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Emmanuel Madira

madiraemmanuel@hotmail.com

Lira University

Matia Tumwesige

Lira University

Beth Namukwana

Lira University

Deborah Andrinar Namutebi

Lira University

Vicky Caroline Achayo

Lira University

Benedict Arebo

Lira University

Didan Jacob Opii

Lira University

Peterson Amumpaire

Lira University

Caroline Kambugu Nabasirye

Lira University

James Okello

Lira Hospital

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Prevalence and Determinants of Birth-Related Perineal Tears Among Women with Vaginal Deliveries at a Tertiary Public Hospital in Northern Uganda: A Retrospective Cross-Sectional Study

Authors: Emmanuel Madira¹, Matia Tumwesige¹, Beth Namukwana¹, Deborah Andrinar Namutebi¹, Vicky Caroline Achayo¹, Benedict Arebo¹, Didan Jacob Opii¹, Peterson Amumpaire¹, Caroline Kambugu Nabasirye¹, James Okello²

Authors affiliation:

1. Department of Midwifery, Lira University; Lira Uganda.

2. Lira Regional Referral Hospital, Lira Uganda

Corresponding Author

Emmanuel Madira

Email: madiraemmanuel@hotmail.com

Tel: +256773721035

Abstract

Background: Birth-related perineal tears are among the most common complications of vaginal delivery and contribute substantially to maternal morbidity through postpartum haemorrhage, perineal pain, infection, anal incontinence, sexual dysfunction, and impaired quality of life. Despite their clinical significance, there is limited evidence regarding the burden and determinants of birth-related perineal tears in Northern Uganda. This study determined the prevalence of birth-related perineal tears and associated factors among women who delivered vaginally at a Public Regional Referral Hospital.

Objectives: To determine the prevalence of birth-related perineal tears and factors associated among women who delivered vaginally.

Design: Retrospective analytical cross-sectional study

Methods: We conducted a hospital-based retrospective analytical cross-sectional study using routinely collected maternity records of women who delivered vaginally at Lira Regional Referral Hospital between October and December 2024. A total of 390 eligible medical records were reviewed using a structured data abstraction tool. Medical records with stillbirths, gestational age below 34 weeks, or incomplete documentation of key variables were excluded. Data were entered into Epi-Data version 4.7, cleaned in SPSS version 27, and analyzed using Stata version 15. Descriptive statistics summarized participant characteristics. Modified Poisson regression with robust standard errors was used to estimate crude and adjusted prevalence ratios (PRs) with 95% confidence intervals (Cis). Variables with $p < 0.20$ at bivariate analysis were included in the multivariable model, and statistical significance was determined at $p < 0.05$.

Results:

Among the 390 women included in the study, 118 sustained birth-related perineal tears, corresponding to an overall prevalence of 30.26% (95% CI: 25.73%-35.08%). After adjustment for potential confounders, nulliparity (aPR=1.25; 95% CI: 1.07-1.47; $p=0.004$), prolonged active first stage of labor (≥ 8 hours) (aPR=1.12; 95% CI: 1.04-1.21; $p=0.004$), and prolonged second stage of labor (>60 minutes) (aPR=1.16; 95% CI: 1.03-1.30; $p=0.017$) were independently associated with birth related perineal tears.

Conclusion Approximately one in three women delivering vaginally at Lira Regional Referral Hospital experienced birth-related perineal tears. Key predictors included nulliparity and prolonged stages of labor. Enhancing labor surveillance and management, along with evidence-based perineal protection strategies, could help reduce these injuries in similar resource-limited environments.

Key words: Birth-related perineal tears, Perineal trauma; Vaginal delivery; Nulliparity; labor duration; Maternal morbidity; Uganda.

Introduction

Birth-related perineal tears are among the most common obstetric complications of vaginal delivery and remain an important contributor to maternal morbidity worldwide. Perineal traumas range from minor injuries involving the vaginal mucosa and perineal skin to severe obstetric anal sphincter injuries (OASIs) involving the anal sphincter complex and rectal mucosa. Although most perineal tears heal without long-term sequelae, severe injuries can result in substantial physical, psychological, and social consequences, including postpartum hemorrhage, wound infection, chronic perineal pain, urinary and fecal incontinence, dyspareunia, sexual dysfunction, pelvic floor disorders, impaired quality of life, and adverse effects on maternal mental health. These complications may persist for years after childbirth, highlighting the importance of effective prevention, early recognition, and appropriate management of perineal trauma(1–3)

Perineal trauma occurs frequently following vaginal birth, although reported prevalence varies considerably across studies owing to differences in study populations, diagnostic practices, obstetric interventions, and classification systems. Globally, approximately 53%-89% of women who deliver vaginally sustain some degree of perineal trauma, while more than 85% experience either spontaneous tears or episiotomy.(1,4) The reported prevalence of severe perineal trauma, particularly obstetric anal sphincter injuries, is substantially lower, ranging between 0.6%-6.6% in many African settings and approximately 1%-11% across sub-Saharan Africa.(5) These wide variations reflect differences in case definitions, provider training, documentation practices, and the quality of post-delivery perineal examination. Consequently, comparisons across settings should be interpreted cautiously. Perineal tears are classified according to the anatomical structures involved. First-degree tears involve the vaginal epithelium and perineal skin only, second-degree tears extend into the perineal muscles without

77 involving the anal sphincter, third-degree tears involve partial or complete disruption
78 of the anal sphincter complex, and fourth-degree tears extend through the rectal
79 mucosa(6). Increasing severity of injury is associated with progressively greater risks of
80 postpartum morbidity, prolonged recovery, pelvic floor dysfunction, and long-term
81 impairment of women's physical and psychosocial well-being. Accurate classification is
82 therefore essential for appropriate clinical management, surveillance, and quality
83 improvement initiatives.

84 The occurrence of birth-related perineal tears is influenced by a complex interaction of
85 maternal, fetal, and intrapartum factors. Previous studies have consistently identified
86 nulliparity, prolonged first and second stages of labor, fetal macrosomia, operative
87 vaginal delivery, occiput posterior fetal position, episiotomy type, maternal age, and
88 instrumental birth as important risk factors for perineal trauma(2,7–11). However, the
89 strength and consistency of these associations vary considerably across populations,
90 healthcare systems, and obstetric practices. Such heterogeneity highlights the
91 importance of generating context-specific evidence to inform locally appropriate
92 prevention strategies and clinical decision-making.

93 Several evidence-based interventions have been shown to reduce the occurrence and
94 severity of birth-related perineal trauma. The World Health Organization recommends
95 careful monitoring of labor progress using the WHO Labor Care Guide, avoidance of
96 unnecessary obstetric interventions, selective rather than routine episiotomy,
97 controlled delivery of the fetal head, manual perineal protection where appropriate,
98 application of warm perineal compresses during the second stage of labor, and
99 comprehensive examination of the perineum after every vaginal birth (9–11).

100 Similarly, international guideline from the Royal College of Obstetricians and
101 Gynecologists and the European Board and College of Obstetrics and Gynecology
102 emphasize standardized prevention bundles and systematic classification of perineal

injuries to improve maternal outcomes. Successful implementation of these recommendations, however depends on understanding local patterns of disease burden and the determinants of perineal trauma within specific health systems.

In Uganda, available evidence on birth-related perineal tears remains limited and is largely derived from referral hospitals in the central region of the country. Studies conducted at Kawempe National Referral Hospital and Mulago National Referral Hospital have identified nulliparity, prolonged labor, and fetal factors as important determinants of perineal trauma, but these findings may not be generalizable to Northern Uganda because of differences in referral patterns, patient characteristics, availability of skilled birth attendants, and intrapartum care practices. Furthermore, there is limited published evidence describing the prevalence and determinants of birth-related perineal tears in tertiary referral hospitals serving the post-conflict Northern Uganda region.

Lira Regional Referral Hospital (LRRH) is the major tertiary referral facility serving approximately 2.5 million people across the Lango sub-region and neighboring districts. The hospital manages a high volume of both routine and complicated deliveries and serves as an important teaching and internship center for medical, nursing, and midwifery trainees. Despite its central role in maternal healthcare delivery, there is limited evidence regarding the burden of birth-related perineal tears and the factors associated with their occurrence among women delivering at this facility. The absence of locally generated evidence limits opportunities to design targeted interventions, strengthen clinical mentorship, improve labor management practices, and monitor the quality of intrapartum care. Therefore, this study aimed to determine the prevalence of birth-related perineal tears and identify factors associated with their occurrence among women who delivered vaginally at LRRH in Northern Uganda. The findings are expected to contribute context-specific evidence to guide evidence-based intrapartum practice,

strengthen quality improvement initiatives, inform maternal health policy, and ultimately reduce preventable maternal morbidity associated with childbirth-related perineal trauma in Uganda and similar low-resource settings.

METHODS AND MATERIALS

Study design

A hospital-based retrospective analytical cross-sectional study was conducted using routinely collected maternity records. The study reviewed medical records of women who underwent vaginal delivery at LRRH between 1st October and 31st December 2024. The retrospective review enabled estimation of the prevalence of birth-related perineal tears and identification of factors associated with their occurrence using existing clinical records. The study was reported according to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)(12).

Study setting

The study was conducted at LRRH, a public tertiary referral hospital located in Lira City, Northern Uganda. LRRH serves as the main referral facility for the Lango sub-region, providing specialized healthcare services to an estimated catchment population of approximately 2.5million people from Lira, Kole, Oyam, Dokolo, Otuke, Alebtong, Amolatar, Apac, and Kwanja districts. The hospital has approximately 401 inpatient beds and serves as an accredited teaching and internship center for medical, nursing, and midwifery trainees. The Department of Obstetrics and Gynecology provides comprehensive emergency and routine maternity services, conducting approximately 390 vaginal deliveries per month. As a high-volume referral facility managing both uncomplicated and complicated pregnancies, LRRH was considered an appropriate setting for investigating birth-related perineal tears and their associated factors

Study population

Source population

The source population comprised all women who delivered vaginally at LRRH

Study population

The study population consisted of medical records of women who delivered vaginally at LRRH between 1st October and 31st December 2024 and met the eligibility criteria.

Eligibility criteria

Inclusion criteria

Medical records were included if they belonged to women who: delivered vaginally at LRRH during the study period; had a gestational age of 34 weeks or greater; had singleton or multiple pregnancies; and contained complete documentation of the outcome and key explanatory variables.

Exclusion criteria

Medical records were excluded if they involved: stillbirths; gestational age below 34 completed weeks; or incomplete, illegible, or missing documentation of the primary outcome or key exposure variables required for analysis

Sample size determination

The required sample size was calculated using the Kish and Leslie (1965) formula for cross-sectional studies(13):

$$n = (Z^2 \times p \times (1 - p)) / e^2,$$

$$n=Z^2 P(1-P)/ d^2$$

where:

n=required sample size, Z=1.96 (95% confidence level), P=anticipated prevalence of birth-related perineal tears (36.5%) based on a previous Ugandan study conducted at Kawempe National Referral Hospital(2), d=margin of error (5%)

The minimum calculated sample size was 354 records. To compensate for incomplete or missing documentation commonly encountered in retrospective chart reviews, an additional 10% was added, resulting in a final sample size of 390 medical records.

Sampling procedure

A consecutive sampling approach was used. The maternity register was used to identify all women who delivered vaginally between 1st October and 31st December. Eligible medical records were retrieved sequentially from the records department and reviewed consecutively until the required sample size of 390 records was achieved. A total of 600 medical records were initially identified. After screening for eligibility, 210 records were excluded because of stillbirths or incomplete documentation, leaving 390 records for analysis.

Study variables

Outcome Variable: The primary outcome was birth-related perineal tear, defined as any documented spontaneous perineal tear sustained during vaginal delivery. The outcome was coded as: 1=Yes, 0=No.

Independent variables: the independent variables included: Socio-demographic variables (maternal age, marital status, tribe, religion, education level, occupation). Obstetric and intrapartum variables (gravidity, parity, gestational age, episiotomy, duration of active stage of labor, duration of second stage of labor, neonatal birthweight, cadre of birth attendant).

Data collection procedures

Data were extracted from maternity medical records using a structured data abstraction form developed from published literature and existing obstetric record templates. The abstraction form captured: socio-demographic characteristics, obstetric and intrapartum characteristics; and birth-related perineal outcomes. Medical records were identified through the maternity register and retrieved from the hospital records department. Data abstraction was conducted by the principal investigator, who reviewed each medical record and entered the required information onto standardized

abstraction form. Daily reviews were undertaken to verify completeness, consistency, and accuracy of data abstraction before data entry.

Data quality assurance

To ensure data quality, a standardized data abstraction tool was developed following a review of similar published studies and national maternity documentation tools. The tool was reviewed independently by an obstetrician, senior midwifery researchers, and the research supervisors to establish content validity and ensure that all study variables aligned with the research objectives. Prior for data collection, the abstraction tool was pre-tested using approximately 5% of medical records from a comparable maternity setting that were not included in the final analysis. Findings from the pre-test informed minor revisions to improve clarity and completeness. The principal investigator received orientation on the abstraction procedures before commencing data collection. Throughout the study, completed abstraction forms were reviewed daily for completeness, consistency, and accuracy. Data entry incorporated range checks and validation rules to minimize transcription errors. Because this study involved retrospective chart abstraction rather than administration of a psychometric questionnaire, internal consistency measures such as Cronbach's alpha were not applicable and were therefore not used.

Data management and statistical analysis

Data were entered into Epi-Data version 4.7, cleaned in IBM SPSS Statistics version 27, and analyzed using Stata version 15. Descriptive statistics were generated to summarize participant characteristics. Categorical variables were summarized using frequencies and percentages, while continuous variables were summarized using appropriate measures of central tendency and dispersion depending on their distribution. The prevalence of birth-related perineal tears was calculated as the proportion of women with documented perineal tears among all women included in the study, together with

corresponding 95% confidence intervals (95% CIs). Associations between independent variables and birth-related perineal tears were initially explored using bivariate modified Poisson regression. Variables with $p < 0.20$, together with variables considered clinically important based on existing literature, were entered into the multivariable model. Because the outcome prevalence exceeded 10%, modified Poisson regression with robust standard errors was used instead of logistic regression to directly estimate prevalence ratios, thereby avoiding overestimation associated with odds ratios in common outcomes. Adjusted prevalence ratios (aPRs) with 95% confidence intervals were reported. Statistical significance was established at $p < 0.05$. Multicollinearity among explanatory variables was assessed using the Variance Inflation Factor (VIF) before fitting the final model.

Operational definitions

Birth-related perineal tear

A documented spontaneous disruption of the perineal skin, vaginal mucosa, perineal muscles, anal sphincter complex, or rectal mucosa sustained during vaginal delivery.

Prevalence

The proportion of women who sustained a birth-related perineal tear among all women who delivered vaginally during the study period.

Prolonged active first stage of labor

Active first stage lasting ≥ 8 hours.

Prolonged second stage of labor

Second stage lasting > 60 minutes

Nulliparity

A woman who had not previously delivered a foetus at viable gestation before the index pregnancy

Ethical considerations

Ethical approval was obtained from the Lira University Research Ethics Committee (Reference No. LUREC-2024-354). Administrative permission to access medical records was granted by the management of Lira Regional Referral Hospital and the Department of Obstetrics and Gynaecology. Given the retrospective nature of the study and the use of routinely collected anonymized clinical records, the Research Ethics Committee approved a waiver of individual informed consent. No personal identifiers were collected during data abstraction. Data were stored on password-protected computers accessible only to the research team and are presented in aggregate form to maintain participant confidentiality.

RESULTS

A total of 600 maternity records of women who delivered vaginally between 1st October and 31st December 2024 were identified from the maternity register. After screening eligibility, 210 records were excluded of which 24 were stillbirths, and 186 had incomplete documentation on the outcome or key explanatory variables. Consequently, 390 medical records met the eligibility criteria and were included in the final analysis.

Socio-demographic characteristics of women who delivered vaginally at PRRH, Northern Uganda (N=390), October to December 2024.

A total of 390 women were included in the study. The majority were aged 20-34 years (82.1%), while 11.5% were adolescents (<20years) and 6.4% were aged 35 years or older. Most participants were married (89.7%), belonged to the Lango ethnic group (70%), had attained primary or secondary education, and were unemployed or engaged in subsistence farming. This is a relatively homogenous, with most women representing the typical reproductive-age population served by LRRH (Table 1)

Table 1. Socio-demographic characteristics of the study participants (N=390), October to December, 2024

Variable	Category	Frequency
Age		
Maternal age	Under 20 years	69
Maternal age	20 years and above	321
Tribe	Lango	322
Tribe	Other tribes	68
Marital status	Single	9
Marital status	Married	381
Religion	Christians	373
Religion	Non-Christians	17
Education level	Higher level	213
Education level	Lower level	177
Occupation	Employed	227
Occupation	Not employed	163

Obstetric and intrapartum characteristics of women who delivered vaginally at a PRRH (N=390)

Most women were multiparous, while approximately one-third were nulliparous. The majority delivered singleton pregnancies at term. Most newborns weighed between 2.5kg and 3.9kg, with relatively few cases of low birth weight or macrosomia. Most women experienced an active first stage of labor lasting less than eight hours, and the second stage lasted 60 minutes or less in the majority of deliveries. Episiotomy was performed infrequently, reflecting current recommendations supporting restrictive rather than routine use. Table 2 summarizes the obstetric and intrapartum characteristics of the study participants.

298 **Table 2. Obstetric characteristics of the study participants (N=390)**

Variable	Category	Frequency	Percentage (%)
Gravidity	Primigravida	137	35.13
Gravidity	Multigravida	253	64.87
Parity	Nulliparous	152	38.97
Parity	Multiparous	238	61.03
Gestational age	Normal gestational age	306	78.46
Gestational age	Abnormal gestational age	84	21.54
Episiotomy	No	320	82.05
Episiotomy	Yes	70	17.95
Duration of active 1st stage of labor	8 hours and above	104	24.67
Duration of active 1st stage of labor	< 8 hours	286	73.33
Duration of second stage of labor	> 60 minutes	24	6.15
Duration of second stage of labor	≤ 60 minutes	366	93.85
Birthweight at delivery	≤ 3.5 kg	345	88.46
Birthweight at delivery	> 3.5 kg	45	11.54
Birth attendant	Qualified	326	83.59
Birth attendant	Unqualified	64	16.41

299

300 **Prevalence of Birth-related perineal tears among women who delivered**
301 **vaginally at a PRRH**

302 Among the 390 women included in the study, 118 sustained birth-related perineal tears,
303 giving an overall prevalence of 30.3% (95% CI: 25.7%-35.1%).

304 Approximately one in every three women who underwent vaginal delivery experienced
305 a documented birth-related perineal tear during the study period (Figure 2)

Figure 2. Prevalence of birth-related perineal tears among women delivering vaginally at a PRRH



Bivariate Analysis of Factors Associated with Birth-related Perineal Tears

At bivariate analysis, several maternal and intrapartum characteristics were associated with birth-related perineal tears. (**Table 3**) Maternal age, parity, duration of the active first stage of labor, duration of the second stage of labor, and birth attendant cadre met the pre-specified criterion ($p < 0.20$) and were therefore considered for inclusion in the multivariable regression model. Other variables, including marital status, education level, religion, neonatal birth weight, gestational age, occupation, were not significantly associated with birth-related perineal tears at the bivariate level.

324 **Table 3. Bivariate Analysis of Factors Associated with Birth-related**
325 **perineal tears (N = 390).**

Variable	Category	No tear, n (%)	Tear, n (%)	cPR (95% CI)	p-value
Maternal age	Under 20 years	36 (52.17)	33 (47.83)	1.1688 (1.0698–1.2769)	0.001
Maternal age	≥ 20 years	236 (73.52)	85 (26.48)	Ref	
Tribe	Lango	223 (69.25)	99 (30.75)	1.0219 (0.9321–1.1203)	0.460
Tribe	Other tribes	49 (72.06)	19 (27.94)	Ref	
Marital status	Married	267 (70.08)	114 (29.92)	0.8995 (0.7162–1.1296)	0.362
Marital status	Single	5 (55.56)	4 (44.44)	Ref	
Religion	Christians	261 (69.97)	112 (30.03)	0.9611 (0.8093–1.1413)	0.651
Religion	Non-Christians	11 (64.71)	6 (35.29)	Ref	
Education level	Higher	143 (67.14)	70 (32.86)	1.0452 (0.9744–1.1212)	0.217
Education level	Lower	129 (72.88)	48 (27.12)	Ref	
Occupation	Employed	154 (67.84)	73 (32.16)	1.0357 (0.9648–1.1117)	0.332
Occupation	Not employed	118 (72.39)	45 (27.61)	Ref	

326 *Abbreviations: cPR, crude prevalence ratio; CI, confidence interval; Ref, reference*
327 *category. Screening threshold for multivariable entry was $p \leq 0.20$.*

328 **Multivariable Analysis**

329 Variables with $p < 0.20$ at bivariate analysis, together with clinically important variables
330 identified from previous literature, were included in the multivariable modified Poisson

regression model. After adjustment for potential confounding, three variables remained independently associated with birth-related perineal tears (**Table 4**). Women who were nulliparous had a 25% higher prevalence of birth-related perineal tears compared with multiparous women (adjusted prevalence ratio (aPR)=1.25, 95% CI: 1.07-1.47; p=0.004). Women who's active first stage of labor lasted eight hours or longer had a 12% higher prevalence of birth-related perineal tears than those whose labor lasted less than eight hours (aPR=1.12, 9.5% CI: 1.04-1.21; p=0.004). Similarly, women who experienced a prolonged second stage of labor (>60 minutes) had a 16% higher prevalence of birth-related perineal tears compared to those whose second stage lasted 60 minutes or less (aPR=1.16, 95% CI: 1.03-1.30; p=0.017).

Table 4. Bivariate analysis of obstetric characteristics associated with birth-related perineal tears (N = 390)

Variable	Category	No tear, n (%)	Tear, n (%)	aPR (95% CI)	p-value
Gravidity	Primigravida	75 (54.74)	62 (45.26)	1.1893 (1.1076–1.2770)	<0.001
Gravidity	Multigravida	197 (77.87)	56 (22.13)	Ref	
Parity	Nulliparous	82 (53.95)	70 (46.05)	1.2154 (1.1344–1.3022)	<0.001
Parity	Multiparous	190 (79.83)	48 (20.17)	Ref	
Gestational age	Normal gestational age	210 (68.63)	96 (31.37)	1.0411 (0.9567–1.1328)	0.350
Gestational age	Abnormal gestational age	62 (73.81)	22 (26.19)	Ref	
Episiotomy	Yes	47 (67.14)	23 (32.86)	1.0244 (0.9349–1.1226)	0.605

Episiotomy	No	225 (70.31)	95 (29.69)	Ref	
Active stage duration	1st ≥ 8 hours	56 (53.85)	48 (46.15)	1.1742 (1.0872– 1.2680)	<0.001
Active stage duration	1st < 8 hours	216 (75.52)	70 (24.48)	Ref	
Second stage duration	> 60 minutes	9 (37.50)	15 (62.50)	1.2681 (1.1195– 1.4365)	<0.001
Second stage duration	≤ 60 minutes	263 (71.86)	103 (28.14)	Ref	
Birthweight at delivery	≤ 3.5 kg	241 (69.86)	104 (30.14)	0.9926 (0.8894– 1.1078)	0.895
Birthweight at delivery	> 3.5 kg	31 (68.89)	14 (31.11)	Ref	
Birth attendant	Qualified	226 (69.33)	100 (30.67)	1.0199 (0.9282– 1.1207)	0.682
Birth attendant	Unqualified	46 (71.88)	18 (28.13)	Ref	

Abbreviations: cPR, crude prevalence ratio; CI, confidence interval; Ref, reference category. Screening threshold for multivariable entry was $p \leq 0.20$

Bivariate and Multivariable Modified Poisson Regression Analysis of Factors Associated with Birth-related Perineal Tears Among Women Delivery Vaginally at Lira Regional Referral Hospital (N=390)

Variables with $p < 0.20$ at bivariate analysis and clinically relevant variables identified from previous literature were entered into multivariable model. Modified Poisson regression with robust standard errors was used to estimate prevalence ratios. In the

crude analysis, Primigravidity, nulliparity, maternal age <20 years, active first stage of labor ≥ 8 hours, and second stage of labor > 60 minutes were significantly associated with birth-related perineal tears (**Table 5**). After adjustment for potential confounders, nulliparity, prolonged active first stage of labor, and prolonged second stage of labor remained independently associated with perineal tears than multiparous women (aPR=1.25, 95% CI: 1.07-1.47; $p=0.004$). an active first stage of labor ≥ 8 hours was associated with a higher prevalence of perineal tears (aPR=1.12, 95% CI: 1.04–1.21; $p=0.004$), as was a second stage >60 minutes (aPR=1.16, 95% CI: 1.03–1.30; $p=0.017$). Primigravidity (aPR=0.91, 95% CI: 0.77–1.07; $p=0.233$) and maternal age <20 years (aPR=1.08, 95% CI: 0.98–1.19; $p=0.134$) were not independently associated with perineal tears.

Table 5. Multivariable modified Poisson regression of factors associated with birth-related perineal tears (N = 390).

Variable	Category	cPR (95% CI)	p-value	aPR (95% CI)	p-value
Gravidity	Primigravida	1.1893 (1.1076– 1.2770)	<0.001	0.9050 (0.7683– 1.0662)	0.233
Gravidity	Multigravida	Ref		Ref	
Parity	Nulliparous	1.2154 (1.1344– 1.3022)	<0.001	1.2546 (1.0735– 1.4664)	0.004
Parity	Multiparous	Ref		Ref	
Maternal age	Under 20 years	1.1688 (1.0698– 1.2769)	0.001	1.0773 (0.9773– 1.1876)	0.134
Maternal age	≥ 20 years	Ref		Ref	

Active stage duration	1st ≥ 8 hours	1.1742 (1.0872– 1.2680)	<0.001	1.1191 (1.0369– 1.2079)	0.004
Active stage duration	1st < 8 hours	Ref		Ref	
Second stage duration	> 60 minutes	1.2681 (1.1195– 1.4365)	<0.001	1.1561 (1.0262– 1.3026)	0.017
Second stage duration	≤ 60 minutes	Ref		Ref	

Abbreviations: aPR, adjusted prevalence ratio; cPR, crude prevalence ratio; CI, confidence interval; Ref, reference category. Statistical significance was defined as $p < 0.05$

Discussion

This study found that 30.3% of women experienced birth-related perineal tears during vaginal delivery. Key factors associated with these tears included being nulliparous, having a prolonged active first stage of labor (≥ 8 hours), and a prolonged second stage of labor (> 60 minutes).

Prevalence of Birth-related Perineal Tears

In this study, it was found that one in three women who delivered vaginally at the PRRH experienced perineal trauma, highlighting it as a significant childbirth-related morbidity. Despite advancements in skilled birth attendance and intrapartum care, perineal injury remains a common complication. Global prevalence estimates vary due to factors like definitions, episiotomy inclusion, parity distribution, obstetric interventions, provider practices, and post-delivery examination quality.

Evidence from low- and middle-income countries (LMICs) reveals significant variation in the prevalence of birth-related perineal trauma, as highlighted in a systematic review and meta-analysis by Wilson et al. (14). This variability stems from differences in clinical

assessments, availability of trained birth attendants, and reporting systems. In many LMICs, perineal trauma is inadequately characterized due to inconsistent routine assessment and documentation of injury severity, particularly in high-volume, resource-constrained maternity services.

The study indicates a prevalence of 30.3% for all grades of perineal tears, which is higher than the prevalence of 6.6% for obstetric anal sphincter injury (OASI) reported by Ali et al. (5) in South Western Uganda. Caution is advised in comparing these figures, as other research often focuses solely on severe injuries, limiting their scope to third- and fourth-degree tears. Weldearegay et al. (2024) also examined OASI prevalence in Ethiopia, but such studies cannot be directly compared to this study's broader definition of perineal tears (15).

The differences in prevalence estimates of perineal trauma between countries arise from diagnostic and documentation variations. High-income regions report higher detection rates, especially among first-time mothers, due to thorough postnatal exams and standardized classifications. In contrast, low-resource areas often under-recognize minor tears due to heavy workloads and limited training, resulting in lower reported rates that reflect under-detection rather than fewer cases. Accurate identification, especially of OASI, is vital to prevent serious long-term consequences like anal incontinence and pelvic floor dysfunction (16).

The study's findings on prevalence align with results from other referral maternity facilities in Uganda. Specifically, Kawempe National Referral Hospital reported a notable occurrence of perineal tears in vaginal deliveries, linking it to factors such as being a first-time mother, prolonged labor, assisted vaginal delivery, and increased foetal birth weight(2). Similarities between Kawempe and Lira Regional Referral Hospital highlight shared characteristics of referral maternity populations managing both uncomplicated and complicated births. However, variations in patient

characteristics, referral patterns, obstetric case mix, provider experience, and documentation practices contribute to differences in prevalence between the two facilities.

The prevalence of complications at Lira Regional Referral Hospital is influenced by its status as a referral centre for the Lango sub-region, where women often present with complex obstetric conditions. Issues like prolonged and obstructed labor, foetal malposition, and previous unsuccessful management contribute to increased mechanical stress on the perineum, raising the risk of perineal trauma. This referral status must be considered alongside facility practices such as intrapartum monitoring, episiotomy use, skilled birth attendants' availability, and adherence to preventive strategies. Inadequate documentation of tear severity limited the interpretation of findings related to perineal tears in the study. While tears were recorded, classification into various degrees was inconsistent, preventing assessment of severe trauma prevalence and severity-specific outcomes compared to studies on OASI. Standardized evaluation and documentation of perineal injuries post-vaginal birth are crucial for effective surveillance, clinical audits, quality improvement, and identifying women needing specialized follow-up care (16).

The study reinforces the importance of enhancing strategies to prevent and manage birth-related perineal trauma. Key interventions include the use of warm compresses, perineal support techniques, careful management during the second stage of labor, avoiding unnecessary episiotomies, and improving provider skills in assessment and repair, all aimed at reducing perineal injuries (17,18). Improving routine documentation of perineal outcomes is essential for maternity quality improvement initiatives to provide reliable local evidence and inform targeted interventions.

Nulliparity is significantly associated with an increased prevalence of birth-related perineal tears, with nulliparous women showing a 25% higher risk than multiparous

women. This is consistent with findings from various regions, including Uganda, Ethiopia, Europe, and Australia, where first vaginal births are strong predictors of perineal trauma (9,11). The increased susceptibility of nulliparous women to perineal trauma during their first vaginal birth is due to the maximal stretching of perineal tissues, pelvic floor muscles, and connective tissues, which have had limited prior adaptation to mechanical stress. Multiparous women may experience increased tissue compliance and remodelling from prior vaginal births, which facilitates greater distension in future deliveries and decreases resistance during foetal descent and crowning. In contrast, nulliparous women often have longer second stages of labor, increased active pushing duration, and greater tissue strain, raising the risk of spontaneous perineal injury (9,11).

In this study, nulliparity and prolonged stages of labor (first stage ≥ 8 hours and second stage > 1 hour) were linked to a higher risk of birth-related perineal tears. The results align with prior evidence suggesting that prolonged labor increases mechanical stress on the pelvic floor and the likelihood of obstetric interventions (instrumental delivery and episiotomy), which may further exacerbate perineal trauma (11,19). A prospective cohort study among primiparous women in Sweden similarly identified prolonged second stage of labor, foetal head circumference, and obstetric interventions as important predictors of perineal and vaginal tears (9).

The association between nulliparity and perineal trauma is significant for clinical practice at Lira Regional Referral Hospital. First-time vaginal births indicate a high-risk group that could benefit from targeted preventive strategies, including continuous labor support, proper monitoring of labor, early management of complications, controlled delivery techniques, and skilled perineal support. Evidence supports interventions like warm perineal compresses and specific protection techniques to reduce severe perineal trauma, recommending their use where possible (11,17).

Prevention and management of perineal trauma in nulliparous women are crucial due to potential long-term impacts such as postpartum pain, dyspareunia, pelvic floor dysfunction, incontinence, and decreased quality of life. Enhancing midwifery practices, improving documentation, and ensuring timely injury recognition and repair are vital for quality intrapartum care.

In this study women with an active first stage of labor lasting eight hours or longer are at a higher risk of birth-related perineal tears compared to those with shorter labors. Prolonged labor can lead to maternal birth-related morbidity, including perineal trauma, due to factors like ineffective uterine activity or foetal malposition. The extended duration puts pressure on pelvic tissues, resulting in oedema, inflammation, and decreased elasticity, which elevate the risk of tearing. Additionally, prolonged labor may cause maternal exhaustion and increase the likelihood of interventions leading to perineal injury. The study's findings are consistent with a recent large cohort study from Sweden, indicating that longer durations in the active first stage of labor correlate with increased risks of severe perineal lacerations and postpartum complications such as infection and urinary retention (20). Prolonged labor characteristics and second-stage factors have been identified as significant predictors of perineal lacerations in women undergoing vaginal birth, indicating that prolonged labor may serve as a crucial clinical marker for heightened risk of perineal trauma (21).

The prolonged labor is associated with perineal injury, potentially influenced by increased obstetric interventions such as oxytocin augmentation, repeated vaginal examinations, amniotomy, and operative vaginal birth, which can heighten mechanical stress on the perineum. Operative vaginal delivery was rare in this study, but prolonged labor is a key indicator of potential difficulties during vaginal birth, emphasizing the need for prompt evaluation and management of abnormal labor progress.

Variations in defining active labor, thresholds for prolonged labor, parity distribution, and adjustment for confounders like foetal birth weight, position, episiotomy, and operative delivery may explain inconsistent findings on the association between the duration of the first stage of labor and perineal trauma across studies(21). Therefore, prolonged first-stage labor should be interpreted as part of a broader clinical risk profile rather than an isolated predictor of perineal trauma.

These findings from Lira Regional Referral Hospital emphasize the need for precise identification of active labor, structured monitoring of its progression, and timely decisions during deviations from expected patterns. Implementing consistent labor monitoring methods, such as the WHO Labor Care Guide, aids in early detection of abnormal labor progression and promotes appropriate interventions, thereby minimizing unnecessary mechanical stress on maternal tissues (22). Practical measures to reduce preventable maternal birth trauma include ensuring adequate hydration, encouraging proper positioning, maintaining bladder care, providing continuous labor support, and timely augmentation or operative birth when necessary.

A prolonged second stage of labor was linked to an increased prevalence of birth-related perineal tears, with women experiencing a second stage lasting over 60 minutes having a 16% higher risk compared to those whose second stage lasted less than one hour. This is consistent with existing evidence that suggests prolonged foetal descent and extended mechanical pressure on pelvic and perineal tissues elevate the risk of maternal birth trauma, including perineal lacerations (2,5).

The prolonged second stage of labor can lead to perineal injury due to the significant stretching of vaginal and perineal tissues during the descent and crowning of the foetus. Extended pressure from the foetal head may cause tissue oedema, impaired blood flow, inflammation, and fatigue in the pelvic floor muscles, hindering the perineum's capacity to stretch further without damage. Prolonged second stage of labor may indicate issues

like foetal malposition, macrosomia, cephalopelvic disproportion, or ineffective maternal pushing, leading to increased mechanical stress on the perineum.

The findings support earlier studies indicating that a prolonged second stage of labor is a significant predictor of perineal trauma. A prospective cohort study in Sweden among first-time mothers highlighted the duration of the second stage and other labor-related factors as key determinants of perineal and vaginal tears.(9). Studies from Uganda highlight that prolonged labor is a significant factor contributing to perineal injury, with findings from Kawempe National Referral Hospital linking prolonged labor and other obstetric factors to a higher risk of perineal tears, while Ali et al. (2020) identified prolonged second stage among factors associated with obstetric anal sphincter injuries at a tertiary hospital in Southwestern Uganda(5).

The relationship between prolonged second stage labor and perineal trauma requires careful evaluation. Current practices emphasize individualized care rather than strict time constraints. In specific scenarios, particularly with epidural analgesia and stable conditions, a longer second stage may decrease unnecessary interventions and caesarean births. Conversely, prolonged labor can increase maternal fatigue and intervention risks, possibly exacerbating perineal trauma. Clinical decisions should weigh labor duration, fetal position, maternal health, descent progress, and birth methods.

Evidence suggests several strategies to reduce perineal trauma during the second stage of labor, including skilled perineal support, controlled delivery of the foetal head, warm perineal compresses, and selective use of mediolateral episiotomy for women at higher risk of severe perineal injury, especially during operative vaginal births (11,23). Recent implementation studies have also demonstrated that structured perineal protection care bundles, incorporating staff training, standardized techniques, and post-birth assessment, can reduce severe perineal trauma in maternity settings(24,25). Newer

technologies like perineal protection devices demonstrate potential benefits, but evidence is still emerging and needs further evaluation before widespread use (26).

These findings highlight the necessity of continuous monitoring of second-stage labor progress and early detection of abnormal descent at Lira Regional Referral Hospital. It suggests that enhancing midwifery-led practices through simulation training, mentorship, and clinical audits can improve compliance with evidence-based perineal protection strategies, potentially reducing preventable perineal trauma during childbirth.

Despite the absence of strong links between various maternal and foetal characteristics, the findings highlight crucial prevention opportunities by enhancing intrapartum care. Key strategies include the continuous monitoring of labor progression, early identification of abnormal patterns, and prompt clinical decision-making to prevent tissue stress and maternal trauma. Additionally, implementing evidence-based perineal protection practices via provider training and audits may enhance maternal outcomes. Recent studies show that structured perineal care bundles can mitigate severe perineal trauma and enhance injury recognition. These bundles include antenatal counselling, skilled manual protection, proper mediolateral episiotomy use, and thorough post-birth examination (27,28). Other preventive approaches, such as warm perineal compresses and supportive second-stage techniques, may help reduce severe perineal injury and should be included in comprehensive intrapartum care(11).

Lastly, improving documentation of perineal injury severity at Lira Regional Referral Hospital is essential. Recording the details of first- to fourth-degree tears and their associated risk factors will enhance surveillance, enable clinical audits, support benchmarking, and improve the evaluation of interventions to reduce birth-related morbidity.

Clinical and public health implications

The study's findings are crucial for maternal health in Uganda and similar low-resource settings, highlighting that significant predictor of birth-related perineal tears can be routinely assessed during labor, allowing for early identification and closer monitoring of at-risk women.

Strengthening adherence to evidence-based intrapartum care, such as systematic labor monitoring, timely management of prolonged labor, continuous support, selective episiotomy, and thorough post-delivery examination, may significantly reduce preventable maternal morbidity related to perineal trauma during childbirth.

Findings endorse ongoing competency-based training for midwives and obstetric clinicians regarding perineal tears, emphasizing the prevention, recognition, classification, and repair of such injuries. Regular audits and quality improvement initiatives in maternity care could further improve maternal outcomes.

Strengths and Limitations

This study estimates birth-related perineal tears in Northern Uganda using clinical data from a tertiary referral hospital. It employs modified Poisson regression for direct prevalence ratios, enhancing validity through adjustment for confounding factors.

Several limitations exist, notably that the retrospective review of medical records depended on the accuracy and completeness of routine clinical documentation, leading to potential information bias and outcome misclassification.

Minor first-degree tears may be under-documented, leading to an underestimation of their prevalence. Additionally, findings from a single tertiary referral hospital may not be applicable to lower-level health facilities or other regions in Uganda. There is also a risk of residual confounding from unmeasured variables such as maternal body mass index, foetal head circumference, maternal position during birth, provider experience, warm compress use, perineal support techniques, and previous obstetric history.

Finally, the cross-sectional retrospective design precludes causal inference; therefore, the observed associations should not be interpreted as causal relationships.

Conclusion

This study reveals that birth-related perineal tears are a frequent complication in vaginal deliveries at Lira Regional Referral Hospital. Key predictors identified include nulliparity and prolonged stages of labor, suggesting improved risk assessment and management strategies could enhance maternal care and reduce morbidity in Uganda and similar settings.

Study strengths and limitations

This study provides facility-specific estimates of the burden of perineal tears and highlights modifiable intrapartum risk factors in a major referral hospital in Northern Uganda. However, interpretation should consider important limitations. The retrospective design relied on clinical documentation, which may be incomplete or inconsistent. Notably, tear degree was not consistently recorded, preventing severity-specific analysis and limiting comparability with studies focused on OASI. Because exposure and outcome data were collected from routine records, misclassification and residual confounding are possible. Additionally, causal inference is limited by the cross-sectional nature of the analysis, and findings may not be fully generalisable beyond similar referral settings.

Conclusion and recommendations

Determinants of birth-related perineal tears emphasize the need for enhanced intrapartum surveillance and the use of evidence-based prevention strategies during vaginal birth. Recommendations include standardized antenatal preparation, such as third-trimester perineal massage and pelvic floor muscle training, along with high-quality intrapartum care involving systematic monitoring of labor using the WHO-

modified partograph, early intervention for abnormal labor patterns, continuous skilled support, and appropriate coaching during the second stage of labor. Additionally, perineal protection techniques and proper indications for episiotomy and operative vaginal birth should be prioritized. Future studies should investigate setting-specific factors and the effectiveness of bundled interventions to minimize perineal trauma.

ABBREVIATIONS

LMICs	Low-Middle Income Countries
LRRH	Lira Regional Referral Hospital
LUREC	Lira University Research Ethics Committee
PRRH	Public Regional Referral Hospital
SSA:	Sub-Saharan Africa
WHO	World Health Organization

DECLARATIONS

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Lira University Research Ethics Committee (Reference No. LUREC-2024-354). Permission to conduct the study was also obtained from the administration of Lira Regional Referral Hospital. The declaration of Helsinki, institutional and national guidelines on human subject protection and privacy protection were strictly followed throughout the study process.

Consent for publication

The requirement for informed consent for participation and publication was waived by the Lira University Research Ethics Committee because this was a retrospective study involving secondary analysis of routinely collected data, with no reporting of personally identifiable information.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available due to privacy and confidentiality considerations related to the participants. However, anonymized data may be made available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' information

Emmanuel Madira is a midwifery scholar in the Department of Midwifery, Faculty of Nursing and Midwifery at Lira University, Uganda. His research interests include midwifery, nursing, maternal, neonatal and child health, fertility, infertility, healthcare experiences, and implementation science.

Authors contribution

All authors read and approved the final manuscript.

Concept and design: Emmanuel Madira, Matia Tumwesigye, Beth Namukwana, Deborah Andrinar Namutebi, Caroline Kambugu Nabasirye, James Okello.

Data collection, analysis, or interpretation of data: Emmanuel Madira, Matia Tumwesigye, Benedict Arebo, James Okello, Vicky Caroline Achayo

Drafting of the manuscript: Emmanuel Madira, Matia Tumwesigye, Benedict Arebo, Vicky Caroline Achayo, Peterson Amumpaire, Caroline Kambugu Nabasirye

Critical review of the manuscript for intellectual content: Deborah Andrinar
 Namutebi, Beth Namukwana, Peterson Amumpaire, Caroline Kambugu Nabasirye,
 James Okello.

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