BMC Pregnancy and Childbirth

RESEARCH

Open Access

Impact of a surgical sponsorship program on compliance with decision-to-delivery intervals in rural hospitals in Uganda

Onesmus Byamukama[1,2*], Jonathan Mwiindi[3], Beth Wangigi[3], Gilbert Tumwiine[4], Phoebe Mungai[3], Rodgers Osumo[3], Edward Muguthu[3], Rigoberto Delgado[5,6] and Priscilla Busingye[4]

Abstract

Background An emergency caesarean section is a critical intervention to reduce maternal and fetal risks during labour complications. The decision-to-delivery interval, recommended internationally of seventy-five minutes or less, is a key indicator of quality in emergency obstetric care. In rural western Uganda, this interval is often prolonged due to financial and infrastructural barriers. This study evaluated the impact of a sponsorship program's case management and documentation procedures on compliance with the decision-to-delivery interval in a rural hospital setting.

Methods A retrospective cross-sectional study was conducted from January 2020 to December 2023 across four comprehensive emergency obstetric care hospitals in southwestern Uganda: Ibanda, Nyakibale, Rushoroza, and Rwibaale. Data were extracted for all emergency caesarean section cases with indications in categories one and two. Documentation rates and compliance with the decision-to-delivery interval (defined as less than seventy-five minutes) were analyzed using descriptive statistics, trends, and stratified graphs. The study sample compared data from non-sponsored and sponsored patients covered by a financing program offered by African Mission Healthcare, a not-for-profit organization working in Africa.

Results Surgical Access for Everyone–sponsored patients consistently demonstrated higher documentation rates for the decision-to-delivery interval (70–80%) compared to non-sponsored patients, especially from 2021 onwards. By the fourth quarter of 2023, documentation in both groups exceeded 75%. All facilities showed a reduction in the median decision-to-delivery interval over time, with Rushoroza and Rwibaale achieving the most significant declines to below 60 min by 2023. Compliance with the decision-to-delivery interval of less than 75 min improved from 30% in 2020 to nearly 70% in 2023. Facility-specific trends revealed overall improvement, with Rushoroza and Rwibaale showing the most significant progress by 2023, while Ibanda exhibited the slowest progress.

Conclusion The Surgical Access for Everyone sponsorship program and its required case management and documentation procedures enhanced compliance with the decision-to-delivery interval in emergency obstetric care, demonstrating benefits for both sponsored and non-sponsored patients. Sustained improvements highlight

*Correspondence:
Onesmus Byamukama
bonesmus@yahoo.com

Full list of author information is available at the end of the article

© The Author(s) 2026. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

the importance of structured funding and oversight. To maintain and expand these gains, targeted facility-level interventions, strengthened data systems, and continued investment in clinical training are recommended.

Keywords Decision to Delivery Interval, Compliance rates, Uganda

Introduction

Emergency caesarean section (EMCS) is a surgical procedure performed to deliver a potentially viable fetus in life-threatening situations to the mother' and/or the fetus [1]. Emergency Caesarean section is one of the most commonly performed surgical procedures worldwide [2]. The World Health Organization (WHO) categorizes EMCS into four depending on the degree of urgency (threat to the life of the fetus and/or the mother). The focus of this study is category I EMCS, where there is an immediate threat to the life of the mother and/or the fetus, and category II EMCS, where there is maternal or fetal compromise but no immediate threat to the life of the woman or fetus [3]. One important indicator of quality in emergency obstetric care is the decision-to-delivery interval (DDI), which is recommended internationally at seventy-five minutes or less. However, there is limited evidence on how well DDI is documented and whether compliance with recommended thresholds is achieved in rural, resource-limited settings in Africa. Furthermore, there is little evidence of the impact targeted interventions have on improving DDI compliance. This study assessed the role the Surgical Access For Everyone (SAFE) intervention had improving quality of emergency cesarean section care in missionary hospitals in Uganda. The SAFE program was introduced in 2020 by the non-profit organization African Mission Healthcare (AMH) with the goals of providing emergency surgical care funding for low-income families and improving quality of care through strict DDI case management and documentation compliance procedures.

In Sub-Saharan Africa, cesarean sections (CS) reduce maternal mortality; however, there are differences in the rates of CS in various countries [4], with the rates in Africa being much lower than the WHO's expected CS rate of 10–15% [5]. The caesarean section rate has risen from 5.7% in 2011 to 7% in 2016 and 14% in 2022, with urban rates (20%) being nearly double those in rural areas (11%) [6, 7]. These low CS rates suggest that many women who may require the procedure are unable to access it due to factors such as faulty equipment, shortage of skilled personnel, transportation challenges, and inadequate health facilities—particularly concerning in a country where a high proportion of women with previous caesarean scars present with short birth intervals and therefore often require repeat CS [4, 8]. Factors like functioning anesthesia machines, trained personnel who can perform a CS, drugs, sundries and electricity are critical for a CS.

Decision to delivery interval (DDI) is the duration from when a decision to deliver by caesarean section is made to when the baby is born [9]. It includes patient preparation and consent, patient transfer to the operating theatre, administration of anesthesia, and skin incision until the extraction of the baby [1]. To optimise outcomes, the American College of Obstetricians and Gynecologists (ACOG) recommends decision-to-delivery intervals of < 75 min [10], while the Royal College of Obstetricians and Gynaecologists (RCOG) and the Royal College of Anesthetists (RCA) recommend a DDI of 30 min for Category I and 75 min for Category II EMCS [11]. Countries worldwide have struggled to achieve the recommended 30 and 75-minute DDI. As a result, increasing cases of uterine rupture and fetal deaths have been recorded among women awaiting EMCS [12]. DDI is an indicator of the quality of maternal care, and when prolonged, it constitutes 3rd delay [13].

Decision-to-delivery intervals vary across the globe, ranging between 23 min and 58.7 min in the UK [14, 15] and averaging 82 min in Thailand and 36.3 min in India [16]. In Sub-Saharan Africa, the reported mean DDI is 248 min in Kenya [17] and 233.9 min in Nigeria [18]. In Uganda, a DDI of 92 min to 330 min have been reported [12, 19, 20]. Delayed DDI rates are concerning, with studies reporting close to 80% in Ethiopia [21], 69% in Malawi [22], and 77% to 99% in Uganda [12, 20]; this is in contrast to rates of 38% in England and Wales [15].

A delayed DDI in EMCS is associated with adverse maternal and neonatal outcomes, including an APGAR < 7 at 5 min, admissions to the neonatal intensive care unit, stillbirths, physical and psychological trauma to the mothers, iatrogenic genitourinary injury, uterine rupture and thus extensive surgery including hysterectomy [12, 21, 23–25]. Shortening the DDI as improved maternal and new-born outcomes [26, 27]. Institutions should implement mechanisms to reduce DDI, significantly improving maternal and fetal outcomes [21].

The SAFE program provides financial sponsorship for low-income women in need of emergency cesarean deliveries at four private not-for-profit hospitals in southwestern Uganda: Rwibaale, Rushoroza, Nyakibale, and Ibanda. Upon admission, if a woman cannot afford the anticipated delivery costs, a SAFE program representative conducts a rapid eligibility assessment. This assessment is based on context-specific criteria, including the patient's financial status, ability to mobilize resources, and household vulnerability, though it does not follow a rigid income-based formula. Once approved, care

proceeds immediately without financial delays. For emergency cesarean sections, the attending clinician documents the exact time the decision is made, ensuring prompt response and program enrollment. Following delivery, both the midwife and surgeon record the delivery time. The Decision-to-Delivery Interval (DDI) is then calculated and documented.

Methods

Study design and setting

This was a retrospective cross-sectional study conducted across four Comprehensive Emergency Obstetric Care (CEmOC) hospitals in southwestern Uganda: Ibanda, Nyakibale, Rushoroza, and Rwibaale. These are private, not-for-profit (PNFP) hospitals supported by African Mission Healthcare (AMH) under the Surgical Access for Everyone (SAFE) program. Each hospital has functioning 24/7 operating theatres and offers both antenatal and delivery services.

Study population

The study population included all women who underwent emergency cesarean section (EMCS) at the four AMH-supported facilities between January 2020 and December 2023 with category I and II EMCS.

Inclusion and exclusion criteria

We included all patients who underwent an emergency cesarean section for Category I or II indications. Category I was defined as an immediate threat to the life of the woman or fetus, including obstructed labor, pulsatile cord prolapse, persistent fetal bradycardia, failed instrumental delivery, antepartum hemorrhage, or successful cardiopulmonary resuscitation following maternal cardiac arrest. Category II included maternal or fetal compromise that was not immediately life-threatening, such as malpresentation in labor, prior uterine scars in labor, poor progress during the first or second stage of labor, and severe pre-eclampsia and/or eclampsia. We excluded women who had an elective cesarean section and those with missing or incomplete data were excluded from the study.

Data collection procedure

We retrospectively reviewed medical records of women who underwent EMCS between January 2020 and December 2023. Data extraction was conducted in January 2024. We collected data of 3,184 patients from four healthcare facilities supported by African Mission Healthcare in South Western Uganda, which provide Comprehensive Emergency Obstetric Care (CEmOC) services: Ibanda, Nyakibale, Rushoroza, and Rwibaale hospitals. The study population consisted of all women who underwent EMCS at the AMH-supported facilities during the study period of January 2020 to December 2023. Data sources were de-identified medical records.

Data were extracted from patient records maintained at each hospital. To ensure data integrity: Data collectors were trained in standardized abstraction protocols, double data entry was conducted to minimize transcription errors, quality assurance procedures included random validation of 10% of records and resolution of discrepancies by a third reviewer. Facility teams conducted periodic audits to ensure ongoing accuracy and completeness of EMCS documentation, especially for DDI timestamps.

Variables

The primary outcome variable was the DDI, defined as the time elapsed from the decision to perform an EMCS to the actual delivery of the baby. Other data collected included maternal demographic (age, parity, occupation, marital status, residency), clinical indications for EMCS (gestation age, duration of labour, indication of EMCS, referral status, previous cesarean section), and time-related factors (time of the day (day/night), day of the week (weekday/weekend/public holiday).

Data analysis

Descriptive statistics were used to summarize the data. Chi square tests were used to describe baseline characteristics. Median DDI values were reported due to the skewed distribution and presence of outliers. Comparisons between SAFE-sponsored and non-sponsored patients were conducted using the Mann–Whitney U test, stratified by hospital. Trends in DDI documentation and compliance (defined as DDI < 75 min) were assessed using bar charts and line graphs. Compliance rates were analyzed annually and by facility. Statistical analyses were performed using R version 4.3.1, and all graphical visualizations were generated using the ggplot2 package. A p-value of < 0.05 was considered statistically significant.

Results

The four hospitals in the study are Private Not-for-Profit (PNFP) institutions dedicated to improving maternal and newborn health outcomes. Each hospital offers antenatal care and delivery services, including emergency cesarean sections and blood transfusion services, with their operating theatres functioning 24/7 to ensure uninterrupted access to emergency surgical interventions. These facilities charge fees for the services provided. However, due to high poverty rates in these communities, a significant number of pregnant women are unable to afford hospital costs. The average cost for a standard vaginal delivery is approximately $39.0, while a cesarean section costs approximately $237.0.

Ibanda Hospital conducts approximately 2,275 deliveries annually, with around 1,117 being emergency

cesarean sections. It is staffed by one resident obstetrician/gynaecologist, four medical officers, four anesthetic officers, and twelve midwives. Nyakibale Hospital handles approximately 1,356 deliveries per year, with about 758 being emergency cesarean sections, and is staffed by one resident obstetrician/gynaecologist, three medical officers, three anesthetic officers, and twenty-seven midwives. Rushoroza Hospital conducts around 1,259 deliveries annually, including approximately 302 emergency cesarean sections, and has three medical officers, two anaesthetic officers, and ten midwives. Rwibaale Hospital records approximately 846 deliveries per year, with 412 emergency cesarean sections, and is supported by two Obstetricians/Gynaecologists, two medical officers, two anaesthetic officers, and nine midwives.

Socio-demographic characteristics of participants

The majority were aged 20–34 years (76.1%), married (96.9%), and residing in rural areas (96.6%). Significant differences were observed in age distribution, marital status, and occupation. SAFE-sponsored patients were more likely to be younger (< 20 years), married, and unemployed compared to non-sponsored patients ($p < 0.05$). No significant differences were found in gravidity, referral status, or residence (Table 1).

Documentation of DDI by the facilities

Initially, non-SAFE patients had a peak documentation rate (~100%) in Q4 2020, followed by a sharp decline in 2021, dropping below 50% by Q2. In contrast, SAFE patients saw a rapid increase in documentation from Q4 2020 to Q1 2021, maintaining consistently higher rates (~70–80%) throughout the period. Non-SAFE documentation rates fluctuated significantly, reaching their lowest point (~40%) in Q2 2022 before gradually improving. By late 2023, the gap between SAFE and non-SAFE documentation narrowed, with non-SAFE patients reaching ~75% and SAFE patients exceeding 80% (Fig. 1).

Documentation of DDI stratified by Facility

In Ibanda, non-SAFE documentation rates were initially below 40% in early 2021 but steadily improved, reaching ~80% by late 2023, aligning with SAFE patients. Nyakibale showed inconsistent trends in both groups. Rushoroza saw an early 2021 decline in non-SAFE documentation, followed by erratic trends, while SAFE patients maintained higher rates, peaking above 80%. By late 2023, both groups 5211neared 100%. Rwibaale consistently had high documentation (~90–100%), with occasional dips in non-SAFE rates in 2022 and 2023, which later aligned with SAFE patients (Fig. 2).

The median decision-to-delivery interval

Due to the highly skewed nature of the DDI data and the presence of extreme outliers, we report the median rather than the mean. The overall median DDI was 59 min. SAFE patients had a median DDI of 58.0 min, compared to 62.0 min for non-SAFE patients. While the difference between groups is modest, the slightly shorter median DDI among SAFE patients may suggest a potential benefit of program implementation in reducing decision-to-delivery intervals. Across most facilities, SAFE patients generally experienced shorter or comparable median DDIs than non-SAFE patients, especially in later years. While early implementation years sometimes showed higher DDIs (possibly due to learning curves or data issues), trends suggest that the SAFE program may be associated with improved decision-to-delivery intervals over time (Fig. 3).

Table 1 Socio-demographic characteristics of participants

Variable	Category	Total No.	SAFE Sponsored	Non-SAFE Sponsored	*P*-value
Age	< 20	604 (14.5%)	403 (15.54%)	201(12.8%)	0.015*
	20–34	3169(76.1%)	1964(75.7%)	1205(76.7%)	
	> 35	392 (9.4%)	227(8.76%)	165(10.5%)	
Marital Status	Married	4035(96.9%)	2519(97.3%)	1516(96.2%)	0.049*
	Unmarried	129(3.1%)	69(2.7%)	60(3.8%)	
Gravidity	1	1390(33.4%)	851(32.8%)	539(34.33%)	0.5675
	2–4	2087(50.12%)	1315(50.7%)	772(49.2%)	
	> 4	687(16.48)	428(16.5%)	259(16.5%)	
Referral Status	No	2741(65.7%)	1686(66.2%)	1055(66.9%)	0.1939
	Yes	1432(34.3%)	911(35.1%)	521(33.1%)	
Occupation	Employed	1028(25.14%)	587(23.1%)	441(28.6%)	< 0.001*
	Unemployed	3061(74.86)	1960(76.9%)	1101(71.4%)	
Residence	Rural	4031(96.6%)	2502(96.3%)	1529(97.01%)	0.2804
	Urban	142(3.4%)	95(3.7%)	47(2.99%)	

* = *P*-value < 0.05

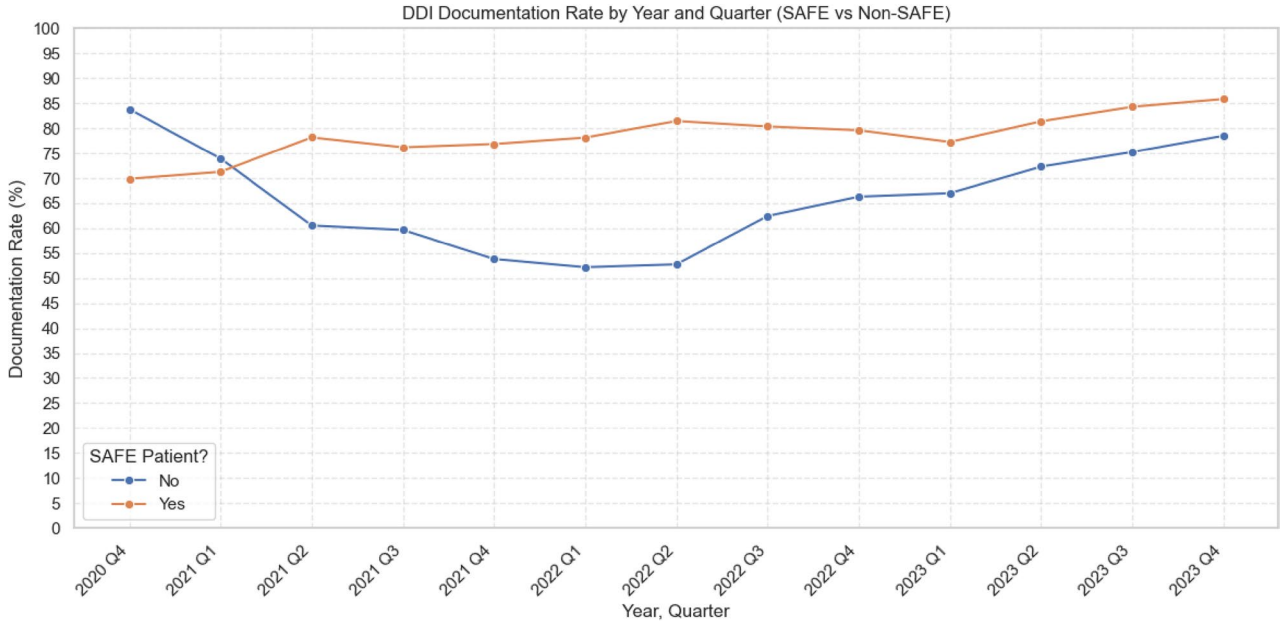


Fig. 1 Comparison of DDI documentation rates between patient groups, 2020–2023

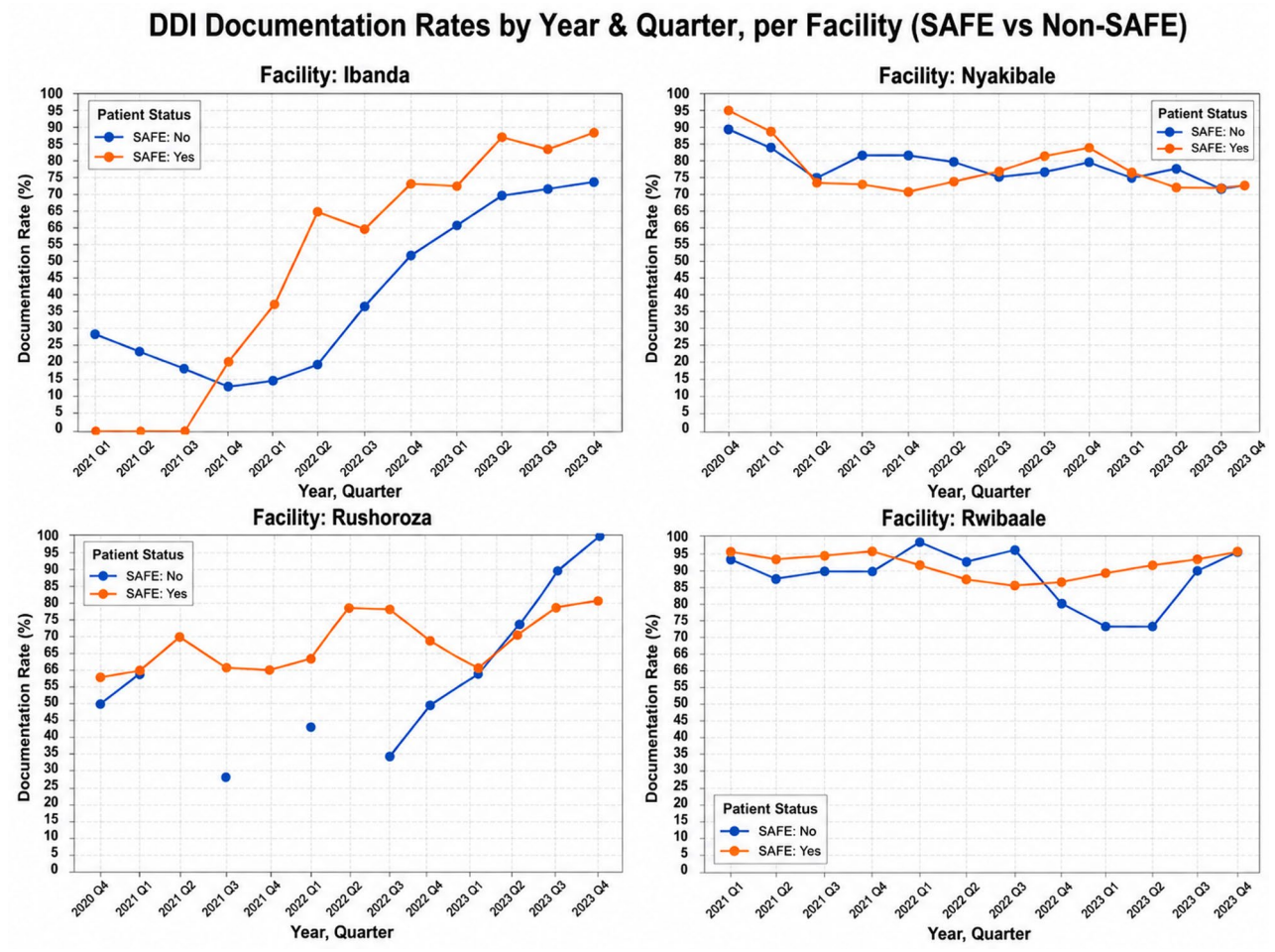


Fig. 2 DDI documentation rates between facility and patient status, 2020–2023

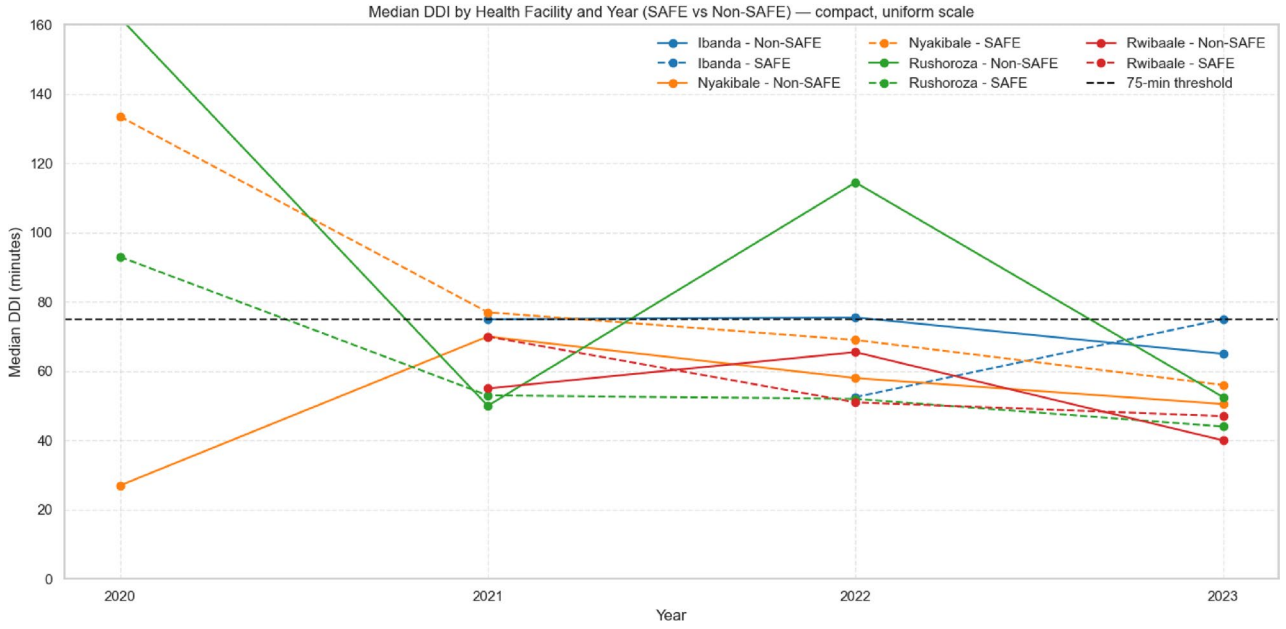


Fig. 3 Median decision-to delivery interval (minutes) by health facility (2020–2023)

Table 2 The comparison of decision to delivery interval between SAFE and non-SAFE patients

Facility	n_SAFE	n_Non_SAFE	U-statistic	*p*-value
Facility	n_SAFE	n_Non_SAFE	U-statistic	p-value
Rwibaale	694	93	38193.5	0.004*
Nyakibale	726	507	198446.0	0.0192*
Ibanda	170	483	41951.5	0.672
Rushoroza	496	15	3311.5	0.469

*p-value <0.05

Comparison of decision-to-delivery interval between SAFE and non-SAFE patients

A two-sided Mann–Whitney U test comparing DDI for SAFE-sponsored ($n = 2{,}086$) versus non-SAFE ($n = 1{,}098$) patients was used due to the non-normal, skewed distribution of DDI values and the presence of outliers. The analysis yielded a statistically significant difference ($U = 1{,}096{,}324.5$, $p = 0.047$) indicating that SAFE-sponsored patients experienced a modest but significant reduction in DDI compared to non-SAFE patients. Facility-level comparisons of DDI distributions revealed statistically significant differences in two of the four facilities. At Rwibaale ($U = 38{,}193.5$, $p = 0.004$) and Nyakibale ($U = 198{,}446.0$, $p = 0.0192$), SAFE-sponsored patients had significantly shorter DDIs than non-SAFE patients. In contrast, no significant differences were observed at Ibanda ($p = 0.672$) or Rushoroza ($p = 0.469$) (Table 2).

The annual compliance rate of DDI < 75 min from 2020 to 2023

Overall, the trend of the proportion of cases where the Decision-to-Delivery Interval (DDI) was within the recommended standard of less than 75 min indicates a steady and consistent improvement in compliance rates over the years. In 2020, the compliance rate was the lowest, around 30%, suggesting that only a small proportion of cases met the international standard for timely emergency cesarean sections. However, by 2021, there was a significant improvement, with compliance rising to approximately 55%. Between 2021 and 2022, the compliance rate continued to improve, reaching above 60%, although the rate of increase was slightly less steep compared to the previous year. By 2023, compliance had approached 70%, indicating continuous progress toward meeting global standards for emergency obstetric care (Fig. 4).

The annual compliance rates of DDI < 75 min across four health facilities

In 2020, Rushoroza had the lowest compliance rate (0%), indicating that none of the emergency cesarean deliveries met the standard. Nyakibale started with a relatively high compliance rate (~65%) but saw a decline in 2021 before gradually improving in later years. Rwibaale and Ibanda started with moderate compliance rates, with Rwibaale improving steadily and surpassing other facilities by 2023. By 2021, Rushoroza significantly improved, with compliance rising sharply to above 60%. However, Nyakibale's compliance dipped below 50%. Ibanda and Rwibaale maintained moderate rates (~55–60%). Between 2021 and 2023, all facilities showed overall improvement. Rushoroza and Rwibaale continued their upward trend, reaching the highest compliance rates (above 80%) by 2023. Nyakibaale, despite initial fluctuations, showed a steady rise from 2022 onward, reaching nearly 65% by 2023. Ibanda exhibited

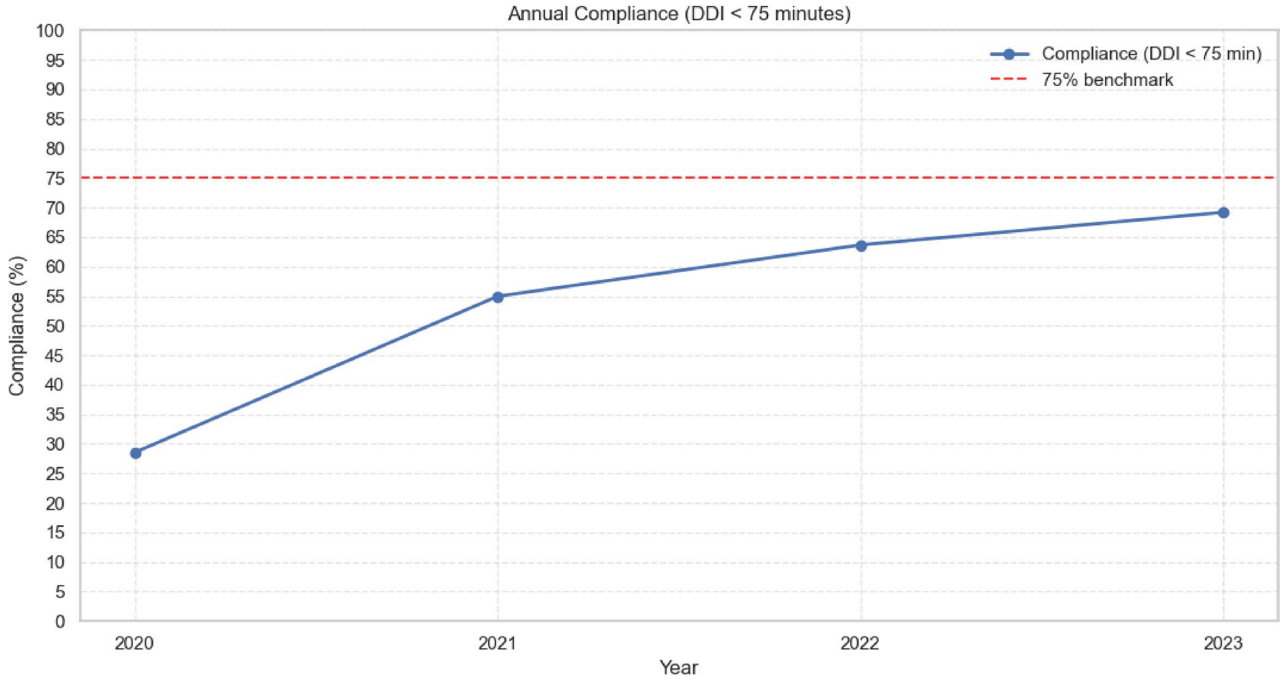


Fig. 4 Annual compliance rates of DDI < 75 min, 2020–2023

the slowest improvement, maintaining a relatively flat trajectory, with compliance increasing slightly over the years (Fig. 5).

Distribution of caesarean section indication categories and decision-to-delivery intervals for category 1 caesarean sections

Category 2 caesarean sections constituted the majority of procedures, accounting for 74% (3,100/4,165), while category 1 caesarean sections accounted for 26% (1,065/4,165) as shown in Fig. 6. Among category 1 caesarean sections, less than one-quarter were delivered within 30 min of decision-making (23%, 248/1,065), whereas most experienced longer decision-to-delivery intervals, with 39% (411/1,065) delivered within 30 to less than 75 min and 38% (406/1,065) delivered after 75 min as shown in Fig. 7.

Discussion

The trend in DDI documentation suggests that SAFE sponsorship improved and sustained compliance with documentation requirements. While non-SAFE patients initially faced challenges, they showed steady improvement from 2022 onward, reflecting increased institutional adoption of established SAFE protocols. However, consistency remains an area for improvement, particularly among non-SAFE patients, a challenge commonly seen in low-resource settings. SAFE sponsorship enhanced documentation for sponsored patients and positively influenced non-SAFE patients. Since the same clinical teams managed both groups, best practices from SAFE-sponsored care likely extended to non-SAFE cases, leading to broader improvements in documentation. Similar indirect benefits of targeted interventions have been documented in other low-resource settings where team-based training, structured protocols, and improved institutional processes often lead to spillover effects, benefiting non-targeted patient groups [28]. However, we recognize that such effects are context-specific and not directly measured in our study. The relatively small difference between SAFE and non-SAFE documentation rates suggests that strict reporting requirements for SAFE procedures necessary for reimbursement may have driven overall compliance, ensuring adherence across all cases.

The decline in DDI across all facilities reflects better adherence to emergency surgical protocols, improved workflow management, and the impact of SAFE-sponsored interventions. The most notable improvements were observed in Rushoroza and Rwibaale, where DDI consistently decreased, aligning more closely with international standards (<75 min). Nyakibale showed gradual improvement, whereas Ibanda faced a minor setback in 2023, highlighting the need for targeted interventions to maintain efficiency. These findings underscore the importance of continuous quality improvement efforts and resource allocation in sustaining the improvements in emergency obstetric care.

SAFE patients experienced shorter median DDIs especially in later years. The clinical audits conducted during this project aimed at improving documentation and compliance to standard obstetric care could have contributed

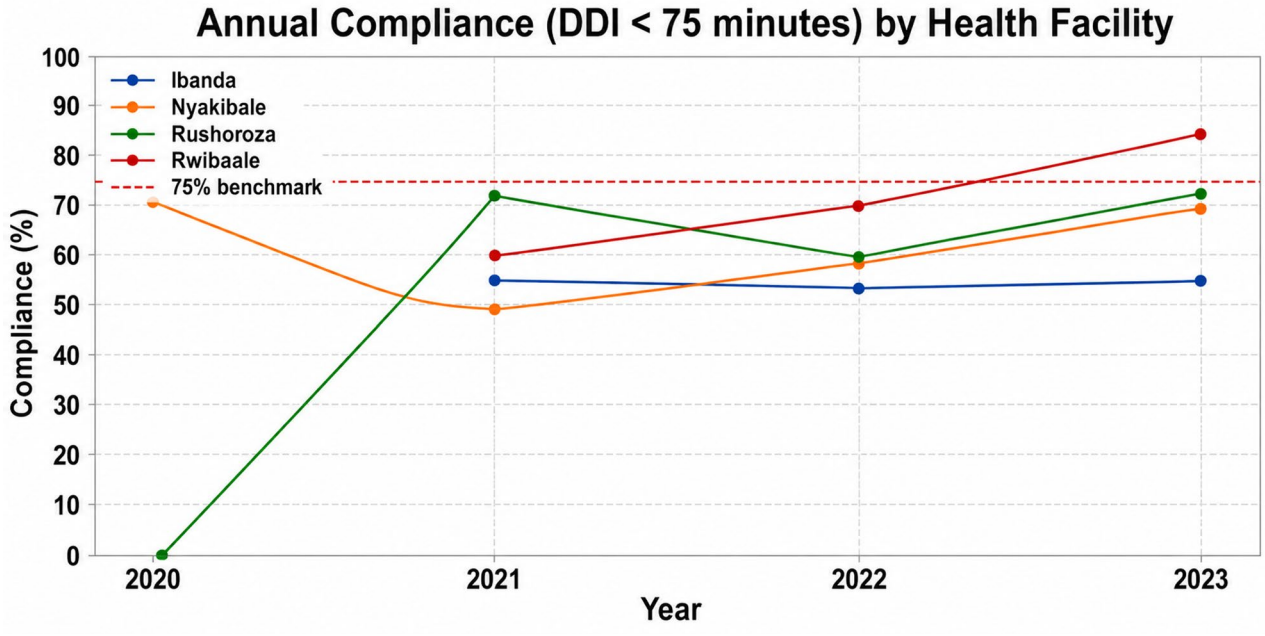


Fig. 5 Annual compliance rate of DDI < 75 min by Health Facility, 2020–2023

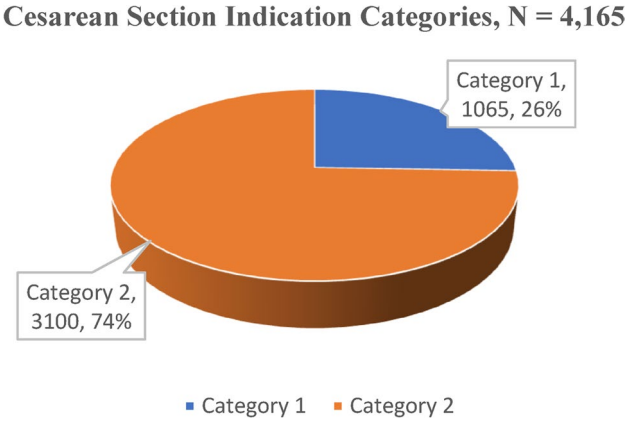


Fig. 6 The distribution of cesarean section indication categories

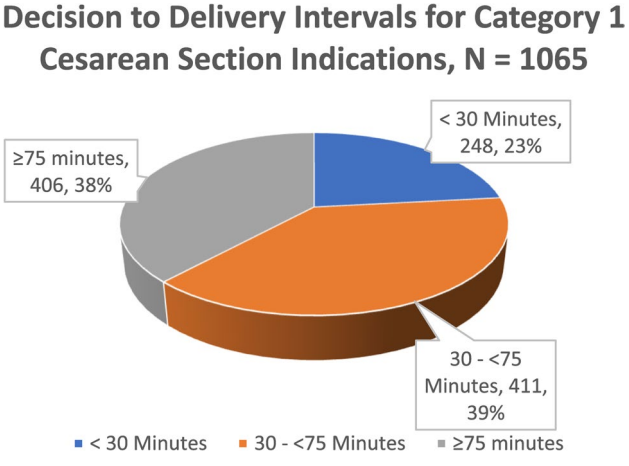


Fig. 7 The decision to delivery intervals for category 1 cesarean section indications

to this observed improvement. Other factors like data issues and natural learning curve can explain the higher DDIs in early implementation years. It worth noting that the trends suggest that the SAFE program may be associated with improved decision-to-delivery intervals over time suggesting a potential benefit of the SAFE program in these setting. However, the absolute difference in medians was small, and the distributions showed substantial overlap, suggesting that while the SAFE program may contribute to improved timeliness, its clinical impact may be limited and influenced by other contextual factors.

Between 2021 and 2022, compliance with the < 75-minute DDI standard rose significantly to above 60%, though the rate of increase slowed compared to the previous year. This trend suggests that while initial interventions had a substantial impact, further improvements required ongoing efforts in efficiency, staffing, and resource management. By 2023, compliance neared 70%, reflecting steady progress toward international benchmarks. Despite these gains, compliance remains below the ideal 75%, indicating the need for further systemic improvements, particularly in training and protocol adherence.

The overall trend highlights that SAFE sponsorship and improved workflow management were instrumental in increasing DDI compliance. Significant improvements in Rushoroza and Rwibaale indicate effective strategies for reducing delays, while Ibanda's slow progress suggests persistent operational challenges. Nyakibale's fluctuations highlight inconsistencies in emergency response. Continued investment in quality improvement initiatives

is essential to ensure uniform and sustained compliance across all facilities.

Although we used a uniform threshold of < 75 min for DDI compliance, this may not adequately capture the urgency of Category I caesarean sections, for which a 30-minute benchmark is recommended [29]. In our data, category II caesarean sections formed the majority of emergency procedures, while only 23% of category I caesarean sections achieved a decision-to-delivery interval of < 30 min. This is comparable to findings from other low-resource settings, where timely delivery for the most urgent caesarean sections remains difficult because of delays in theatre access, staffing, anesthesia, and patient transfer [20, 30, 31]. These observations suggest that improvements in overall DDI compliance should be interpreted alongside category-specific performance, particularly for Category I emergencies.

The cesarean section rates observed in three of the four study facilities were notably higher than Uganda's national facility-based average of 14% [7]. This elevation is likely due to their roles as referral centers, managing a higher proportion of high-risk and complicated obstetric cases. The variation in CS rates across the facilities likely reflects differences in patient volume, case complexity, referral patterns, and institutional capacity. Facilities with higher annual CS volumes may face greater strain on operating theatres, anesthesia teams, and clinical staff—particularly during peak hours or when resources are limited—which can contribute to delays in achieving optimal DDIs [20]. Conversely, lower-volume facilities may have less surgical backlog and faster access to theatres but can still face challenges such as limited staffing or reduced preparedness for managing emergencies [28, 32]. Understanding how facility-level factors interact with surgical volume to affect emergency response times is critical for designing targeted interventions and allocating resources effectively.

This study has some limitations that warrant consideration. As a retrospective record review, it is subject to inherent biases, including missing data, and potential inaccuracies in recorded time stamps, particularly in low-resource settings where data systems are often paper-based. Although efforts were made to validate the data, some documentation errors may have influenced the accuracy of DDI measurements. Secondly, we used a uniform threshold of <75 min for DDI compliance, we acknowledge that this may not be appropriate for Category I cesarean sections, where international guidelines recommend a 30-minute benchmark. Additionally, while the observed improvements in documentation and compliance suggest a positive impact of the SAFE program, it is unclear whether these gains are sustainable without continued external support and oversight. The study was conducted in four private not-for-profit hospitals, which may differ in resources, staffing, and organizational culture from public facilities, thus limiting the generalizability of findings to other contexts. Future prospective studies, including public sector hospitals and longer follow-up periods, are needed to assess long-term impact and broader applicability.

Policymakers should consider expanding targeted support programs to both public and private sectors, with appropriate training and supervision to ensure quality and equity of care.

Lastly, the results from this study point to several opportunities for future research, including exploring the long-term sustainability, cost-effectiveness, and impact on clinical outcomes, such as maternal and neonatal morbidity and mortality, of interventions like SAFE. Additionally, prospective studies assessing the influence of such programs on non-sponsored patients and across different health system levels are needed to understand the broader applicability and potential spillover effects of targeted obstetric care interventions.

Conclusions

Programs such as SAFE, which provide funding for low-income families and introduce strict documentation and compliance protocols, have positive effects in improving DDI. To sustain and scale these improvements, it is important to institutionalizing standardized DDI documentation protocols, and integrating financial risk protection mechanisms into national maternal health strategies.

Abbreviations

ACOG	American College of Obstetricians and Gynecologists
AMH	African Mission Healthcare
CDC	Centers for Disease Control and Prevention
CEmOC	Comprehensive Emergency Obstetric Care
CS	Caesarean Section
DDI	Decision to Delivery Interval
EMCS	Emergency Caesarean Section
NGO	Non-Governmental Organization
PNFP	Private Not-for-Profit
RCA	Royal College of Anesthetists
RCOG	Royal College of Obstetricians and Gynaecologists
SAFE	Surgical Access For Everyone
WHO	World Health Organization

Authors' contributions

OB, JM, GT, and PB conceptualized and designed the study, supervised data collection, and led manuscript drafting. OB, JM, GT, RO, RD, EM, and PB contributed to the study design, data analysis, and interpretation. BW, EM, and PM assisted in data acquisition, quality checks, and preliminary data synthesis. PB provided overall project oversight. All authors reviewed, contributed to, and approved the final version of the manuscript for submission.

Funding

This study did not receive any external funding.

Data availability

The datasets generated and analysed for this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Mbarara University of Science and Technology Research Ethics Committee (REC No. 04/10–20) and Uganda National Council of Science and Technology No. HS1093ES. Administrative clearance was obtained from the offices of the Hospital Directors of the participating hospitals. Written informed consent was obtained from each study participant before recruitment and participation in the study. Confidentiality of the study participants was ensured by using unique identifiers. Participants were free to withdraw from the study at any time. Recruitment into the study was voluntary and free.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Department of Obstetrics and Gynaecology, Mbarara University of Science and Technology, Mbarara, Uganda
[2]Department of Obstetrics and Gynaecology, Mbarara Regional Referral Hospital, P.O. Box 40, Mbarara, Uganda
[3]African Mission Healthcare, Methodist Ministries Centre, Oloitoktok Road, Nairobi, Kenya
[4]Department of Obstetrics and Gynaecology, St. Francis Hospital Nsambya, Kampala, Uganda
[5]School of Biomedical Informatics, University of Texas Health Science Centre at Houston, Houston, Texas, USA
[6]College of Business, Texas Woman's University, Denton, Texas, USA

Received: 5 July 2025 / Accepted: 6 May 2026
Published online: 13 May 2026

References

1. Soltanifar S, Russell R. The National Institute for Health and Clinical Excellence (NICE) guidelines for caesarean section, 2011 update: implications for the anaesthetist. Int J Obstet Anesth. 2012;21(3):264–72.
2. Sway A, Nthumba P, Solomkin J, Tarchini G, Gibbs R, Ren Y, et al. Burden of surgical site infection following cesarean section in sub-Saharan Africa: a narrative review. Int J women's health. 2019;11:309–18.
3. Lucas D, Yentis S, Kinsella S, Holdcroft A, May A, Wee M, et al. Urgency of caesarean section: a new classification. J R Soc Med. 2000;93(7):346–50.
4. Yaya S, Okonofua F, Ntoimo L, Kadio B, Deuboue R, Imongan W, et al. Increasing women's access to skilled pregnancy care to reduce maternal and perinatal mortality in rural Edo State, Nigeria: a randomized controlled trial. Global Health Res Policy. 2018;3:1–10.
5. OrganizationWH. WHO recommendations non-clinical interventions to reduce unnecessary caesarean sections. World Health Organization; 2018. https://pmc.ncbi.nlm.nih.gov/articles/PMC6933434/.
6. Atuheire EB, Opio DN, Kadobera D, Ario AR, Matovu JKB, Harris J, et al. Spatial and temporal trends of cesarean deliveries in Uganda: 2012–2016. BMC Pregnancy Childbirth. 2019;19(1):132.
7. UBOS. Uganda Demographic Health Surv. 2022;1(1). https://www.ubos.org/uganda-demographic-and-health-survey-2022-main-report/.
8. Byamukama O, Migisha R, Kalyebara PK, Tibaijuka L, Lugobe HM, Ngonzi J, et al. Short interbirth interval and associated factors among women with antecedent cesarean deliveries at a tertiary hospital, Southwestern Uganda. BMC Pregnancy Childbirth. 2022;22(1):268.
9. Wong TCT, Lau CQH, Tan EL, Kanagalingam D. Decision-to-delivery intervals and total duration of surgery for caesarean sections in a tertiary general hospital. Singapore Med J. 2017;58(6):332.
10. Obstetricians, ACo. Gynecologists. ACOG Committee Opinion 487: Preparing for clinical emergencies in obstetrics and gynecology. Obstet Gynecol. 2011;117(4):1032–4.
11. NICE. Caesarean birth, NICE guideline. 2021;1(1). Published: 31 March 2021. https://www.nice.org.uk/guidance/ng192.
12. Nakintu E, Murokora D. Emergency caesarean sections: decision to delivery interval and obstetric outcomes in Nsambya hospital, Uganda-A Cross Sectional Study. J Gynecol. 2016;1(4):122.
13. Tunçalp Ö, Were W, MacLennan C, Oladapo O, Gülmezoglu A, Bahl R, et al. Quality of care for pregnant women and newborns—the WHO vision. BJOG. 2015;122(8):1045.
14. Kolås T, Hofoss D, Øian P. Predictions for the decision-to-delivery interval for emergency cesarean sections in Norway. Acta Obstet Gynecol Scand. 2006;85(5):561–6.
15. Cerbinskaite A, Malone S, McDermott J, Loughney AD. Emergency caesarean section: influences on the decision-to-delivery interval. Journal of pregnancy. 2011;2011. https://doi.org/10.1155/2011/640379.
16. Gupta S, Naithani U, Madhanmohan C, Singh A, Reddy P, Gupta A. Evaluation of decision-to-delivery interval in emergency cesarean section: a 1-year prospective audit in a tertiary care hospital. J Anaesthesiol Clin Pharmacol. 2017;33(1):64.
17. Kanario P, Mburugu P, Kabuga S, Wangari L, Wanjiku L, Luchemo P, et al. Decision to delivery interval of emergency caesarean section and associated maternal and neonatal outcomes in a county hospital in Kenya. East Afr Med J. 2021;98(7). https://www.ajol.info/index.php/eamj/article/view/213039.
18. Ayeni OM, Aboyeji AP, Ijaiya MA, Adesina KT, Fawole AA, Adeniran AS. Determinants of the decision-to-delivery interval and the effect on perinatal outcome after emergency caesarean delivery: a cross-sectional study. Malawi Med J. 2021;33(1):28–36.
19. Hughes NJ, Namagembe I, Nakimuli A, Sekikubo M, Moffett A, Patient CJ, et al. Decision-to-delivery interval of emergency cesarean section in Uganda: a retrospective cohort study. BMC Pregnancy Childbirth. 2020;20:1–10.
20. Businge J, Turanzomwe S, Akol MA, Kakama C, Kajabwangu R, Kanyesigye M, et al. Decision to delivery interval and predictors for delayed decision to delivery interval among women delivering by emergency caesarean section at a tertiary hospital, Southwestern Uganda: a prospective cohort study. BMC Pregnancy Childbirth. 2025;25(1):546.
21. 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;21:1–7.
22. O'Regan M. Delivery times for caesarean section at Queen Elizabeth Central Hospital, Blantyre, Malawi: is a 30-minute 'informed to start of operative delivery time'achievable? Anaesthesia. 2003;58(8):756–9.
23. Fesseha N, Getachew A, Hiluf M, Gebrehiwot Y, Bailey P. A national review of cesarean delivery in Ethiopia. Int J Gynecol Obstet. 2011;115(1):106–11.
24. Thomas J, Paranjothy S, James D. National cross sectional survey to determine whether the decision to delivery interval is critical in emergency caesarean section. BMJ. 2004;328(7441):665.
25. Byamukama O, Tarnay C, Ainomugisha B, Tibaijuka L, Kajabwangu R, Kalyebara PK, et al. Iatrogenic Female Genitourinary Fistula in Uganda: Etiology, Twelve-Year Trends, and Risk Factors for Development Following Cesarean Section. Int J women's health. 2024;16:1865–73.
26. Weiner E, Bar J, Fainstein N, Ben-Haroush A, Sadan O, Golan A, et al. The effect of a program to shorten the decision-to-delivery interval for emergent cesarean section on maternal and neonatal outcome. Am J Obstet Gynecol. 2014;210(3):224. e1-. e6.
27. Quant HS, Hamm RF, Schwartz N, Srinivas SK. A multidisciplinary approach to improving process and outcomes in unscheduled cesarean deliveries. Am J Obstet Gynecol MFM. 2020;2(1):100070.
28. Rowe AK, de Savigny D, Lanata CF, Victora CG. How can we achieve and maintain high-quality performance of health workers in low-resource settings? Lancet (London, England). 2005;366(9490):1026-35.
29. Birth NC. NICE guideline. UK: 2021. https://www.nice.org.uk/guidance/NG192.
30. Apako T, Wani S, Oguttu F, Nambozo B, Nahurira D, Nantale R, et al. Decision to delivery interval for emergency caesarean section in Eastern Uganda: A cross-sectional study. PLoS ONE. 2023;18(9):e0291953.
31. 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.
32. Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates: 1990–2014. PLoS ONE. 2016;11(2):e0148343.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.