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*Article*

# Assessing the Burden of Cesarean Deliveries in Diyala, Iraq: Incidence, Underlying Factors, and Health Implications for Mothers and Infants

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**Abstract**. Aim of the study: The study aimed to investigate the causes, risk factors, and incidence of caesarean sections in Diyala province during the research period. Patients and Methods: This prospective study was conducted at Al-Batool Maternity Teaching Hospital between October 2023 and December 2023. The study population consisted of 96 women who attended the labor ward for delivery after 32 weeks of gestation, irrespective of the delivery method. Patients' data were collected using an organized questionnaire. The data were analyzed using the Chi-square test for independence between variables. Results: Study outcomes revealed that the percentage of cesarean sections increased significantly with age, peaking among women aged 20-35 and those over 35 (67.1% and 77.8%, respectively), in contrast to the group under 20, where most deliveries were vaginal (81.8%). An increasing number of previous deliveries (four or more) led to a higher chance of cesarean sections in subsequent pregnancies (76.9% compared to 58.8%) for those with two to four previous deliveries versus those who were primipara (52.6%). The most common indication for elective cesarean sections among participants was a scarred uterus (62.5%), followed by fetal indications such as malposition, abnormal presentation, post-date, and oligohydramnios (15%). The leading reasons for unplanned cesarean sections included obstructed labor (30%), followed by cephalo-pelvic disproportion (20%), and maternal factors (15%). Conclusion: study finding highlight key risk factors influencing delivery methods, suggesting the need for tailored obstetric care to optimize birth outcomes and reduce unnecessary CS procedures.

***Keywords:*** *Caesarean Section, Elective CS, Emergency CS, Risk factors.*

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## 1. Introduction

A cesarean section (C-section) is the most common surgical procedure globally, where the fetus, placenta, and membranes are delivered through abdominal and uterine incisions. C-sections are classified into three types: planned, unplanned, and necessary (1). Undoubtedly, C-section is considered a life-saving procedure for both mothers and newborns. Still, like all other surgical operations, it is associated with potential health risks that might negatively impact the course and outcomes of subsequent pregnancies (2). According to the recommendations of the World Health Organization (WHO), the appropriate rate of C-sections should fall between 5% and 15%, as this range is considered safe. Over the past 15 years, there has been a significant increase in the global C-section rate, which has doubled to 21% and is projected to reach 28.5% by 2030. It has been observed

that when the C-section rate in a population exceeds 15%, no significant improvement is seen in maternal or child health; rather, it may lead to complications. (3-5)

Comparing high- and mid-income countries, it has been found that Argentina and Paraguay achieved faster rates of C-section in recent decades, unlike countries with higher incomes. Furthermore, a global survey conducted in 2012 showed that Japan and the USA had C-section rates of 19.8% and 32.8%, respectively. Additionally, the average rate of C-section in 18 European Union states was 26.8% in 2012 (6). A high percentage of C-sections is observed in Asia. For example, in Iran, the C-section rate is nearly 40%, with some regions reporting even higher rates, exceeding 52.8%. In China, the C-section rate reached 34.9%, while rural areas reported even higher rates (7). Changes in women's risk profiles are among factors contributing to the global rise in cesarean section rates, whether clinical or otherwise. Socioeconomic determinants of health, such as social, cultural, and economic factors, clearly affect the increasing prevalence of cesarean sections. Variables related to physicians and institutions may also influence cesarean section rates, regardless of obstetric risk factors. (8)

Another study was conducted that shed light on the factors contributing to the increased rate of C-sections, including the adoption of policies that promote subsequent C-sections and discourage vaginal births after cesareans. Other factors encouraging the choice of this technique include concerns about malpractice in the case of breech or forceps deliveries, the childbirth process, healthcare reimburse/ment mechanisms, and fetal monitoring technology. (9). Indeed, a C-section subjects mothers to significant complications that can impact both short- and long-term outcomes, including hysterectomy, abnormal placentation, uterine rupture, stillbirth, preterm birth in future pregnancies, bleeding, the necessity for blood transfusions, pelvic adhesions, and intraoperative surgical injuries. Nonetheless, hysterectomy is particularly concerning as it is increasingly viewed as an inevitable outcome of CS. (10)

Additionally, it states that 7% of cases experience severe bleeding, and some minor studies indicate damage to internal organs such as the urinary tract, bowel, and major vessels. Furthermore, it references two systematic reviews that reported 4% to 42% of cases experiencing abdominal pain after C-section, which appears significant, but varies in detail outcomes. (11)

Additionally, another study supports what is mentioned in this research by confirming the correlation between C-sections and the risk of asthma, obesity in children, and complications related to subsequent pregnancies, including uterine rupture, placenta accreta, placenta previa, ectopic pregnancy, infertility, hysterectomy, and intraabdominal adhesions. (12)

Aside from the complications that arise from giving birth via C-section, there are still various indications for performing this procedure. These accounted for 70% of operations prior to C-section deliveries and include issues like malpresentation (mainly breech), failure to progress, or suspected fetal distress during labor. Other indications, such as multiple pregnancies, placental abruption, placenta previa, and fetal or maternal diseases, have been regarded as less significant.(13) In line with this, several studies have been conducted that still reveal limitations in assessing the burden of cesarean deliveries among Iraqi women in Diyala, Iraq. Our study aims to explore the causes, risk factors, and rate of cesarean sections in Diyala Province.

## 2. Patients and methods

### 2.1. Study Design

It is a prospective study conducted at Al-Batool Maternity Teaching Hospital in the Department of Obstetrics and Gynecology/Labor Ward from October 2023 to December 2023.

### 2.2 Inclusion Criteria

Including all women who attended the labor ward for delivery after 32 weeks of gestation, regardless of the mode of delivery. One hundred women were admitted for labor during the study period, and 96 women were included while severely ill.

Inclusion Criteria

Women who were unable to respond or were unsure about their information were excluded.

### 2.3 Questionnaire

Participants were interviewed face-to-face by the researcher using an organized questionnaire that included socio-demographic information (mother's age, education, and occupation), clinical characteristics (preeclampsia, anemia, urinary tract infection, high blood pressure, diabetes mellitus, hospitalization during the current pregnancy), obstetric characteristics (number of fetuses, history of low or preterm delivery, previous cesarean section, history of stillbirth or neonatal death, history of abortion, timing of the first antenatal visit, number of antenatal care visits), indications for cesarean section (either planned or emergent), and pregnancy outcomes (stillbirth or alive, Apgar score at 1 minute and 5 minutes).

All this information was compiled in tables to identify the risk factors associated with Cesarean sections and their complications for both mothers and fetuses during our study period.

### 2.4 Ethical Approval

The study obtained approval from the Medical Faculty at the University of Diyala, Baqubah. The patient agreed to provide data for the questionnaire.

### 2.5 Statistical Analysis

The data were analyzed using the chi-square test for independence between variables. The variable for Cesarean section frequency was assessed with the chi-square goodness of fit. Differences in the study parameters among vaginal delivery, elective Cesarean section, and emergency Cesarean section were tested using the chi-square test for independence (SPSS version 26), with a p-value of $\leq 0.05$ considered statistically significant and a p-value of $\leq 0.001$ regarded as highly significant. (14)

## 3. Results

### 3.1 Mode of Delivery

Regarding the outcomes of the mode of delivery, the study results reveal that the percentage of cesarean sections significantly increased with age. This rate was highest among women aged 20 to 35 and those over 35 years, with rates of 67.1% and 77.8%, respectively. In contrast, most women under 20 delivered vaginally, at a rate of 81.8%. These findings were statistically significant.

On the other hand, a mother's education had no significant effect on the sex of the fetus. Additionally, the percentage of cesarean sections was higher among employed women compared to homemakers (83.3% vs. 61.1%), but this difference was not significant. However, being pregnant with male fetuses increased the chance of delivery by cesarean section compared to those who delivered girls (75.6% vs. 50%). Table 1

**Table 1. mode of Delivery among pregnant women based on socio-demographic characteristics**

| Variables | Mode of delivery | | Total n. (%) | P -value |
|---|---|---|---|---|
| | Vaginal delivery: No (%) | Cesarean section: No (%) | | |
| Age | | | | |
| < 20 | 9(81.8%) | 2(18.2%) | 11(100%) | 0.026 |
| 20-35 | 25(32.9%) | 51(67.1%) | 76(100%) | |
| > 35 | 2(22.2%) | 7(77.8%) | 9(100%) | |
| Mother's education | | | | |
| primary | 25(43.9%) | 32(56.1%) | 57(100%) | 0.25 |
| secondary | 5(27.8%) | 13(72.2%) | 18(100%) | |
| college | 6(28.6%) | 15(71.4%) | 21(100%) | |

| | | | | |
|---|---|---|---|---|
| Occupation | | | | |
| employee | 1(16.7%) | 5(83.3%) | 6(100%) | 0.532 |
| housewife | 35(38.9%) | 55(61.1%) | 90(100%) | |
| Baby's gender | | | | |
| male | 11(24.4%) | 34(75.6%) | 45(100%) | 0.038 |
| female | 25(49%) | 16(51%) | 51(100%) | |

Furthermore, the mode of delivery concerning medical complications revealed that all the medical issues reported by participants, such as urinary tract infection, anemia, hypertension, preeclampsia, and hospitalization during the current pregnancy, did not affect the mode of delivery, whether vaginal or cesarean section. The results were statistically non-significant, with a p-value greater than 0.05. table 2

**Table 2. Mode of delivery among participants based on medical characteristics.**

| Medical characteristic | Mode of delivery | | Total n. (%) | P -value |
|---|---|---|---|---|
| | Vaginal delivery: No (%) | Cesarean section: No (%) | | |
| Anemia | | | | |
| yes | 18(34%) | 35(66%) | 53(100%) | 0.772 |
| no | 18(41.9%) | 25(58.1%) | 43(100%) | |
| Urinary tract infection | | | | |
| yes | 25(41%) | 36(59%) | 61(100%) | 0.476 |
| no | 11(31.4%) | 24(68.6%) | 35(100%) | |
| High blood pressure | | | | |
| yes | 3(20%) | 12(80%) | 15(100%) | 0.21 |
| no | 33(40.7%) | 48(59.3%) | 81(100%) | |
| Preeclampsia | | | | |
| yes | 1(33.3%) | 2(66.7%) | 3(100%) | 0.546 |
| no | 35(37.6%) | 58(62.4%) | 93(100%) | |
| Hospitalization during the current pregnancy | | | | |
| yes | 2(22.2%) | 7(77.7%) | 9(100%) | 0.535 |
| no | 34(39.1%) | 53(60.9%) | 87(100%) | |

Concerning obstetrical characteristics, the percentage of cesarean sections was higher among women with a history of low/preterm delivery (77.8%), a history of previous cesarean sections (93.62%), a history of stillbirth/neonatal death (62.5%), and a history of abortion (65.8%), compared to the rates of vaginal delivery (22.2%, 6.38%, 37.5%, 34.2%, respectively). However, this difference was statistically non-significant (p-value > 0.05). It was observed that an increasing number of previous deliveries (para 4 and more) led to a higher chance of cesarean sections in subsequent pregnancies (76.9% vs. 58.8%) among those who were para (2-4) compared with primipara (52.6%). These findings were statistically significant (p-value 0.012). Table 3

**Table 3. Mode of Delivery among participants based on obstetric characteristics**

| Obstetrics characteristic | Mode of delivery | | Total No (%) | P -value |
|---|---|---|---|---|
| | ivery: No (%) | ction: No (%) | | |
| Number of fetuses | | | | 0.887 |
| single | 35(37.6%) | 58(62.4%) | 93(100%) | |
| multiple | 1(33.3%) | 2(66.7%) | 3(100%) | |
| History of low/preterm delivery | | | | 0.246 |
| yes | 2(22.2%) | 7(77.8%) | 9(100%) | |
| no | 34(39.1%) | 53(60.9%) | 87(100%) | |
| History of previous CS | | | | 0 |
| yes | 3(6.38%) | 44(93.62%) | 47(100%) | |
| no | 33(67.34%) | 16(32.66%) | 49(100%) | |
| History of stillbirth/neonatal death | | | | 0.821 |
| yes | 6(37.5%) | 10(62.5%) | 16(100%) | |
| no | 30(37.5%) | 50(62.5%) | 80(100%) | |
| History of abortion | | | | 0.272 |
| yes | 13(34.2%) | 25(65.8%) | 38(100%) | |
| no | 23(39.7%) | 35(60.3%) | 58(100%) | |
| Number of deliveries | | | | 0.012 |
| 0 to 1 | 9(47.4%) | 10(52.6%) | 19(100%) | |
| 2 to 4 | 21(41.2%) | 30(58.8%) | 51(100%) | |
| more than 4 | 6(23.1%) | 20(76.9%) | 26(100%) | |

### 3.1 Indications of Elective CS

Study findings indicate that the most common reasons for elective cesarean sections among participants were as follows: scarred uterus (62.5%), followed by fetal indications such as malposition, abnormal presentation, being post-date, and oligohydramnios (15%). Other relatively common reasons included cephalopelvic disproportion (12.5%) and the mother's reasons (10%). For example, the findings related to the mother's situation were highly relevant and significant. table 4

**Table 4. Most common indications of elective CS among participants**

| Indication | No (%) | p-value |
|---|---|---|
| Scarred uterus | 25(62.5%) | 0.000001 |
| Cephalopelvic disproportion | 5(12.5%) | |
| Other mother reasons | 4(10%) | |
| Other fetal reasons | 6(15%) | |

Regarding the indications for emergency cesarean section among participants, the findings showed that the most frequent reason was obstructed labor (30%), followed by cephalo-pelvic disproportion (20%), then maternal reasons (15%), such as antepartum hemorrhage and maternal exhaustion. Fetal reasons accounted for 15%, including prolonged fetal distress, while labor process reasons constituted 10%, with issues such as failed labor induction, premature labor pain, and eclampsia also at 10%. Again, these results were statistically highly significant. Table 5

**Table 5. The indicators of emergency CS among participants**

| Indication | No (%) | p-value |
|---|---|---|
| Eclampsia | 2(10%) | 0.000001 |
| Cephalopelvic disproportion | 4(20%) | |
| Obstructed labour | 6(30%) | |
| Other mother reasons | 3(15%) | |
| Fetal reasons | 3(15%) | |
| Other labor process reasons | 2(10%) | |

### 3.1 Fetal Complications

The study of fetal complications according to the mode of delivery demonstrated that, the majority of newborns delivered by cesarean section having a normal Apgar score at 1 minute compared to those delivered vaginally (88% vs. 12% respectively), these findings were statistically non-significant (p value > 0.05). On the other hand, poor and intermediate Apgar scores at 5 minutes were recorded among newborns delivered by cesarean section (75% vs. 55.6%, respectively), and these findings were also statistically nonsignificant. Table 6

**Table 6. Fetal complications according to mode of delivery among participants**

| Fetal complications | Mode of delivery | | Total No (%) | P -value |
|---|---|---|---|---|
| | Vaginal delivery: No (%) | Cesarean section: No (%) | | |
| Apgar score 1 minute | | | | 0.598 |
| poor (0-3) | 4(36.3%) | 7(63.7%) | 11(100%) | |
| intermediate (4-7) | 31(40.2%) | 46(59.8%) | 77(100%) | |
| normal (8-10) | 1(12%) | 7(88%) | 8(100%) | |
| Apgar score at 5 minutes | | | | 0.808 |
| poor (0-3) | 2(25%) | 6(75%) | 8(100%) | |
| intermediate (4-7) | 4(44.4%) | 5(55.6%) | 9(100%) | |
| normal (8-10) | 30(38%) | 49(62%) | 79(100%) | |

## 4. Discussion

During the period of this study at Albatool Maternity Teaching Hospital in the Department of Obstetrics and Gynecology, it was observed that the rate of cesarean sections was 62.5%, compared to 37.5% for vaginal deliveries. A similarly high rate of cesarean sections was found in previous studies conducted by Insam H. et al. in Baghdad (2018) and by Atiya K. in Sulimania (2022), with rates of 47.1% and 34.6%, respectively. (15, 16) , but it is considerably lower than the rate found by Noor N. et al. in Mosul (18.2%) in 2020 (17) . However, Nazar P. (2012) reported that the overall cesarean section rate in Iraq was 24.4%. (18) .

All those findings were much higher than the WHO recommendation of 5-15% (19). This may be due to the fact that in the region where this study was conducted, there is only one governmental maternity hospital, which serves patients from all rural areas. Given the limited number of staff, delivery rooms, midwives, care units, proper beds, and cardiotocography equipment, this situation makes the hospital very crowded.

These results lead to many related issues, such as inadequate medical care, which causes relatives to have a negative experience. This, in turn, instills a fear of vaginal delivery in women. Additionally, the Caesarean section has been enhanced and simplified over time, making it safer, so women prefer to choose this method of childbirth.

Those findings align with studies conducted by Alaa H. et al. in Jordan (37.5%, 2018) and Mustafa M. et al. in Turkey (57.55% and 28.83%, respectively, from 2018 to 2023).(20, 21)

The present study showed that the Cesarean section rate significantly increased with maternal age, peaking among women in the age groups of 20-35 and those older than 35 years (67.1% and 77.8%, respectively). Wasan Gh. et al. found that most mothers who delivered by Cesarean section were in the 20-30 and 31-40 age groups (54.9% and 31.7%, respectively). Additionally, Khawaja M. et al. found that women over 35 years of age were more likely to undergo Cesarean section delivery than women from other age groups. (22, 23) This disagrees with Hanan M. et al., who found no significant association between cesarean section rates and maternal age. (8)

However, older women's tendency for more complicated pregnancies and deliveries can explain their higher rates of Cesarean section deliveries. Other significant factors that may influence Cesarean section deliveries include maternal preferences, medical professionals' perceptions of potential issues, and the convenience of delivery. Although we did not find a difference in Cesarean section rates based on women's education levels, we observed that the percentage of Cesarean sections was higher among employed women compared to housewives (83.3% vs. 61.1%). These findings contradict a study by Mohammad O. et al., which indicated that housewives were more likely than employed women to opt for Cesarean sections and that women with higher education levels had higher rates of Cesarean sections compared to those with only primary education. (24)

This diversity may stem from the varying levels of women's awareness and fear concerning the risks and disadvantages of cesarean sections, regardless of their education, employment status, or occupation, perhaps due to differing income levels.

Our study found that pregnant women with male fetuses had a higher incidence of cesarean sections compared to those who delivered female fetuses (75.6% vs 50%). This finding contradicts that of Mizuki T. et al., who reported that a child's sex was not related to the cesarean section rate. (25)

We found that no medical conditions reported or researched by the participants, such as anemia, hypertension, preeclampsia, urinary tract infections, and hospitalization during the current pregnancy, impacted the mode of delivery, whether vaginal or cesarean section. These findings are in agreement with a study conducted in Egypt in 2019 by Shatha et al. and also align with Calistus et al. regarding anemia, where no correlation was found between cesarean delivery and any level of anemia (mild, moderate, or severe). (26, 27). However, our findings disagree with those of Ishag A. et al., who discovered that anemic pregnant women had a 1.63 times higher risk of cesarean delivery compared to non-anemic pregnant women. I also disagree with Lejla K. et al. regarding preeclampsia, as they observed that pregnant women with preeclampsia risk factors are 2.54 times more likely to undergo a cesarean section. (28, 29) . A plausible explanation for our findings may stem from the small sample included in our study.

In our study, the rate of cesarean sections was higher among women with a history of previous cesarean sections (93.62%) compared to the rate of vaginal delivery (6.38%). Additionally, high parity (para 4 and more) led to an increased chance of cesarean sections in subsequent pregnancies—76.9% vs. 58.8% in those who were para (2-4). This aligns with the study conducted by Michael J. Turner (29) . This may be due to the lack of specialized centers, as seen in developed countries, that explain to women the benefits of normal labor and train them in exercises that strengthen the pelvic muscles, making normal labor easier. This contrasts with the study done by S. Momon S. and Shazia A. et al., who found that the incidence of cesarean sections decreased with increasing parity. (19, 30) .

The most common reported reason for planned cesarean sections in the current study was a scarred uterus, followed by fetal indications (malposition, abnormal presentation, post-term, and oligohydramnios). Other relatively common reasons included cephalopelvic disproportion and maternal preferences, such as the mother's desire for a cesarean. This aligns with the findings of a study conducted by Neetu S. et al., which concluded similar results.(19) , This could be due to women's refusal to have a vaginal delivery after one cesarean section (VBAC) because they are preoccupied with the risks of trial of labor after cesarean, especially the risk of uterine rupture due to insufficient patient counseling by most obstetricians about the benefits and risks of VBAC.

On the other hand, this contradicts a study conducted by Adnan A. et al., which found that fetal distress was the most common reason for a cesarean section, occurring at a rate of 30%, followed by failure to progress in labor at a rate of 25%. (31) .

Regarding the indications for emergency caesarean sections, obstructed labor accounted for 30%, followed by cephalo-pelvic disproportion at 20%. This is inconsistent with the findings of Abida S. et al., who discovered that fetal distress was the most common reason

for emergency cesarean sections at 30.5%, followed by a previous scar, which accounted for 25.6%. (32) .

Our study revealed that the majority of newborns delivered by Cesarean section had normal Apgar scores at 1 minute compared to those delivered vaginally (88% vs. 12%, respectively). On the other hand, poor and intermediate Apgar scores at 5 minutes were also recorded among newborns delivered by Cesarean section (75% vs. 55.6%, respectively). This contradicts K. Rahmanian et al.'s findings that Cesarean section seems to affect and reduce Apgar scores at 5 minutes of life, and it disagrees with L. Paudyal et al., who concluded that there is no significant difference in Apgar scores among newborns from vaginal and Cesarean deliveries at both the 1st and 5th minute birth. (33, 34) Our study faced a number of conflicts. First, the pregnant women who participated in this study were selected from Albatool Maternity Teaching Hospital, which is the only hospital in one district of Iraq; therefore, the results may not be representative of the situation across the nation. Second, the study period is believed to have been too brief to provide an accurate rate of cesarean sections. Third, the study's sample size was 96. Moreover, not every hospital admission was examined in the research.

## 5. Conclusion

The present study documents a concerningly high prevalence of cesarean deliveries in Baqubah, Iraq, substantially surpassing WHO-recommended thresholds. Our findings demonstrate a distinct age-related and parity-dependent pattern, with significantly elevated CS rates among older and multiparous women. Analysis of indications revealed that elective procedures were predominantly performed for previous uterine scarring (62.5%) and fetal compromise, whereas emergency interventions were chiefly indicated for obstructed labor (30%) and cephalopelvic disproportion (20%). These patterns suggest systemic overreliance on surgical intervention, potentially reflecting gaps in labor management and limited VBAC implementation. To address this critical public health issue, we recommend: (1) rigorous application of evidence-based delivery guidelines, (2) capacity building for comprehensive labor monitoring, and (3) establishment of structured VBAC programs. Such multifaceted interventions could effectively reduce unnecessary cesarean deliveries while safeguarding maternal-fetal health outcomes in this population.

**Author Contributions:**

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Gathering and organizing data: Anfal Adnan Ahmed

Data analysis/interpretation: Alyaa Aziz Ahmed

Article composition: Sawsan Talib Salman

Critique the essay for significant ideas: Anfal Adnan Ahmed

Statistical analysis expertise: Alyaa Aziz Ahmed

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The authors indicate that this work does not use generative AI or AI-assisted technologies.

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