Original Article

Prevalence and Factors Associated With Cesarean Section Delivery among Pregnant Women Attending Rwamagana Level Two Teaching Hospital, Rwanda

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Abstract

Background
Cesarean section (CS) is an essential, life-saving procedure when clinically justified. However, exceeding the World Health Organization's recommended prevalence (10–15%) may lead to adverse outcomes. This study aimed to determine the prevalence of CS at Rwamagana Hospital and to assess the associated factors.

Methods
This cross-sectional study was conducted among 426 postpartum women at Rwamagana Hospital. Data were analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics and multivariable logistic regression were employed. Statistical significance was set at a 5% level.

Results
The results showed a 38% prevalence of CS. Women younger than 25 years were 9.51 times more likely to undergo CS compared to those aged 36-45 years (AO:9.51, 95% CI: 3.37-26.83, p < 0.001), Fetal malposition (AOR:106.8, 95% CI: 29.89-382.25, p < 0.001), experiencing no labour (AOR: 4.64, 95%CI: 1.71 - 12.63, p = 0.003), and first-time mothers (Parity=1) (AOR: 19.65, 95%CI: 8.91-43.33, p<0.001) were positively associated with CS. However, Previous vaginal birth reduced the odds of CS by 89% (AOR:0.11, 95% CI: 0.06-0.21, p < 0.001).

Conclusion
The prevalence of CS at Rwamagana Hospital exceeds the WHO recommendation. There is a need for enhanced community education to support safe vaginal deliveries.

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Keywords: Cesarean section, Maternal health, Postpartum women, Rwanda

Introduction

Maternal health refers to the health and well-being of women during pregnancy, childbirth, and the postpartum period. Ensuring both the mother and child receive proper care during these stages is critical to safeguarding their health.[1] Access to quality services for pregnancy, labor, and delivery at all levels of healthcare facilities is essential for promoting maternal and fetal safety.[2] The Sustainable Development Goals (SDGs) have set a global framework for improving maternal health, with specific targets such as reducing the global maternal mortality ratio to less than 70 deaths per 100,000 live births by 2030 and achieving universal health coverage.[3] Achieving these goals requires comprehensive coverage of reproductive, maternal, newborn, and child health services.[2]

Cesarean section (CS) is a crucial medical intervention that can save lives when complications arise during childbirth. [4] However, its global prevalence continues to rise, currently accounting for over 21% of all deliveries.[5] While CS is often necessary for specific medical situations, performing it without clear medical indications can expose both the mother and baby to risks including surgical site infections, postpartum haemorrhage, anaesthesia-related complications, and future pregnancy risks such as uterine rupture.[6]

Globally, caesarean section rates have risen from around 7% in 1990 to 21% in 2021, and are projected to continue increasing over this current decade.[7] If this trend continues, by 2030 the highest rates are likely to be in Eastern Asia at 63%, Latin America and the Caribbean, at 54%, Western Asia, 50%, Northern Africa, 48%, Southern Europe, 47% and Australia and New Zealand, 45%.[5]

A meta-analysis identified the countries with the highest cesarean section (CS) rates in each region. In Latin America, the Dominican Republic ranked first with a prevalence of 56.4%, followed by Brazil at 55.6%. In Asia, Iran and Turkey had CS prevalence rates of 47.9% and 47.5%, respectively. Italy reported the highest CS rate in Europe at 38.1%, while the United States led in Northern America with a rate of 32.8%. In Oceania, New Zealand recorded the highest prevalence at 33.4%. In Africa, Egypt had the highest prevalence of CS, reported at 51.8%.[8]

In Rwanda, the rate of CS rose from 2.2% (95% CI 1.8–2.6) in 2000 to 15.6% (95% CI 13.9–16.5) in 2019–20.[9] The rate is consistently increasing among women aged between 24 to 35 years, women residing in urban areas, those with secondary or higher levels of education, those from the wealthiest households with access to information on paid employment, and those who had one child, male babies, and multiple pregnancies across the years.[9] The regional disparities in the prevalence of CS across the years were observed, whereas in the Eastern province region, the average rate of CS was 23 % in the five years from 2015 to 2019.[10]

Rwamagana Hospital reported an increase in the rate of cesarean section, where 44% (1893/4325) were delivered by cesarean section between August 2022 and July 2023.[11] This increasing CS prevalence continues to impact maternal and child health negatively for instance in terms of prolonged hospital stay (3 to 4 days). RDHS 2019-2020 report shows that about two-thirds (68%) of women who had a vaginal delivery in a health facility stayed in the health facility 1-2 days after delivery, while 87% of women who gave birth by CS stayed at the health facility for three or more days.[12] The CS delivery is also more expensive than normal delivery where the cost of normal delivery is 1,200 RWF while it is 10,800 RWF for CS delivery with community-based health insurance.[13]

Although cesarean section (CS) can reduce risks in specific medical scenarios compared to vaginal delivery,

unnecessary CS procedures may result in avoidable complications, including increased healthcare costs, prolonged hospital stays, and heightened risks of maternal and neonatal infections. While existing reports have highlighted CS utilization at the hospital, no comprehensive analysis had been conducted to explore its prevalence and associated factors. This study aimed to fill this gap by examining the prevalence of CS and identifying maternal, fetal, and socio-demographic factors contributing to its use at Rwamagana Level Two Teaching Hospital. The findings aim to provide evidence-based insights to guide policies and interventions, promoting the appropriate use of CS to enhance maternal and neonatal health outcomes in Rwanda and similar settings.

Methods

Study design and setting

A quantitative cross-sectional study was conducted at Rwamagana Level Two Teaching Hospital in Rwanda one month (February 2024). The hospital is located in Rwamagana District, Eastern Province, approximately 50 kilometres east of Kigali, the capital city of Rwanda. The hospital serves a predominantly rural population, with a total catchment area encompassing approximately 400,000 residents. Its central role in providing maternal healthcare made it an ideal setting for this study, which aimed to assess cesarean section prevalence and associated factors.

Study population

The study included 426 women who delivered at Rwamagana Hospital during February 2024. Both cesarean and vaginal deliveries were analyzed to facilitate comparisons and identify factors associated with CS. Data were collected from medical records and supplemented with interviews conducted during the study period to ensure comprehensive and reliable information. The study adopted a total population sampling approach, focusing on all deliveries that occurred in February 2024. This period was chosen to align with the study's timeline and logistical feasibility.

Study Variables

The dependent variable in this study was the mode of delivery, categorized as cesarean section (CS) or vaginal delivery. The independent variables included maternal factors such as age, parity, antenatal care (ANC) attendance, and body mass index (BMI); fetal factors such as fetal malposition and gestational age at delivery; and socio-demographic factors, including marital status, education level, occupation, household income, residence (urban or rural), and health insurance status. Additionally, obstetric history, such as previous vaginal birth, was also considered as an independent variable. These variables were selected for their potential impact on the mode of delivery, as highlighted in previous research and clinical practice.

Data collection

Data were collected using a structured approach to ensure validity and reliability. Information was obtained from medical records of women who delivered at Rwamagana Hospital during February 2024. These records provided key details on socio-demographic, maternal, fetal, and obstetric factors. To enhance the validity of the data, interviews were conducted with the women during the study period to supplement and cross-verify information, particularly for variables not consistently recorded in the medical files. The combination of medical records and interviews ensured a comprehensive and triangulated dataset for analysis. Reliability was ensured through standardized data collection procedures and the use of a data collection form developed based on existing literature. Trained research assistants conducted and reviewed all data entries to minimize errors, maintain consistency, and enhance inter-rater reliability.[9]

Statistical analysis

Data were entered into IBM SPSS Statistics for Windows version 27.0 (IBM Corp, Armonk, NY, USA) for analysis. Descriptive statistics were used to summarize demographic and clinical characteristics.

Bivariate analysis was conducted using crude odds ratios (CORs) to evaluate the initial association between each independent variable and the dependent variable (mode of delivery). Variables with a p-value < 0.05 in the bivariate analysis were considered for inclusion in the multivariable logistic regression model. This step allowed for the adjustment of potential confounding factors, yielding adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Statistical significance for the final multivariable model was declared at a p-value < 0.05. The process ensured that the AORs reflected the independent effects of each variable on the likelihood of cesarean delivery, after accounting for other covariates.

Study Variables

Dependent Variable

The dependent variable in this study was the mode of delivery, categorized as either cesarean section (CS) or vaginal delivery.

Independent Variables

The independent variables included a range of maternal, fetal, socio-demographic, and obstetric factors that could potentially influence the mode of delivery.

Maternal Factors

Maternal characteristics considered included age, parity (the number of previous births), antenatal care (ANC) attendance, and body mass index (BMI). These factors were analyzed due to their established association with delivery outcomes.

Fetal Factors

Fetal-related variables included fetal malposition and gestational age at delivery, as these are critical determinants of the mode of delivery.

Socio-Demographic Factors

Socio-demographic factors analyzed in the study were marital status, education level, occupation, household income, residence (categorized as urban or rural), and health insurance status. These variables were included to assess their influence on delivery choices and accessibility to healthcare services.

Obstetric History

The study also included previous vaginal birth as an independent variable. This obstetric history factor is clinically significant in determining the likelihood of cesarean section in subsequent pregnancies.

Ethical consideration

Ethical approval for this study was obtained from the Mount Kenya University Rwanda (MKUR) Ethics Committee (MKU/ETHICS/23/01/2024(1)) and the hospital research review board at Rwamagana Level Two Teaching Hospital (No 14/058/HOP/RGNA/2024).

Informed consent was obtained from all participants after providing detailed information about the study's objectives, procedures, risks, and benefits. Participation was voluntary, and confidentiality was assured. Participants could withdraw at any time without consequences, and signed consent forms were collected to document their agreement. These measures ensured adherence to ethical principles.

Results

Demographic Characteristics of participants

The majority of mothers were aged between 25 and 35 years (41.5%), with 38.7% under 25 and 19.7% between 36 and 45 years old. Most babies were born on their first day of life (44.1%), followed by 37.3% on the second day. Male newborns slightly outnumbered females at 52.3%. The majority of mothers (70.7%) were married, and most were engaged in farming (65.5%). Regarding education, 69.7% had primary education, while 8.2% had no formal education. Most mothers had normal BMI (58.2%), and 92% were covered by Community-Based Health Insurance (CBHI). A large majority (94.6%) had a household income of less than 50,000 Rwandan Francs per month, and 93.4% lived in rural areas. (Table 1)

Table 1. Socio-demographic characteristics of postpartum women

Variables	Frequency (N=426)	Percent (%)
Mother Age		
Less than 25	165	38.7
25-35	177	41.5
36-45	84	19.7
Fetal Age (days)		
Same-day delivery	188	44.1
Second-day delivery	159	37.3
3rd Day or later	79	18.5
Marital status of the mother		
Single	125	29.3
Married	301	70.7
Mother's occupation		
Farmer	279	65.5
Employed	55	12.9
Unemployed	92	21.6
Mother's Education level		
No formal education	35	8.2
Primary	297	69.7
Secondary or more	94	22.1
Fetal weight at birth		
Underweight	59	13.8
Normal	367	86.2
Mother's BMI		
Normal	248	58.2
Overweight	178	41.8
Health insurance		
CBHI	392	92
RSSB	34	8
Household income (Frw) per month		
Less than 50000	403	94.6
50000 and above	23	5.4
Residence		
Urban	28	6.6
Rural	398	93.4

Source: Primary data and medical records, 2024

Prevalence of Cesarean Section among post-partum women in Rwamagana Hospital

The prevalence of CS was 38% (161 out of 426 deliveries). The remaining 62% had vaginal deliveries.

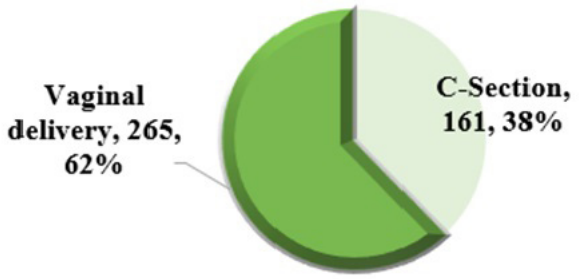

Figure 1. The prevalence of cesarean section among post-partum women in Rwamagana Hospital

Source: Primary data and medical records, 2024

Analysis of socio-demographic factors associated with CS

The analysis revealed that young maternal age (<25 years) was a significant predictor of cesarean delivery, with women in this age group being over nine times more likely to undergo CS compared to those aged 36–45 years (AOR: 9.51, 95% CI: 3.37–26.83, $p < 0.001$). Other socio-demographic factors, such as child's sex, marital status, occupation, health insurance, household income, residence, and maternal education level, were not significantly associated with cesarean delivery after adjustment. These findings suggest that younger maternal age plays a critical role in driving cesarean delivery rates, while other factors may have limited influence in this context.

Table 2. The socio-demographic factors associated with cesarean section among post-partum women in Rwamagana Hospital (N=426)

Variables	Caesarian delivery		COR	95% CI	P-Value	AOR	95% CI	P-Value
	Yes n (%)	No n (%)						
Mother Age								
Less than 25	6 (3.6)	159 (96.4)	13.25	[5.21 - 33.67]	<0.001	9.51	[3.37 - 26.83]	<0.001
25-35	46 (26)	131 (74)	1.42	[0.81 - 2.50]	0.22	1.34	[0.74 - 2.43]	0.328
36-45	28 (33.3)	56 (66.7)	**Ref**			**Ref**		
Fetal Age (days)								
Same-day delivery	26 (13.8)	162 (86.2)	1.22	[0.59 - 2.53]	0.58	0.95	[0.44 - 2.06]	0.89
second-day	41 (25.8)	118 (74.2)	0.56	[0.284 - 1.13]	0.108	0.51	[0.24 - 1.07]	0.07
3rd Day or later	13 (16.5)	66 (83.5)	**Ref**			**Ref**		
Marital status of mother								
Single	9 (7.2)	116 (92.8)	3.97	[1.92 - 8.24]	<0.001	2.12	[0.96 - 4.69]	0.064
Married	71 (23.6)	230 (76.4)	**Ref**			**Ref**		
Mother's occupation								
Farmer	61 (21.9)	218 (78.1)	0.29	[0.12 - 0.66]	0.004	0.91	[0.32 - 2.51]	0.842
Employed	12 (21.8)	43 (78.2)	0.25	[0.10 - 0.80]	0.017	1.09	[0.31 - 3.92]	0.885
Unemployed	7 (7.6)	85 (92.4)	**Ref**			**Ref**		
Health insurance								
CBHI	73 (18.6)	319 (81.4)	1.13	[0.47 - 2.70]	0.78	1.23	[0.19 - 7.76]	0.828
RSSB	7 (20.6)	27 (79.4)	**Ref**			**Ref**		
Household income (Frw)								
Less than 50000	74 (18.4)	329 (81.6)	1.57	[0.59 - 4.11]	0.36	1.61	[0.39 - 6.63]	0.505
50000 and above	6 (26.1)	17 (73.9)	**Ref**			**Ref**		
Residence								
Urban	5	23	0.93	[0.34 - 2.54]	0.89	1.09	[0.12 - 10.04]	0.938
Rural	75	323	**Ref**			**Ref**		
Mothers' education level								
No education	7 (20)	28 (80)	0.7	[0.25 - 1.91]	0.486	0.79	[0.21 - 3.07]	0.736
Primary	59 (19.9)	238 (80.1)	0.71	[0.37 - 1.33]	0.283	0.82	[0.28 - 2.36]	0.716
Secondary and more	14 (14.9)	80 (85.1)	**Ref**			**Ref**		

Source: Primary data and medical records, 2024

Analysis of maternal and child factors associated with CS

The analysis revealed that fetal malposition and absence of labor were the strongest predictors of cesarean delivery, with fetal malposition increasing the odds by over 100 times (AOR: 106.8, 95% CI: 29.89–382.25, $p < 0.001$) and absence of labor raising the likelihood by nearly five times (AOR: 4.64, 95% CI: 1.71–12.63, $p = 0.003$).

First-time mothers were also significantly more likely to undergo CS compared to women with higher parity (AOR: 19.65, 95% CI: 8.91–43.33, $p < 0.001$). Conversely, previous vaginal birth was a protective factor, reducing the odds of CS by 89% (AOR: 0.11, 95% CI: 0.06–0.21, $p < 0.001$).

Table 3. The maternal factors associated with cesarean section among post-partum women in Rwamagana Hospital (N = 426)

Variables	Caesarian delivery		COR	95% CI	P-Value	AOR	95% CI	P-Value
	Yes n(%)	No n(%)						
Previous Vaginal birth								
Yes	37 (24.8)	112 (75.2)	2.45	[1.57 - 3.81]	<0.001	0.11	[0.06 - 0.21]	<0.001
No	124 (44.8)	153 (55.2)	Ref			Ref		
ANC Attendance								
≥4	124 (40.9)	179 (59.1)	0.62	[0.39 - 0.97]	0.037	1.21	[0.90 - 1.61]	0.21
< 4	37 (30.1)	86 (69.9)	Ref			Ref		
The foetal malposition happened during labour								
Yes	54 (94.7)	3 (5.3)	0.02	[0.01 - 0.07]	<0.001	106.8	[29.89 - 382.25]	<0.001
No	107 (29)	262 (71)	Ref			Ref		
Labour happened								
No	13 (54.2)	11 (45.8)	0.49	[0.21 - 1.13]	0.09	4.64	[1.71 - 12.63]	0.003
Yes	148 (36.8)	254 (63.2)	Ref			Ref		
BMI Category								
Normal	85 (34.3)	163 (65.7)	1.43	[0.96 - 2.12]	0.07	1.07	[0.62 - 1.85]	0.79
Overweight	76 (42.7)	102 (57.3)	Ref			Ref		
Parity								
1	44 (27)	119 (73)	2.02	[1.27 - 3.22]	0.003	19.65	[8.91 - 43.33]	<0.001
2	49 (47.1)	55 (52.9)	0.84	[0.51 - 1.38]	0.49	0.98	[0.53 - 1.81]	0.95
3	68 (42.8)	91 (57.2)	Ref			Ref		

Source: Primary data and medical records, 2024

Discussion

This study aimed to assess the prevalence of caesarian delivery and identify the associated factors. The analysis indicated a 38% cesarean section (CS) prevalence among postpartum women at Rwamagana Hospital, which is higher than the World Health Organization's (WHO) recommended range of 10-15%.[14] This rate is consistent with other findings from sub-Saharan Africa, where CS prevalence varies widely depending on the healthcare context. A Study in Sub-Saharan Africa reported CS rates ranging from 2% to over 50% across sub-Saharan African countries, and the 38% rate at Rwamagana fits within this regional variation.[15] However, this rate is significantly higher than the global average of 18.6% reported by another study in sub-Saharan Africa.[16] This difference suggests that factors specific to the Rwandan healthcare context, such as healthcare access and clinical practices, may be influencing this high rate.

Comparing this finding with regional data, the 38% prevalence at Rwamagana Hospital exceeds the 21.6% reported in rural referral hospitals of Tanzania.[17] The difference could be due to varying healthcare infrastructures, as Rwanda's healthcare system may have better access to CS procedures, or differing clinical practices, where medical staff may be more inclined to perform CS. Additionally, regional disparities, such as differences in antenatal care utilization and patient demographics, could also explain the higher CS prevalence in Rwanda.

Maternal age was a key factor influencing CS, with women under 25 years old having higher odds of undergoing CS compared to those aged 36-45 years. This aligns with findings from the study conducted in Haiti which reported that younger mothers are more likely to undergo CS due to increased risks of pregnancy-related complications and a lack of childbirth experience.[18] However, contrary to the study in Rwanda that identified socio-economic status and urban residency as significant predictors of CS, factors like marital status, occupation, income, and place of residence did not significantly influence CS rates in this study.[19] This may indicate that, in the Rwamagana context, clinical necessity takes precedence over socio-economic factors in determining the mode of delivery. This is likely due to the preponderance of rural dwellers, farmers, low-income earners of less than Frw 50,000, and those with primary-level education resulting in considerable variability in socioeconomic data making it hard for the regression model to identify the associations.

Women with a history of vaginal birth were less likely to undergo CS, consistent with findings from the study conducted in Ethiopia, which demonstrated that previous vaginal deliveries reduce the likelihood of CS in subsequent pregnancies.[20] This suggests that promoting vaginal delivery when safe could lower the overall CS rates in Rwanda. Additionally, fetal malposition emerged as the most significant predictor of CS in this study, with an odds ratio of 106.8. This finding is consistent with research which highlights the increased risk of CS associated with breech or transverse fetal positions.[21] Therefore, early detection and intervention for fetal malposition during pregnancy ANC visits could help reduce the need for emergency CS, improving both maternal and neonatal outcomes; hence the need for full visits to ANC cannot be overemphasized.

This study found that first-time mothers (primiparous women) had markedly higher odds of undergoing CS. This result is in accord with the study carried out in low- and middle-income countries,[22] First-time mothers often face a higher risk of complications during labour, which tends to lead to CS. This calls for healthcare providers to offer additional support and counselling to first-time mothers, encouraging safe vaginal delivery where possible.

Strengths and Limitations of the study

The strengths of the study are that the sample size was relatively large, which enhances statistical power; and that the focus was on a provincial and level two teaching hospital, thereby providing valuable local insight. The limitations include a cross-sectional design which limits the establishment of causal relationships, and responses may have been influenced by social desirability and recall biases. However, these were minimized by conducting the interviews in a relaxed fashion to reduce pressure on the respondents thereby building rapport and trust.

Conclusion

In conclusion, the high CS prevalence at Rwamagana Hospital suggests a need for targeted interventions that promote vaginal deliveries where medically appropriate. Factors such as maternal age, fetal malposition, and parity should be carefully considered in clinical decision-making to avoid unnecessary CS. Improving ANC attendances and associated quality of ANC services will address fetal malposition early, and most likely help to reduce CS rates. These measures could contribute to better maternal health outcomes and reduce the burden of surgical deliveries in Rwamagana and in Rwanda. These findings highlight the need for policies promoting the integration of antenatal care services with routine screening for delivery risks, enhanced community education to support vaginal deliveries where safe, and improved access to trained health professionals to optimise CS use.

Authors' contribution

The study was conceptualized by UJB, who also developed the methodology, designed the research tools, and contributed to writing the manuscript. MAG and MM provided supervision throughout the study and made substantial contributions to the research protocol. TK performed data analysis and assisted with manuscript preparation.

Conflict of interest declaration

The study's authors state that they had no relationships or affiliations that would have created a conflict of interest. The authors jointly agreed to submit the study to the current journal.

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