

Decision-to-Delivery Interval and Perinatal Outcomes Following Emergency Cesarean Section in Southern Ethiopia

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Abstract

Background:

A prolonged decision-to-delivery interval (DDI) during Emergency Cesarean Section (ECS) is a significant contributor to adverse perinatal outcomes in limited resource settings. The interval between the decision for an emergency cesarean section and the delivery of the fetus should be within 30 minutes. This study aimed to assess the decision-to-delivery interval and its associated perinatal outcomes at Hawassa University Comprehensive Specialized Hospital (HUCSH).

Methods:

An institution-based cross-sectional study was conducted from August to December 2025 among 284 women who underwent emergency cesarean delivery. A systematic sampling technique was applied to select the required samples. Data were collected through interview-administered questionnaires and medical record reviews. Descriptive statistics were used to summarize the findings. Binary logistic regression models were used to identify factors associated with prolonged decision-to-delivery interval (>30 minutes), and to assess its association with perinatal outcomes.

Results:

The mean age of participants was 28 ± 4.3 years. Only 16.5% of emergency cesarean sections achieved the recommended decision-to-delivery interval of ≤ 30 minutes, with a median decision-to-delivery interval of 55 minutes (IQR: 41-75). After controlling for potential confounding variables, a previous cesarean section (AOR=4.97, 95% CI: 2.50-9.88), delayed availability of surgical materials and drugs (AOR= 2.48, 95% CI: 1.10-5.64), decision-to-theatre arrival time >15 minutes (AOR = 5.06, 95% CI: 2.12-12.06), and incision-to-delivery interval >5 minutes (AOR =

3.11, 95% CI: 1.08-8.96) were independently associated with prolonged decision-to-delivery interval. Prolonged decision-to-delivery interval (>30 minutes) was significantly associated with a low first-minute Apgar score (COR = 3.47, 95% CI: 1.74–6.89).

Conclusion:

Most emergency cesarean sections did not meet the recommended decision-to-delivery interval of less than 30 minutes. Improving operating theatre readiness, securing the timely availability of surgical supplies, minimizing operating room transfer time, and enhancing intraoperative efficiency may help shorten the decision-to-delivery interval and improve neonatal outcomes.

Keywords: Decision-to-delivery interval; Emergency cesarean section; Perinatal outcomes; Emergency obstetric care; Southern Ethiopia.

Introduction

Emergency Cesarean Section (ECS) is a surgical procedure performed to deliver a fetus when vaginal delivery is unsafe for the mother or fetus after 28 weeks of gestation [1]. Timing is critical in emergency cesarean delivery to reduce maternal and fetal morbidity and mortality. The decision-to-delivery interval (DDI), defined as the time between the clinical decision for ECS and the delivery of the fetus, is a key indicator for evaluating the quality of emergency obstetric care [2,3]. The degree of urgency of a cesarean section is generally classified into 4 categories: category 1 involves an immediate threat to life (fetal or maternal); category 2 involves maternal or fetal compromise that is not immediately life-threatening; category 3 involves a need for early intervention, but no maternal or fetal compromise; and category 4 involves delivery planned at the convenience of the patient or the obstetric team [2].

Category 1 ECS should be performed within 30 minutes of the clinical decision [2]. Although this recommendation is widely accepted, achieving the recommended DDI remains a challenge in many low- and middle-income countries due to logistical, institutional, and resource-related constraints [4–6]. Data from several countries reveal significant delays in ECS services. According to studies conducted in Thailand, Tanzania, and Uganda, only 3.5%, 12.3%, and 2% of ECS met the recommended DDI threshold, respectively [7–9]. Similarly, a systematic review and meta-analysis of 25 studies conducted in various African countries showed that a pooled estimate of 10.23% of ECS achieved the recommended DDI [6]. In Ethiopia, Gamo Zone, Gondar, and Gojjam regions, only 21.5%, 17.5%, and 21.9% of ECS met the recommended DDI benchmark, respectively [10–12]. These findings show that delays in emergency obstetrics care remain common across both low- and middle-income countries.

A prolonged DDI during ECS represents a third delay in access to maternal health care and is associated with adverse maternal and neonatal outcomes, including birth asphyxia, low Apgar score, admissions to the neonatal intensive care unit (ICU), stillbirths, and physical and psychological trauma to the mothers [3,13,14]. Several studies have identified multiple factors associated with prolonged DDI, such as delay in theatre transfer, previous cesarean section, anesthesia-related delay, lack of

readily available surgical materials and drugs, intraoperative difficulties, and shortage of operating rooms [5,15,16].

Despite the growing trend of cesarean sections in Ethiopia, literature from the Sidama region evaluating DDI and its impact on perinatal outcomes remains limited. To help practitioners identify clinical gaps and apply findings to improve clinical practice, it is important to examine the magnitude of prolonged DDI and its impact on perinatal outcomes. Understanding these associations will provide valuable insights that could inform clinical decision-making and ultimately improve fetomaternal outcomes in similar low-resource settings. This study aimed to determine the magnitude of prolonged DDI, identify its associated factors, and assess its impact on perinatal outcomes among women undergoing ECS at Hawassa University Comprehensive Specialized Hospital (HUCSH).

Methods

Study design and participants

An institution-based cross-sectional study was conducted from August 1 to December 31, 2025, at HUCSH in Hawassa town, Sidama Regional State. HUCSH serves as the main tertiary referral center for the Sidama Region. The hospital provides obstetric services, averaging 4200 deliveries per year, and serves a population of approximately 18 million people. The obstetric care is provided by a team comprising consultant obstetricians, obstetrics and gynecology residents, and midwifery nurses.

Indications for cesarean section are primarily determined by junior residents and confirmed by senior residents or consultant obstetricians. Cesarean sections are performed by residents or consultant obstetricians, often with the assistance of junior residents or interns. Notes are made in the patient's file by the resident doctors, and the time and date of the decision to deliver by caesarean section are documented. The junior residents and midwifery nurses prepare the patient for the caesarean section. Preparation involves inserting a urinary catheter, administering intravenous fluids, and pre-operative antibiotics. The anesthesia team reviews the woman preoperatively. The woman is wheeled to the theater as soon as theater space is available. In the theater, the anesthetist documents various times on an anesthesia chart. The study was conducted among pregnant mothers who underwent ECS at HUCSH during the study period and excluded mothers who underwent elective caesarean section, mothers with Intrauterine Fetal Death (IUFD) and lethal congenital anomalies who underwent ECS, and women who were critically ill. Informed consent was obtained from each participant.

Sample size determination and sampling technique

The sample size was determined using two approaches. First, the single-population proportion formula was applied, using the reported proportion of ECS achieving the recommended DDI of 21.3% from a previous institutional study conducted in Gamo Zone, Ethiopia. Using a 95% confidence level, a 5% margin of error, and a 10% allowance for non-response, the calculation yielded 284 participants. Second, the sample size needed to identify factors associated with DDI was calculated using Epi

Info version 7, considering nighttime surgery as a key exposure variable, with an estimated AOR = 3.08 (95% CI: 1.04-9.07), 80% power, and a 5% significance level, yielding 237 participants [11]. Finally, a sample size of 284 was selected for this study. During the study period, an average of 650 women (130 per month × 5 months) were expected to deliver by ECS, based on prior service utilization records. To select the required sample of 284 participants, systematic random sampling was used. The first participant was randomly selected using a lottery method. Subsequently, every second mother was selected using a calculated sampling interval, rounded to 2 ($k = 2.3$; approximately $650/284$).

Variables and measurement

After reviewing relevant literature, a structured interviewer-administered questionnaire and a medical record review checklist were developed to collect data [10,11]. The questionnaire assessed socio-demographic characteristics and maternal obstetric factors, while institutional and healthcare provider-related factors, including time of decision for ECS, type of anesthesia, intraoperative difficulty, decision-to-theater arrival, time taken to give anesthesia, incision-to-delivery interval, and total decision-to-delivery interval, were extracted from medical records. Three data collectors were trained for two days, and close supervision was maintained during data collection. Interviews were conducted after delivery. All questionnaires were double-checked for consistency and completeness. In this study, the decision-to-delivery interval and adverse perinatal outcomes are the dependent variables. Independent variables were categorized into three primary groups; Socio-demographic related factors (age, occupation, educational level, average monthly family income, place of residence), obstetrics related factors (gravidity, parity, previous CS scar, antenatal care visits, gestational age, pregnancy complications, referral status, indication of ECS), facility and health care providers related factors (time of procedure, professional level of the surgeon, availability of operating room (OR) materials, delay in transferring to OR, free functional OR table, delay in obtaining consent, type of anesthesia given, intraoperative difficulty, anesthesia induction time, and incision-to-delivery interval).

Operational Definition

Decision-to-delivery interval (DDI): defined as the time between the clinical decision for ECS and the delivery of the neonate. A DDI of more than 30 minutes was considered prolonged [2,15].

Emergency cesarean section (ECS): a cesarean section performed when there is a maternal or fetal indication requiring unplanned, urgent delivery. In this study, NICE urgency categories 1 and 2 were included [2,15].

Adverse perinatal outcome: Presence of at least one of the following perinatal outcomes: stillbirth, first-minute APGAR score of less than seven, admission to the neonatal intensive care unit (NICU), and neonatal death [1].

Decision-to-operating room interval (Transfer time): The time from the decision for ECS to arrival in the operating theatre. A transfer time of more than 15 minutes was considered prolonged [3].

Operating room-to-incision interval (Anesthesia time): The time between the start of anesthesia and skin incision [17].

Incision-to-delivery interval (IDI): The time from skin incision to baby delivery. An IDI of more than 5 min was considered prolonged [3,17].

Data analysis

Data were entered and analysed using the Statistical Package for the Social Sciences (SPSS), version 26. Continuous variables were summarized using means and standard deviations or medians with interquartile ranges, while frequencies and percentages were used to summarize categorical variables. Logistic regression models were used to explore factors associated with dependent variables. Variables that yielded a p-value ≤ 0.25 in an unadjusted model were included in the fully adjusted models to control for confounding.

We further analysed the association of DDI with adverse neonatal outcomes in an exploratory fashion. The results of adverse perinatal outcomes were dichotomized into yes or no, depending on the outcomes. An unadjusted logistic regression model was fitted to determine associations. Model fit was assessed using the Hosmer–Lemeshow test. The strength of associations was reported using odds ratios (ORs) with corresponding 95% confidence intervals (CIs). Statistical significance was determined at a two-sided alpha level of 0.05.

Result

Socio-demographic characteristics of the respondents

In this study, 284 mothers who underwent emergency cesarean section at HUCSH achieved a 100% response rate. Among the study participants, 209 (73.6%) were aged 24-35 years, with a mean age of 28 ± 4.3 years. The majority of participants, 209 (73.6%), came from urban areas. Regarding educational status, 104 (36.6%) had a college/university degree, and 23 (8.1%) had no formal education. Most participants were married, 281 (98.9%), and 116 (40.8%) were housewives (**Table 1**).

Table 1: Socio-demographic characteristics of women who underwent emergency cesarean section at HUCSH, 2025 (n=284)

Variables	Category	Frequency	Percent(%)
Age	< 24 years	51	18.0
	24-35 years	209	73.6
	≥ 35 years	24	8.5
Place of Residence	Rural	75	26.4
	Urban	209	73.6

Educational status	No formal education	23	8.1
	Primary school	95	33.5
	Secondary school	62	21.8
	College /University	104	36.6
Occupation	Housewife	116	40.8
	Others	16	5.6
	Merchant	36	12.7
	Government employee	116	40.8
Marital status	Single	3	1.1
	Married	281	98.9
Religion	Orthodox	59	20.8
	Protestant	170	59.9
	Muslim	55	19.4
Monthly Household Income (in Birr)	<5000	140	49.3
	5000-10000	78	27.5
	≥10000	66	23.2

198

199 **Obstetric-related characteristics**

200 Among the study participants, 169 (59.5%) and 115 (40.5%) were multigravida and
201 primigravida mothers, respectively. A previous history of cesarean delivery was
202 reported in 103 (36.3%) of participants, and the majority, 271(95.4%), had ANC
203 follow-up in the current pregnancy. The commonest indication for ECS was Non-
204 Reassuring Fetal Heart Rate Pattern (NRFHRP) (41.9%), and 67.2% of deliveries
205 occurred at term (**Table 2**).

206 **Table 2: Obstetrics-related characteristics of women who underwent**
207 **emergency cesarean section at HUCSH, 2025 (n=284).**

Variables	Category	Frequency	Percent
Gravidity	Primigravida	115	40.5
	Multigravida	169	59.5
Parity	nulliparous	101	35.6

	Primiparous	104	36.6
	Multiparous	79	27.8
Previous cesarean section	Yes	103	36.3
	No	181	63.7
Antenatal care follow-up	Yes	271	95.4
	No	13	4.6
Any Complications during pregnancy	No Complication	174	61.3
	Hypertensive disorders	52	18.3
	PROM	24	8.5
	Antepartum hemorrhage	19	6.7
	Other	11	3.9
	PROM and APH	4	1.4
Birth preparedness and complication readiness counseling	Yes	215	75.7
	No	69	24.3
Referral status	Self-referred	204	71.8
	Referred from another health facility	80	28.2
Indication for ECS	NRFHRP	119	41.9
	Labor abnormality	59	20.7
	CPD	51	18
	APH	23	8.1
	MSAF with LFSOL	17	5.9
	Obstructed labor	8	2.85
	Cord prolapse	7	2.45
Gestational age of the current Pregnancy	Preterm	53	18.7
	Term	191	67.2

Unknown	40	14.1
gestational age		

Abbreviations: Non-Reassuring Fetal Heart Rate Pattern (NRFHRP); Premature Rupture of Membranes (PROM); Antepartum Hemorrhage (APH); Meconium-Stained Amniotic Fluid (MSAF); Latent First Stage of Labor (LFSOL); Cephalopelvic Disproportion (CPD)

Health system-related factors and adverse perinatal outcomes

The majority of surgical decisions (183, 64.4%) were made during the daytime, and in 58.5% of cesarean sections, OR materials and drugs were readily available. Junior residents performed most ECS (80.6%), and 92.6% had spinal anesthesia. Over two-thirds (71.8%) of mothers had decision-to-theater arrival intervals greater than fifteen minutes, and 47 (16.5%) of ECS were within the recommended DDI of ≤30 minutes. About 80.3% of women had a decision-to-delivery interval of 30 to 75 minutes, whereas 3.2% of ECS had decision-to-delivery times of more than 75 minutes. The median DDI was 55 minutes (IQR=41-75 minutes). A poor first-minute Apgar score was diagnosed in 19% of all newborns, and 16.2% of neonates were admitted to the NICU. About 3.2% of all newborns were stillborn, and early neonatal death occurred in 4.9% (**Table 3**).

Table 3 Health system-related factors and adverse perinatal outcomes of women who underwent emergency cesarean section at HUCSH, 2025 (n=284).

Variables	Category	Frequency	Percent
Time of decision made for surgery	Day	183	64.4
	Night	101	35.6
A free functional OR table was present while the women arrived in the OR	yes	229	80.6
	no	55	19.4
OR materials and drugs availability	Easily available	166	58.5
	Delayed availability	118	41.5
Availability of blood during the decision	Available	245	86.3
	Not available	39	13.7
Level of attending surgeon	Senior residents and consultants	55	19.4
	Junior residents	229	80.6

	(R3 and below)		
Immediate consent obtained	yes	274	96.5
	no	10	3.5
Type of anesthesia given	General	21	7.4
	Spinal	263	92.6
Intraoperative difficulty	yes	80	28.2
	No	204	71.8
Decision-to-theater arrival interval	≤15 minutes	80	28.2
	>15 minutes	204	71.8
Anesthesia induction time	≤10 minutes	208	73.2
	>10 minutes	76	26.8
Incision-to-delivery interval	≤ 5 minutes	144	50.7
	>5 minutes	140	49.3
Decision-to-delivery interval (DDI)	≤30 minutes	47	16.5
	30-75 minutes	228	80.3
	≥ 75 minutes	9	3.2
Adverse perinatal outcome	yes	123	43.3
	no	161	56.7
NICU admission	yes	46	16.2
	no	238	83.8
First minute Apgar score < 7	yes	54	19
	no	230	81
Stillbirth	yes	9	3.2
	no	275	96.8
Early neonatal death	yes	14	4.9
	no	270	95.1

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228 **Factors associated with prolonged decision-to-delivery interval**

229 Multivariable logistic regression analyses were performed to identify factors
 230 associated with prolonged DDI among pregnant women who underwent ECS at
 231 HUCSH (**Table 4**). After controlling for potential confounders, women with a previous
 232 cesarean section were nearly five times more likely to have prolonged DDI than
 233 those without a previous cesarean section (AOR=4.97, 95% CI: 2.50-9.88). Similarly,
 234 mothers who faced unavailability of surgical materials and drugs at the time of

decision were twice as likely to have prolonged DDI than those for whom materials and drugs were immediately available (AOR= 2.48, 95% CI: 1.10-5.64). Mothers whose decision-to-theatre arrival time exceeded 15 minutes had 5-fold higher odds of prolonged DDI than those transferred within 15 minutes (AOR = 5.06, 95% CI: 2.12-12.06). In addition, an incision-to-delivery interval of more than five minutes was associated with a threefold increase in the likelihood of prolonged DDI (AOR = 3.11, 95% CI: 1.08-8.96).

In contrast, residence, referral status, decision-making time, level of the surgeon, and anesthesia induction time showed no statistically significant association with prolonged DDI.

Table 4: Multivariable logistic regression analysis of factors associated with prolonged decision-to-delivery interval among women who underwent emergency cesarean section at HUCSH, 2025 (n=284)

Variable	Category	DDI ≤30 min n (%)	DDI >30 min n (%)	AOR (95% CI)	P-value
Residence	Urban	29	180	1	
	Rural	18	57	0.64 (0.28–1.46)	0.287
Previous cesarean section	No	42	139	1	
	Yes	5	98	4.97 (2.50 – 9.88)	< 0.001
Referral status	Self-referred	35	169	1	
	Referred from another facility	12	68	1.17 (0.57–2.41)	0.816
Time of decision made for surgery	Day	31	152	1	
	Night	16	85	1.14 (0.58–2.24)	0.702
Availability of surgical materials and drugs	Available immediately	37	129	1	
	Delayed availability	10	108	2.48 (1.10–5.64)	0.029

Level of attending surgeon	Senior residents/consultants	10	45	1	
	Junior residents (R3 and below)	37	192	1.21 (0.55–2.66)	0.634
Decision-to-theatre arrival interval	≤15 minutes	26	54	1	
	>15 minutes	21	183	5.06 (2.12–12.06)	<0.001
Anesthesia induction time	≤10 minutes	39	169	1	
	>10 minutes	8	68	1.42 (0.53–3.79)	0.483
Incision-to-delivery interval	≤5 minutes	39	105	1	
	>5 minutes	8	132	3.11 (1.08–8.96)	0.036

Bold value indicates statistical significance (p < 0.05)

Association of decision-to-delivery interval with adverse perinatal outcome

Table 5 summarizes the result of an unadjusted logistic regression model exploring adverse perinatal outcomes associated with DDI. Prolonged DDI was significantly associated only with low first-minute Apgar score (COR=3.47, 95% CI: 1.74–6.89, p < 0.001).

Table 5: Bivariate logistic regression for decision-to-delivery interval association with perinatal outcome among pregnant women who underwent emergency cesarean section at HUCSH, 2025

DDI	Perinatal outcome		COR	p-value
	NICU admission			
	Yes(N)	No(N)		
≤30 minutes	10	37	1	
>30 minutes	36	201	1.51 (0.69–3.30)	0.301†
	1 st minute APGAR_score			
	<7	≥7		
≤30 minutes	18	29	1	
>30 minutes	36	201	3.47 (1.74–6.89)	<0.001†
	Stillbirth			

	Yes	No		
≤30 minutes	3	44	1	
>30 minutes	6	231	2.63 (0.64–10.82)	0.173*
Neonatal death				
	Yes	No		
≤30 minutes	4	43	1	
>30 minutes	10	227	2.11 (0.63–7.05)	0.260*

* Fisher's exact test was used because of small, expected cell counts.

† Pearson's chi-square test

Bold value indicates statistical significance ($p < 0.05$).

Discussion

This study explored the magnitude of prolonged DDI during ECS at HUCSH in Southern Ethiopia and its associated factors. DDI is a critical time interval that determines the fetomaternal outcome in ECS [18]. This study found that only 16.5% of mothers who underwent ECS were delivered within the recommended 30-minute DDI, and the median DDI was 55 minutes (IQR: 41-75 minutes). These results align with studies from the University of Gondar (19.6%) and Debre Tabor (17.5%), as well as a systematic review and meta-analysis of 19 studies published between 2018 and 2022, which reported that only 3 achieved a 30-minute response time for ECS [12,14,17]. However, this rate is higher than estimates from South Africa (5.2%), Tanzania (12%), and Thailand (3.5%) [7,8,19], and lower than findings from India (29.1%), Sierra Leone (37 %), and from Gojjam Zone, Ethiopia (21.9 %) [10,20,21]. The comparable magnitude may be explained by the common challenges faced in low-resource settings, such as shortages of essential supplies, limited operating room availability, and limited staff. However, the discrepancy may be explained by differences in healthcare infrastructure, study populations, and referral patterns.

Mothers with a prior history of cesarean delivery were more likely to experience prolonged DDI than those without a prior cesarean section. This could be explained by anticipated technical difficulty due to adhesions, which would require additional time to release. This finding was supported by a previous study conducted in Uganda, Nigeria, and Singapore [15,16,22]. This information would be valuable for women considering a maternal-request caesarean delivery and could help them make an informed choice.

Delayed availability of surgical materials and drugs was another significant determinant of prolonged DDI. This finding underscored the need to maintain a continuous supply of essential surgical materials and medications for ECS. Limited hospital resources and inadequate supply chain management may contribute to such delays [23]. A study conducted at the Chinese University of Hong Kong concluded that if operational supplies were readily available, a DDI below 30 minutes would be

achievable [24]. This finding is consistent with a similar study conducted in India, Cameroon, and the Gamo Zone, Ethiopia [5,11,25].

A prolonged decision-to-theatre arrival was significantly associated with prolonged DDI. Delays in patient preparation, communication among healthcare providers, and transportation may contribute to prolonged transfer times. According to a systematic review and meta-analysis of 25 studies conducted in African countries, preparation and transfer to the operating theatre significantly prolongs DDI [6]. Similarly, a prolonged DDI was associated with an incision-to-delivery interval of greater than five minutes. In this study, the difficulty of dissecting surgical adhesions and other intraoperative challenges may extend the time from skin incision to delivery, thereby prolonging the overall DDI. This result highlights the need to improve surgical efficiency during ECS and aligns with a study conducted in Qatar [26].

Regarding perinatal outcomes, prolonged DDI was significantly associated with a poor first-minute Apgar score. This finding shows that the delay in ECS was associated with an increase in neonatal complications at birth, particularly in cases where the ECS indication was fetal distress; notably, nearly 42% of ECS in this study were performed with the indication of NRFHRP. Similar results have been reported from a study conducted in Bhutan and from Gojjam Zone, Ethiopia [10,27]. In contrast, a study conducted in India as well as in the Gamo and Gondar Zone of Ethiopia found no statistically significant association between prolonged DDI and perinatal outcomes [11,12,25]. The lack of associations between prolonged DDI and stillbirth or neonatal death in this study may be explained by low statistical power, given the small number of events. Future studies should include larger sample sizes or multicenter cohorts to increase statistical power and improve the ability to detect associations between prolonged DDI and adverse perinatal outcomes.

This study simultaneously evaluated both health system- and procedure-related factors contributing to prolonged DDI and examined their relationship with perinatal outcomes. The findings identify modifiable institutional delays, particularly operating theatre transfer and the availability of surgical materials, providing practical evidence to inform quality improvement initiatives aimed at optimizing emergency cesarean care in similar resource-limited settings.

Strengths and Limitations

This study provides context-specific evidence on DDI and associated perinatal outcomes. Nevertheless, several limitations should be acknowledged. First, the single-center, hospital-based design limits the generalizability of the findings to the wider community. Second, the cross-sectional design and exploratory nature of the analysis preclude inference regarding causal and temporal relationships. Third, time recordings extracted from medical records and anesthesia charts may be subject to documentation inaccuracies. Finally, the bivariate-only analysis of perinatal outcomes limits the ability to control for confounders.

Conclusion

This study found that only 16.5% of ECS met the recommended DDI of less than 30 minutes. Delays in the availability of surgical materials and drugs, a history of cesarean delivery, prolonged decision-to-theatre arrival time, and prolonged incision-to-delivery interval were significant predictors of prolonged DDI. In addition, prolonged DDI was significantly associated with a poor first-minute Apgar score. These results highlight the need to improve emergency obstetric care by securing timely availability of surgical supplies, minimizing operating room transfer time, and improving intraoperative efficiency to optimize neonatal outcomes.

Declarations

Abbreviations

APGAR	Appearance, Pulse rate, Grimace Activity, and Reflex
DDI	Decision-to-Delivery Interval
ECS	Emergency Cesarean Section
HUCSH	Hawassa University Comprehensive Specialized Hospital
ICU	Intensive Care Unit
IUFD	Intra Uterine Fetal Death
NICE	National Institute for Health and Care Excellence
NICU	Neonatal Intensive Care Unit
NRFHRP	Non-Reassuring Fetal Heart Rate Pattern
OR	Operating Room

Ethical approval

Before data collection, ethical clearance was obtained from the Institutional Review Board of Hawassa University College of Medicine and Health Sciences. A formal approval letter was obtained from the college's ethical review committee. The data collectors explained the significance of the study and the secure data management and privacy protocol before obtaining informed consent from each participant. Informed consent was obtained from each participant. All procedures were conducted in accordance with the ethical standards of the institutional research committee and the principles of the Declaration of Helsinki.

Consent for publication: Not applicable

Availability of data and materials: The datasets used during the current study are available from the corresponding author on reasonable request

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