pregnancy were you diagnosed with diabetes?

□ I have not been diagnosed with diabetes (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

35. At what stage of the pregnancy were you diagnosed with asthma?

□ I have not been diagnosed with asthma (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

36. At what stage of the pregnancy were you diagnosed with sickle cell disease?

□ I have not been diagnosed with sickle cell (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

37. At what stage of the pregnancy were you diagnosed with anemia?

□ I have not been diagnosed with anemia (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

38. At what stage of the pregnancy were you diagnosed with depression?

□ I have not been diagnosed with depression (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

39. At what stage of the pregnancy were you diagnosed with malaria?

□ I have not been diagnosed with malaria (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

40. At what stage of the pregnancy were you diagnosed with dengue?

□ I have not been diagnosed with dengue (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

41. At what stage of the pregnancy were you diagnosed with urinary tract infection?

□ I have not been diagnosed with urinary tract infection (0)

□ Before the pregnancy (1)

□ In the first trimester (1st to 3rd month) (2)

□ In the second trimester (4th to 7th month) (3)

□ In the third trimester (7th to 9th/10th month) (4)

42. Were you admitted at the hospital during this pregnancy for any sickness? □ Yes (1) □ No (0)

If no, move to question 44.

43. If yes, for which condition? □ No admission □ Anemia (1) □ Malaria (2) □ pre-eclampsia/eclampsia (3)

□ Diabetes (4) □ Hypertension (5) □ Vaginal bleeding (6) □ Other (7) (Specify) ……..

44. Did you use folic acid and/or iron supplements during this pregnancy? □ Yes (1) □ No (0)

45. If yes, how often did you use it? □ No intake (0) □ One per day (1) □ One per week (2) □ Irregularly (3)

V. Characteristics of the delivery and health of the neonates

46. Date of the birth: ……./……./…… (Day/month/year)

47. Sex of the neonate: □ Male 1) □ Female (2)

48. Type of delivery: □ Vaginal delivery (1) □ C-section (2)

49. Gestational age (in weeks): …….. Weeks

50. Inter-pregnancy interval (time interval between the last birth or abortion)

and the beginning of the present pregnancy: ……months

51. Order of this birth: □ First (1) □ Second (2) □ Third (3) □ Fourth or more (4)

52. Did your child have any health problems after the delivery? □ Yes (1) □ No (0)

If no, move to question 55.

53. What health problem is the child having or has had?

□ None (0) □ Birth defects (1) □ Birth injuries (2) □ Breathing problems (3) □ Jaundice (4) □ Infections (5) □ Low blood sugar (6) □ Premature birth (7) □ Other (9) (specify)……..

54. Have you already put your child to the breast? □ Yes (1) □ No (0)

If no, move to question 56.

55. How long after birth did you put your child to breast?

□ Less than 1 hour (1) □ 1 hour to 23 hours (2) □ 24 to 48 hours (3) □ More than 48 hours (4)

56. Are you planning to breastfeed your child? □ Yes (1) □ No (0)

If no, move to question 58.

57. If yes, up to what age do you intend to breastfeed your child? Up to……. (months)

58. In the first 24 hours after delivery, was your child given anything for drinking/feeding other than breast milk? □ Yes (1) □ No (0)

If no, move to question 61.

60. What was your child given to drink/feed?

□ Plain water (1) □ Sugar/glucose water (2) □ Gripe water (3) □ Sugar-salt-water solution (4) □ Fruit juice (5) □ Infant formula (6) □ Other (7) (specify)……

61. Baby's length at birth: __ __, __ cm

62. Baby's head circumference at birth: __ __, __ cm

63. Baby's weight at birth: __ __ __ __ grams, or in pounds: ….....lbs.

Web appendix Figure: Conceptual framework for relationship between the independent variables and type of delivery.

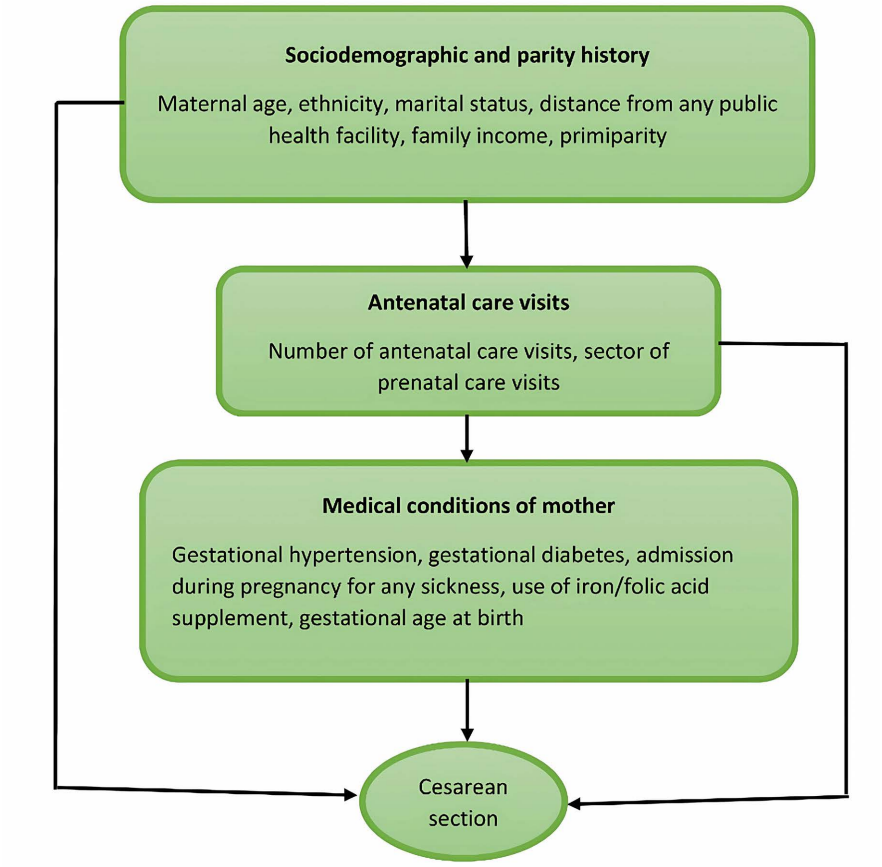

Figure S1. Conceptual framework for relationship between the independent variables and type of delivery.