Research Proposal

Title: Prevalence of Emergency versus Elective Cesarean Sections and Associated Feto-Maternal Outcomes: A Hospital-Based Cross-Sectional Study at Dongola Maternity Hospital, Northern State, Sudan, 2026

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1. Introduction

1.1 Background

Cesarean section (CS) is one of the most commonly performed surgical procedures globally [1]. While it is a life-saving intervention when medically indicated, rising CS rates worldwide have raised concerns about maternal and neonatal morbidity [2]. The World Health Organization recommends that CS rates should not exceed 10-15% at the population level, yet many countries have rates exceeding 30% [2].

Cesarean deliveries are broadly categorized into two types [1]:

1. Elective (planned) cesarean: Performed before the onset of labor based on predetermined medical or maternal indications.

2. Emergency cesarean: Performed when an acute threat to maternal or fetal life arises during labor or before its onset.

Emergency cesarean sections are associated with significantly higher risks of maternal and neonatal complications compared to elective procedures [3,4]. Studies have shown that emergency cesareans result in increased need for blood transfusion, higher rates of wound infection, bladder injury, and greater neonatal intensive care unit (NICU) admissions [3,4].

1.2 Problem Statement

Despite the clinical importance of distinguishing between emergency and elective cesarean sections, there is limited recent data from Northern Sudan on the prevalence of each type and their respective maternal and neonatal outcomes [5,6]. Dongola Maternity Hospital serves as one of the key referral facilities for maternal

care in Northern State. The region faces significant challenges, including the influx of more than 400,000 internally displaced people since the outbreak of war in April 2023 [6].

Understanding the current prevalence and outcomes of emergency versus elective cesarean sections is crucial for:

- Improving preoperative planning and patient counseling

- Optimizing resource allocation (blood bank, NICU, operating theaters)

- Informing hospital policies to reduce emergency cesarean rates where possible

- Addressing healthcare inequities in displaced populations [6]

1.3 Justification

This cross-sectional study is important because:

1. Emergency cesarean sections are associated with increased maternal morbidity including transfusion requirements, bladder injury, and wound infection [3].

2. Neonates delivered by emergency cesarean have significantly lower APGAR scores, lower birth weights, and higher NICU admission rates [4,5].

3. Existing Sudanese studies (from Khartoum and other regions) show that emergency CS accounts for 14.7% to 72.3% of all cesarean deliveries, with significant differences in neonatal outcomes [5,8,10].

4. There is no recent data specific to Dongola Maternity Hospital comparing emergency and elective cesarean outcomes [7,9].

5. The current humanitarian situation in Sudan may have impacted maternal healthcare access and outcomes, particularly in Northern State which has received a large number of displaced persons.

2. Research Aim and Objectives

2.1 Aim

To determine the prevalence of emergency versus elective cesarean sections and compare their associated feto-maternal outcomes at Dongola Maternity Hospital.

2.2 Specific Objectives

1. To determine the prevalence of emergency and elective cesarean sections among all cesarean deliveries during the study period.

2. To compare maternal outcomes between emergency and elective cesarean groups, including:

- Need for blood transfusion
- Post-operative complications (wound infection, bladder injury, endometritis)
- Duration of hospital stay
- Maternal mortality

3. To compare neonatal outcomes between the two groups, including:

- APGAR scores at 1 and 5 minutes
- Birth weight

- NICU admission rate

- Perinatal mortality

4. To identify the most common indications for emergency versus elective cesarean sections.

3. Research Questions

1. What is the current prevalence of emergency versus elective cesarean sections at Dongola Maternity Hospital?

2. Are there significant differences in maternal complications between emergency and elective cesarean deliveries?

3. Are there significant differences in neonatal outcomes between emergency and elective cesarean deliveries?

4. What are the most common indications for emergency cesarean sections at Dongola Maternity Hospital?

4. Literature Review

4.1 Cesarean Section Rates in Sudan

Ribat University Hospital, Khartoum (2006) [8]

- Total deliveries: 2,092

- Elective CS: 16.2%

- Emergency CS: 14.7%

- Main indications for emergency CS: Contracted pelvis (13.3%), failure of progress (12%), pregnancy-induced hypertension (11%)

Khartoum Hospital (2011) [9]

- Total deliveries: 2,128

- Emergency CS: 19.1%

- Elective CS: 24.1%

Bashair Hospital, Khartoum (2022) [5]

- Emergency CS: 72.3% (248 cases)

- Elective CS: 27.7% (95 cases)

- This study focused on nulliparous women only

4.2 Neonatal Outcomes: Emergency vs. Elective CS

A cross-sectional study from Bashair Hospital, Khartoum (n=343) found significant differences between emergency and elective cesarean sections [5]:

Outcome	Emergency CS (n=248)	Elective CS (n=95)	P-value
Mean 5-min APGAR	8.79 ± 0.54	9.01 ± 0.36	0.003
Mean birth weight	2.89 ± 0.42 kg	3.04 ± 0.38 kg	0.012
NICU Admission	14.5%	5.3%	0.008
Neonatal Mortality	2.4%	0%	0.045

4.3 Indications for Cesarean Sections in Sudan

From the Ribat University Hospital study [8]:

Indication	Percentage
Contracted pelvis	13.3%
Failure of progression	12.0%
Pregnancy-induced hypertension	11.0%
More than one previous scar	10.7%
Fetal distress	10.4%

Elective CS Indications:

Indication	Percentage
Contracted pelvis	35.5%
Multiple scars	24.9%
Bad obstetric history	7.6%

4.5 Research Context in Northern Sudan

Recent research in Northern Sudan (Merowe locality, 2024–2025) involving 267 postpartum women revealed [6]:

- Perinatal death rate: 3.4%

- Preterm delivery rate: 10.1%

- NICU admission rate: 7.1%

- Adverse maternal outcomes: 26.2%

- Displaced women showed higher rates of eclampsia and preeclampsia (p = 0.002)

- Rural residence was a predictor of adverse maternal outcomes (AOR = 2.52)

4.6 Placenta Previa at Dongola Maternity Hospital

A study conducted at Dongola Maternity Hospital (2018–2019, n=52) found [10]:

- Previous cesarean section was the strongest risk factor (69.2%)

- Maternal complications: hemorrhage (40.4%), cesarean hysterectomy (21.2%)

- NICU admission rate: 25%

4.7 Resource Limitations at Dongola Maternity Hospital

A recent study identified significant resource challenges at Dongola Maternity Hospital [7]:

- Shortage of incubators for neonates

- Shortage of blood bank equipment

- Shortage of midwives (13 midwives deficit)

- Referral times up to 3 hours from some areas.

5. Methodology

5.1 Study Design

This will be a descriptive and analytical cross-sectional study conducted at Dongola Maternity Hospital. Data will be collected using a single structured data collection form. The primary source of data will be medical records, and the same form will be completed through direct patient interview only when key information is missing from the records.

5.2 Study Setting

Dongola Maternity Hospital, Northern State, Sudan.

Context:

- The facility is located in an area that has received over 400,000 internally displaced people since 2023 [6].

- The hospital serves as a referral center for the Northern State, including areas such as Merowe and Karima [6,7].

- A research unit (Dongola Maternity Hospital Research Unit - DMHRU) was established to support research activities [7].

5.3 Study Population

Study Population: Women who underwent cesarean section during the study period and met the eligibility criteria.

5.4 Inclusion Criteria

1. Women who delivered by cesarean section at Dongola Maternity Hospital

2. Singleton pregnancy

3. Gestational age ≥ 28 weeks

4. Medical records available for key study variables. Cases with missing supplementary variables will be included if the woman is available for a supplementary interview to complete the missing data.

5.5 Exclusion Criteria

1. Multiple pregnancies

2. Stillbirths

3. Incomplete medical records with missing key variables that cannot be completed through patient interview (e.g., patient unavailable, discharged, or does not consent).

5.6 Study Period

1-month period at the time of data collection

5.7 Sample Size Determination

Using the formula for cross-sectional studies:

$n = Z^2 \times p \times (1-p) / e^2$

- Z = 1.96 (95% confidence level)

- p = 19.1% (expected prevalence of emergency CS based on Khartoum studies) [9]

- e = 5% (margin of error)

$n = (1.96)^2 \times 0.191 \times 0.809 / (0.05)^2$

$n \approx 238$

With 10% added for potential non-response, the required sample size is approximately 262 participants.

5.8 Sampling Technique

Simple random sampling will be used. Each eligible case will be assigned a computer-generated random number during data collection. This process will continue until the target sample size (n=262) is reached.

All eligible cases will be identified from medical records. For cases with missing key variables, the woman will be approached during her postnatal hospital stay to complete the missing information using the same structured data collection form. If the woman is not available or does not consent, the case will be excluded if the missing variables are essential for analysis.

5.9 Data Collection Tool

A single structured data collection form will be developed and reviewed by three obstetricians to collect information from obstetric admission records, operation

theater logs, neonatal records, and discharge summaries. The same form will be used to complete any missing key variables through direct patient interview during the postnatal hospital stay. The interview will be conducted in Arabic after obtaining informed consent and will take approximately 5–10 minutes. This approach ensures consistency of data collection and minimizes missing data.

Variables to be collected:

Maternal Variables:

- Demographic: Age, parity, gravidity, residence (urban/rural),).

- Obstetric: Gestational age, gestational diabetes, hypertension

- Type of cesarean: Emergency vs. elective

- Indication for cesarean (categorized)

- Maternal complications: Blood transfusion, wound infection, bladder injury, endometritis [3]

- Duration of hospital stay

- Maternal mortality

Neonatal Variables:

- Birth weight (grams)

- APGAR score at 1 and 5 minutes

- NICU admission (yes/no)

- Respiratory distress syndrome

- Birth asphyxia (APGAR < 7 at 5 minutes)

- Perinatal mortality [5,6]

5.10 Classification of Cesarean Type

Emergency Cesarean:

Defined as cesarean performed due to acute maternal or fetal compromise requiring immediate delivery [1]. This includes:

- Category 1: Immediate threat to life

- Category 2: Maternal/fetal compromise not immediately life-threatening

Elective Cesarean:

Defined as planned cesarean performed before the onset of labor [1].

5.11 Data Analysis

Data will be entered into Microsoft Excel and analyzed using SPSS version 27.0.

- Descriptive statistics: Frequency and percentages for categorical variables; mean ± SD for continuous variables.

- Inferential statistics: Chi-square test for categorical variables; independent t-test or Mann-Whitney U test for continuous variables.

- Multivariate analysis: Logistic regression for predictors of adverse outcomes where sample size permits.

- Significance level: $p < 0.05$ considered statistically significant.

6. Operational Definitions

Emergency cesarean: Cesarean performed due to acute maternal or fetal compromise requiring immediate delivery [1]

Elective cesarean: Planned cesarean performed before the onset of labor.

Birth asphyxia: APGAR score < 7 at 5 minutes [5]

NICU admission: Admission to neonatal intensive care unit within 24 hours of birth [5,6].

Displaced woman: Woman who fled her place of residence due to conflict and currently resides in Northern State [6]

Perinatal mortality: Death of fetus or neonate from 28 weeks gestation to 7 days after birth.

7. Ethical Considerations

1. Ethical Approval: Protocol will be submitted to ministry of health.

2. Confidentiality: Patient data will be anonymized; no identifiable information will be collected or published. Data will be stored in password-protected computers.

3. Informed Consent: For data collected from medical records, a waiver of informed consent will be requested from the ethics committee. For supplementary information obtained directly from the patient to complete missing data, written or verbal informed consent will be obtained. The study objectives and procedures will be explained in Arabic, and confidentiality will be maintained by anonymizing all data and storing it in password-protected files.

8. Timeline

Activity	week 1	week 2	week 3	week 4	week 5	week 6
Ethics approval	✓					
Tool development & testing	✓					
Data collection		✓ ✓	✓			
Data entry & cleaning				✓		
Data analysis					✓	
Report writing					✓	✓
Manuscript submission						✓

9. Expected Outcomes

1. Prevalence rates of emergency and elective cesarean sections at Dongola Maternity Hospital.

2. Comparison of maternal and neonatal complications between emergency and elective cesarean groups.

3. Identification of common indications for emergency cesarean in Northern Sudan.

4. Data that can inform hospital policies and resource allocation (e.g., NICU capacity, blood bank needs).

10. References

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