ASSESSING THE EFFECT OF THE LABOUR CARE GUIDE ON URGENT CAESAREAN SECTIONS AT A TERTIARY LEVEL HEALTH FACILITY IN UGANDA: AN INTERRUPTED TIME SERIES STUDY

Peter Gathoga[1], Romano N. Byaruhanga[1], Anthony Kayiira[1], Castro Kisuule[1], Deo Benyumiza[2]

ABSTRACT

BACKGROUND: The Labour Care Guide (LCG) has numerous benefits, including providing respectful care during labour and childbirth and reducing the rate of urgent caesarean sections. However, there is limited literature on the effects of the LCG in low- and middle-income settings in Africa. This study aimed to evaluate the impact of implementing the LCG on urgent caesarean section rates in a low-resource, tertiary health facility in Uganda.

METHODS: This Interrupted Time Series (ITS) study involved a retrospective review of medical records of pregnant women between July 1, 2021, and June 30, 2023. Data were collected from pregnant women admitted in labour and monitored using the modified WHO Partograph or the WHO Labour Care Guide at St. Francis Hospital Nsambya. Analysis was done using STATA 17/MP, with continuous variables presented as means ± SD and proportions for categorical variables. Linear segmental regression was used to analyse the outcome data, with a significance level set at ≤ 0.05.

RESULTS: A total of 2,451 pregnant women were included in the study, with no significant differences between the two groups monitored during labour. The ITS model showed a significant decrease in urgent caesarean section rates (0.80, p-value = 0.016) immediately after the introduction of the LCG, with no significant change in the slope post-intervention (0.015, p-value = 0.053). From the aggregated data, the LCG accounted for a 14.0% [95% CI: 17.2–10.8] risk difference in urgent caesarean section deliveries and an odds ratio (OR = 0.44 [95% CI: 0.36–0.53], p-value < 0.00). However, the study found no statistically significant difference in maternal complications or newborn outcomes immediately after delivery between the two labour monitoring tools (p-value > 0.05).

CONCLUSION AND RECOMMENDATION: This study highlights a significant reduction in urgent caesarean section rates following the implementation of the WHO Labour Care Guide. The adoption of the Labour Care Guide is recommended as a reliable method for decreasing urgent caesarean sections in Uganda.

KEYWORDS: Labour, Labour Care Guide, Caesarean section rate, Interrupted Time Series, Uganda, low-middle resource setting.

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1. Department of Obstetrics and Gynaecology, Mother Kevin Postgraduate School Nsambya, Uganda Martyrs University, Kampala City, Uganda.

2.Department of Midwifery, Faculty of Health Sciences, Lira University, Lira City, Uganda.

BACKGROUND

In sub-Saharan Africa, maternal mortality remains a critical issue for women of reproductive age. While there has been a global decrease in maternal mortality ratio (MMR) by 34.2% between 2000 and 2020, the African region still faces significant challenges, with 69% of maternal deaths occurring in sub-Saharan Africa[1, 2]. Uganda reports a current MMR of 189 maternal deaths per 100,000 births[3], with a majority of maternal deaths attributed to prolonged and obstructed labour. About 90% of perinatal mortality due to birth asphyxia is directly linked to obstructed labour[4].

To address these challenges, urgent caesarean sections are recommended when medically necessary, as they can effectively prevent maternal and perinatal morbidity and mortality[5]. However, it is important to note that there is no evidence supporting the benefits of caesarean delivery for women or infants who do not require the procedure[6].

Globally, 15% of women require caesarean sections for optimal maternal and perinatal outcomes[7]. Caesarean section rates below 5% are considered inadequate access to emergency obstetric care, while rates between 10% and 15% are deemed optimal[8,9]. Rates exceeding 15% do not show a reduction in maternal or newborn morbidity or mortality[5,7].

The introduction of the World Health Organization (WHO) Labour Care Guide (LCG) aims to improve intrapartum monitoring and support evidence-based, respectful care during labour and childbirth. The LCG replaces the traditional partograph for labour monitoring and addresses concerns over rising caesarean section rates without a corresponding improvement in maternal and newborn outcomes[10]. Implementing the LCG into routine intrapartum care is essential to enhance healthcare provider practices during labour and childbirth. This strategy can optimize the use of caesarean sections, improve maternal and perinatal health outcomes, and enhance women's overall care experience[11]. Recent studies have shown the positive impact of the WHO LCG on reducing primary caesarean deliveries. The use of the LCG resulted in a significant decrease in urgent caesarean section rates, leading to improved maternal and neonatal outcomes[12]. There is a lack of literature on the adoption and implementation of the Labour Care Guide in Africa, particularly in Uganda[13]. Thus, our study focuses on evaluating the effects of the Labour Care Guide on urgent caesarean sections at a tertiary-level facility in Central Uganda using an Interrupted Time Series study approach.

METHODS

Study Design and Setting

Evaluation of healthcare policies can present challenges, particularly when considering ethical concerns related to randomization. To address these challenges, this study utilized an Interrupted Time Series (ITS) approach. By constructing a time series of the outcomes and statistically testing for changes in outcome rates before and after the implementation of the Labour Care Guide, valuable insights were gained. The review was conducted over four months, from June 1, 2023, to September 30, 2023. This study was carried out at the Obstetrics and Gynaecology Department of St. Francis Hospital Nsambya. This is a private, not-for-profit hospital offering both inpatient and outpatient services. The hospital has two labour wards: a general and a private wing. The modified WHO Partograph has been used as the labour monitoring tool in the hospital since 1994, while the WHO Labour Care Guide was adopted as the sole labour monitoring tool from July 1, 2022. The hospital conducts an average of 3,600 deliveries per year (about 300 deliveries per month).

Study Population

The study reviewed files of all pregnant women who were monitored in labour using either the modified WHO Partograph or the LCG at St. Francis Hospital Nsambya during the study period between July 1, 2021, and June 30, 2023. All pregnant women's labour records that lacked minimum documentation (a single tracing of either the patient's name, fetal heart rate, cervical dilatation tracing, or missing labour outcomes) were excluded from the study.

Sample Size Considerations

Determining the appropriate sample size for an Interrupted Time Series study is essential, yet clear guidance on the exact formula remains lacking. The study power is optimized through a strategic trade-off between the number of time points and sample size per time point. To ensure stability in estimates and reduce variability and outliers within the ITS, a sample size of 100 at each time point is deemed desirable (1). Based on this recommendation, all mothers who were admitted to labour and monitored using either the Partograph or LCG were included in this study.

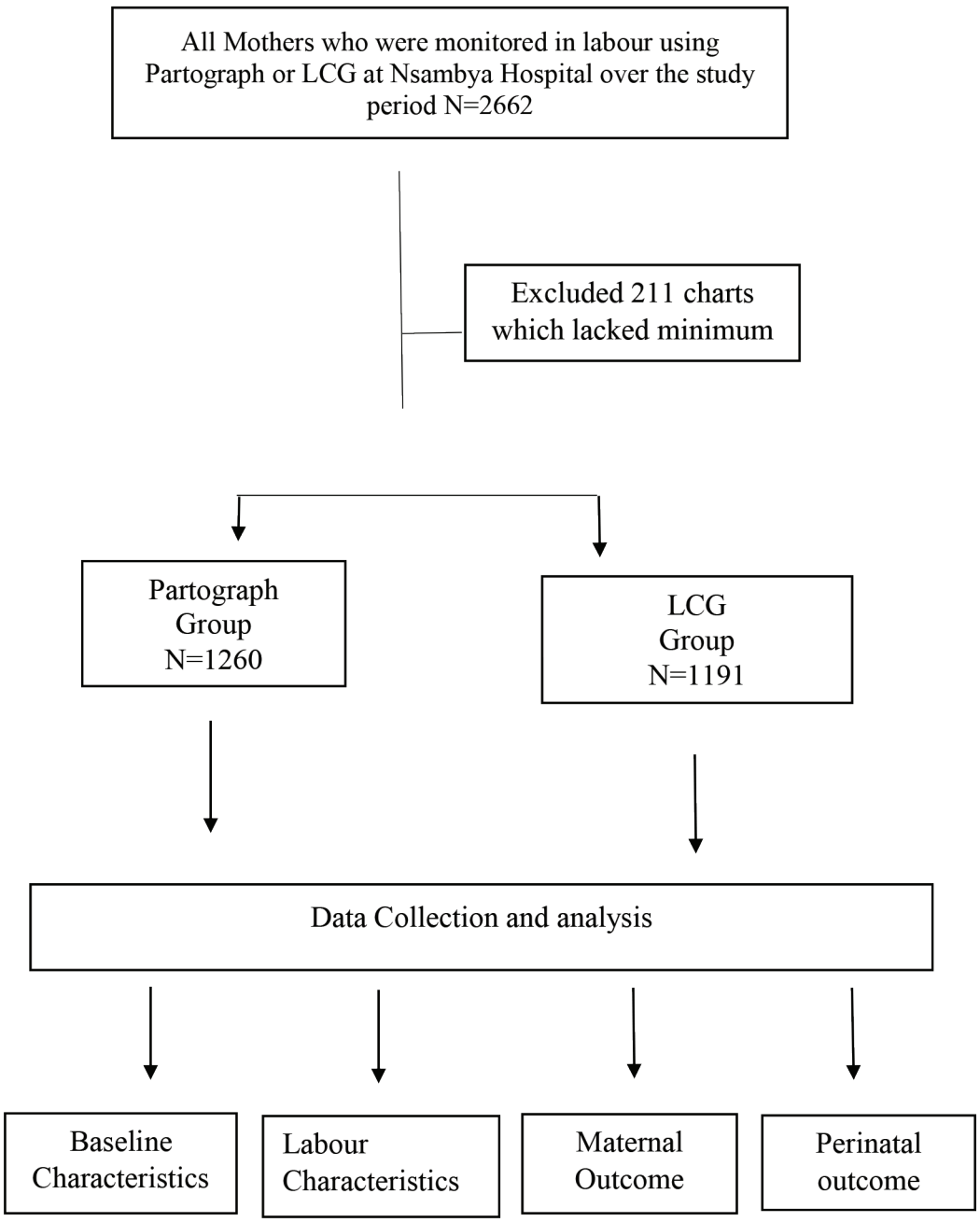

Figure 1: Showing Flow Chart of the Study.

Data Collection Tool

A pretested structured questionnaire was used to extract data from the patients' files. The questionnaire comprised five sections:

Section A: Socio-demographic information of study participants (maternal age, religion, education level);

Section B: Obstetric and medical history (gestational age, parity, HIV status, hypertensive disorders, diabetes in pregnancy, and urinary tract infection);

Section C: Labour characteristics (labour onset, artificial rupture of membranes, augmentation with oxytocin, duration of labour, mode of delivery, and indications for caesarean section);

Section D: Maternal complications after delivery (postpartum haemorrhage, peripartum hysterectomy, admission to high dependency unit/ critical care unit);

Section E: Newborn outcomes (live birth, stillbirth).

Data Collection

The data were collected by three research assistants who had a medical background. A total of 2,451 charts were included in the study; 1,260 were monitored using the WHO-modified Partograph, and 1,191 were monitored using the LCG. On completion of every data extraction session, questionnaires were checked for completeness. The filled data tools were then entered by the researcher into REDCap (Research Electronic Data Capture).

Data Management and Statistical Analysis

Data entry checks were created in REDCap to ensure that no missing or out-of-range data were entered. Data were imported into STATA 17/MP software for analysis. Continuous variables like age were summarised by mean ± SD, while proportions were used for categorical variables. Quantitative variables were compared using the Student t-test and qualitative variables using the Chi-square test. For statistical significance, a p-value of <0.05 was considered significant. A segmental regression analysis was performed to draw inferences about the effects of the Labour Care Guide on urgent caesarean section, duration of the active phase of labour, ARM, and oxytocin augmentation. The change in slope and intercept was used to define each segment of the ITS.

The regression model used was;

$$Logit\ Y_t = \beta_0 + \beta_1 t_i + \beta_2 X_{it} + \beta_3 ti*X_{it} + \beta_{4i}\text{-}n\ \Sigma\ (X_1 \text{ to } X_n)$$

Where β_0 represents the baseline outcome at T = 0, β_1 the change in outcome associated with a time unit increase (representing the underlying pre-intervention trend), β_2 the level change following the LCG adoption, and β_3 indicates the slope change following the intervention using the interaction between time and intervention: (t_i*X_t), and $\beta_{4i\text{-}n}$ represented the respective change on log odds associated with a unit change in the corresponding confounder variable adjusted for.

RESULTS

Demographic characteristics of the study participants

A total of 2451 participants were included in the study with a mean age of 29.75 years (SD ± 5.2). The age range of the participants was 15 to 45 years. The 2 groups of women had comparable social demographic characteristics as shown in Table 1 below.

Table 1: Socio-demographic characteristics of women monitored in Labour.

Demographic	Categories	Labour Monitoring tool		p-value
		Partograph Frequency (n, %)	Labour care guide Frequency (n, %)	
Maternal age	Mean, SD±	29.5±5.1	29.9±5.3	0.065
Maternal age	<19years	9(0.71)	12(1.01)	0.065
	20-34years	1019(80.87)	918(77.08)	
	≥35years	232(18.41)	261(21.91)	
Religion	Catholic	577(45.79)	520(43.66)	0.051
	Christian	296(23.49)	318(26.70)	
	Muslim	366(29.05)	283(23.76)	
	Others*	21(1.67)	70(5.85)	
Education level	No formal education	3(0.24)	5(0.42)	0.133
	Primary education	52(4.13)	61(5.12)	
	Secondary education	412(32.70)	427(35.85)	
	Tertiary education	798(62.740	698(58.61)	

*Others: these included Hindu and atheists

Obstetric and Clinical Characteristics of the Study Participants.

The mean gestation age at delivery was 39 ± 1.5 weeks. A total of 93 (3.9%) mothers had preterm births. The majority N = 1400 (57.1%) had a parity between 2-4. The two groups had comparable obstetric and clinical factors as shown in Table 2 below.

Table 2: Obstetric and Clinical Characteristics of the Study Participants.

Obstetric & clinical factors	Categories	Labour Monitoring tool		p-value
		Partograph Frequency (n, %)	Labour care guide Frequency (n, %)	
Gestational age	<37 weeks	46(3.65)	47(3.940)	
	37-42weeks above	1204(95.55)	1129(94.79)	
	≥42weeks	10(0.79)	15(1.25)	0.449
Parity	1	422(33.49)	388(32.58)	0.558
	2-4	708(56.19)	692(58.10)	
	5 +	130(10.32)	111(9.32)	
HIV status	Negative	1211(96.11)	1148(96.39)	0.143
	Not screened	5(0.40)	11(0.92)	
	Positive	44(3.49)	32(2.68)	
PIH	No	1132(89.84)	1070(89.84)	0.999
	Yes	128(10.16)	121(10.16)	
Hyperglycaemia in pregnancy	No	1242((98.57)	1169(98.15)	0.414
	Yes	18(1.43)	22(1.85)	
UTI in pregnancy	No	1251(99.29)	1188(99.75)	0.101
	Yes	9(0.71)	3(0.25)	
Mode of delivery	Vaginal Birth	890(70.63)	1008(84.63)	0.001
	Urgent C/Section	370(29.37)	370(29.37)	

A time series analysis of monthly fitted proportions of mothers delivered before and after the introduction of the labour care guide, showing a slow change in the slope before and an immediate significant (p=0.0015) change in the level after the intervention is shown in Figure 2 below.

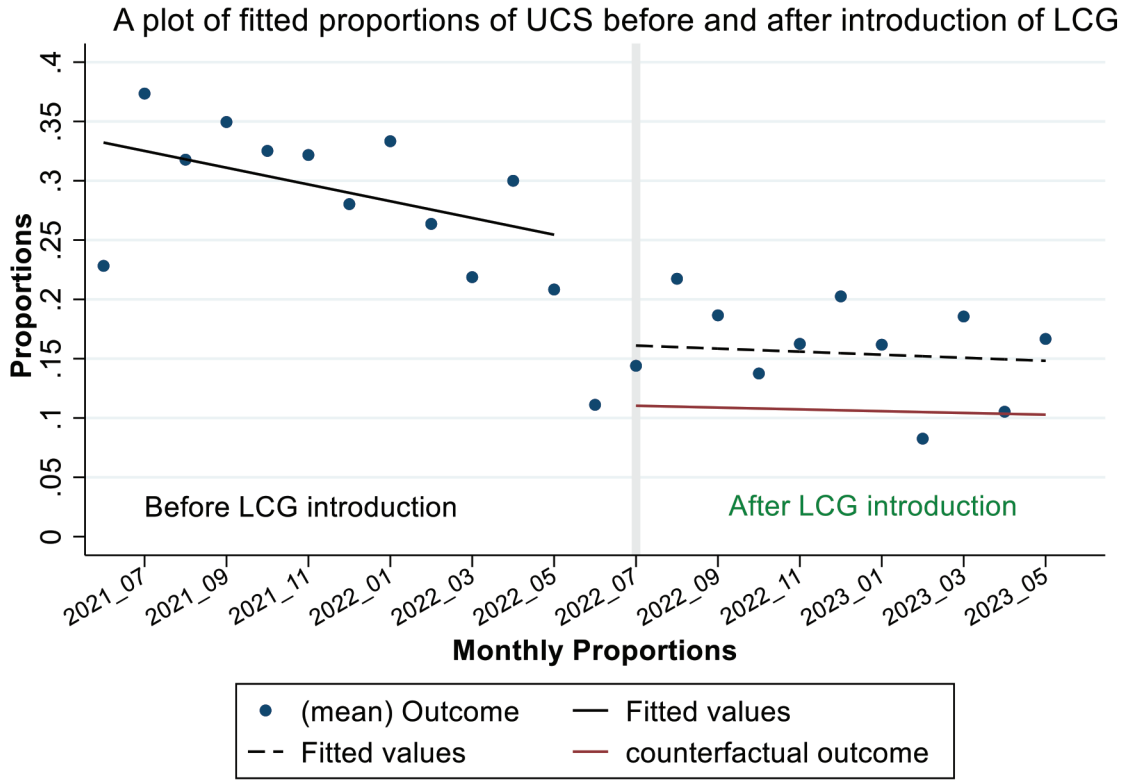

Figure 2: A plot of fitted proportions of patients who had an urgent caesarean section before and after the introduction of LCG.

Table 3: Interrupted Series Model for the Outcome

Change in proportion of UCS over time	Coefficient	P-value	95% CI
Before LCG	-0.071	0.031	-0.080 to -0.059
Immediately after the introduction of LCG	-0.80	0.016	-0.142 to -0.014
Interaction of outcome and time	-0.015	0.053	-0.006 to 0.017

There was an immediate change in the UCS (0.80) after the intervention (LCG). This effect is statistically significant, suggesting that right after the intervention, there was a significant abrupt change in the UCS (proportion of urgent caesarean sections performed). There was a slow negative trend in the outcome over time before the intervention (0.071). After the intervention, the slope of UCS changed by -0.015 compared to the pre-intervention trend.
From the aggregated data, the proportion of mothers delivered by urgent caesarean section using the partograph was 29.4% compared to 15.4% when the LCG was introduced. By adjusting for the years, LCG accounted for 14.0% [95% CI: 17.2 – 10.8] risk difference in urgent caesarean section deliveries and an odds ratio (OR = 0.44 [95% CI: 0.36-0.53], P<0.001) as shown in Table 3 above.
Maternal complications immediate post-delivery
The commonest complication was PPH in 130 (5.3%) of the participants followed by admission to HDU/ICU at 33 (1.4%). There was no significant difference between the labour monitoring tools used as shown in Table 4 below.

Table 4: Maternal complications after delivery of the 2451 study participants.

Maternal complication	Total	Partograph	LCG	P-value
PPH 130	66 (50.7)	64(49.2)	0.56	
Admission to HDU/ICU	33	20(60.6)	13(39.3)	0.862
Maternal Death	3	2 (66.6)	1 (33.3)	0.93

Newborn outcomes of the 2451 study participants

The commonest delivery outcome was live birth (n=2441, 99.6%), 3 (0.1%) were FSB and the rest were MSB. Of the live births, 1253 (51.3%) were delivered by monitoring using the Partograph and 1188 (48.7%) by LCG. There was no significant association between newborn outcomes and the labour monitoring tool as indicated in Table 5 below.

Table 5: Newborn outcomes of the 2451 study participants.

Outcomes	Total	Partograph	LCG	P-value
Live Birth	2441 (99.6)	1253 (51.3)	1188(48.7)	0.056
FSB	3 (0.1)	1 (33.3)	2 (66.7)	
MSB	7 (0.3)	6 (85.7)	1 (14.3)	

DISCUSSION

The implementation of the Labour Care Guide (LCG) at St. Francis Hospital Nsambya in Uganda resulted in a significant reduction in urgent caesarean rates. This innovative labour monitoring-to-action tool provides real-time monitoring of labour progress and prompts timely interventions, when necessary, ultimately improving maternal and newborn outcomes. The Labour Care Guide emphasizes the importance of individualized woman-centered care during labour and childbirth. It aims to reduce the unnecessary use of interventions such as artificial rupture of membranes and oxytocin augmentation in otherwise healthy pregnant women. Interventions are only recommended when there is a clear medical indication, leading to improved outcomes and reduced healthcare costs.

This interrupted time series study showed a significant immediate decrease in urgent caesarean section rates following the implementation of the Labour Care Guide (level change -0.80, p-value 0.016). The study revealed that there was no significant change in the overall trend of caesarean sections after the adoption of the LCG, indicating sustained benefits over time (-0.015, p-value 0.053). From the aggregated data, the LCG accounted for a 14.0% [95% CI: 17.2–10.8] risk difference in urgent caesarean section deliveries and an odds ratio (OR = 0.44 [95% CI: 0.36–0.53], $p < 0.001$). Similar results have been observed in other countries such as India, where the use of the Labour Care Guide resulted in a substantial reduction in caesarean section rates[12]. This decline may lead not only to a decrease in long-term maternal and newborn morbidity associated with caesarean deliveries but also allow resources to be redirected towards other healthcare needs and research initiatives.

The study also found no statistically significant difference in maternal complications or newborn outcomes immediately after delivery between the two labour monitoring tools. This implies that the impact of the LCG does not lead to a worse maternal or newborn outcome but a reduction in urgent caesarean section rates, which in the long run is beneficial.

Strengths of the study

When evaluating the impact of LCG on urgent caesarean sections, interrupted time series analysis proved to be a valuable tool. This method allows for a clear graphical representation of results, enabling the assessment of both intended and unintended consequences of the intervention[14].

Study Limitations

Despite the robust nature of quasi-experimental studies, certain limitations need to be acknowledged. These include autocorrelation, non-stationarity, and seasonality[14].

Furthermore, randomization is not conducted in interrupted time series analysis, leading to limited control over confounders. It is crucial to note that the interrupted time series is only valid if the program of interest is the sole factor that changes during the study period[14]. In our study, the assumption was made that the Labour Care Guide at St. Francis Hospital Nsambya was the only intervention introduced during the research period.

Conclusion

The Labour Care Guide is a valuable tool that has the potential to transform maternity care practices in Uganda and beyond. By promoting evidence-based interventions and individualized care, the LCG aims to improve maternal and newborn outcomes while reducing unnecessary healthcare costs.

With the results of this study showing much-needed care in line with the WHO intrapartum care guidelines, we strongly recommend the adoption of the Labour Care Guide as a policy tool in intrapartum care not just in the whole of Uganda, Sub-Saharan Africa, but the world over. The incorporation of respectful maternal care stands out in this tool and thus is highly recommended.

Declaration
This study was conducted following the Helsinki Declaration.

Ethics approval and consent to participate
Ethical approval for this study was obtained from the St. Francis Hospital Nsambya Research Ethics Committee with a clearance number: SFH-2023-84. A waiver of consent to access the charts was also sought from the REC (Research Ethics Committee, No.: SFH-2023-84). Administrative permission was sought from the Director of Clinical Services at St. Francis Hospital Nsambya to grant permission to access patients' files. During data collection, study identification numbers were used on all study-related documents to maintain confidentiality and privacy.

Consent for Publication
Not applicable

Data availability
The data sets used and/or analyzed during the study are available from the corresponding author upon reasonable request.

Conflicts of interests
The authors declare that they have no conflicts of interest.

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Authors contribution
Peter Gathoga, Romano N. Byaruhanga, Anthony Kayiira, Castro Kisuule, and Deo Benyumiza participated in topic development, protocol development, and data collection. Peter Gathoga., Romano N. Byaruhanga, Anthony Kisuule, and Deo Benyumiza participated in data analysis and manuscript writing. Peter Gathoga, Romano N. Byaruhanga, Castro Kisuule, Anthony Kayiira and Deo Benyumiza reviewed the manuscript.

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Abbreviations

WHO:	World Health Organization
SFH:	St. Francis Hospital
LCG:	Labour care guide
HIV:	Human immune deficiency
ARM:	Artificial rupture of membranes
PIH:	Pregnancy induced Hypertension
UTI:	Urinary tract infection

Correspondence should be addressed to Peter Gathoga; pgathoga60@gmail.com

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