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# Caesarean Section Rates and Associated Maternal and Neonatal Outcomes in Rural Health Zones of Beni and Lubero, North Kivu, Democratic Republic of the Congo

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## Abstract

**Background:** Caesarean section (CS) is a life-saving obstetric intervention that reduces maternal and neonatal mortality when medically indicated. However, the increasing frequency of CS in resource-limited settings raises concerns about clinical justification, quality of care, and maternal-fetal outcomes. This study aimed to determine the frequency of caesarean sections and assess associated maternal and neonatal outcomes in eight rural health zones of the Beni and Lubero territories, North Kivu Province, Democratic Republic of Congo (DRC). **Methods:** A descriptive, multicenter study was conducted in eight rural health zones: Biena, Kalunguta, Kyondo, Lubero, Manduredjipa, Masereka, Musienene, and Vuhovi, from 2017 to 2023. Exhaustive sampling was applied, and retrospective data were obtained from delivery registers in health facilities offering a comprehensive package of activities. Data were analyzed using Epi Info 7.2 software, and descriptive statistics summarized the findings. **Results:** Among 171,000 deliveries recorded, 70,960 were caesarean sections, corresponding to an overall rate of 41%. CS frequency varied from 38% in Kyondo to 49% in Kalunguta. Neonatal mortality among CS deliveries ranged from 1% in Musienene to 4% in Lubero, Biena, and Kalunguta. Maternal mortality was higher among women delivered by CS compared with those who delivered vaginally. The leading indications for CS were previous uterine scar (29.07%), cephalopelvic disproportion (15.09%), and fetal distress (9.06%). **Conclusions:** The CS rate in the rural health zones of Beni and Lubero is considerably

higher than the WHO-recommended threshold of 15%. Further investigation is required to identify the factors underlying this high rate and to strengthen obstetric care quality and equity in rural DRC.

## Keywords

Caesarean Section, Maternal Outcomes, Neonatal Outcomes, Rural Health, North Kivu

## 1. Introduction

Caesarean section (CS) is an essential intervention in modern obstetrics that can prevent maternal and neonatal deaths when performed for appropriate medical indications [1] [2]. Over recent decades, CS rates have increased markedly worldwide, with the WHO estimating a nearly threefold rise in global rates, although this increase varies widely between and within countries [3] [4]. While elective CS has become more common in high-income settings [5], emergency CS continues to predominate in sub-Saharan Africa, where delays in decision-making, inadequate resources, and limited skilled staff contribute to poor outcomes [6].

Across Africa, CS rates increased from 5.4% in 2004 to 21.2% in 2018 [7]; in Cameroon, rates rose from 9.8% (2000-2010) to 14.7% (2010-2019) [8]. Despite improvements in obstetric and anesthetic techniques, maternal complications following CS remain high, at 10.3% in Morocco [9] and up to 40.55% in Guinea [10]. The rate of CS in health facilities serves as a proxy for access to essential obstetric care and can inform policymakers monitoring maternal and child health services [11]. According to the 2023-2024 Demographic and Health Survey (DHS) of the DRC, the CS rate in North Kivu Province reached 20.9%, exceeding the WHO benchmark of 15% [12].

This study, therefore, aimed to describe the frequency and maternal-fetal outcomes of cesarean deliveries in eight rural health zones of North Kivu Province, eastern DRC, between 2017 and 2023.

## 2. Methods

### 2.1. Study Design and Setting

A descriptive multicentre study was conducted in eight rural health zones: Biena, Kalunguta, Kyondo, Lubero, Manduredjipa, Masereka, Musienene, and Vuhovi, located in the Beni and Lubero territories of North Kivu Province. These zones included 33 health facilities offering a complementary package of activities. The latter organise the four basic services (internal medicine, surgery, paediatrics, and gynaecology-obstetrics). In addition, they have a functional laboratory and all activities related to medication management and transfusions. Among the healthcare professionals, there must be a medical team and midwives.

### 2.2. Study Population

The study population comprised all women who delivered in the selected facilities during the study period (2017-2023).

**Inclusion and Exclusion Criteria**

Included were women residing in the respective health zones who gave birth in the targeted facilities between 2017 and 2023, regardless of delivery mode. Women who did not reside in these zones or whose newborn outcomes were missing were excluded.

**Sampling and Data Collection**

An exhaustive sampling strategy was applied. Data were collected retrospectively from delivery registers in the obstetrics and gynecology departments using a standardized data collection sheet. Variables included delivery mode (vaginal or CS), indication for CS, maternal and neonatal outcomes, health facility, health zone, and year of delivery. To ensure the quality of the data collected, we triangulated with data from other registers and reports, including the operating room register, the delivery register, and the department data analysis reports.

### 2.3. Data Analysis

Data from 33 health facilities were analyzed using Epi Info 7.2 to describe the frequency of caesarean sections (CS) and maternal-neonatal outcomes across eight rural health zones. Descriptive statistics summarized delivery modes, maternal, perinatal, and neonatal mortality, and CS indications. Temporal trends (2017-2023) and geographic variations were visualized using line graphs, bar charts, and maps generated in Excel 2016 and QGIS 3. Comparisons between CS and vaginal deliveries were performed using cross-tabulations. This approach provided a clear overview of CS prevalence, associated outcomes, and spatiotemporal patterns in rural North Kivu.

### 2.4. Ethical Consideration

The secondary data used in this study were taken from hospital medical records between 2017 and 2023. Ethical approval was obtained from the Ethics Committee of Université de Goma under reference number No. UNIGOM/CEM/006/2022. Authorization to access and use the data was granted by the administrative authorities of the participating health facilities. Prior to analysis, all data were anonymized to protect patient privacy and confidentiality. The information was not utilized to re-identify any individuals; it was used only for research.

## 3. Results

### 3.1 Trends in Caesarean Section Rates (2017-2023)

The CS rate fluctuated between 37% and 43% (**Figure 1**), with a peak in 2022, showing a saw-tooth pattern across the study period. As shown in **Figure 2**, Kalunguta Health Zone reported the highest CS rate (49%), while Kyondo had the lowest (38%).

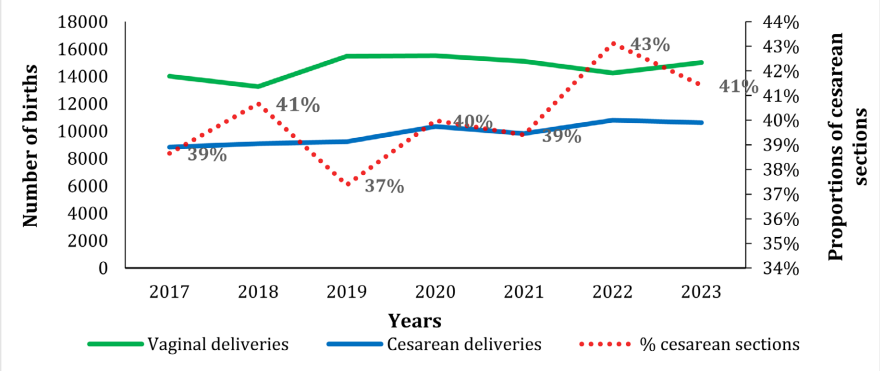


**Figure 1.** Evolution of caesarean sections in the north Kivu health zones from 2017 to 2023.

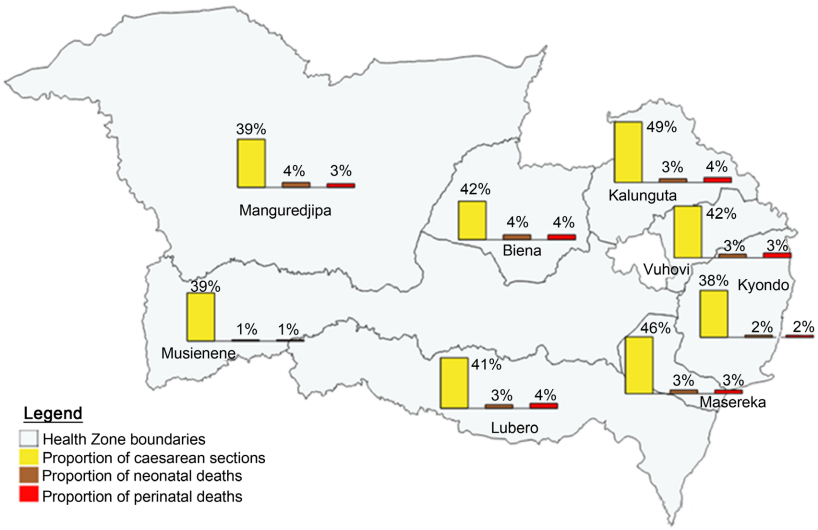


**Figure 2.** Proportions of cesarean cases, neonatal and perinatal deaths among cesarean-delivered women.

## 3.2. Maternal Mortality

Maternal deaths were consistently higher among women who delivered by CS compared with those who had vaginal births (Figure 3).

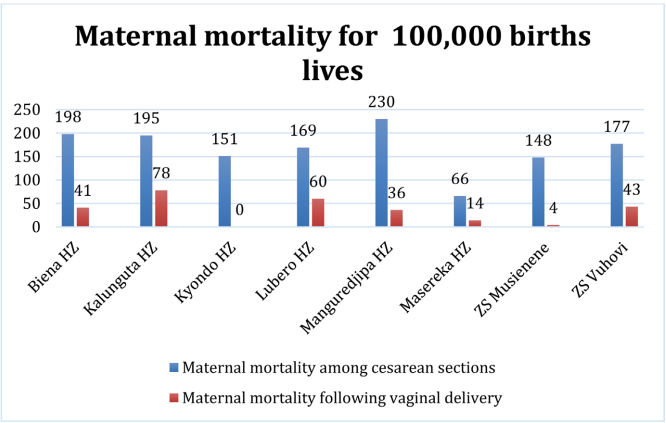


**Figure 3.** Maternal mortality ratio among cesarean section and vaginal delivery.

### 3.3. Perinatal and Neonatal Mortality

Perinatal mortality was higher among CS deliveries than vaginal ones, except in Kalunguta and Musienene, where similar proportions were observed. Neonatal mortality among CS deliveries ranged from 1% in Musienene to 4% in Biena (Figure 4, Figure 5).

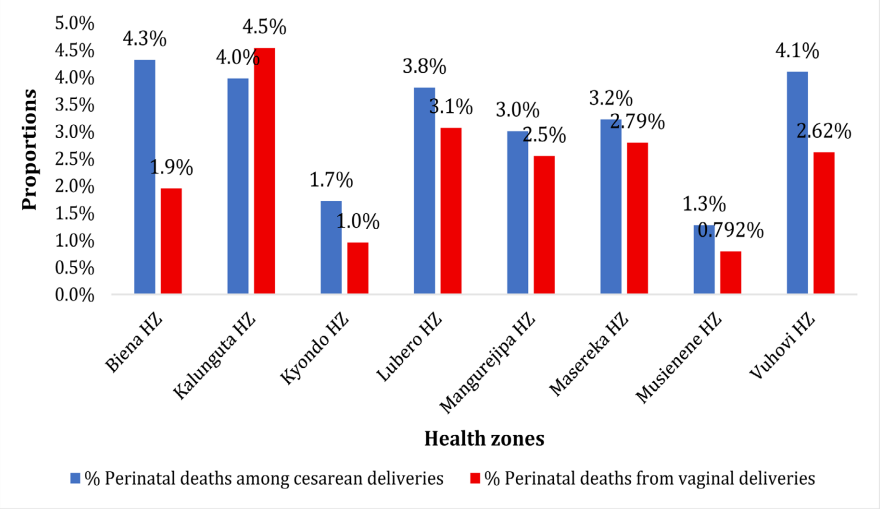


Figure 4. Comparison of the frequencies of perinatal deaths in vaginal and caesarean deliveries.

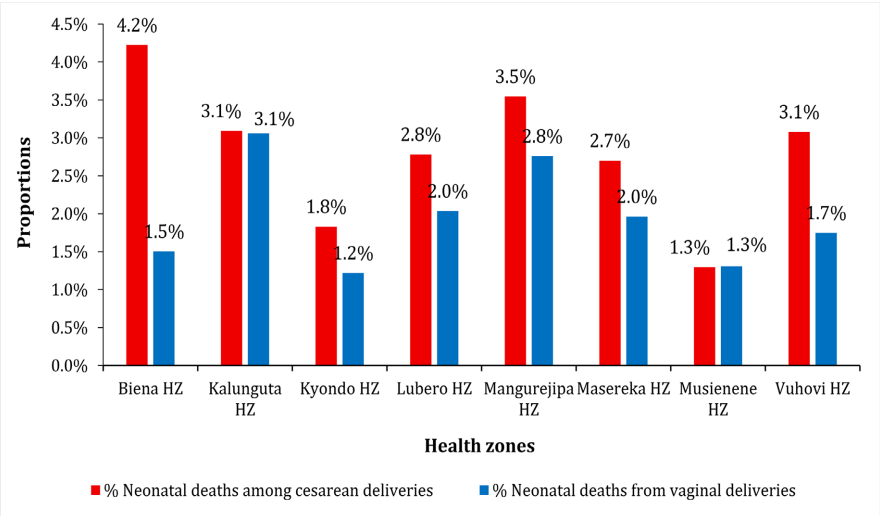


Figure 5. Comparison of the frequencies of neonatal deaths in vaginal and cesarean deliveries.

### 3.4. Indications for Caesarean Section

The most common indications for CS were: previous uterine scar—29.07%; cephalopelvic disproportion—15.09%; and fetal distress—9.06%. Other less frequent indications included malpresentation, twin pregnancy, and placenta previa (Figure 6).

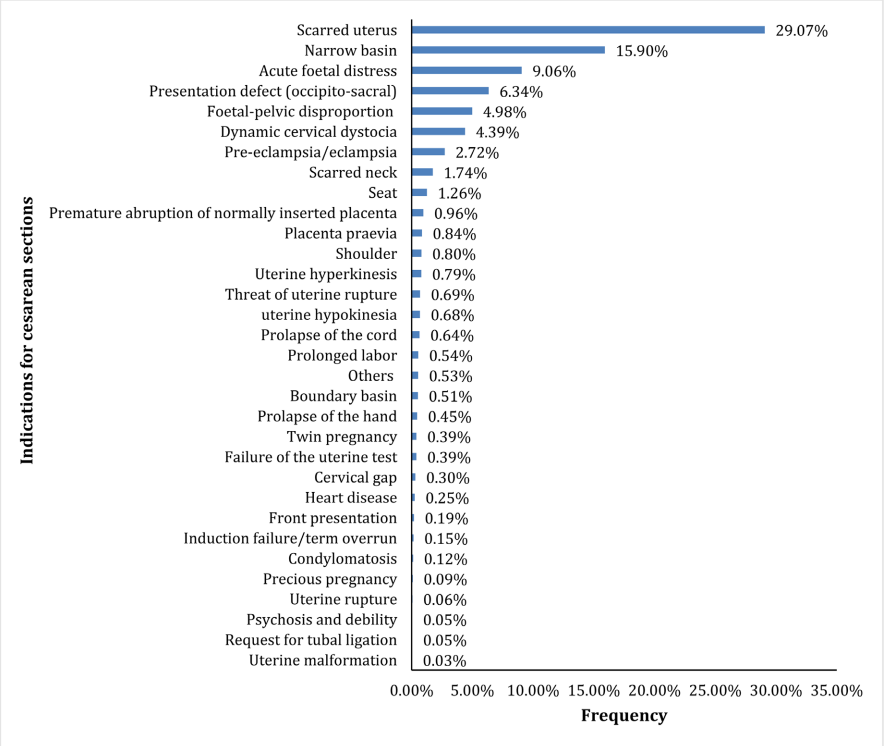


**Figure 6.** Indications for cesarean section.

## 4. Discussion

The frequency of CS observed (37% - 43%) far exceeds the WHO's recommended threshold of 15% for district hospitals [13].

These results contrast with those reported in the literature. Overall, in developing countries, the frequency of caesarean section is higher in urban areas than in rural settings [14] [15]. Several factors explain this difference, including the fact that urban areas have better access to emergency obstetric care compared to rural regions [16].

Such elevated rates in rural North Kivu may be linked to subsidized deliveries in certain facilities and differences in technical capacity and service organization.

Maternal mortality was higher among CS deliveries, consistent with findings from Morocco [17] [18] and Brazil [19], where similar trends were observed. Except for the Masereka Health Zone, all other zones included in the study exhibited triple-digit maternal mortality rates. This indicates that maternal health outcomes in these areas remain far from the targets set by Sustainable Development Goal 3 (SDG 3). According to this goal, the global maternal mortality ratio should be reduced to double-digit levels—specifically, fewer than 70 deaths per 100,000 live births—by 2030. [20]

In rural DRC, emergency obstetric care faces persistent challenges, including resource constraints, delayed referrals, limited surgical capacity, and sociocultural barriers [21] [22].

Likewise, neonatal deaths were more frequent after CS, corroborating findings

by Ghahiri [23]. In contrast, developed countries have experienced a decline in perinatal mortality despite increasing CS rates [24]. In our context, many CS procedures are performed late and as emergencies following failed vaginal delivery attempts, often due to cultural expectations surrounding "natural" childbirth [25]. Poor prenatal care coverage, inadequate referral mechanisms, and limited neonatal care infrastructure exacerbate these outcomes [26].

The predominance of absolute indications such as uterine scar, cephalopelvic disproportion, and fetal distress reflects delays in the detection and referral of high-risk pregnancies [27] [28].

## 5. Strengths and Limitations

This study provides rare insight into CS rates and outcomes in rural areas of North Kivu Province. The archiving service is rudimentary in the healthcare establishments targeted by this study. The use of secondary data limited the ability to explore some clinical and sociodemographic determinants in detail.

## 6. Conclusion

The rate of caesarean deliveries in rural North Kivu is excessively high and is associated with elevated maternal and neonatal mortality. Further analytical studies are needed to identify the factors contributing to this trend and to strengthen health system capacity for the safer and more judicious use of CS in rural DRC.

## Author Contributions

All authors made substantial contributions to the conception, data collection, analysis, and drafting of this manuscript and approved the final version.

## Conflicts of Interest

The authors declare no conflicts of interest.

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