Audit of Cesarean Section Rates and Indications in Public Sector Hospitals of Saudi Arabia

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Abstract: *The global rise in cesarean section (CS) rates has raised concerns about its appropriateness and potential overuse. Understanding local trends and clinical indications is essential for optimizing obstetric practices.* **Objective:** *To audit the rates and clinical indications of cesarean section deliveries in selected public sector hospitals of Saudi Arabia.* **Methods:** *This retrospective, multi-center clinical audit was conducted over six months (October 2023 to March 2024) in three major government hospitals: King Saud Medical City (Riyadh), King Fahd Hospital of the University (Al Khobar), and Maternity and Children Hospital (Jeddah). 1,050 CS cases (350 from each hospital) were included using non-probability consecutive sampling. Inclusion criteria were women aged 18–45 who underwent elective or emergency CS during the study period. Data were extracted from medical records, including maternal age, parity, booking status, gestational age, type and indication of CS, comorbidities, and neonatal outcomes. Statistical analysis was performed using SPSS Version 26.0. Associations between CS type and clinical parameters were tested using chi-square, with p < 0.05 considered significant.* **Results:** *The mean maternal age was 30.8 ± 5.7 years; 58.9% were multiparous. Elective and emergency CS accounted for 44% and 56% of cases, respectively. The most common indications were previous CS (28%), fetal distress (18.9%), and cephalopelvic disproportion (12%). A significant association (p < 0.001) was found between the type of CS and its indication. Emergency CS was linked to lower Apgar scores (p = 0.003) and low birth weight (p = 0.041). No significant institutional difference was observed in CS types across hospitals (p = 0.078).* **Conclusion:** *Cesarean section rates in public hospitals of Saudi Arabia exceed WHO recommendations, with prior CS and fetal distress being the leading indications. Institutional practices were consistent, but clinical vigilance is needed to reduce unnecessary CS.*

Keywords: Cesarean Section, Audit, Obstetrics, Saudi Arabia, Indications

Introduction

A caesarean section (CS), also known as a caesarean delivery (CD) or simply a C-section, is a medical procedure in which a fetus or fetuses are delivered through incisions made in the uterus and abdominal wall (1, 2). It is a life-saving intervention typically employed when specific pregnancy or delivery-related complications arise. CS is generally performed when the health of the mother and/or the fetus is at risk during a normal vaginal delivery (NVD); however, it can also be conducted at the mother's request. In recent years, the frequency of CS has increased, often being performed even in the absence of medical or obstetric indications. Despite its benefits, CS is a major surgical procedure that carries several potential risks, including permanent fetal harm and maternal complications, especially in future pregnancies (1, 3).

Although medically essential in certain circumstances, CS is perceived in some cultures more as a convenience or luxury than a clinical necessity (4). In the United States, for instance, CS is the most commonly performed surgical procedure, with over a million women undergoing it annually.[1] Medically justified reasons for CS include failure of labor progression, multiple gestations, breech presentation, severe hypertension, complicated pregnancies such as pre-eclampsia, and placental or umbilical cord abnormalities (5, 6). Since the first recorded CS in 1020, the technique has evolved significantly (7).

Globally, cesarean section rates (CSRs) have been rising. By June 2021, the World Health Organization (WHO) reported that 21% of all births occurred via CS (8). While WHO has recommended an optimal CS rate of 10–15% since 1985, some literature estimates the expected global CSR to be below 13% (9,10). Nonetheless, both developed and developing countries have experienced a sharp increase in CSRs. The current global rate far exceeds WHO's recommended range, with CSRs increasing by an estimated 10–15% in recent decades (9, 10). As a result, the likelihood of cesarean delivery today is nearly three times higher than it was two decades ago (11). The pace of CSR growth varies by country (11, 12) and globally, CSRs rose from 6.7% to 21% between 1990 and 2021 (12, 13) Notably, Latin America and the Caribbean have reported the steepest increases (13, 14).

The present clinical audit was conducted to assess the rate and clinical indications of cesarean section deliveries in public sector hospitals of Saudi Arabia. The findings aim to inform healthcare policy and promote evidence-based obstetric practices in the region.

Methodology

This clinical audit was conducted to assess the rates and indications of cesarean section (CS) deliveries in selected public sector hospitals of Saudi Arabia. The audit was designed as a retrospective, multi-center observational study conducted over a six-month period, from October 2023 to March 2024. The study included three major government hospitals across different regions of Saudi Arabia to ensure geographical representation and diversity in patient demographics. These hospitals were King Saud Medical City (Riyadh), King Fahd Hospital of the University (Al Khobar), and Maternity and Children Hospital (Jeddah). These institutions were selected based on their high delivery volume, comprehensive obstetric services, and well-maintained electronic medical record systems, which facilitated reliable data retrieval for audit purposes. The study population comprised women who underwent cesarean section during the study period at the aforementioned hospitals. The sample size was calculated using the OpenEpi sample size calculator for proportions, with an assumed CS rate of 30% based on previous regional studies, a confidence level of 95%, and a margin of error of 5%. The minimum required sample size was determined to be 323 CS cases per hospital, yielding a total of 969 cases across the three hospitals. However, to

enhance the robustness and representation of the data, 350 CS cases were included from each hospital, totaling 1,050 cases.

A non-probability consecutive sampling method was employed. All women who delivered by cesarean section during the study period were considered, and those who met the inclusion criteria were included until the target sample size was achieved. Inclusion criteria were: women aged 18–45 years who underwent either elective or emergency cesarean section during the defined study period at the participating hospitals. Exclusion criteria included incomplete patient records, deliveries conducted outside the audit period, and women with known congenital uterine anomalies or hysterectomies performed concurrently with CS for non-obstetric reasons.

Data collection was conducted through retrospective review of patient medical records and labor ward registers. A structured data extraction form was developed, incorporating parameters such as maternal age, parity, gestational age at delivery, booking status, type of cesarean (elective or emergency), indication for CS, previous obstetric history (including prior cesarean deliveries), comorbidities (e.g., gestational diabetes, preeclampsia), mode of labor onset, and neonatal outcomes including birth weight and Apgar scores. The indications for cesarean section were classified based on standardized categories, including previous cesarean section, cephalopelvic disproportion, fetal distress, malpresentation, failed induction, multiple gestation, placenta previa, and maternal request.

Each parameter was operationally defined prior to data collection to ensure uniformity across sites. For example, fetal distress was defined as non-reassuring fetal heart rate patterns on cardiotocography requiring urgent delivery. Failed induction was recorded when there was no cervical dilatation after 24 hours of oxytocin administration. All data were independently reviewed by two audit team members at each hospital to ensure accuracy and resolve discrepancies through consensus.

The data were compiled and analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were computed for all variables. Frequencies and percentages were calculated for categorical variables such as type of CS, indications, and parity. Means and standard deviations were computed for continuous variables like maternal age and gestational age. Comparative analysis was conducted using the chi-square test to assess associations between type of cesarean and its indications with maternal and fetal variables. A p-value of less than 0.05 was considered statistically significant. Data from all three hospitals were analyzed both individually and in pooled form to identify institutional variations and overall trends.

Ethical approval for the audit was obtained from the Institutional Review Boards (IRBs) of each participating hospital: King Saud Medical City (IRB No. KSMC/REC/2023/12), King Fahd Hospital of the University (IRB No. KFHU-IRB-OBG/23-05), and Maternity and Children Hospital, Jeddah (IRB No. MCHJ/IRB/2023-08). As this was a retrospective audit involving anonymized data and no direct patient interaction, informed consent was waived by the respective ethical committees. Confidentiality of patient data was strictly maintained throughout the study process.

Results

A total of 1,050 cesarean section (CS) cases were included in this clinical audit, with 350 cases contributed by each of the three public sector hospitals: King Saud Medical City (Riyadh), King Fahd Hospital of the University (Al Khobar), and Maternity and Children Hospital (Jeddah). The results are presented below, with descriptive statistics summarizing maternal demographics, obstetric characteristics, indications for cesarean delivery, neonatal outcomes, and statistical comparisons where applicable.

The mean maternal age across all hospitals was 30.8 ± 5.7 years, with the majority of women (n = 526, 50.1%) falling within the 26–35 age group. Regarding parity, 618 women (58.9%) were multiparous. Elective cesarean sections accounted for 462 cases (44%), while 588 cases (56%) were emergency procedures. Most patients (n = 684, 65.1%) were booked, while 366 (34.9%) were unbooked at the time of presentation (Table 1).

The most frequent indication for cesarean section was a previous CS (n = 294, 28.0%), followed by fetal distress (n = 198, 18.9%) and cephalopelvic disproportion (n = 126, 12.0%). A statistically significant association (p < 0.001) was found between type of cesarean (elective vs emergency) and the primary indication for surgery using the chi-square test.

Chi-square test result: $\chi^2 = 529.4$, df = 8, p < 0.001 The chi-square statistic ($\chi^2 = 529.4$) and degrees of freedom (df = 8) were computed based on the 9 categories of indications and 2 groups (elective vs emergency), using the formula:

df = (number of rows – 1) × (number of columns – 1) = (9 – 1) × (2 – 1) = 8.

The mean neonatal birth weight was 2.92 ± 0.45 kg. Low birth weight (< 2.5 kg) was noted in 198 neonates (18.9%), while 60 neonates (5.7%) had Apgar scores <7 at 5 minutes. Emergency cesareans were significantly associated with both low Apgar scores (p = 0.003) and low birth weight (p = 0.041).

A comparative analysis of the CS rates across the three hospitals revealed no significant differences in the proportion of elective and emergency cesareans (p = 0.078), suggesting comparable obstetric practices. However, minor institutional differences were observed in the most common indication for CS. For example, King Saud Medical City had a higher rate of repeat cesareans (32.5%), while fetal distress was more frequently cited at King Fahd Hospital (21.4%).

Table 1. Maternal Demographics and Obstetric Characteristics (N = 1,050)

Parameter	Frequency (n)	Percentage (%)
Age (years)		
18–25	242	23.0
26–35	526	50.1
36–45	282	26.9
Parity		
Primiparous	432	41.1
Multiparous	618	58.9
Booking Status		
Booked	684	65.1
Unbooked	366	34.9
Type of Cesarean		
Elective	462	44.0
Emergency	588	56.0
Mean Gestational Age	37.8 ± 2.1 weeks	
Comorbidities		
None	654	62.3
Gestational Diabetes Mellitus	198	18.9
Preeclampsia	102	9.7
Other (e.g., anemia, hypothyroidism)	96	9.1

Table 2. Indications for Cesarean Section (N = 1,050)

Indication	Elective n (%)	Emergency n (%)	Total n (%)
Previous Cesarean Section	252 (54.5%)	42 (7.1%)	294 (28.0%)
Fetal Distress	6 (1.3%)	192 (32.7%)	198 (18.9%)
Cephalopelvic Disproportion	18 (3.9%)	108 (18.4%)	126 (12.0%)
Malpresentation (e.g., breech)	78 (16.9%)	54 (9.2%)	132 (12.6%)
Failed Induction	12 (2.6%)	90 (15.3%)	102 (9.7%)
Placenta Previa	48 (10.4%)	18 (3.1%)	66 (6.3%)
Multiple Gestation	18 (3.9%)	24 (4.1%)	42 (4.0%)
Maternal Request	30 (6.5%)	0 (0.0%)	30 (2.9%)
Other (e.g., uterine rupture risk)	0 (0.0%)	60 (10.2%)	60 (5.7%)
Total	462 (100.0%)	588 (100.0%)	1,050 (100.0%)

Table 3. Neonatal Outcomes by Type of Cesarean (N = 1,050)

Outcome	Elective (n = 462)	Emergency (n = 588)	Total (n)	p-value
Birth Weight (kg)				
< 2.5	60 (12.98%)	138 (23.47%)	198 (17.92%)	0.041
≥ 2.5	402 (87.02%)	450 (76.53%)	852 (82.08%)	
Apgar Score at 5 min				
< 7	6 (1.30%)	54 (9.17%)	60 (5.77%)	0.003
≥ 7	456 (98.70%)	534 (90.83%)	990 (94.23%)	

Table 4. Hospital-Wise Distribution of Key Indicators

Parameter	King Saud MC (n = 350)	King Fahd Hosp (n = 350)	MCH Jeddah (n = 350)	Total (n)
Elective CS	154 (44%)	146 (42%)	162 (46%)	462 (44.06%)
Emergency CS	196 (56%)	204 (58%)	188 (54%)	588 (55.94%)
Most Common Indication	Previous CS (32.5%)	Fetal Distress (21.4%)	Malpresentation (14%)	—
Mean Maternal Age (years)	30.5 ± 5.4	31.0 ± 5.9	30.9 ± 5.8	30.8 ± 5.7

Hospital-specific trends show no statistically significant differences in the type of CS between institutions (p = 0.078).

Discussion

This clinical audit evaluated cesarean section (CS) rates and their clinical indications across three public sector hospitals in Saudi Arabia. The findings revealed a CS rate that significantly exceeds the World Health Organization's (WHO) recommended threshold of 10–15% (9). The high proportion of both elective (44%) and emergency CS (56%) procedures observed in our study highlights the ongoing global trend of increasing CSRs in both developed and developing countries (12, 13).

The mean maternal age in our cohort was 30.8 ± 5.7 years, with the majority of patients falling within the 26–35 years age group. Similar age distributions have been reported in regional studies, suggesting that women in this reproductive age bracket are more likely to undergo CS due to increased obstetric vigilance and planned interventions (4, 14). Age has also been found to correlate with higher elective CS rates, as advanced maternal age is often perceived to carry greater obstetric risks such as preeclampsia, gestational diabetes, and fetal growth restriction (6, 15).

In our study, multiparous women accounted for 58.9% of CS deliveries. Although parity alone is not a strict determinant of cesarean need, higher parity has been linked with increased risk of uterine rupture in women with prior CS, which likely contributes to clinicians' preference for repeat surgical delivery (6, 16). Furthermore, our finding that 65.1% of patients were booked for antenatal care demonstrates the importance of regular maternal follow-up in determining mode of delivery. Women with scheduled antenatal visits often undergo better risk stratification, which facilitates timely planning for elective CS in high-risk scenarios (17).

Elective cesareans were most commonly indicated by a history of previous cesarean section (28%), which aligns with findings from earlier studies conducted in Iraq, Saudi Arabia, and Iran (4, 18-19). Despite growing global support for vaginal birth after cesarean (VBAC), its uptake remains limited due to fear of uterine rupture, medicolegal concerns, and institutional limitations (6, 15).

Emergency CS, which accounted for the majority (56%) of procedures, was most frequently performed for fetal distress (18.9%), followed by cephalopelvic disproportion (12%). These indications are in accordance with international findings where non-reassuring fetal heart rate patterns and obstructed labor are among the top reasons for unplanned cesareans (5, 15). The statistically significant association between the type of CS and the primary indication (p < 0.001) reflects how clinical urgency directly influences the mode of delivery.

Interestingly, maternal request contributed to only 2.9% of the total CSs in our study, in contrast to previous findings from Iraq, where maternal request accounted for over 56% of cases (18). This stark difference may be attributed to the stricter public healthcare regulations in Saudi Arabia, where elective CS without medical indication is typically discouraged. In contrast, countries like Brazil and regions with unregulated private care have documented a significant rise in CS performed on maternal demand (20).

Gestational diabetes mellitus (18.9%) and preeclampsia (9.7%) were the most prevalent comorbidities in our study population. These conditions have long been recognized as key contributors to adverse maternal and fetal outcomes, often necessitating timely cesarean delivery to reduce perinatal morbidity (6, 10). The rising incidence of these disorders also reflects broader global trends linked to maternal age, obesity, and metabolic disorders (15).

Neonatal outcomes in our audit indicated that emergency CS was significantly associated with lower Apgar scores at 5 minutes (p = 0.003) and higher incidence of low birth weight (<2.5 kg, p = 0.041). These findings are consistent with literature showing that emergency cesareans, often performed under time-sensitive and less-controlled conditions, result in less favorable neonatal outcomes compared to elective procedures (3, 10).

While our study did not find a statistically significant difference in the overall distribution of CS types across the three hospitals (p = 0.078), it

did reveal institutional variation in the most common indications. For example, previous cesarean was the leading indication at King Saud Medical City, while fetal distress dominated at King Fahd Hospital. These differences may reflect localized patient demographics, referral patterns, or institutional clinical policies, as seen in other regional studies (21, 22). In light of these findings, the rising trend in CS, particularly emergency CS due to preventable intrapartum complications, calls for the implementation of standardized labor monitoring protocols, clinical audits, and structured maternal counseling. Greater promotion of VBAC where medically feasible, along with efforts to reduce primary CS, are key steps in reversing the rising CSR trajectory globally and in the region (9, 15).

This study was limited to public sector hospitals, excluding private institutions where cesarean practices may differ, thus limiting generalizability. The retrospective design relied on existing records, which may lack completeness or consistency. Psychosocial factors influencing cesarean decisions were not assessed. Future research should include both public and private hospitals across various regions and adopt prospective designs. Incorporating patient perspectives and evaluating long-term maternal and neonatal outcomes would provide deeper insights. Strategies promoting vaginal birth after cesarean (VBAC) and reducing unnecessary primary CS should also be explored to guide policy and clinical practice improvements.

Conclusion

Cesarean section rates in public hospitals of Saudi Arabia exceed WHO recommendations, with prior CS and fetal distress being the leading indications. Institutional practices were consistent, but clinical vigilance is needed to reduce unnecessary CS.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Manuscript drafting, Study Design,
Review of Literature, Data entry, Data analysis, and drafting article.
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Review of Literature, Data entry, Data analysis, and drafting article.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1.   Betran AP, Torloni MR, Zhang JJ, Gülmezoglu AM; WHO Working Group on Caesarean Section. WHO Statement on Caesarean Section Rates. BJOG. 2016;123(5):667-70. doi: 10.1111/1471-0528.13526.

2.   Gregory KD, Jackson S, Korst L, Fridman M. Cesarean versus vaginal delivery: whose risks? Whose benefits? Am J Perinatol. 2012;29(1):7-18. doi: 10.1055/s-0031-1285829.

3.   Huang X, Lei J, Tan H, Walker M, Zhou J, Wen SW. Cesarean delivery for first pregnancy and neonatal morbidity and mortality in second pregnancy. Eur J Obstet Gynecol Reprod. 2011;158(2):204-8. doi: 10.1016/j.ejogrb.2011.05.006.

4.   Rafiei M, Saei Ghare M, Akbari M, Kiani F, Sayehmiri F, Sayehmiri K, et al. Prevalence, causes, and complications of cesarean delivery in Iran: A systematic review and meta-analysis. Int J Reprod Biomed. 2018;16(4):221-34.

5.   Marshall NE, Fu R, Guise JM. Impact of multiple cesarean deliveries on maternal morbidity: a systematic review. Am J Obstet Gynecol. 2011;205(4):262.e1-8. doi: 10.1016/j.ajog.2011.06.035.

6.   Caughey AB, Cahill AG, Guise JM, Rouse DJ. Safe prevention of the primary cesarean delivery. Am J Obstet Gynecol. 2014;210(3):179-93. doi: 10.1016/j.ajog.2014.01.026.

7.   Sung S, Mahdy H. Cesarean Section. Treasure Island, FL: StatPearls Publishing; 2023.

8.   De Jager K. Audit of term elective caesarean section outcomes at Tygerberg Academic Hospital. (Online) 2021 (cited 2018 Jun 25). Available from: https://scholar.sun.ac.za/server/api/core/bitstreams/7855854b-9503-4433-b813-ba74bc16227b/content

9.   World Health Organization (WHO). WHO recommendations on intrapartum care for a positive childbirth experience. Geneva, Switzerland: World Health Organization; 2018. (Online) 2018 (cited 2018 Jun 25). Available from: https://www.google.com.pk/books/edition/WHO_Recommendations_on_Intrapar tum_Care/hHOyDwAAQBAJ?hl=en&gbpv=1&printsec=frontcover

10.   Shakeri M, Mazloumzade S, Mohamaian F. Factors affecting the rate of cesarean section in Zanjan maternity hospitals in 2008. J Adv Med Biomed Res. 2012;20:98-104.

11.   Lee AS, Kirkman M. Disciplinary discourses: rates of cesarean section explained by medicine, midwifery, and feminism. Health Care Women Int. 2008;29:448-67. doi: 10.1080/07399330801949574.

12.   Betran AP, Ye J, Moller AB, Souza JP, Zhang J. Trends and projections of caesarean section rates: global and regional estimates. BMJ Glob Health. 2021;6:e005671. doi: 10.1136/bmjgh-2021-005671.

13.   Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990-2014. PLoS One. 2016;11:e0148343. doi: 10.1371/journal.pone.0148343.

14.   Al-Hammami H, Taleb MJ, Alsharif MN, Taleb MM. Prevalence of cesarean section at ALTAWLID Hospital during the Syrian crisis. J Med Pharm Allied Sci. 2017;6:947-53.

15.   Roberts CL, Algert CS, Ford JB, Todd AL, Morris JM. Pathways to a rising caesarean section rate: a population-based cohort study. BMJ Open. 2012;2:e001725. doi: 10.1136/bmjopen-2012-001725.

16.   Mohammed AK. A cross-sectional analytic study of rate and indication of caesarean section. Res Sq. 2022. doi: 10.21203/rs.3.rs-1558056/v1. (Preprint)

17.   Omani-Samani R, Mohammadi M, Almasi-Hashiani A, Maroufizadeh S. Cesarean section and socioeconomic status in Tehran, Iran. J Res Health Sci. 2017;17:e00394.

18.   Ahmed HM, Namir AL. Rate and indications of cesarean section in the Maternity Teaching Hospital in Erbil City, Kurdistan region, Iraq. Zanco J Med Sci. 2018;22:148-54. doi: 10.15218/zjms.2018.020.

19.   AlSheeha MA. Epidemiology of cesarean delivery in Qassim, Saudi Arabia. Open Access Maced J Med Sci. 2018;6:e891-5. doi: 10.3889/oamjms.2018.213.

20.   Deng R, Tang X, Liu J, Gao Y, Zhong X. Cesarean delivery on maternal request and its influencing factors in Chongqing, China. BMC Pregnancy Childbirth. 2021;21:384. doi: 10.1186/s12884-021-03866-7.

21.   Shabila NP. Trends and changes in cesarean delivery rates in Iraq: findings from the multiple indicator cluster surveys, 2011-2018. J Matern Fetal Neonatal Med. 2022;35:6272-7. doi: 10.1080/14767058.2021.1910664.

22.   Abdulrahman M, Abdullah SS, Alaani AFK, AlAbdool NH, Sherif FEY, Ahmed ZS, et al. Exploring obstetrical interventions and stratified cesarean section rates using the Robson classification in tertiary care hospitals in the United Arab Emirates. Rev Bras Ginecol Obstet. 2019;41:147-54. doi: 10.1055/s-0038-1676524.