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Perinatal Mortality and Associated Maternal, Obstetric and Health-System Factors in Southwestern Uganda: A Multicentre Cross-Sectional Study in Kabale District

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Abstract

Background: Perinatal deaths remain a major challenge in Uganda, yet evidence across different levels of maternity care in southwestern Uganda is limited. We estimated facility-based perinatal mortality and examined associated maternal, obstetric and service-related characteristics in Kabale District.

Methods: This multicentre cross-sectional study systematically sampled 718 women delivering at nine facilities between April and June 2026. Stillbirths from 26 weeks of gestation and early neonatal deaths recorded before discharge or day seven for those still admitted constituted the composite outcome. Associations were assessed using Firth penalized logistic regression, reporting adjusted odds ratios (aORs) and 95% confidence intervals (CIs).

Results: Nineteen perinatal deaths were documented (26.5 per 1,000 births; 95% CI 17.0–41.0). Factors associated with death were no formal education (aOR 7.75, 95% CI 1.43–42.14), adverse obstetric history (4.60, 1.06–19.96), referral from another facility (6.77, 1.84–24.87), preterm delivery (19.69, 5.72–67.77), hypertension in pregnancy (5.80, 1.22–27.58), elective caesarean delivery (5.16, 1.07–24.97) and emergency caesarean delivery (6.98, 1.98–24.66).

Conclusion: Perinatal mortality was substantial in the sampled facilities. Strengthening early risk recognition, referral pathways and care for preterm newborns may be important. Operative delivery associations should not be interpreted causally. Limited post-discharge follow-up may underestimate mortality through day seven.

Keywords: perinatal mortality; stillbirth; early neonatal death; Uganda; obstetric referral; prematurity

Background

Perinatal mortality remains a major public health challenge and an important indicator of maternal and newborn healthcare quality, particularly in low- and middle-income countries.[1] Encompassing

stillbirths and deaths within the first seven days of life, perinatal mortality reflects interactions between maternal health, obstetric complications, fetal characteristics and healthcare delivery.[2] Despite improvements in under-five survival, progress in preventing stillbirths and early neonatal deaths has been comparatively slow.[1] Inadequate documentation of stillbirths further obscures the true burden of perinatal mortality and limits opportunities for targeted interventions.[1,2]

Sub-Saharan Africa bears a disproportionate burden of perinatal deaths, reflecting persistent inequalities in access to quality maternal and newborn care. A meta-analysis of Demographic and Health Surveys across 21 sub-Saharan African countries estimated 34.7 perinatal deaths per 1,000 births, with considerable geographical variation.[1] Another systematic review confirmed substantial mortality but highlighted heterogeneity in study populations, settings and outcome ascertainment.[3] In Uganda, community-based prospective studies reported 41 perinatal deaths per 1,000 pregnancies in Eastern Uganda and 43 deaths per 1,000 births in Northern Uganda.[2,4] These findings underscore the persistent burden and importance of locally relevant evidence beyond referral hospitals.

Perinatal mortality has multifactorial determinants encompassing maternal, fetal, obstetric and health-system characteristics. Studies across Uganda and sub-Saharan Africa consistently identify prematurity, low birth weight, multiple gestation, previous adverse obstetric outcomes and maternal complications as important associated factors.[2,3,5,6] Prematurity is particularly consequential because of increased vulnerability to respiratory complications, infections and other neonatal conditions. At Tororo District Hospital, preterm delivery was strongly associated with perinatal death, while a Northern Ugandan community cohort identified nulliparity and advanced maternal age as important risk markers.[2,5] Similarly, research from rural western Uganda linked maternal delivery complications to both stillbirth and neonatal mortality.[6]

Socioeconomic circumstances and healthcare access are important determinants of perinatal outcomes, although their associations vary across populations and healthcare

settings.[3,7] Maternal education, geographical accessibility, antenatal care utilization and referral pathways influence opportunities for early identification and appropriate management of pregnancy-related complications.[3,7] However, evidence remains inconsistent: regional studies associate inadequate antenatal care and socioeconomic disadvantage with increased perinatal mortality, whereas community-based studies in Uganda have reported weaker or statistically nonsignificant associations for some of these factors.[2–4,7]. Such differences may reflect variations in population characteristics, healthcare quality and service utilization. Importantly, antenatal attendance does not necessarily indicate timely or comprehensive care.

Health-system challenges, including delays in recognizing obstetric complications, accessing appropriate referral facilities and receiving timely emergency obstetric and newborn care, may contribute to increased perinatal mortality.[5,6] Although caesarean delivery and complications requiring higher-level obstetric care have been associated with adverse perinatal outcomes, these relationships require cautious interpretation because women undergoing operative delivery or requiring referral frequently present with more severe obstetric complications.[5,6] Observed associations may therefore reflect clinical indications, delayed intervention or underlying disease severity rather than adverse effects of these interventions.[5,8]

Despite growing Ugandan evidence, studies integrating primary healthcare facilities and referral hospitals remain limited, particularly in southwestern Uganda. Understanding facility-level differences in maternal risk, obstetric complications and healthcare access is essential for developing context-specific interventions. This study therefore aimed to estimate perinatal mortality and identify associated maternal sociodemographic, obstetric and health-service factors among women delivering at nine selected health facilities in Kabale District, southwestern Uganda. The findings are intended to inform clinical risk identification, referral strengthening and quality improvement across the maternal and newborn care continuum.

Methods

Study design and setting

A multicentre, facility-based cross-sectional study was conducted between April and June 2026 in nine health facilities in Kabale District, Kigezi Region, southwestern Uganda. Kabale District has an estimated population of 285,097 and a total fertility rate of 4.3 children per woman, compared with the national average of 4.5 (Uganda Bureau of Statistics, 2024). The district serves a predominantly rural population, with agriculture, livestock farming and tourism constituting major economic activities.

The study included Kabale Regional Referral Hospital, Rushoroza Hospital, Kamukira and Maziba Health Centre IVs, and Buhara, Buhara NGO, Kaharo, Kamuganguzi and Karujanga Health Centre IIIs. These facilities represented different levels of Uganda's healthcare delivery system, including government and private-not-for-profit institutions providing routine maternity services, basic emergency obstetric and newborn care, and specialized referral services.

Facility selection followed a combination of purposive and random sampling. Kabale Regional Referral Hospital was purposively selected because it is the principal referral centre for specialized obstetric and newborn care in the Kigezi region. One of two private hospitals, two of four Health Centre IVs and five of 15 Health Centre IIIs were randomly selected. This approach provided representation across different facility levels and ownership categories.

Study population and eligibility criteria

The study population comprised women aged 15–45 years who delivered at a gestational age of at least 26 completed weeks in the participating facilities during the study period. Women delivering in maternity or gynaecology wards were eligible, irrespective of mode of delivery.

Women were excluded if their clinical records lacked essential information on gestational age, birth weight or neonatal survival status at discharge. Deliveries involving severe congenital abnormalities considered incompatible with life were also excluded.

Sample size determination

The sample size was calculated separately for estimating the magnitude of perinatal mortality and identifying associated factors. The larger estimate was selected as the study sample size.

Sample size for estimating perinatal mortality

The sample size was determined using the Kish–Leslie single-population proportion formula:

$$n = \frac{Z^2_{\alpha/2}\, p(1-p)}{d^2}$$

Where: n = minimum required sample size; $Z_{\alpha/2}$= 1.96, corresponding to a 95% confidence level; p= anticipated institutional perinatal mortality proportion of 0.023 (23 deaths per 1,000 births), based on Ugandan surveillance data from 2017–2021 reported by Agaba et al [8]; d = desired absolute precision of 0.0115, equivalent to half the anticipated mortality proportion, following the precision approach described by Naing et al (2022).[9] The minimum required sample was therefore approximately 653 participants. To account for an anticipated 10% non-response or incomplete-data allowance, the dissertation applied an additive adjustment, the study adopted a final target sample size of 718 women, as reported in the dissertation.

Sampling procedure and participant recruitment

A two-stage sampling strategy involving facility-level proportional allocation and systematic participant selection was used. First, the total sample was distributed across the nine facilities proportionately according to their annual delivery volumes. The facilities collectively reported

approximately 8,170 deliveries annually. Second, systematic sampling was conducted at each facility using maternity discharge records as the sampling frame. Every third eligible mother scheduled for discharge was selected until the facility-specific target was attained. Recruitment took place between April and June 2026. Eligible women were approached in the postnatal sections of maternity or gynaecology wards. Women whose newborns remained admitted to neonatal intensive care units were enrolled at maternal or neonatal discharge if this occurred within seven days of birth; otherwise, enrolment and outcome assessment occurred on day seven. A total of 718 women were recruited across the nine participating facilities.The distribution of study participants across the nine participating health facilities is presented in Table 1.

Table 1. Distribution of study participants by health facility

Health facility	Ownership	Annual deliveries	Recruited, n
Kabale Regional Referral Hospital	Public	3,671	328
Rushoroza Hospital	PNFP	989	89
Kamukira HC IV	Public	1,180	100
Maziba HC IV	Public	463	42
Buhara HC III	Public	246	20
Buhara NGO HC III	PNFP	415	36
Kaharo HC III	Public	320	25
Kamuganguzi HC III	Public	455	40
Karujanga HC III	Public	431	38
Total		8,170	718

Abbreviations: HC, Health Centre; PNFP, private not-for-profit.

Study outcome and operational definitions

The primary outcome was perinatal mortality, defined as a documented stillbirth occurring at or beyond 26 completed weeks of gestation or death of a live-born infant within the first seven days after birth.

Stillbirth was defined as delivery of a fetus without signs of life at or beyond the study's gestational-age threshold. Early neonatal death was defined as death of a live-born infant within seven completed days of birth.

Perinatal mortality was calculated as:

$$[Perinatal\ mortality = \frac{Stillbirths + documented\ early\ neonatal\ deaths}{Total\ births} \times 1{,}000]$$

The outcome was classified as a binary variable indicating whether a perinatal death was documented.

Perinatal survival status was determined at maternal or neonatal discharge, or on day seven for mothers or newborns who remained admitted. Infants discharged before day seven were not routinely followed up. Consequently, the study measured documented facility-associated perinatal deaths rather than complete seven-day mortality among all live births.

Explanatory variables and measurements

Explanatory variables were grouped into maternal sociodemographic, healthcare utilization, obstetric and delivery-related characteristics.

Maternal sociodemographic variables included age in completed years, marital status, educational attainment, employment status and age at first childbirth. Educational attainment was categorized as no formal education, primary education, or secondary/tertiary education.

Healthcare utilization variables included the number of antenatal care contacts, distance to the nearest health facility, health insurance coverage and referral status. Distance was measured in kilometres and categorized as less than 5 km or at least 5 km. Referral status distinguished women referred from lower-level facilities from those presenting without formal referral.

Obstetric variables included parity, interbirth interval, pregnancy plurality, previous adverse obstetric outcomes, gestational age and pregnancy-related illnesses. Parity was recorded as the number of previous pregnancies carried beyond 26 weeks. Previous adverse obstetric history included abortion, intrauterine fetal death, stillbirth or neonatal death.

Gestational age was recorded in completed weeks using the last normal menstrual period or, when unavailable, early- or mid-trimester ultrasonography. Preterm delivery was defined as birth before 37 completed weeks.

Pregnancy-related complications included hypertensive disorders, diabetes, antepartum haemorrhage and prolonged labour. Hypertensive disorders were identified from documented clinical diagnoses and relevant findings, including blood pressure of at least 140/90 mmHg and proteinuria where applicable. Prolonged labour was defined as labour exceeding 12 hours from onset to delivery.

Labour monitoring was assessed through documentation of partograph use, including fetal heart rate monitoring every 30 minutes, assessment of membrane status every four hours and assessment of descent of the presenting part every two hours.

Mode of delivery was obtained from maternity records and classified as spontaneous vaginal, breech, instrumental, elective caesarean or emergency caesarean delivery, as documented.

Data collection procedures

Data were collected using a structured interviewer-administered questionnaire and a standardized clinical-record abstraction form. Trained research assistants administered the questionnaire to eligible women at discharge from the maternity or gynaecology ward, provided discharge occurred within seven days of delivery. Women who remained admitted beyond this period were interviewed on day seven.

The questionnaire collected information on maternal sociodemographic characteristics, reproductive history, socioeconomic circumstances and healthcare utilization. Additional obstetric and clinical information was abstracted from antenatal care cards, maternity admission forms, integrated maternity registers and discharge records.

Clinical-record abstraction captured gestational age, pregnancy complications, labour monitoring, referral status, mode of delivery, birth weight and documented neonatal survival status. Information obtained through interviews was complemented by available clinical records to improve data completeness.

Data quality assurance

Several measures were implemented to improve the validity, reliability and completeness of collected data. The questionnaire was translated from English into Runyakitara and back-translated into English to assess consistency of meaning.

Before the main study, the questionnaire was pretested among 36 mothers attending the maternity ward. The feedback enabled improvements in questionnaoire comprehension and formatting. Research assistants were Assistant Nursing Officers (Midwifery) stationed at participating facilities,

with additional training in basic counselling and communication. The research assistants received one day of study-specific training covering study objectives, eligibility assessment, informed consent, questionnaire administration, clinical-record abstraction, confidentiality and ethical considerations, particularly when interviewing women who had experienced perinatal loss.

The principal investigator conducted weekly supervision across study sites. Daily data checks were performed to identify incomplete or inconsistent entries, with discrepancies addressed using the available source records. Data entry was undertaken by the principal investigator with assistance from a data clerk, while statistical analysis was conducted with support from a statistician.

Data management and statistical analysis

Data were entered into EpiData version 4.7 and exported to STATA version 19 for cleaning and statistical analysis. Electronic data were protected using password-controlled access.

Continuous variables were assessed for normality and summarized using appropriate descriptive statistics. Maternal age was presented as the median and interquartile range, while categorical variables were summarized using frequencies and percentages.

Participant characteristics were compared by perinatal survival status using the Mann–Whitney U test for continuous variables and Pearson's chi-square or Fisher's exact test for categorical variables, as appropriate.

The magnitude of perinatal mortality was calculated as the number of documented stillbirths and early neonatal deaths divided by total births and expressed per 1,000 births.

Associations between explanatory variables and perinatal mortality were examined using bivariable and multivariable Firth penalized logistic regression. This method was selected because perinatal death was relatively uncommon and conventional maximum-likelihood logistic regression could produce biased or unstable estimates under sparse-data conditions.

Variables associated with perinatal mortality at $p<0.05$ in bivariable analysis were considered for inclusion in the multivariable model. Candidate variables were assessed for multicollinearity before simultaneous inclusion in the final model.

Crude odds ratios (cORs) and adjusted odds ratios (aORs), with corresponding 95% confidence intervals (CIs), were reported. Statistical significance was assessed at a two-sided p-value of 0.05.

Given the relatively small number of observed perinatal deaths, multivariable estimates were interpreted cautiously. Firth penalization was used to mitigate small-sample estimation bias but could not eliminate potential overfitting, imprecision or residual confounding.

Ethical considerations

The study received clearance from the Kabale University Faculty Research Committee and ethical approval from the Kabale University Research Ethics Committee (Approval number: KABREC-2026-1001, Approval date: 08/04/2026). Administrative clearance was received from participating health facilities prior to study initiation. Eligible participants received information about the study objectives, procedures, anticipated benefits, potential risks and voluntary nature of participation before providing written informed consent. Participant information sheets and consent documents were translated into Runyakitara to facilitate understanding. Women younger than 18 years provided assent alongside consent from their caregivers, as documented in the dissertation. Participants were provided copies of the participant information sheet and consent documentation. Confidentiality was maintained through the use of unique identification codes combining facility, research assistant and participant identifiers. Electronic study data were stored in password-protected systems with restricted access. Participants received a bar of soap as compensation for the time spent participating in the study.

Results

Participant flow

A total of 718 women who delivered at nine selected health facilities in Kabale District, southwestern Uganda, were enrolled and included in the final analysis (Figure 1). Of these, 19 (2.6%) experienced a documented perinatal death, while 699 (97.4%) had no documented perinatal death during the observation period. All 718 enrolled participants were included in the reported analysis. However, the numbers initially assessed for eligibility, excluded before enrolment or declining participation were not available in the study records provided.

Baseline sociodemographic and health-system characteristics

The median maternal age was 26 years (interquartile range [IQR], 22–30 years), and 359 participants (50.0%) were aged 25–34 years. Most women were married (681/718, 94.8%), 315 (43.9%) had primary education, and 458 (63.8%) lived within 5 km of a health facility. At least four antenatal care (ANC) visits were reported by 584 women (81.3%), while 185 (25.8%) had been referred from a lower-level facility. Compared with women without a documented perinatal death, those experiencing a death differed by educational attainment (p=0.012), previous adverse obstetric history (p<0.001), ANC attendance (p=0.039) and referral status (p<0.001) (Table 2).

Table 2. Baseline sociodemographic and health-system characteristics of participants

Variable	Total (N=718)	Died Yes (n=19)	Alive (n=699)	p-value
Median maternal age (IQR)	26 (22–30)	29 (23–34)	26 (22–30)	0.407
Mother's age				1.000
<25 years	281 (39.1%)	7 (36.8%)	274 (39.2%)	
25–34 years	359 (50.0%)	10 (52.6%)	349 (49.9%)	
≥35 years	78 (10.9%)	2 (10.5%)	76 (10.9%)	
Education level				0.012
No formal education	142 (19.8%)	9 (47.4%)	133 (19.0%)	
Primary level	315 (43.9%)	7 (36.8%)	308 (44.1%)	
Secondary/tertiary	261 (36.4%)	3 (15.8%)	258 (36.9%)	

Marital status				0.617
Married	681 (94.8%)	19 (100.0%)	662 (94.7%)	
Not married	37 (5.2%)	0 (0.0%)	37 (5.3%)	
Poor obstetric history				<0.001
Yes	39 (5.4%)	5 (26.3%)	34 (4.9%)	
No	679 (94.6%)	14 (73.7%)	665 (95.1%)	
Number of ANC visits				0.039
<4 visits	134 (18.7%)	7 (36.8%)	127 (18.2%)	
≥4 visits	584 (81.3%)	12 (63.2%)	572 (81.8%)	
Distance to nearest health facility				0.363
Within 5 km	458 (63.8%)	14 (73.7%)	444 (63.5%)	
≥5 km	260 (36.2%)	5 (26.3%)	255 (36.5%)	
Referred from lower facility				<0.001
Yes	185 (25.8%)	14 (73.7%)	171 (24.5%)	
No	533 (74.2%)	5 (26.3%)	528 (75.5%)	
Health insurance				1.000
Yes	64 (8.9%)	1 (5.3%)	63 (9.0%)	
No	654 (91.1%)	18 (94.7%)	636 (91.0%)	

Values are n (%) unless otherwise indicated. IQR, interquartile range; ANC, antenatal care. p-values are from Mann–Whitney U, chi-square or Fisher's exact tests, as appropriate.

Baseline obstetric characteristics

Most participants had parity of two to four (432/718, 60.2%) and delivered at term (679/718, 94.6%). Vaginal delivery accounted for 541 deliveries (75.3%), emergency caesarean section for 112 (15.6%), and elective caesarean section for 65 (9.1%). The distribution of gestational age, antepartum haemorrhage, hypertensive disorders, mode of delivery and partograph use differed significantly by documented perinatal death status (Table 3).

Table 3. Baseline obstetric characteristics of participants

Variable	Total (N=718)	Died (n=19)	Alive (n=699)	p-value
Parity				0.219
1	222 (30.9%)	3 (15.8%)	219 (31.3%)	
2–4	432 (60.2%)	13 (68.4%)	419 (59.9%)	
≥5	64 (8.9%)	3 (15.8%)	61 (8.7%)	
Short interbirth interval				0.529
Yes	327 (45.5%)	10 (52.6%)	317 (45.4%)	
No	391 (54.5%)	9 (47.4%)	382 (54.6%)	
Gestational age at delivery				<0.001
Preterm	39 (5.4%)	11 (57.9%)	28 (4.0%)	

Term	679 (94.6%)	8 (42.1%)	671 (96.0%)	
Antepartum haemorrhage				0.031
Yes	27 (3.8%)	3 (15.8%)	24 (3.4%)	
No	691 (96.2%)	16 (84.2%)	675 (96.6%)	
Hypertension in pregnancy				<0.001
Yes	14 (1.9%)	4 (21.1%)	10 (1.4%)	
No	704 (98.1%)	15 (78.9%)	689 (98.6%)	
Mode of delivery				<0.001
Vaginal delivery	541 (75.3%)	7 (36.8%)	534 (76.4%)	
Elective CS	65 (9.1%)	3 (15.8%)	62 (8.9%)	
Emergency CS	112 (15.6%)	9 (47.4%)	103 (14.7%)	
Use of partograph				<0.001
Yes	538 (74.9%)	7 (36.8%)	531 (76.0%)	
No	115 (16.0%)	9 (47.4%)	106 (15.2%)	
Not applicable	65 (9.1%)	3 (15.8%)	62 (8.9%)	
Duration of labour				0.433
≤12 hours	540 (75.2%)	16 (84.2%)	524 (75.0%)	
>12 hours	178 (24.8%)	3 (15.8%)	175 (25.0%)	

CS, caesarean section. Values are n (%). p-values from chi-square or Fisher's exact tests, as appropriate

Magnitude and types of perinatal deaths

Among 718 births reported in the study, 19 perinatal deaths were documented, corresponding to a perinatal mortality rate of 26.5 per 1,000 births (95% confidence interval [CI], 17.0–41.0 per 1,000). The remaining 699 births (97.4%) had no documented perinatal death. Of the 19 perinatal deaths, 8 were macerated, 7 were fresh still births and 4 were early neonatal deaths.

Bivariable analysis of sociodemographic and health-system factors

At bivariable analysis, no formal maternal education (crude odds ratio [cOR] 5.26; 95% CI 1.52–18.22), previous adverse obstetric history (cOR 7.32; 95% CI 2.59–20.69), fewer than four ANC visits (cOR 2.69; 95% CI 1.07–6.80) and referral from a lower-level facility (cOR 8.12; 95% CI 3.00–22.01) were associated with documented perinatal death. Maternal age, distance to the nearest health facility and health insurance were not statistically associated with the outcome in the reported bivariable model (Table 4).

Table 4. Bivariable analysis of sociodemographic and health-system factors associated with perinatal death

Variable	Died (n=19)	Alive (n=699)	cOR (95% CI)	p-value
Mother's age				
<25 years	7 (36.8%)	274 (39.2%)	0.91 (0.35–2.35)	0.845
25–34 years	10 (52.6%)	349 (49.9%)	Ref	
≥35 years	2 (10.5%)	76 (10.9%)	1.09 (0.27–4.42)	0.906
Education level				
No formal education	9 (47.4%)	133 (19.0%)	5.26 (1.52–18.22)	0.009
Primary level	7 (36.8%)	308 (44.1%)	1.80 (0.50–6.45)	0.370
Secondary/tertiary	3 (15.8%)	258 (36.9%)	Ref	
Poor obstetric history				
Yes	5 (26.3%)	34 (4.9%)	7.32 (2.59–20.69)	<0.001
No	14 (73.7%)	665 (95.1%)	Ref	
Number of ANC visits				
<4 visits	7 (36.8%)	127 (18.2%)	2.69 (1.07–6.80)	0.036
≥4 visits	12 (63.2%)	572 (81.8%)	Ref	
Distance to nearest facility				
Within 5 km	14 (73.7%)	444 (63.5%)	Ref	
≥5 km	5 (26.3%)	255 (36.5%)	0.66 (0.24–1.78)	0.412
Referred from lower facility				
Yes	14 (73.7%)	171 (24.5%)	8.12 (3.00–22.01)	<0.001
No	5 (26.3%)	528 (75.5%)	Ref	
Health insurance				
Yes	1 (5.3%)	63 (9.0%)	Ref	
No	18 (94.7%)	636 (91.0%)	1.23 (0.23–6.63)	0.809

cOR, crude odds ratio; CI, confidence interval; ANC, antenatal care; Ref, reference category

Bivariable analysis of obstetric factors

Preterm delivery showed the largest bivariable association with perinatal death (cOR 31.88; 95% CI 12.17–83.47). Other associated characteristics included antepartum haemorrhage (cOR 5.85; 95% CI 1.72–19.85), hypertension in pregnancy (cOR 19.06; 95% CI 5.66–64.17), elective caesarean delivery (cOR 3.99; 95% CI 1.09–14.58), emergency caesarean delivery (cOR 6.54; 95% CI 2.45–17.43) and absence of partograph use (cOR 6.32; 95% CI 2.37–16.84). Parity, short interbirth interval and labour duration were not significantly associated with the outcome (Table 5).

Table 5. Bivariable analysis of obstetric factors associated with perinatal death

Variable	Died (n=19)	Alive (n=699)	cOR (95% CI)	p-value
Parity				
1	3 (15.8%)	219 (31.3%)	0.50 (0.15–1.62)	0.246
2–4	13 (68.4%)	419 (59.9%)	Ref	
≥5	3 (15.8%)	61 (8.7%)	1.77 (0.53–5.91)	0.354
Short interbirth interval				
Yes	10 (52.6%)	317 (45.4%)	1.33 (0.55–3.24)	0.528
No	9 (47.4%)	382 (54.6%)	Ref	
Gestational age at delivery				
Preterm	11 (57.9%)	28 (4.0%)	31.88 (12.17–83.47)	<0.001
Term	8 (42.1%)	671 (96.0%)	Ref	
Antepartum haemorrhage				
Yes	3 (15.8%)	24 (3.4%)	5.85 (1.72–19.85)	0.005
No	16 (84.2%)	675 (96.6%)	Ref	
Hypertension in pregnancy				
Yes	4 (21.1%)	10 (1.4%)	19.06 (5.66–64.17)	<0.001
No	15 (78.9%)	689 (98.6%)	Ref	
Mode of delivery				
Vaginal delivery	7 (36.8%)	534 (76.4%)	Ref	
Elective CS	3 (15.8%)	62 (8.9%)	3.99 (1.09–14.58)	0.036
Emergency CS	9 (47.4%)	103 (14.7%)	6.54 (2.45–17.43)	<0.001
Use of partograph				
Yes	7 (36.8%)	531 (76.0%)	Ref	
No	9 (47.4%)	106 (15.2%)	6.32 (2.37–16.84)	<0.001
Not applicable	3 (15.8%)	62 (8.9%)	3.97 (1.09–14.50)	0.037
Duration of labour				
≤12 hours	16 (84.2%)	524 (75.0%)	Ref	
>12 hours	3 (15.8%)	175 (25.0%)	0.58 (0.20–1.69)	0.320

cOR, crude odds ratio; CI, confidence interval; CS, caesarean section; Ref, reference category

Multivariable analysis of factors associated with perinatal death

In the multivariable Firth penalized logistic regression model, no formal maternal education (adjusted odds ratio [aOR] 7.75; 95% CI 1.43–42.14), previous adverse obstetric history (aOR 4.60; 95% CI 1.06–19.96), referral from a lower-level facility (aOR 6.77; 95% CI 1.84–24.87), preterm delivery (aOR 19.69; 95% CI 5.72–67.77), and hypertension in pregnancy (aOR 5.80; 95% CI 1.22–27.58) remained associated with documented perinatal death. Relative to vaginal delivery, both elective caesarean delivery (aOR 5.16; 95% CI 1.07–24.97) and emergency caesarean delivery (aOR 6.98; 95% CI 1.98–24.66) were associated with the outcome. Fewer than four ANC

visits and antepartum haemorrhage were not statistically significant after adjustment (Table 6). Given the 19 observed events and wide confidence intervals, these estimates require cautious interpretation; referral and operative delivery associations are especially vulnerable to confounding by indication.

Table 6. Factors associated with perinatal death in multivariable analysis

Variable	cOR (95% CI)	p-value	aOR (95% CI)	p-value
Education level				
No formal education	5.26 (1.52–18.22)	0.009*	7.75 (1.43–42.14)	0.018*
Primary level	1.80 (0.50–6.45)	0.370	1.88 (0.40–8.81)	0.421
Secondary/tertiary	Ref		Ref	
Poor obstetric history				
Yes	7.32 (2.59–20.69)	<0.001*	4.60 (1.06–19.96)	0.042*
No	Ref		Ref	
Number of ANC visits				
<4 visits	2.69 (1.07–6.80)	0.036*	2.50 (0.75–8.39)	0.138
≥4 visits	Ref		Ref	
Referred from lower facility				
Yes	8.12 (3.00–22.01)	<0.001*	6.77 (1.84–24.87)	0.004*
No	Ref		Ref	
Gestational age at delivery				
Preterm	31.88 (12.17–83.47)	<0.001*	19.69 (5.72–67.77)	<0.001*
Term	Ref		Ref	
Antepartum haemorrhage				
Yes	5.85 (1.72–19.85)	0.005*	1.53 (0.22–10.85)	0.672
No	Ref		Ref	
Hypertension in pregnancy				
Yes	19.06 (5.66–64.17)	<0.001*	5.80 (1.22–27.58)	0.027*
No	Ref		Ref	
Mode of delivery				
Vaginal delivery	Ref		Ref	
Elective CS	3.99 (1.09–14.58)	0.036*	5.16 (1.07–24.97)	0.041*
Emergency CS	6.54 (2.45–17.43)	<0.001*	6.98 (1.98–24.66)	0.003*

cOR, crude odds ratio; aOR, adjusted odds ratio; CI, confidence interval; ANC, antenatal care; CS, caesarean section; Ref, reference category.

Discussion

Across nine facilities in Kabale District, 19 of 718 births were recorded as perinatal deaths. The observed 26.5 deaths per 1,000 births is close to Uganda's reported institutional surveillance average of 23 per 1,000 for 2017–2021, but lower than the 43 per 1,000 reported in a Northern

Uganda community cohort.[2,8] These figures should not be treated as directly comparable: populations, gestational thresholds, referral patterns and follow-up differ. Crucially, most infants in the present study were not followed after discharge, so deaths occurring later in the first week could have been missed.

Prematurity had the largest adjusted association, consistent with findings from Tororo District Hospital and broader sub-Saharan African evidence.[3,5] Preterm infants face multiple interacting vulnerabilities, including respiratory distress, infection and thermal instability. The large estimate in Kabale (aOR 19.69) also has a wide confidence interval, reflecting sparse events; it should motivate stronger prevention and newborn-care pathways rather than be interpreted as a precise causal effect.

Previous adverse obstetric history and hypertensive disorders were associated with perinatal death. Similar signals appear in Ethiopian and Tanzanian studies, supporting careful review of previous pregnancy losses and systematic screening and management of hypertensive complications.[6,10] Importantly, these characteristics may share pathways through placental dysfunction, medically indicated preterm birth and other complications; the adjusted estimates do not isolate any single mechanism.

Referral from a lower-level facility was strongly associated with death. This may indicate delayed access, but also reflects the concentration of high-risk cases at higher-level services. Findings from western Uganda likewise highlight geographic access and obstetric complications as important considerations.[4] Improving referral communication, stabilization, transport and readiness to provide emergency care is a reasonable service priority, although this study cannot quantify the effect of any particular intervention.

Both elective and emergency caesarean deliveries were associated with perinatal death compared with vaginal delivery. This is especially vulnerable to confounding by indication: women with fetal compromise, severe maternal illness or obstetric emergencies are more likely to require surgery. Observational comparisons of delivery setting and mode do not justify inferring that caesarean

section causes these deaths or withholding indicated operations.[3,7] Better measurement of surgical indications, fetal status at decision, decision-to-incision time and referral delays is needed.

No formal maternal education was also associated with mortality. Socioeconomic circumstances can shape health literacy, autonomy and access to timely care, but this association was not consistent in all Ugandan community studies.[2] Education is therefore best viewed as a marker of broader vulnerability rather than a sufficient explanation for an individual death. Similarly, fewer than four antenatal contacts and antepartum haemorrhage were associated at bivariable but not multivariable analysis; the results do not establish that these factors are irrelevant.

This study adds evidence across health centres and hospitals in a relatively understudied district. Limitations include facility-based selection, a cross-sectional observational design, incomplete post-discharge ascertainment, potential recall and documentation error, exclusion of some complicated births, and only 19 outcome events for a multivariable model with several coefficients. These limitations restrict generalizability, increase risk of model instability and preclude causal inference. Future studies should use standardized stillbirth thresholds, complete seven-day follow-up, report component outcomes separately and account for facility clustering and referral indication.

Conclusions

Perinatal mortality remained substantial among deliveries in selected Kabale District facilities. Prematurity, hypertensive pregnancy disorders, adverse obstetric history, referral status, lower maternal education and caesarean delivery were associated with recorded deaths, but estimates were imprecise and do not imply causation. Priority areas for further evaluation include quality antenatal risk assessment, timely obstetric referral and comprehensive care for preterm infants.

Abbreviations

ANC, antenatal care; aOR, adjusted odds ratio; CI, confidence interval; cOR, crude odds ratio; CS, caesarean section; HC, Health Centre; IQR, interquartile range; KABREC, Kabale University Research Ethics Committee; PNFP, private not-for-profit; Ref, reference category; STATA, statistical software for data analysis.

Declarations

Ethics approval and consent to participate: The study was conducted in accordance with the principles of the Declaration of Helsinki and UNCST guidelines for research involving humans. Ethical approval was obtained from the Kabale University Research Ethics Committee (Approval number: KABREC-2026-1001; approval date: 8 April 2026). Administrative clearance was obtained from the participating health facilities before study initiation.

Consent for publication: Not applicable. No identifiable individual participant information is presented.

Availability of data and materials: The datasets analysed during the current study are available from the corresponding author on reasonable request, subject to applicable ethical and regulatory requirements in Uganda.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: APT, PO and ST conceived the study, developed the proposal and participated in research implementation. APT, PO, ST and GB reviewed the proposal. APT, ST and PO analysed the data. APT, DA and EN drafted the manuscript. All authors reviewed and approved the final manuscript.

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References

1. Akombi BJ, Renzaho AM. Perinatal Mortality in Sub-Saharan Africa: A Meta-Analysis of Demographic and Health Surveys. Annals of Global Health. 2019;85(1):106.doi:10.5334/aogh.2348

2. Arach AAO, Tumwine JK, Nakasujja N, Ndeezi G, Kiguli J, Mukunya D, et al. Perinatal death in Northern Uganda: incidence and risk factors in a community-based prospective cohort study. Global Health Action. 2021;14(1):1859823. doi:10.1080/16549716.2020.1859823

3. Tesfalul MA, Natureeba P, Day N, Thomas O, Gaw SL. Identifying risk factors for perinatal death at Tororo District Hospital, Uganda: a case-control study. BMC Pregnancy and Childbirth. 2020;20(1):45. doi:10.1186/s12884-020-2727-3

4. Moyer CA, Kolars CK, Oppong SA, Bakari A, Bell A, Busingye P. Predictors of stillbirths and neonatal deaths in rural western Uganda. International Journal of Gynecology & Obstetrics. 2016;134(2):190–3. doi:10.1016/j.ijgo.2016.01.009

5. Tiruneh D, Assefa N, Mengiste B. Perinatal mortality and its determinants in sub-Saharan African countries: systematic review and meta-analysis. Maternal Health, Neonatology and Perinatology. 2021;7(1):1. doi:10.1186/s40748-020-00120-4

6. Roro EM, Sisay MM, Sibley LM. Determinants of perinatal mortality among cohorts of pregnant women in three districts of North Showa zone, Oromia Region, Ethiopia: Community based nested case control study. BMC Public Health. 2018;18:888. doi:10.1186/s12889-018-5757-2

7. Chinkhumba J, De Allegri M, Muula AS, Robberstad B. Maternal and perinatal mortality by place of delivery in sub-Saharan Africa: a meta-analysis of population-based cohort studies. BMC Public Health. 2014;14:1014. doi:10.1186/1471-2458-14-1014

8. Agaba B, Nelly HN, Kabami Z, Kizito SN, Simbwa B, Zavuga R, et al. Trends and spatial distribution of perinatal deaths, Uganda: a descriptive analysis of surveillance data, 2017–2021.

Quarterly Epidemiological Bulletin. 2023;8(1). Available from: https://uniph.go.ug/amp/trends-and-spatial-distribution-of-perinatal-deaths-uganda-a-descriptive-analysis-of-surveillance-data-2017-2021/

9. Naing L, Nordin RB, Abdul Rahman H, Naing YT. Sample size calculation for prevalence studies using Scalex and ScalaR calculators. BMC Medical Research Methodology. 2022;22(1):209. doi:10.1186/s12874-022-01694-7

10. Schmiegelow C, Minja D, Oesterholt M, Pehrson C, Suhrs HE, Boström S, et al. Factors associated with and causes of perinatal mortality in northeastern Tanzania. Acta Obstetricia et Gynecologica Scandinavica. 2012;91(9):1061–8. doi:10.1111/j.1600-0412.2012.01478.x

Figure Legend

Figure 1. Participant flow based on the reported analytical sample. Numbers screened, excluded and declining participation were not available in the supplied results.