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Original Research

Early Delivery Decision, Delivery Complication and Its Associated Factors Among Mothers Who Underwent Emergency Cesarean Section in Dire Dawa Health Facilities: Prospective Follow Up Study

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Abstract

Background: The unpredictable nature of childbirth is why emergency obstetric care has been called the keystone in the arch of safe motherhood. Knight defines the third delay as failure to receive adequate and appropriate care once a mother reaches a health facility. The objective of this study was to assess the current average decision-to-delivery interval for emergency cesarean sections (EmCS) and to propose an optimum, realistic, and feasible time frame within which caesarean sections should be performed following the decision.

Methods: An institution-based cross-sectional study was carried out from March to June 2024 in Dire Dawa city hospitals, Eastern Ethiopia. A systematic random sampling technique was used to select 414 study participants. The collected data was entered into the Kobo tool and then exported into SPSS version 25.0 for data analysis. Then, binary logistic regression analysis was carried out to identify the association between dependent and independent variables at a confidence interval of 95% and a significance level of P-value < 0.05.

Results: A total of 405 women who underwent emergency cesarean section were recruited. The median decision delivery interval was 65 (35, 115) minutes. Only 57 (14.1%) with (95% CI: 10.67, 17.48) of EmCS were operated within 30 min from decision time. Need to stabilize (AOR = 3.017, 95% CI: 1.004, 9.06); week of working day (AOR = 2.69, 95% CI: 1.006, 7.22); anesthesia time (AOR = 2.914, 95% CI: 1.24, 6.81); and presence of materials (AOR = 4.05, 95% CI: 1.64, 9.96) were positively associated with the decision to delivery interval.

Conclusion: Decision-to-delivery interval within the recommended time is not achieved. Being a marital status, antenatal care follow-up, place of residency, patient need for stabilization, material in the labor ward, and week of the day emergency cesarean section was performed are associated factors of the decision-to-delivery interval. So that all health professionals need to engage in improving the decision-to-delivery interval by designing different strategies for patients who need stabilization before operation, the health providers facilitate the antenatal care follow-up.

Keywords: Caesarean Section, Decision to Delivery, Delivery Complication, Early Delivery

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1. Introduction

Emergency cesarean section (EmCS) can be a life-saving procedure if pregnant women experience abnormal conditions in the process of vaginal delivery. Deciding to perform EmCS is complicated process, occurring only in specific obstetric conditions, and requires awareness & rapid assessment of the risky situation [1]. Life-threatening situations may develop rapidly and without warning, often in previously uncomplicated pregnancies. It is because of the unpredictable nature of childbirth that emergency obstetric care has been called the 'keystone in the arch of safe motherhood.' Knight defines the third delay as failure to receive adequate and appropriate care once a mother reaches a health facility [2].

The decision-to-delivery interval is the duration from the time when the decision to birth a baby by emergency cesarean section is made to the time the baby is birthed [3]. It is a key indicator of the quality of obstetric care and affects perinatal outcomes [4]. The World Health Organization recommends a decision-to-delivery interval of 30 to 75 minutes depending on the context [5]. According to the Royal College of Obstetricians and Gynecologists and the American College of Obstetricians and Gynecologists, the decision-to-delivery interval for emergency cesarean sections should be within 30 minutes, and it is an indicator of the quality of care in maternity service, and if prolonged, it constitutes a third-degree delay [6].

The current global maternal mortality ratio (MMR) (223/100,000 live births) is unacceptably high, and the vast majority, 94%, of these deaths occur in low and middle-income countries [7]. At the global level, in 2020, an estimated 287,000 women globally died from a maternal cause, equivalent to almost 800 maternal deaths every day and approximately one every two minutes. Sub-Saharan Africa accounts for 70% of global maternal deaths and 43% of global newborn deaths [8]. Ethiopia is among the 16 Sub-Saharan countries with the highest MMR of 412 per 100,000 live births. The differences in MMR between low- and high-income countries arise from differences in healthcare service utilization and in the quality of care provided [9].

The three delays increase the risk of maternal death because of the delay in deciding to seek health care (first delay), delay in reaching a health facility (second delay), and delay in receiving medical care timely and appropriately once reached in a health facility (third delay) [10]. The first two delays are related to demand-side barriers that prevent women from utilizing and accessing delivery services [11]. The third delay in accessing maternal health care is closely linked to various factors associated with health facilities and the quality of care provided. These

factors encompass the absence of emergency obstetric care services and supplies, shortage of trained staff, poor management of emergency obstetric care provision, long waiting times, poor referral practices, and poor coordination among staff [12]. In low-income countries, a considerable number of mothers died or faced adverse maternal outcomes after they had reached healthcare facilities [13].

In Ethiopia, the emergency cesarean section rate is high; this results in psychological and physical trauma to the mother. However, similar to other developing nations, poor neonatal outcomes after delivery by EmCS are high [14]. In case of an emergency cesarean section, an early delivery decision must be considered to be completed in the target. Early delivery decision remains an important indicator for evaluating the quality of maternity care in EmCS. Currently, there is a paradigm shift from the first and second phase delays to the third phase delay as the main contributor to maternal mortality [15].

In Ethiopia, the Maternal Death Surveillance Report (MDSR) analysis showed that delay three was cited in 48.6% of the total report of maternal deaths, which was higher than the previous year's report [16]. Different factors to receive care in a health facility affect not only the outcomes at the facility level but also in the community by providing feedback for subsequent decision-making to utilize emergency obstetric care [17].

This study was designed to describe the current average time interval between decision and delivery of the baby by EmCS and propose an optimum, realistic, and feasible time frame within which cesarean sections should be conducted after a decision has been made. Data got from this study will help us to better establish attainable early delivery decision standards for EmCS in our settings for mothers (pregnant), DDRHB, health professionals, and academics. It will also help us better estimate the magnitude of delays. The results from the study will inform modification of policy on optimum early delivery decisions in Ethiopia and other similar low-resource settings for all stakeholders.

2. Methods and Materials

2.1. Study Area, Period and Design

The study was conducted in Dire Dawa city hospitals on emergency cesarean section patients. In Dire Dawa, city hospitals are located 515 kilometers from Addis Ababa, the capital city of Ethiopia. Dire Dawa city has different hospitals. This city has seven hospitals (two governmental and five private); among these are one referral hospital, two general hospitals,

and four primary hospitals. These hospitals service a population of over 565,865 and have a total of 319 skilled birth attendants. All these hospitals have 195 beds for labor and delivery services and approximately 12,500 deliveries per year. The hospitals have a different specialty. In the operation room there are different specialty departments. An institution-based cross-sectional study was conducted from March to June 2024 in Dire Dawa city health facilities.

2.2. Population

All women who underwent EmCS at Dire Dawa City Hospitals were the source population, and all women who underwent EmCS during the study period at Dire Dawa City Hospitals were the study population. All women who will give birth by emergency cesarean section were included in the study. A diagnosis of intrauterine fetal death before the decision for CD was a reason for exclusion (most of these exclusions were for surgeries for a ruptured uterus). Women with incomplete records on delivery model as well as women with mental illness were excluded from the study.

2.3. Sample Size Determination and Sampling Procedure

Sample size was determined using the double population formula by using Epi Info version 7 by considering the following assumptions: confidence interval (CI) 95%, power 80%, ratio 1:1, and non-response rate 10%. The factors were taken from a previous study conducted in Bahir Dar, Debre Tabor, and Southern Ethiopia [6,18]. So, the final sample size for this study was 376, and by assuming a 10% non-response rate, the sample size was 414.

The sample size was proportionally allocated to each hospital by using K=n/N. The total number of cases within two months in 2023 before the data collection period was 920 in Dilchora Referral Hospital (DCRH), Sabian General Hospital (SGH), Delt General Hospital (DGH), Art General Hospital (AGH), Bilal General Hospital (BGH), Eftu Hospital (EH), and Central Hospital. Finally, a systematic random sampling technique was used to recruit the study participants.

2.4. Variables of the Study

2.4.1. Dependent Variables

- Early delivery decision

2.4.2. Independent Variables

- Socio-demographic factors, obstetric related factors, Operation room related factors:

2.5. Measurement Definitions

Emergency cesarean section: is an unplanned operation to birth your baby, pregnant women with life-threatening conditions of the mother and/or fetus [6,19].

Decision to delivery interval: After calculating to the minute, 30 min was used as a cutoff point to say recommended/delayed [6,20].

Transfer time: The time taken from the decision for EmCS to arrival in the operation theater and 15 min was used as the cut-off point to say delayed or not [6].

2.6. Data Collection Tools and Procedures

An interviewer-administered questionnaire, after reviewing different literatures, validated the questionnaire, which was conducted in Bahir Dar with a similar title [6], and a chart review checklist and a structured interviewer-administered questionnaire were used for data collection from mothers in the postnatal ward. First, the English version of the questionnaire was prepared. Then it was translated to Amharic, Afan Oromo, and Af Somali versions of the language and then translated back to English to check its consistency.

Based on mothers' EmCS order of registration in the delivery registration book, the systematic random sampling technique was used to select mothers for interview. Data was collected by reviewing mothers' chart variables such as presence of cesarean scar, referral status, indication of EmCS, time of day, and day of the week of EmCS.

2.7. Data Processing, Analysis and Interpretation

The collected data were entered and cleaned using ODK, then exported to SPSS version 25.0 for analysis. Descriptive analysis was conducted to summarize the data, and the final result of the study was interpreted in the form of text, figures, and tables. Binary logistic regression analysis was executed to see the association between independent and dependent variables.

All explanatory variables with $p<0.2$ in binary logistic regression were entered into multivariable logistic regression analysis, and significant associations were identified based on $p<0.05$ and odds ratio with 95% CI in multivariable logistic regression. The final model fitness was checked using Hosmer-Lemeshow Goodness of Fit.

3. Results

3.1. Socio-Demographic Characteristics

A total of 405 parturient women were involved in the study with a 396 (97.83%) response rate. The mean age of the participants was 29.07 years with a range of 17-37 with an SD of 4.718. Most of the participants, 372 (91.9%), were in the age group of 17-34 years. Most of the patients were married 323 (79.8%), and about 148 (36.5%) were housewives (Table 1).

Table 1: Socio-demographic characteristics of parturient undergoing emergency cesarean section, at Dire Dawa hospitals, 2023/2024, (n=405).

Variable	Categories	Frequency (Percentage %)
Age in year	15-19	38 (9.4)
	20-24	115 (28.4)
	25-29	153 (37.8)
	30-34	66 (16.3)
	>35	33 (8.1)
Residency	Rural	123 (30.4)
	Urban	282 (69.6)
Marital status	Single	82 (20.2)
	Married	323 (79.8)
Educational status	No formal education	48 (11.9)
	Primary school	70 (17.3)
	Secondary school	98 (24.2)
	College and university	189 (46.7)

3.2. Obstetrical Characteristics of Respondents

The majority of the parturient, 160 (39.5%), had three visits during the ANC follow-up, whereas 258 (63.7%) had a previous uterine scar (Table 2).

Table 2: Obstetrics characteristics among parturient undergoing emergency cesarean section, at Dire Dawa hospitals, 2023/2024, (n= 405).

Characteristics	Categories	n(%)
Gravidity	Primigravida	107(26.4)
	Multigravida	298(73.6)
Parity	Nulliparous	200(29.4)
	Primiparous	114(28.1)
	Multiparous	91(22.5)
ANC follow	First visit	27(6.7)
	Second visit	60(14.8)
	Third visit	160(39.5)
	Fourth and above	158(39)
Scared Uterus	Yes	258(63.7)
	No	147(36.3)

3.3. Operation Room Related Characteristics

From preoperative factors, the majority of the decisions and surgeries were done by senior surgeon 213 (52.6%), whereas the patients needed stabilization before the operation 386 (95.3%), and the material needed for EmCS preparation was available at the labor ward for 289 (71.4%) women. When I see the intraoperative, the operation tables were busy for 6 (1.5%) cases, and the majority of the patients were given regional anesthesia, 367 (90.6%).

3.4. Indications for Emergency Cesarean Section

About 108 (26.6%) of participants had an emergency cesarean section with the diagnosis of fetal distress, 16.3% with 8.1% of fetal bradycardia and 2.2% of NRFHB (Figure 1).

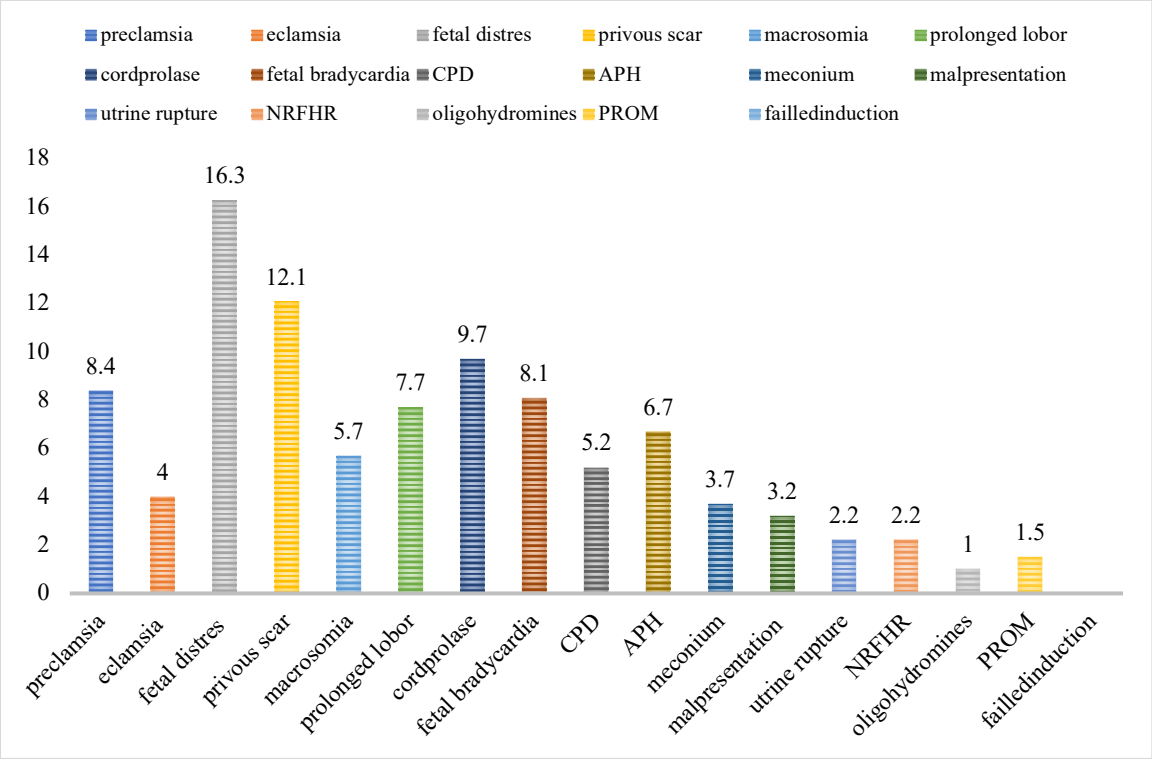

Figure 1: Percentage of indication for emergency cesarean section

3.5. Proportion of Recommended Decision to Delivery Interval

The recommended decision to delivery interval was found to be 57 (14.1%) with (95% CI: 10.67, 17.48) of EmCS. The median (IQR) time of DDI was 65 (35, 115) minutes. Emergency cesarean section was not performed in 94 (23.2%) women until 1 h after the decision time. The proportion of the day of the decision for EmCS, with 327 (80.7%) on weekdays and 78 (19.3%) on weekends and public holidays, and more than half of the cases were done on the day of 226 (55.6%).

3.6. Factor Associated with Decision to Delivery Interval

In the multivariable logistic regression analysis, after adjusting for potential confounders using the backward likelihood stepwise method, several factors were found to be significantly associated with decision-to-delivery interval (DDI). These included availability of materials in the ward, day of the week, patient stabilization needs, anesthesia time, marital status, and place of residence. Women who did not require stabilization before transfer to the operating theater were 3.91 times more likely to achieve the recommended DDI compared to those requiring stabilization (AOR = 3.91, 95% CI: 1.34, 11.36).

Similarly, women whose emergency cesarean section (EmCS) was performed on weekdays were 3.66 times more likely to have the recommended DDI compared to those operated on weekends or holidays (AOR = 3.66, 95% CI: 1.22, 10.93). The presence of essential materials in the labor ward increased the likelihood of achieving the recommended DDI by 4.05 times compared to their absence (AOR = 4.05, 95% CI: 1.64, 9.96). Furthermore, an anesthesia induction time of less than 10 minutes was associated with a 2.91 times higher likelihood of meeting the recommended DDI compared to anesthesia induction times exceeding 10 minutes (AOR = 2.91, 95% CI: 1.24, 6.81) (Table 3).

Table 5: Bivariate and multivariate analysis of factor affecting decision to delivery time interval (n = 405) at eastern Ethiopian hospitals 2023/24.

Variable	Category	DDI		COR(95%CI)	AOR(95%CI)	P-value
		≤30 min	>30 min			
		N (%)	N (%)			
Marital status	Married	51 (12.6)	272 (67.2)	2.38 (.982, 5.75)	2.957 (1.13, 7.67)	.026*
	Unmarried	6 (1.5)	76 (18.8)	1	1	
Place of residency	Urban	49 (12.1)	232 (57.3)	3.06 (1.40, 6.68)	2.903 (1.29, 6.49)	.010*
	Rural	8 (1.97)	116 (28.6)	1	1	
ANC follow up	No	5 (1.23)	53 (13.1)	1	1	0.717
	Yes	52 (12.8)	295 (72.8)	1.86 (.713, 4.89)	1.23 (.402, 3.765)	
Day of week	Week day	53 (13.1)	278 (68.6)	2.62 (1.008, .6.80)	3.66 (1.22, 10.93)	.020*
	Weekend	5 (1.23)	70 (17.2)	1	1	
Need to stabilization	No	7 (1.72)	12 (2.96)	3.92 (1.47, 10.4)	3.91 (1.34, 11.36)	.021*
	Yes	50 (12.3)	336 (82.9)	1	1	
Presence of material in labour ward	No	6 (1.48)	110 (27.1)	1	1	
	Yes	51 (12.5)	238 (58.7)	3.92 (1.63, 9.43)	4.05 (1.64, 9.96)	.002*
Time of the day	Day	39 (9.6)	186 (45.9)	1.88 (1.039, 3.42)	1.708 (.867, 3.36)	0.122
	Night	18 (4.44)	162 (40)	1	1	
Referral status	No	51 (12.5)	260 (64.1)	2.877 (1.19, 6.93)	1.732 (.620, 4.83)	0.295
	Yes	6 (1.48)	88 (21.7)	1	1	
Gravidity	Primigravida	7 (1.72)	99 (24.4)	1	1	

	Multigravida	50 (12.3)	249 (61.4)	2.84 (1.24, 6.477)	1.87 (.783, 4.508)	0.158
Anesthesia time	≤10 min	50 (12.3)	252 (62.2)	2.72 (1.19, 6.21)	2.914 (1.24, 6.81)	.014*
	>10 min	7 (1.72)	96 (23.7)	1	1	
Transfer time	≤15	26 (6.41)	95 (23.4)	2.234 (1.26, 3.95)	1.393 (.701, 2.76)	0.344
	>15	31 (7.65)	253 (62.4)	1	1	

Note: ANC – Antenatal Care

4. Discussion

This study found that only 14.1% of the women were operated on within 30 min, with a median DDI of 65 min and a result of 95% (CI: 10.67, 17.48). This outcome was similar to a study conducted in a retrospective cross-sectional study in Northern Tanzania; 12% were operated on within 30 min from decision time [21]. This similarity may be due to the accessibility of logistics like pharmaceutical medication, ward equipment, and other relevant equipment in hospitals and the practice and experience of professionals. Also, this finding is greater than that of studies conducted outside the country: a prospective cross-sectional study conducted in Nigeria; another observational study in Nigeria, Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso, Nigeria; a retrospective study on University of Benin Teaching Hospital, Benin City, Nigeria; Mbale Regional Referral Hospital in Uganda; St. Francis Hospital Nsambya's postnatal ward, Uganda; and Mulago National Referral Hospital, Uganda, with recommended DDIs of 2.1%, 0.9%, 5.7%, 2%, and 0.7%, respectively [3, 22-27].

The difference may be due to general infrastructure and medical access differences in general from those countries. On the other hand, this finding is less than that of a study conducted in our country. A cross-sectional study was conducted at City Public Hospitals Bahir Dar, and a cross-sectional study was conducted in the South Gondar Zone, Northwest Ethiopia, with the recommended DDI of 20.3% and 17.5%, respectively [6, 28]. Also, this finding is less than that of studies conducted outside the country: a prospective observational study in France, Norway; a prospective observational study in the USA; another observational study in the USA; and a developing country, rural Kenyan public hospital, with the recommended DDI of 45%, 35%, 46%, 27%, 19%, and 74%, respectively [29, 30-34]. This difference may be due to funds for surgical materials in the study area of France, the USA, Norway, and Kenya, as patients' relatives.

Women who did not need stabilization before being transferred to the operation theater were 3.91 times more likely to have recommended DDI than those who stabilization before being transferred to the operation theater. This finding was consistent with study findings in northern

Tanzania, Mulago National Referral Hospital in Uganda, a rural Kenyan public hospital, Ladoke Akintola University of Technology Teaching Hospital in Ogbomoso, Nigeria, and University of Benin Teaching Hospital in Benin City, Nigeria [21,24,25,27,34]. An emergency cesarean delivery may have negative implications for the patient and her support person because the child's birth does not take place as they had planned. The preparation for the procedure occurs so abruptly that a thorough explanation of the physiologic and surgical processes may not be possible, which can have further negative consequences. Focusing on the newborn's birth rather than the surgery is important. Due to this reason, the delivery interval for those mothers who need stabilization before anesthesia directly influences the decision to delivery interval.

The presence of material in the labor ward was significantly associated with DDI. This finding was supported by the fact that lack of funds and non-provision of surgical material results in the delay of a decision to delivery interval. Women whose EmCS was performed during the week of the working day were 3.66 times more likely to have recommended DDIs than women whose EmCS was performed during the weekend and holiday. The findings of this study were in line with those of studies conducted in Norway, at Mbale Regional Referral Hospital in Uganda, at St. Francis Hospital Nsambya's postnatal ward in Uganda, in northern Tanzania, in the South Gondar Zone, in Northwest Ethiopia, and at Bahir Dar City Public Hospitals [3,6,21,24,28,30].

The increased number of staff during the workday/weekday for emergency response compared to the weekend or holiday, which makes it easy to access logistics and laboratory service, might explain this difference. In addition, weekend/holiday seasons are important for healthcare staff to take vacations and engage with their families. A shortage of healthcare professionals could be a more crucial problem during weekend/holiday seasons than on weekends. This situation suggests that patients admitted during the weekend/holiday season might receive less care than those admitted during regular times/weekdays.

Emergency C/S performed for the urban people had a shorter DDI when compared with the rural mothers. This result was comparable to studies conducted at Bahir Dar City Public Hospitals with shorter DDI [6]. They were who had taken anesthesia; time preparation for operation was significantly associated with DDI. There may be several possible justifications, especially in resource-limited and busy obstetric units. From these: problems in early detection

and treatment, absence of needed material on hand, a busy and preoccupied operation table, and delay due to the mother's hesitation for operation consent.

5. Conclusion

Decision-to-delivery interval within the recommended time is not achieved. Being a marital status, place of residency, patient need for stabilization, material in the labor ward, anesthesia time, and week of the day an emergency cesarean section is performed are associated factors of DDI. Hence, to address institutional delays in EmCS, providers and facilities should be prepared in advance and ready for rapid emergency action.

Abbreviations

DDI: Decision to Delivery Interval, DDRHB: Dire Dawa Regional Health Bureau, EmCS: Emergency Cesarian Section, MMR: Maternal Mortality Ratio, MDSR: Maternal Death Surveillance Report, SPSS: Statistical Package for Social Science, WHO: World Health Organization

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Authors Contribution

All authors made significant contributions throughout the study, from the initial conception of the research idea to proposal development, data collection, data analysis and interpretation, and manuscript preparation. They also actively participated in proposal development, data analysis, and manuscript drafting for publication. All authors reviewed and approved the final version of the manuscript.

Ethics Approval

Ethical clearance was obtained from Institutional Review Board (IRB) of Dire Dawa University. Further approval was also granted from Dire Dawa city health office and respective hospitals. The aim of the study was informed for each study participant, and the study participants had a right to refuse or discontinue participating in the research without any

restriction. Informed oral consent was obtained from each department heads of each hospital and informed written consent were obtained from health professional.

Conflict of Interests

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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Availability of Data and Materials

The data supporting these findings are available upon reasonable request. Interested researchers may obtain the data by contacting the corresponding author via email.

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