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Original Article

Analysis of Category I Cesarean Section Response Time on Maternal-Neonatal Outcomes at Adam Malik Hospital Medan

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Abstract

Background : Maternal and neonatal mortality remain significant global health concerns. Category I cesarean sections are performed in life-threatening obstetric emergencies, with a recommended decision-to-incision interval (DII) of ≤30 minutes. The aims of this study was to evaluate the proportion of category I emergency cesarean sections performed ≤ 30-minute response time at Adam Malik Hospital, Medan, and to identify factors contributing to delays.

Methods : This retrospective cohort study included 44 consecutively selected cases of category I emergency cesarean sections performed at Adam Malik Hospital, Medan, between January 1 and December 31, 2023. Eligible cases involved immediate threats to maternal or fetal life and had complete documentation of surgical timings. Time data including decision-to-incision interval and its components were extracted from electronic medical records and cross-validated with operating room and delivery ward logs. The primary outcome was decision-to-incision interval (DII), dichotomized at 30 minutes. Variables associated with DII (p <0.25) were included in multivariate analysis using Firth's penalized logistic regression to account for small sample size and data separation.

Results : 43.2% of cases achieved a DII of ≤30 minutes. Multivariable analysis identified patient transfer time (AOR = 16.91, 95% CI: 2.19–358.36) and anesthesia duration (AOR = 27.21, 95% CI: 2.29–889.18) as significant predictors of delay. No significant associations were found between DII and adverse maternal or neonatal outcomes.

Conclusion : Delays in patient transfer and anesthesia were the main contributors to prolonged DII in emergency cesarean sections. While these delays did not significantly impact short-term clinical outcomes, targeted improvements in emergency obstetric workflows may help hospitals meet national response time standards and enhance quality of care.

Keywords : Emergency Caesarean Section, Decision to incision interval, Response time, Maternal Mortality rate, Neonatal mortality rate, Medan

INTRODUCTION

Maternal mortality rates remain high, with approximately 287,000 women dying during or after pregnancy and childbirth in 2020. Nearly 95% of all maternal deaths occurred in low- and lower-middle-income countries in 2020, and most of them were preventable.[1] In Indonesia, the 2020-2024 National Medium-Term Development Plan (RPJMN) targets reducing the maternal mortality ratio (MMR) to 183 per 100,000 births, down from 305 per 100,000 births.[2] Currently, Indonesia has an MMR of 189 per 100,000 live births, which is significantly higher than other countries in Southeast Asia.[3] In North Sumatra, maternal deaths in 2020 reached 195 per 100,000 live births, based on the population census long form.[4] According to data from the 2018 Sampling Registration System (SRS), 76% of maternal deaths occurred during labor and postpartum phases, with 24% during pregnancy, 36% during labor, and 40% postpartum. Over 62% of maternal and infant deaths occurred in hospitals.[5]

Based on data from the Central Statistics Agency (BPS), Indonesia's infant mortality rate (IMR) was 16.9 per 1,000 live births according to the 2020 population census, a 1.74% decrease compared to the previous year. Papua Province had the highest IMR at 38.17, while DKI Jakarta had the lowest at 10.38.[6] The high maternal mortality rate indicates that there is a need to improve the quality of antenatal care and delivery services. The National Institute for Health Care Excellence (NICE) divides emergency cesarean sections into four categories.[7] Category I cesarean section refers to a procedure where there is a direct threat to the life of the mother or fetus. The time from when the operation decision is made to the start of the surgical incision must be ≤ 30 minutes.[8]

Response time refers to the time required to respond to an incident. Specifically, the Decision to Incision Interval (DII) is the time elapsed (in minutes) from the obstetrician's decision to perform a cesarean section until the surgical incision is made.[9] While the response time system for category 1 cesarean sections has been implemented at Adam Malik Hospital, delays in achieving the target Decision-to-Incision Interval (DII) may still occur due to various contributing factors. According to the Indonesian Ministry of Health Regulation Number 30 of 2022, the national target is for 80% of category 1 cesarean sections to be performed within 30 minutes as a national indicator for hospital service quality. However, evidence from several Indonesian studies indicates that even vertical hospitals have struggled to meet this benchmark, and international literature similarly shows that few countries have achieved the 80% target. This suggests systemic and institutional barriers that warrant further investigation. Therefore, this study aims to evaluate whether Adam Malik Hospital meets the national DII performance target, to identify and analyze the factors contributing to delayed response times, and to assess how significantly these delays impact maternal and neonatal outcomes. By understanding these associations, the study seeks to inform targeted improvements in emergency obstetric care delivery.

METHODS

This retrospective cohort study was conducted at Adam Malik Hospital Medan, Indonesia, covering the period from January 1 to December 31, 2023. The study aimed to evaluate response times for category I cesarean sections and their associations with maternal and neonatal outcomes. All women undergoing emergency category I cesarean sections which defined as operations performed for immediate threats to maternal or fetal life were screened for inclusion. Indications included persistent fetal distress, umbilical cord prolapse, failed instrumental delivery (vacuum or forceps), signs of uterine rupture, antepartum hemorrhage with hypovolemic shock, placental abruption, and failed vaginal birth after cesarean (VBAC). Exclusion criteria were extrauterine pregnancies, major fetal anomalies, and maternal death occurring before the decision for cesarean section was made.

Time data were extracted primarily from electronic medical records and validated against operating room and delivery ward logs. Key time intervals were calculated from recorded timestamps and verified across data sources. Records with missing key timestamps (e.g., pediatric or anesthesia team arrival times) were excluded or flagged as incomplete to ensure accurate calculation of time intervals. No imputation or substitution was performed for missing values; only verifiable data were used. Cases were consecutively selected based on inclusion criteria, and only those with complete and internally consistent time data were retained for analysis (n=44). The primary outcome – decision-to-incision time – was defined as the interval from the clinical decision for cesarean delivery to the initial skin incision. This variable was first treated continuously, then dichotomized at >30 minutes to reflect clinically relevant delay. Component intervals were also calculated, including administrative preparation time (decision by obstetricians to anesthesia and/or pediatric consults answered), patient transfer time (decision to transfer to arrival in preoperative room), surgical preparation (arrival in preoperative room to anesthesia start), and anesthesia duration (start of anesthesia to incision). Regarding the maternal outcomes included postpartum hemorrhage (>1000 mL), blood transfusion, ICU admission, and in-hospital maternal death. Neonatal outcomes included low Apgar scores (<7 at 5 minutes), need for neonatal resuscitation, NICU admission, and neonatal death. These were extracted from surgery report and electronic medical records.

Descriptive statistics were used to summarize baseline characteristics. All analyses were performed using R version 4.3.0. Categorical variables were reported as frequencies and percentages, and continuous variables as medians with minimum and maximum due to non-normal distributions (verified by the Shapiro-Wilk test). To test the robustness of our delay definitions, alternative percentile thresholds (75^{th}, 90^{th}) were explored. In addition, log-transformed linear regression models were used to analyze decision-to-incision time as a continuous variable. These complementary analyses ensured that findings were not dependent on arbitrary dichotomization thresholds. The final delay-related predictors, we then dichotomized the variables based on the median of time distributions due to its robustness; for example, transfer delays were defined as durations exceeding 15.5 minutes. The univariate analysis including anesthesia type (general vs. regional) and time of operation (day vs. night) were done using chi-square and fisher exact tests. Variables with *p-value* <0.25 were included into the multivariable analysis and adjusted ORs (AORs) with 95% confidence intervals (CIs) were reported. Firth's penalized logistic regression was used to mitigate bias from small sample sizes and separation.

RESULTS

A total of 44 cases that met the inclusion criteria were included in this study, 9 cases (20%) originated from the

TABLE 1
Characteristics of subjects with category I cesarean section at Adam Malik Hospital Medan

Maternal Neonatal Characteristics	(n = 44)
Mother age (years old)	30.95 ± 5.92
Education	
Primary school	2 (4.5%)
Junior high school	9 (20.5%)
Senior high school	23 (52.3%)
Bachelor	9 (20.5%)
Uneducated	1 (2.3%)
Parity	
Primigravidae	11 (25.0%)
Secundigravidae	6 (13.6%)
Multigravidae	24 (54.6%)
Grande Multigravidae	3 (6.8%)
History of C-Section	
None	21 (47.7%)
1 time	8 (18.2%)
2 times	9 (20.5%)
3 times	6 (13.6%)
Gestational age (week)	34.54 ± 4.41
Aterm	21 (47.7%)
Preterm	23 (52.3%)
Birth weight (gram)	2.540 ± 772
Normal	25 (56.8%)
Low birthweight (<2500 gr)	14 (31.8%)
Very low birthweight (<1500 gr)	2 (4.5%)
Extremely low birthweight (<1000 gr)	3 (6.8%)

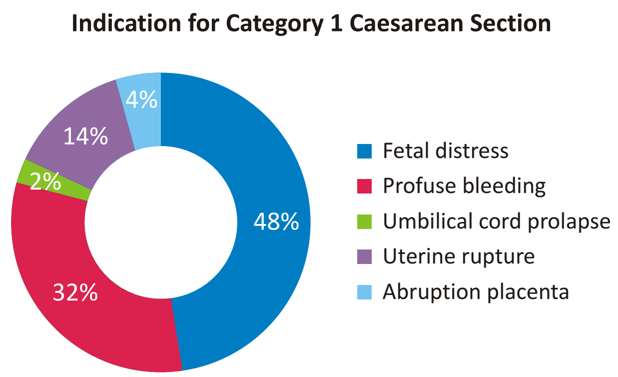

Figure 1. A pie chart shows indication of category 1 caesarean section in Adam Malik General Hospital Medan

TABLE 2
Response time and limitation to category I caesarean section

Response time and limitation	(n=44) (%)
Response time	
Decision to incision interval (median (min–max))	41 (22 – 250)
≤ 30 minute	19 (43.2%)
31 – 74 minute	16 (36.4%)
≥ 75 minute	9 (20.5%)
Factors affecting delay (median (min–max))	
Time for administration preparation	6 (2 – 79)
Time for transfer	15.5 (3 – 175)
Time for surgery preparation	13.5 (5 – 75)
Anesthesia time	15 (5 – 70)
Incision to delivery	15 (4 – 80)

obstetrics ward, while the remaining 35 cases (80%) were referred from the emergency department of Adam Malik Hospital in Medan. The monthly distribution of category I cesarean sections showed that August had the highest number of cases, with 7 cases (16%), while February and December each recorded only 1 case (2%). The demographic characteristics of the study population are presented in Table 1. The mean maternal age was 30.95 years with a standard deviation of 5.92 years. Most mothers had a high school level of education (52.3%), were multigravida (54.6%), and had no prior history of cesarean section (47.7%). The average gestational age was 34.54 ± 4.41 weeks, and the mean birth weight of the newborns was 2.540 grams ± 772 grams.

The indications for performing category I cesarean sections are illustrated in Figure 1. The three most common indications were fetal distress, which accounted for 21 cases (47.7%), profuse vaginal bleeding in 14 cases (31.8%), and uterine rupture in 6 cases (13.6%). The median decision-to-incision interval was 41 minutes, ranging from 22 to 250 minutes. A total of 19 mothers (43.2%) underwent surgery within 30 minutes, 16 mothers (36.4%) between 31 and 74 minutes, and 9 mothers (20.5%) after 75 minutes. The time required for instrument preparation had a median of 13.5 minutes, ranging from 5 to 75 minutes. Patient transfer required a median of 15.5 minutes, with the shortest time being 3 minutes and the longest 175 minutes. The duration of anesthesia had a median of 15 minutes, ranging from 5 to 70 minutes. Lastly, the time from incision to delivery of the baby was also a median of 15 minutes, with a minimum of 4 minutes and a maximum of 80 minutes (Table 2).

Table 3 presents the factors associated with delayed response time in category I cesarean sections. In the univariate analysis, patient transfer time, surgery

TABLE 3
Factors that affecting response time

Delaying factors	Response time ≤30 minute (n=19)	Response time >30 minute (n=25)	COR (95%CI)	*p-value*	AOR (95% CI)	*p-value*
Time of decision			1.026 (0.31 – 3.39)	0.967[a]	NA*	NA*
Working hour	9 (47.4%)	12 (48.0%)				
Shift hour	10 (52.6%)	13 (52.0%)				
Type of Anesthesia			3.82 (0.94 – 15.55)	0.088[b]	2.55 (0.28 – 44.83)	0.423
General	8 (42.1%)	4 (16.0%)				
Regional	11 (57.9%)	21 (84.0%)				
Administration prep			5.29 (1.42 – 23.91)	0.0144[b]	5.94 (0.87 – 74.06)	0.07
≤ 6 minutes	15 (79%)	10 (40%)				
> 6 minute	4 (21%)	15 (60%)				
Patient transfer time			15.06 (3.57 – 87.37)	0.0002[b]	16.91 (2.19 – 358.36)	0.005
≤ 15.5 minute	16 (84%)	6 (24%)				
> 15.5 minute	3 (16%)	19 (76%)				
Surgery prep			8.87 (2.31 – 42.06)	0.0019[b]	1.55 (0.17 – 12.56)	0.677
≤ 13.5 minute	15 (79%)	7 (28%)				
> 13.5 minute	4 (21%)	18 (72%)				
Anesthesia time			26.42 (4.29 – 709.71)	0.0001[b]	27.21 (2.29 – 889.18)	0.007
≤ 15 minute	18 (95%)	9 (36%)				
> 15 minute	1 (5%)	16 (64%)				

[a] = chi-square, [b]= fisher-exact, NA=Not included in multivariate model ($p > 0.25$ in univariate analysis); AOR = Adjusted Odds Ratio from multivariable Firth logistic regression; COR = Crude Odds Ratio from bivariate Firth logistic regression.

preparation time, anesthesia duration, and administration preparation time were significantly associated with whether the decision-to-incision interval was within or beyond 30 minutes. Patients with a transfer time of 15.5 minutes or less were significantly more likely to receive surgery within 30 minutes (COR: 15.06; 95% CI: 3.57–87.37; p = 0.0002), and this remained significant in the multivariate model (AOR: 16.91; 95% CI: 2.19–358.36; p = 0.005). Similarly, shorter anesthesia duration (≤15 minutes) was strongly associated with timely intervention (COR: 26.42; 95% CI: 4.29–709.71; p = 0.0001), and this association persisted after adjustment (AOR: 27.21; 95% CI: 2.29–889.18; p = 0.007). While surgery preparation time (≤13.5 minutes) showed a strong association in univariate analysis (COR: 8.87; 95% CI: 2.31–42.06; p = 0.0019), it was not statistically significant in the multivariate model (AOR: 1.55; 95% CI: 0.17–12.56; p = 0.677). Administration preparation time (≤6 minutes) was also significant in univariate analysis (COR: 5.29; 95% CI: 1.42–23.91; p = 0.0144) but lost significance after adjustment (AOR: 5.94; 95% CI: 0.87–74.06; p = 0.07). Neither time of decision (working hours vs. shift hours) nor type of anesthesia (general vs. regional) showed significant associations with response time and were excluded from the multivariate model due to *p-values* greater than 0.25 in univariate analysis.

In the Firth logistic regression analysis, none of the maternal or neonatal outcomes showed a statistically significant crude association with delayed decision-to-incision time, although maternal death approached significance (COR = 0.09, 95% CI: 0–1.04, p = 0.055). After adjusting for other clinical variables using multivariable Firth logistic regression, no significant adjusted associations were observed. Notably, neonatal resuscitation had an elevated, though imprecise, adjusted odds ratio (AOR = 7.13, 95% CI: 0.63–119.60, p = 0.112), suggesting a potential signal that warrants further investigation. Other outcomes such as transfusion, low

TABLE 4
Comparison of maternal and neonatal outcomes based on decision to incision interval

Outcomes	Decision to incision interval		COR (95% CI)	*p-value*	AOR (95% CI)	*p-value*
	≤30 minute (n=19)	>30 minute (n=25)				
Maternal						
Estimated blood loss > 1000 mL			0.55 (0.16 – 1.87)	0.366[a]	1.31 (0.15 – 11.55)	0.800
Yes	8 (42.1%)	7 (28.0%)				
No	11 (57.9%)	18 (72.0%)				
Blood Transfusion			0.72 (0.22 – 2.31)	0.578[a]	1.25 (0.21 – 0.45)	0.818
Yes	10 (52.6%)	11 (44.0%)				
No	9 (47.4%)	14 (56.0%)				
Hysterectomy**			0.66 (0.19 – 2.21)	0.495[a]	–	–
Yes	8 (42.1%)	8 (32.0%)				
No	11 (57.9%)	17 (68.0%)				
Maternal death			0.09 (0 – 1.04)	0.0547[b]	0.14 (0 – 2.56)	0.197
Yes	3 (15.8%)	0 (0%)				
No	16 (84.2%)	25 (100.0%)				
Neonatal						
APGAR <7			0.52 (0.14 – 1.81)	0.3[b]	0.76 (0.11 – 4.76)	0.765
Yes	7 (36.8%)	4 (16.0%)				
No	12 (63.2%)	21 (84.0%)				
Resuscitation			1.41 (0.42 – 4.94)	0.582[a]	7.13 (0.63 – 119.6)	0.112
Yes	6 (31.6%)	10 (40.0%)				
No	13 (68.4%)	15 (60.0%)				
NICU admission			1.07 (0.33 – 3.54)	0.907[a]	0.33 (0.03 – 3.15)	0.332
Yes	8 (42.1%)	11 (44.0%)				
No	11 (57.9%)	14 (56.0%)				
Neonatal death			0.30 (0.08 – 1.03)	0.0549[a]	0.29 (0.03 – 1.97)	0.207
Yes	10 (52.6%)	6 (24.0%)				
No	9 (47.4%)	19 (76.0%)				

[a] = chi-square, [b]= fisher-exact; AOR = Adjusted Odds Ratio from multivariable Firth logistic regression; COR = Crude Odds Ratio from bivariate Firth logistic regression. **The variable Hysterectomy was excluded from the multivariable model due to collinearity or model convergence limitations.

Apgar score, NICU admission, and neonatal death also demonstrated no statistically significant associations with surgical delay. These findings may reflect limited statistical power due to the small sample size (n = 44), and thus larger studies are needed to confirm or refute these trends (Table 4).

DISCUSSION

In this study, we found that mothers who underwent category 1 cesarean sections had a mean age of 30.95 ± 5.92 years. This finding can be compared with several international studies on similar populations. For instance, a study by Andisha and Cronje in South Africa involving

153 patients who underwent category 1 cesarean sections reported that 52.9% of the mothers were aged between 2029 years, and 69.3% had a gestational age of 37–42 weeks.[10] Similarly, a retrospective cross-sectional study by Dorjey *et al*. at a tertiary hospital in Bhutan analyzed 78 category 1 cesarean sections performed in 2020.[11] most mothers were between 26–35 years old, with 47.4% being multigravida and 74.4% delivering at term. In another study conducted by Wangwe *et al*. in a Tanzanian tertiary hospital, 427 emergency cesarean sections were performed over a three-month period, of which 40 were classified as category 1.[12] Among these, 37% of the patients were aged 25–29 years, 65.6% had a parity of 2–4, 45.7% had a primary school education, and 65.3% were at term (gestational age 37–42 weeks). These comparative findings highlight variations in maternal demographics across different regions, underscoring the importance of local context in obstetric care and response system evaluations.

The most common indication for category I cesarean section was fetal distress, with decision-to-incision interval (DII) ranging from 22 to 250 minutes, and a median of 41 minutes. Similar indications have been reported in previous studies. For example, Shahwar *et al*. conducted a study at a tertiary hospital in Pakistan and identified only two primary indications for category I cesarean sections: fetal distress (59 cases) and placental abruption (34 cases).[13] Likewise, a retrospective cohort study by Dunn *et al*. in Singapore involving 390 pregnant women found that fetal distress was the leading indication (61.8%), followed by breech presentation (13.3%), umbilical cord prolapses (8.7%), and placental abruption (8.5%).[14] Response times for category I cesarean sections have also been documented in various studies. Dunn *et al*. reported a mean DII of just 9.4 ± 3.2 minutes, with a mean transfer time of 3.9 ± 2.6 minutes, anesthesia time of 3.3 ± 2.2 minutes, and surgery start time of 2.3 ± 1.3 minutes.[14] However, longer response times exceeding 30 minutes are more commonly reported in studies from developing countries. In the present study, one extreme case recorded a DII of 250 minutes. This patient, previously hospitalized for third-trimester abnormal vaginal bleeding, developed fetal distress while being treated in the obstetric ward. The significant delay was attributed to several logistical challenges: the obstetric ward was located in a separate building far from the operating theater, and both the anesthesia and perinatology teams were occupied with other emergencies during the night shift. Additionally, administrative preparations and the physical transfer of the patient contributed to the prolonged delay.

In the study by Dorjey *et al*.[11], only 29.5% of patients underwent category I caesarean section within the recommended 30-minute decision-to-delivery interval (DDI). Their reported median times were: transfer 13 (12–15) minutes, anesthesia 20 (15–28) minutes, anesthesia-to-delivery 3 (2–5) minutes, and total delivery time 25 (23–30) minutes. Similarly, Wangwe *et al*.[12] found a mean DDI of 126.73 minutes, with only 0.5% of cases meeting the ≤ 30-minute target. Kitaw *et al*.[1] reported that just 20.3% of procedures met the recommended interval. Our study showed a slightly better outcome, with 43.2% of cases achieving a response time ≤ 30 minutes, a higher proportion than in previous studies. Yeni *et al*.[1], at Zainoel Abidin Hospital, reported a mean response time of 36.29 ± 8.59 minutes for 19 eligible category I cases, while Gunawan *et al*.[1] at Sardjito Hospital observed a much higher mean of 115 ± 52 minutes, with only 40% of cases falling within 30–90 minutes.

In our bivariate analysis, several factors were associated with response time delays, including administrative preparation, transfer time, surgical setup, and anesthesia. However, multivariate analysis identified only transfer time and anesthesia as statistically significant contributors. These findings are supported by Kitaw *et al*.[1], who noted that transfer time (AOR = 5.26, 95% CI: 2.65–10.46), referral status, and type of anesthesia significantly impacted DDI. Similarly, Tebeu *et al*.[1] and Temesgen *et al*.[1] reported transfer delays and surgical preparation as significant contributors to DDI >30 minutes. Chow *et al*.[2] also emphasized patient transfer and theater preparation as key delays ($p < 0.001$), as did Mariam *et al*.[21]. The wide confidence intervals in multivariate analysis likely stem from a small sample size––only 44 category I caesarean sections were performed over one year––highlighting a limitation in our study. Additionally, accurate DII records were only available from January 2023 onward.

Regarding maternal outcomes, we found no significant differences in postoperative bleeding, transfusion, or hysterectomy between the ≤ 30 and > 30-minute groups. However, maternal mortality was higher in the ≤ 30-minute group (3 cases), this may occur because the severity of patients in the ≤ 30 minutes group is generally more severe than in the group with response times >30 minutes. 3 cases were diagnosed with respectively loss of consciousness d/t massive bleeding ec placenta accreta spectrum, profuse bleeding ec placenta accreta spectrum, and profuse bleeding ec placenta accreta spectrum with anemia (6.0 gr/dL). So the maternal condition before the caesarean section was already in a poor prognosis condition, it can be said that whether the surgery was carried out or not, the possibility of maternal death remains equally high.

For neonatal outcomes, there were no significant differences in 5-minute APGAR scores, resuscitation, NICU admission, or mortality. This contrasts with Yeni *et al*.[1], who reported significant differences in fever, ICU need, and maternal mortality favoring the ≤ 30-minute group. Their study also found worse neonatal outcomes––including APGAR scores, NICU need, and intubation––in the > 30-minute group. On the other hand, Dorjey *et al*.[11] reported no significant differences in maternal or neonatal outcomes between groups, although neonates in the ≤30-minute group had more frequent low 1-minute APGAR scores and meconium presence. Grace *et al*.[22] found worse neonatal outcomes overall in category I versus non-category I caesareans but did not analyze outcomes by DDI. Radhika *et al*.[23] similarly found no significant neonatal outcome differences between DDI ≤ 30 and > 30-minute groups. While our findings align with previous studies showing that response time frequently exceeds 30 minutes, we observed a comparatively higher proportion of timely interventions. Maternal and neonatal outcomes were largely similar across groups, except for maternal mortality, which may reflect greater clinical severity in faster-managed cases. Differences across studies may be due to variations in patient characteristics, severity, and sample sizes. Future research with larger, more representative samples and improved recordkeeping is recommended to validate and generalize these findings.

This study contributes valuable insights into the real-world execution of category I caesarean sections in a tertiary hospital in Indonesia, particularly in terms of documenting detailed delay components and exploring both maternal and neonatal outcomes. The inclusion of multivariate analysis allowed us to adjust for confounding variables and better identify independent factors contributing to delayed response times. However, several limitations must be acknowledged. The small sample size may have limited the statistical power to detect differences, especially in maternal and neonatal outcomes. Additionally, the retrospective nature of the study, reliance on hospital records, and incomplete DII documentation prior to 2023 may have introduced information bias. The study was also conducted in a single center, which may limit its generalizability to other settings with different logistical challenges or healthcare infrastructure. Furthermore, while maternal mortality was higher in the ≤ 30-minute group, we were not able to explore individual clinical trajectories or contextual factors underlying those deaths. Similarly, extreme delay cases (e.g., DII >75 minutes or the 250-minute case) deserve more in-depth qualitative assessment in future research. Prospective, multi-center studies with larger samples and richer clinical data are recommended to validate and extend these findings. For further study, after we have done evaluating decision to incision interval (DII), we will proceed to next step to evaluate decision to delivery interval (DDI) for better performance in our hospital settings.

CONCLUSION

This study found that (43.2%) of category I caesarean sections were performed within the recommended 30-minute Decision-to-Incision Interval (DII), reflecting persistent delays despite slightly better performance compared to previous studies. Transfer time and anesthesia were identified as the most significant contributors to these delays. While no statistically significant differences were observed in maternal and neonatal outcomes between those managed within and beyond 30 minutes, the higher maternal mortality rate in the ≤ 30-minute group suggests that clinical urgency may have influenced response time prioritization. These findings underscore the need for systematic improvements in emergency response processes, particularly in patient transfer and anesthesia initiation. Strengthening these aspects may improve timely delivery and potentially enhance outcomes in high-risk obstetric cases. Further research with larger samples and more comprehensive data collection is recommended to confirm and expand upon these findings.

REFERENCES

1. Shahid Ali S. Maternal Mortality Rate. Vol. 02, Journal of Pregnancy and Child Health. 2015 [cited 2024 Apr 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/maternal-mortality
2. Badan Pusat Statistik. Profil Kesehatan Ibu dan Anak 2022. Badan Pusat Statistik. 2022
3. United Nation Population Funds UNFPA. Strengthening Data to Reduce Maternal Deaths in Indonesia. 2023 [cited 2024 Apr 24]. Available from: https://indonesia.unfpa.org/en/news/strengthening-data-reduce-maternal-deaths-indonesia
4. Badan Pusat Statistik. Sensus Penduduk 2020. BpsGoId. 2023;(27):152. Available from: https://papua.bps.go.id/pressrelease/2018/05/07/336/indeks-pembangunan-manusia-provinsi-papua-tahun-2017.html
5. Kementrian Kesehatan RI. Kemenkes Perkuat Upaya Penyelamatan Ibu dan Bayi Sehat Negeriku. 2021 [cited 2024 Apr 24]. Available from: https://sehatnegeriku.kemkes.go.id/baca/umum/20210914/3738491/kemenkes-perkuat-upaya-penyelamatan-ibu-dan-bayi/
6. Badan Pusat Statistik Indonesia. Sensus Penduduk 2020 - Indonesia. 2023;(09):1–44. Available from: http://sp2010.bps.go.id/
7. National Institute for Health and Care Excellence (NICE). Caesarean birth (NG192). 2021. Available from: www.nice.org.uk/guidance/ng192
8. Kementrian Kesehatan RI. Peraturan Menteri Kesehatan Republik Indonesia Nomor 30 Tahun 2022 Tentang Indikator Mutu Pelayanan Kesehatan. Indonesia; 2022. Available from: www.peraturan.go.id
9. Pengurus Pusat Perkumpulan Obstetri dan Ginekologi Indonesia (POGI). Panduan Klinis Seksio Sesarea. Jakarta; 2022
10. Andisha E, Cronjé L. Evaluating the decision-to-delivery interval in category 1 emergency caesarean sections at a tertiary referral hospital. S Afr J Obstet Gynaecol. 2019;25(3):95–9
11. Dorjey Y, Tshomo Y, Wangchuk D, Bhandari P, Dorji C, Pradhan D, *et al*. Evaluation of decision to delivery interval and its effect on feto-maternal outcomes in Category-I emergency cesarean section deliveries in Phuentsholing General Hospital, 2020: A retrospective cross-sectional study. Health Sci Rep.

2023;6(1):1–11.
12. Wangwe P, Kibwana M, August F, Kikula AI. Decision to delivery interval, maternal and fetal outcomes in emergency caesarean sections in a tertiary teaching hospital, Dar es salaam, Tanzania. Afr Health Sci. 2023;23(3):17–26
13. Dur-e-Shahwar, Ahmed I, Amerjee A, Hoodbhoy Z. Comparison of neonatal outcomes between category-1 & non-category-1 primary emergency cesarean section: A retrospective record review in a tertiary care hospital. Pak J Med Sci. 2018;34(4):823–7
14. Dunn CN, Zhang Q, Sia JT, Assam PN, Tagore S, Sng BL. Evaluation of timings and outcomes in category-one caesarean sections: A retrospective cohort study. Indian J Anaesth. 2016;60(8):546–51.
15. Kitaw TM, Limenh SK, Chekole FA, Getie SA, Gemeda BN, Engda AS. Decision to delivery interval and associated factors for emergency cesarean section: a cross-sectional study. BMC Pregnancy Childbirth. 2021;21(1):1–7
16. Yeni CM, Hasanuddin H, Maharani CR, Maulida NF. Evaluasi Response Time Seksio Emergensi Kategori I Terhadap Luaran Maternal dan Neonatal Dengan Tersedianya Alur Pelayanan Seksio Sesarea Emergensi Di RSUDZA Juli-Oktober 2021. J Med Sci. 2022;3(1):10–8
17. Gunawan T, Attamimi A, Pradjatmo H. Hubungan Response Time Seksio Sesarea Emergensi Kategori 1 dengan Luaran Perinatal di RSUP Dr.Sardjito. Jurnal Kesehatan Reproduksi. 2018;5(1):60
18. Tebeu PM, Tchamte CN, Kamgaing N, Antaon JSS, Mawamba YN. Determinants of the decision to incision interval in case of emergency caesarean section in Yaoundé' hospitals. Afr Health Sci. 2022;22(2):511–7
19. Temesgen MM, Gebregzi AH, Kasahun HG, Ahmed SA, Woldegerima YB. Evaluation of decision to delivery time interval and its effect on feto-maternal outcomes and associated factors in category-1 emergency caesarean section deliveries: Prospective cohort study. BMC Pregnancy Childbirth. 2020;20(1):1–11.
20. Chow KM, Mak SL. Maternal and Fetal Outcomes in Extremely Urgent Caesarean Delivery in Relation to the Decision-to-delivery Interval. Hong Kong J Gynaecol Obstet Midwifery. 2015;15(1):16–22.
21. Maducolil MK, Ajmal S, Alzebdeh EA, Abdel Rahim AY, Ali Rudwan EM, Joel S, *et al*. Category 1 cesarean section decision to delivery interval: the causes of delay and impact on neonatal outcomes. International Journal of Pregnancy & Child Birth. 2021;7(4):98–104.
22. Grace L, Greer RM, Kumar S. Perinatal consequences of a category 1 caesarean section at term. BMJ Open. 2015;5(7):1–6
23. K Radhika, E Gomathy. A prospective observational study on decision to delivery interval and perinatal outcome in emergency caesarean section in tertiary care hospital. International Journal of Clinical Obstetrics and Gynaecology. 2021;5(1):19–25