PREDICTORS OF EMERGENCY SECOND CAESAREAN SECTION AMONG WOMEN WITH ONE PREVIOUS SCAR DELIVERING AT IRINGA REGIONAL REFERRAL HOSPITAL: HOSPITAL BASED CROSS-SECTIONAL STUDY

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ABSTRACT

BACKGROUND: A significant increase in second emergency caesarean sections (CS) is associated with numerous adverse obstetric outcomes. Women have the opportunity to undergo planned childbirth, potentially preventing the need for a second emergency caesarean section.

Objective: To determine the predictors of emergency second caesarean section among pregnant women delivering at Iringa Referral Hospital.

METHODOLOGY: The study was conducted at Iringa Hospital over six months using a cross-sectional design. Participants were recruited serially, involving women with one previous scar arriving for delivery. Data were collected using a structured questionnaire, and analysis was conducted using SPSS. Chi-square tests were used to test the association of variables, and binary logistic regression assessed significance at a 95% confidence interval (CI) with a p-value <0.05.

RESULTS: The study recruited a total of 355 participants who had second caesarean deliveries, with 204 (57.46%) having an emergency caesarean and 151 (42.54%) having an elective caesarean. The significant predictors of emergency second CS were lack of employment [AOR=3.02, 95% CI (1.59, 15.46)], late booking (11–20 weeks) [AOR=4.70, 95% CI (1.18, 18.64)] and >21 weeks [AOR=6.53, 95% CI (1.02, 41.67)], category of healthcare provider [AOR=3.87, 95% CI (1.30, 11.53)], lack of information on the mode of delivery during ANC [AOR=3.02, 95% CI (2.59, 15.46)], third-trimester ultrasound scanning [AOR=10.05, 95% CI (3.95, 25.61)], and pregnancy interval [AOR=10.05, 95% CI (3.95, 25.61)].

CONCLUSION: Emergency second caesarean sections (CS) are prevalent. Most women originate from primary healthcare centers, where nurses primarily manage them during ANC without establishing a birth plan. The number of antenatal visits and delays in booking exacerbate the situation. Therefore, all women with previous scars who arrive late for booking must receive attention from a physician. They should undergo critical evaluation and counseling on their birth plan.

KEYWORDS: Predictors, emergency, second caesarean section, previous scar, Iringa.

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INTRODUCTION

An emergency second caesarean section (CS) is a surgical procedure performed on pregnant women, involving an abdominal incision (laparotomy) and a uterine incision (hysterotomy) to deliver the baby when there are life-threatening risks to either the mother, the baby, or both. It is commonly performed after the onset of labor[1]. There are four categories of caesarean sections: in Category I, there is an immediate threat to the fetus and mother; in Category II, the health of either the mother or the fetus is compromised, but there is no immediate risk to life; in Category III, early delivery is necessary, but neither the mother nor the fetus is in danger; and in Category IV, an elective caesarean section is planned[2].

The rate of second caesarean sections is increasing. Globally, the average rate of caesarean sections is rising by 21.1%. Estimates based on global and regional data from 2010 to 2018 reveal significant variations: from 5% in sub-Saharan Africa to 42.8% in Latin America and the Caribbean. Projections indicate further increases by 2030, with an expected 28.5% of women worldwide delivering via caesarean section, ranging from 7.1% in sub-Saharan Africa to 63.4% in Eastern Asia[3].

In Tanzania, there is also a noticeable increase in the caesarean delivery rate. Specifically, the occurrence of emergency second caesarean sections was observed to be 64.4% at Muhimbili National Hospital (MNH) and 62.4% at Kilimanjaro Christian Medical College (KCMC) Hospital among women with one previous caesarean scar[1,4]. Emergency second CS is associated with higher adverse obstetric outcomes compared to vaginal birth after caesarean section (VBAC) and elective caesarean section[5,6]. Women with one previous scar are required to have a birth plan before reaching term pregnancy during antenatal care. This birth plan may include trial labor after caesarean section (TOLAC) or elective second caesarean[7,8]. TOLAC has a 60–80% success rate for vaginal birth after caesarean section (VBAC)[9].

Despite this, many women with one previous scar attending antenatal care present in labor without a birth plan, resulting in emergency second CS. This is associated with higher maternal and fetal adverse outcomes compared to VBAC and elective caesarean section[1,10,11].

This study aims to identify the predictors of emergency second CS and address these predictors in antenatal care settings to ensure early intervention for at-risk women, thereby reducing complications related to emergency second CS. Understanding predictors of emergency second CS helps healthcare providers identify patients prone to emergencies early, enabling the establishment of a birth plan before labor-related emergencies arise.

METHODOLOGY
Study Setting and Design

The study was conducted at Iringa Regional Referral Hospital, a teaching and tertiary hospital situated in the Iringa region of the southern highlands of Tanzania. The hospital serves not only Iringa District hospitals but also mission hospitals within the region. The study took place in the Obstetrics department, which comprises a 78-bed facility divided into five sections: the antenatal ward, postnatal ward, labour ward, gynaecology ward, and outpatient clinic. The department is staffed with 4 specialists, 8 residents from The University of Dodoma (UDOM), 4 medical doctors, 1 assistant medical officer, and 51 nurses and medical students from UDOM. Despite this staffing, there remains a high demand for healthcare providers, necessitating task shifting. Consequently, during nighttime, staffing levels are reduced, impacting the delivery of care. The department handles approximately 400 deliveries per month, with around 250 (60%) being caesarean sections. A study done in 2018 showed that emergency second caesarean section was observed to be 38.6% among all patients admitted for Trial of Labour After Caesarean (TOLAC). TOLAC is performed at this facility; however, TOLAC was not convenient during the night due to limited staffing and the hospital's role as a referral centre that accepts emergencies at all times. This had an effect on delays in intervention when necessary,

although it occurred on rare occasions. This was a quantitative cross-sectional hospital-based study.

Study Period

The study was conducted over a period of six months, from August 2023 to February 2024.

Study Population

All women who came for delivery at Iringa Regional Referral Hospital and had one previous scar.

Inclusion Criteria

- Women with one previous scar at term admitted to the labour ward with labour pain and who eventually had an emergency second caesarean section.
- Women with one previous scar who came for an elective caesarean section, not in labour.

Exclusion Criteria

- Women who had a failed trial of labour leading to an emergency caesarean section.
- All women with one previous scar in labour who had been diagnosed with other medical conditions, including pre-eclampsia, diabetes mellitus, and sickle cell disease.

Sampling Technique

All women admitted for delivery with one previous caesarean scar were interviewed. Upon admission, we assessed those in labour through a history, physical examination, and bedside ultrasound investigation. We directly enrolled those who came for an elective caesarean section in the study. We used the checklist (attached as Appendices 1) to determine the mode of delivery for each patient presenting with labour pain. We immediately prepared patients who did not qualify for TOLAC for an emergency caesarean section and included them in the study. Those who met the TOLAC criteria were closely monitored for their labour progress and excluded if necessary.

Study Variables

Social Demographic Characteristics: Age (years), referral status, marital status (married/single), educational level, parity, place of residence (rural/ urban).

Obstetric Characteristics: Gestational age at booking (weeks in first visit), number of antenatal visits, duration from last ANC visit to admission in weeks, ultrasound scan in the last trimester, inter-pregnancy interval (months), previous vaginal birth after CS, previous vaginal birth before CS, category of previous CS (emergency or elective), duration of labour (hours).

Health Facility Characteristics: Level of health facility during the last ANC (dispensary, health center, district hospital, referral hospital), category of healthcare provider (nurse [midwife] /doctor).

Dependent Variable (Primary Outcome)

- Emergency second caesarean section/elective caesarean section.

Operational Definition

Caesarean Delivery: A mode of delivery through the incision made on the abdomen (laparotomy) and uterus (hysterotomy).

Emergency Caesarean: A mode of delivery through laparotomy and hysterotomy when there is an immediate threat to the mother and foetus.

Categorisation of Emergency Caesarean Section:

- **Category 1:** Pregnancy has an immediate threat to the foetus and mother.
- **Category II:** Pregnancy compromises the maternal or foetal health but has no immediate life-threatening risk.
- **Category III:** Early delivery is needed, but there is no maternal or foetal compromise.
- **Category IV:** Planned for elective caesarean section.

Elective Caesarean Section: A mode of delivery through laparotomy and hysterotomy when vaginal delivery is not possible and usually performed before the onset of labour at term pregnancy.

Obstetric Outcomes: The pregnancy outcomes after delivery, describing both maternal and foetal outcomes of a particular pregnancy.

Primary Caesarean Section: The delivery through caesarean section for the first time, even if the mother had a previous vaginal delivery.

Second Caesarean Section: The mode of delivery by caesarean section for the second time after having a previous caesarean section.

Repeat Caesarean Section: The mode of delivery by making an incision on the abdomen and uterus for

a patient who had a previous caesarean section. In this study, it will refer to all patients who underwent caesarean section for the second time.

Data Collection Procedure

Data collection began with demographic information, including socio-demographic characteristics (age, residence, education level), and obstetric details such as parity, previous mode of delivery, antenatal visit history (including evidence from antenatal cards), the level of the health facility visited last, number of antenatal visits, gestational age at first booking, and planned mode of delivery as recorded during antenatal care. We collected all this information using a structured questionnaire designed based on previous studies. We collected information from patients during their admission, and after surgery for those with emergency conditions who were unable to provide information. We also collected additional data on maternal and foetal outcomes during surgery and obtained post-delivery information from patient files.

Data Analysis

After collecting the data, we checked the questionnaires for completeness. We coded and entered the completed questionnaires into the Statistical Package for Social Sciences (SPSS). We cleaned the data by examining the error codes and making the necessary corrections. We then conducted an analysis, initially analyzing demographic data, obstetric information, and outcomes using frequency tables, figures, and chi-square tests. We checked the variables with a p-value of 0.2 for statistical association using chi-square tests. Both unadjusted and adjusted logistic regression were performed at a 95% confidence interval, with a p-value of less than 0.05 considered statistically significant.

Ethical Clearance

The UDOM Research Ethical Committee granted ethical clearance under reference number MA.84/261/64/99, and the Iringa Regional Referral Hospital administration issued a research permit for data collection under reference number IRRH/E10/16/Vol.xxxiii/137. Participants were given a comprehensive explanation of the study's aims and benefits before giving consent, along with the assurance that they could freely opt out if they did not wish to participate. For those who were unable to read or write, the researcher or research assistant read the information to them. If they agreed to participate, they were asked to use fingerprint ink on the written consent form. No payment or allowance was provided to participants during this study. The study participants received a unique identification number, which was coded with the patient file number and recorded on various papers for easy reference. We informed patients that withdrawing from the study would not impact their treatment plan during the entire period of admission and would require further follow-up, if necessary. All participant information was kept confidential.

Results:

This study recruited 355 participants who had second CS. The majority of them 214 (60.28%) were referrals, ages of participants ranged from 21 to 45 years with a mean age of 32.09±6.15. About 313(88.17%) were married, and a large number of the participants, 208 (58.59%), resides in rural areas. The employment rate was low, with 215 (60.56%) not being employed and 207 (58.31%), has completed primary and secondary education **(Table 1)**.

Table 1: Socio-demographic characteristics of women with emergency second caesarean section after one previous scar

Variable characteristics	Frequency	Percentage
Referral status		
Yes	214	60.28
No	141	39.72
Age (32.09±6.15)		
20-34	203	57.18
≥35	152	42.82
Marital status		
Married/Cohabiting	313	88.17
Separated	26	7.32
Widow	16	4.51
Level of education		
Primary and secondary level	207	58.31
College	148	41.69
Occupation		
Unemployed	215	60.56
Employed	140	39.44
Residence		
Urban	147	41.41
Rural	208	58.59

Proportional of emergence CS among women with one previous CS

The study recruited a total of 355 participant who had second caesarean delivery with 204 (57.46%) having an emergency cesarean and 151 (42.54%) having an elective cesarean (**Figure 1**).

Proportiona of emergence caesarean section among women with one previous scar

57%
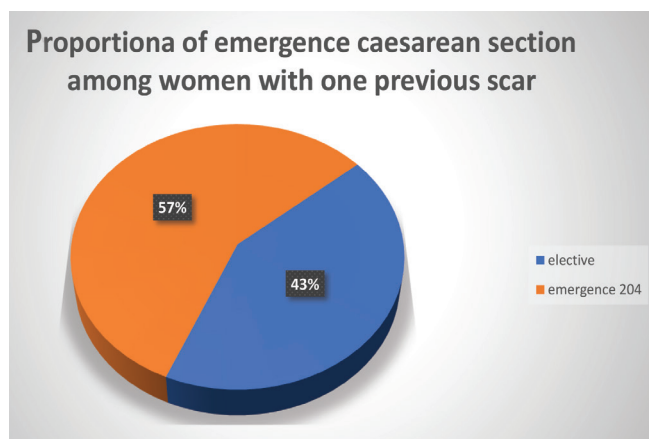43%

■ elective
■ emergence 204

Fig1 proportional of emergency second caesarean section among patient with one previous scar

The large number of participants had emergency caesarean section.

Predictors of emergency second caesarean section among women with one previous scar delivered by second CS

The predictors of emergency second cesarean sections (CS) were analyzed using chi-square tests to identify associations. Variables with significant associations were then tested in a logistic regression model, as shown in **Table 2**. In unadjusted logistic model, we found that socio- demographics such as young age, education level, occupation, residence, referral status, and obstetrics characteristics such as the location of the antenatal visit, the interpregnancy interval, the absence of ultrasound in the third trimester, the time since the last visit, the category of previous Caesarean section, and the absence of a birth plan all influence the emergency second caesarean section. However, in multivariate analysis, we observed significant associations with certain predictors: individuals referred from another facility showed a significant association of emergency second CS than elective [AOR = 3.26, 95% CI (1.30, 8.17), P = 0.01]. Furthermore, the study revealed a significant association between employment status and the likelihood of undergoing an emergency caesarean section in unemployed individuals [AOR = 3.02, 95% CI (1.59, 15.46), P = 0.02]. Gestational age at booking also showed significance; the likelihood of an emergency caesarean section increased with late booking, particularly for those booked at 11–20 weeks [AOR=4.70, 95% CI (1.18, 18.64), P=0.03] and >21 weeks [AOR=6.53, 95% CI (1.02, 41.67), P=0.04]. Furthermore, the category of health care provider significantly influenced the emergency of a second emergency caesarean section, with those under the care of a nurse/midwife having a higher chance [AOR=3.88, 95% CI (1.30, 11.54), P=0.01]. and all women lacking birth plan had higher chances of emergency second CS [AOR= 3.02,95%CI (2.59,15.46), P=0.02]

Table 2: Chi- square test for predictors of emergency caesarean section among women with one previous scar delivered at Iringa referral hospital.

Variable	Emergency Second C/S		Chi-Value	P-Value
	YES n=204	NO(elective) n=151	250.58	<0.05
Mode of delivery at ANC				
Informed	28(15.80)	149(84.20)		
Not informed at all	176(98.88)	2(1.12)		
Referral status			151.08	<0.05
Yes	179(83.64)	35(16.36)		
No	25(17.73)	116(82.27)		
Age			46.25	<0.05
21-34	148(72.91)	55(27.09)		
≥35	56(36.84)	96(63.16)		
Marital status			0.08	0.77
Married/Cohabiting	179(57.19)	134(42.81)		
Separated/Widow	25(59.52)	17(40.48)		
Level of education			104.94	<0.05
Primary and Secondary level	166(80.19)	41(19.81)		
College	38(25.68)	110(74.32)		
Occupation			99.68	<0.05
Unemployed	169(78.60)	46(21.40)		
Employed	35(25.00)	105(75.00)		
Residence			35.85	<0.05
Urban	57(38.78)	90(61.22)		
Rural	147(70.67)	61(29.33)		
Place of antenatal visit			75.55	<0.05
Dispensary	77(62.60)	46(37.40)		
Health center	111(76.03)	35(23.97)		
District hospital	13(20.97)	49(79.03)		
Referral hospital	3(12.50)	21(87.50)		
Gestation age at booking weeks			65.89	<0.05
≤10	5(11.90)	37(88.10)		
11-20	142(56.57)	109(43.43)		
≥21	57(91.94)	5(8.06)		
Number of antenatal visits			91.70	<0.05
≤4	138(81.66)	31(18.34)		
5-7	57(44.88)	70(55.12)		
≥8	9(15.25)	50(84.74)		
Interval from last antenatal visit to delivery. (Weeks)			35.85	<0.05
<3	25(18.3)	128(81.7)		
>3	179(88.6)	23(11.4)		
Health care provider			159.12	<0.05
Nurse	192(80.67)	46(19.33)		
Doctor	12(10.26)	105(89.74)		
Ultrasound scan in 3rd trimester			170.74	<0.05
Yes	18(13.43)	116(86.57)		
No	186(84.16)	35(15.84)		
Inter pregnancy interval			55.11	<0.05
Less than 18 months	14(19.18)	59(80.82)		
More than 18 moths	190(67.38)	92(32.62)		
Category of previous caesarean section			8.22	0.04
Emergency	178(60.96)	114(39.04)		
Not emergency	26(41.27)	37(58.73)		

We found a significant association between ultrasound scanning and the emergency of a second caesarean section. Those who did not undergo scanning in last trimester had a higher chance of experiencing an emergency second CS [AOR=10.05, 95% CI (3.95, 25.60), P<0.05]. Additionally, we found that an inter-pregnancy interval of more than 18 weeks significantly increases the likelihood of having an emergency second CS [AOR=7.85, 95% CI (2.77, 22.22), P=0.05] **Table 3**.

Table 3: Binary Logistic Regression for predictors of emergency second caesarean section among women with one previous scar delivered at Iringa Regional Referral hospital

Variable	Unadjusted logistic model OR [95%CI]	p-variable	Adjusted logistic model AOR [95%CI]	p-variable
Age				
21-34	4.61[2.94,7.25]	<0.05	1.95[0.33,2.75]	0.93
≥35	Ref		Ref	
Level of education				
Primary and Secondary level	11.72[7.09,19.38]	<0.05	1.49[0.37,6.01]	0.57
College	Ref		Ref	
Occupation				
Unemployed	11.02[6.67,18.22]	<0.05	3.02[1.59,15.46]	0.02
Employed	Ref		Ref	
Residence				
Urban	0.26[0.17,0.41]	<0.05	0.60[0.27,1.31]	0.20
Rural	Ref		Ref	
Place of ANC on last visit				
Dispensary	11.72[3.31,41.46]	<0.05	1.74[0.13,4.07]	0.73
Health center	22.20[6.23,78.90]	<0.05	1.98[0.17,5.97]	0.98
District hospital	1.86[0.48,7.20]	0.37	1.65[0.12,3.54]	0.62
Referral hospital	Ref		Ref	
Gestation age at booking weeks				
≤10	Ref		Ref	
11-20	9.64[3.67,25.35]	<0.05	4.70[1.18,18.64]	0.03
≥21	84.36[22.84,311.64]	<0.05	6.53[1.02,41.67]	0.05
Number of antenatal visits				
≤4	Ref		Ref	
5-7	0.18[0.11,0.19]	<0.05	0.66[0.23,1.88]	0.45
≥8	0.04[0.02,0.09]	<0.05	0.33[0.28,6.44]	0.72
Interval from last antenatal visit to delivery.				
≤3weeks	0.06[0.03,0.11]	<0.05	0.47[0.15,1.45]	0.19
>3weeks	Ref		Ref	
Who provided the service to you on last visit				
Nurse	36.52[18.53,71.97]	<0.05	3.88[1.30,11.54]	0.01
Doctor	Ref		Ref	
Birth plan				
YES (SVD+CS	Ref		Ref	
NO(not informed)	12.33[5.66,32.73]	0.05	3.02[2.59,15.46]	0.02
Ultrasound scan in 3rd trimester				
Yes	Ref		Ref	
No	34.25[18.54,63.28]	<0.05	10.05[3.95,25.60]	0.05
Inter pregnancy interval				
Less than 18 months	Ref		Ref	
More than 18 months	8.70[4.62,16.40]	<0.05	7.85[2.77,22.22]	0.05

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DISCUSSION

The proportion of women who underwent emergency second CS was 204 (57.46%). The results of this study bear a striking resemblance to the Muhimbili study (64.2%)[1] and a study from Rwanda (54.9%)[21]. This similarity may be due to the fact that all studies involved patients who came in labor during admission.

A large number of participants came from rural areas and were unemployed. Among them, the majority underwent emergency second CS. Studies conducted in Ethiopia, Nigeria, and Bangladesh reveal a lower overall rate of Caesarean sections among this group[22-24]. This is likely due to the difficulty in accessing early health services, leading to delayed hospital presentations, which results in a higher incidence of emergency caesarean sections.

From this study, the lack of a birth plan established during antenatal care (ANC) was associated with a higher chance of having an emergency second caesarean section (CS). These findings are similar to those from studies conducted in Rwanda and Muhimbili, Tanzania, which indicate that the majority of women who underwent emergency second CS did not have a birth plan established during ANC[1,21].

The study also found that the category of healthcare provider during the ANC visit influences the occurrence of emergency second caesarean sections (CS). These findings are similar to a study conducted in California, which indicates that maternal outcomes were better for those attended by doctors compared to those attended by nurses[25]. Additionally, the study identified that the absence of a third-trimester ultrasound and an interpregnancy interval exceeding 18 weeks increases the chances of emergency second caesarean section. Other studies that evaluated these predictors also found similar findings[26-28].

The study found that social demographic data, such as age, level of education, and obstetric characteristics, including place of antenatal visit, number of antenatal visits, and duration from the last antenatal visit, were not significantly associated with emergency second caesarean section. However, some studies show different results. A study conducted in Brazil shows that education level, increased maternal age, and more antenatal visits are protective factors for emergency caesarean section but increase the likelihood of elective caesarean delivery[29,30].

Limitations of the Methods

This study was conducted at the point of care, where all information was obtained directly from the patients. This approach posed a challenge in verifying whether verbal counseling was actually provided by healthcare providers during antenatal care (ANC).

Limitations of the Study

This study was conducted at a referral hospital where more severe or complex cases are typically transferred. As a result, the sample may be skewed towards more complicated cases, potentially limiting the generalizability of the identified predictors. To enhance the applicability of the findings, further research is needed in lower-level healthcare facilities where less complex cases are managed. The study could also be conducted at the antenatal point of care with follow-up, which would help determine whether the predictors identified in this study are relevant across different healthcare settings.

CONCLUSIONS AND RECOMMENDATIONS

Patients who have previously undergone a caesarean section still have a high rate of emergency second caesarean sections. Most of these patients come from primary healthcare facilities and receive care from nurses. This group often lacks a birth plan, has fewer antenatal visits, books late, and lacks ultrasound. The factors that predict emergency second caesarean sections include not having a birth plan, not having an ultrasound in the third trimester, having a nurse attend the last visit, and being unemployed.

All unemployed women with one previous scar who arrive late for their antenatal visit should undergo a thorough evaluation and investigation. A birth plan should be arranged for their index pregnancy, and all women with one previous scar pregnancy should be referred before the onset of labor.

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Appendices

Check list used to evaluate patient for Emergence Second caesarean section (adopted and modified from Canadian Medical Association journal.(31).

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S/N MATERNAL FACTORS	FETAL FACTORS
1 maternal age during primary CS >35years	Estimated fetal weight≥3.5kg
2 Body mass index >35kg/m2	Any early perinatal death or low score outcome in primary caesarean section
3 Short Inter-pregnancy interval from primary caesarean section <18 months	Prolonged rupture of membrane.
4 Prolonged labour during primary CS that end up with prolonged catheterization	Fetal station above 0 with strong contraction
5 Previous pregnancy losses	Mal-presentation
6 Gestation age >41 weeks	
7 Had secondary suture or prolonged wound dressing more than 2 weeks during primary caesarean section	
8 Primary caesarean section at gestation age less than 28 weeks (hysterotomy)	
9 Any known complication from primary caesarean section like fistula, uterus rupture	
10 Contracted pelvis or history of pelvic fracture	
11 Disagree Consent to have TOLAC.	

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Any of the above factor was considered to be candidate for repeat CS