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Research Article

Keywords: Birth-related perineal tears, Perineal trauma, Vaginal delivery, Nulliparity, labor duration, Maternal morbidity, Uganda

Posted Date: October 15th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10852597/v1

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Additional Declarations: No competing interests reported.

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

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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 (≥ 8hours) (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

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

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

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

Similarly, international guideline from the Royal College of Obstetricians and Gynecologists and the European Board and College of Obstetrics and Gynecology 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,

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

132 **METHODS AND MATERIALS**

133 **Study design**

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

141 **Study setting**

142 The study was conducted at LRRH, a public tertiary referral hospital located in Lira City,
143 Northern Uganda. LRRH serves as the main referral facility for the Lango sub-region,
144 providing specialized healthcare services to an estimated catchment population of
145 approximately 2.5million people from Lira, Kole, Oyam, Dokolo, Otuke, Alebtong,
146 Amolatar, Apac, and Kwania districts. The hospital has approximately 401 inpatient
147 beds and serves as an accredited teaching and internship center for medical, nursing,
148 and midwifery trainees. The Department of Obstetrics and Gynecology provides
149 comprehensive emergency and routine maternity services, conducting approximately
150 390 vaginal deliveries per month. As a high-volume referral facility managing both
151 uncomplicated and complicated pregnancies, LRRH was considered an appropriate
152 setting for investigating birth-related perineal tears and their associated factors

153 **Study population**

154 **Source population**

155 The source population comprised all women who delivered vaginally at LRRH

156 **Study population**

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

159 **Eligibility criteria**

160 **Inclusion criteria**

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

165 **Exclusion criteria**

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

169 **Sample size determination**

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

172 $$n = (Z^2 \times p \times (1 - p)) / e^2,$$

173 $$n=Z^2 P(1-P)/ d^2$$

174 where:

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

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

181

182 **Sampling procedure**

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

190 **Study variables**

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

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

199 **Data collection procedures**

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

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

209 **Data quality assurance**

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

225 **Data management and statistical analysis**

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

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

244 **Operational definitions**

245 **Birth-related perineal tear**

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

248 **Prevalence**

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

251 **Prolonged active first stage of labor**

252 Active first stage lasting ≥8 hours.

253 **Prolonged second stage of labor**

254 Second stage lasting > 60minutes

255 **Nulliparity**

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

258 **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)**

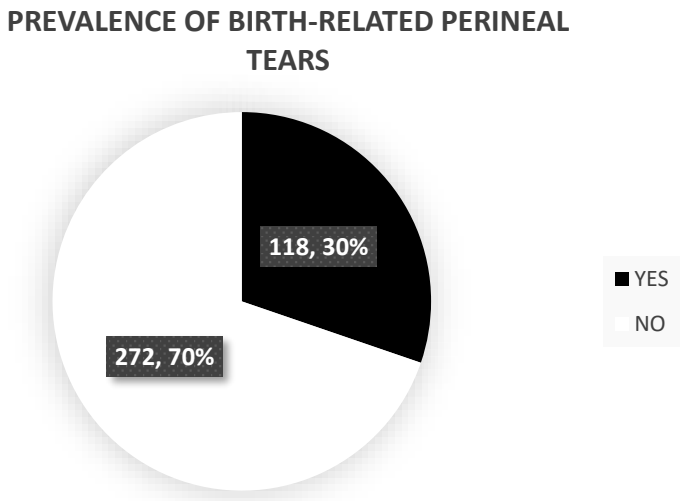
Variable	Category	Frequency	Percentage (%)
Gravidity	Primigravida	137	35.13
Gravidity	Multigravida	253	64.87
Parity	Nulliparous	152	38.97
Parity	Multiparous	238	61.03
Gestational age	Normal gestational age	306	78.46
Gestational age	Abnormal gestational age	84	21.54
Episiotomy	No	320	82.05
Episiotomy	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)

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



308

309 **Bivariate Analysis of Factors Associated with Birth-related Perineal Tears**

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

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Table 3. Bivariate Analysis of Factors Associated with Birth-related 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	

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

Multivariable Analysis

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

331 regression model. After adjustment for potential confounding, three variables remained
332 independently associated with birth-related perineal tears (**Table 4**). Women who were
333 nulliparous had a 25% higher prevalence of birth-related perineal tears compared with
334 multiparous women (adjusted prevalence ratio (aPR)=1.25, 95% CI: 1.07-1.47;
335 p=0.004). Women who's active first stage of labor lasted eight hours or longer had a
336 12% higher prevalence of birth-related perineal tears than those whose labor lasted less
337 than eight hours (aPR=1.12, 9.5% CI: 1.04-1.21; p=0.004). Similarly, women who
338 experienced a prolonged second stage of labor (>60 minutes) had a 16% higher
339 prevalence of birth-related perineal tears compared to those whose second stage lasted
340 60 minutes or less (aPR=1.16, 95% CI: 1.03-1.30; p=0.017).

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

Variable	Category	No tear, n (%)	Tear, n (%)	cPR (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 1st stage duration	≥ 8 hours	56 (53.85)	48 (46.15)	1.1742 (1.0872–1.2680)	<0.001
Active 1st stage duration	< 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 ≤ 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

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

362 **Table 5. Multivariable modified Poisson regression of factors associated**
363 **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 1st stage duration	≥ 8 hours	1.1742 (1.0872–1.2680)	<0.001	1.1191 (1.0369–1.2079)	**0.004**
Active 1st stage duration	< 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

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

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

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

432 Nulliparity is significantly associated with an increased prevalence of birth-related
433 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).

460 Prevention and management of perineal trauma in nulliparous women are crucial due
461 to potential long-term impacts such as postpartum pain, dyspareunia, pelvic floor
462 dysfunction, incontinence, and decreased quality of life. Enhancing midwifery practices,
463 improving documentation, and ensuring timely injury recognition and repair are vital
464 for quality intrapartum care.
465 In this study women with an active first stage of labor lasting eight hours or longer are
466 at a higher risk of birth-related perineal tears compared to those with shorter labors.
467 Prolonged labor can lead to maternal birth-related morbidity, including perineal
468 trauma, due to factors like ineffective uterine activity or foetal malposition. The
469 extended duration puts pressure on pelvic tissues, resulting in oedema, inflammation,
470 and decreased elasticity, which elevate the risk of tearing. Additionally, prolonged labor
471 may cause maternal exhaustion and increase the likelihood of interventions leading to
472 perineal injury. The study's findings are consistent with a recent large cohort study from
473 Sweden, indicating that longer durations in the active first stage of labor correlate with
474 increased risks of severe perineal lacerations and postpartum complications such as
475 infection and urinary retention (20). Prolonged labor characteristics and second-stage
476 factors have been identified as significant predictors of perineal lacerations in women
477 undergoing vaginal birth, indicating that prolonged labor may serve as a crucial clinical
478 marker for heightened risk of perineal trauma (21).
479 The prolonged labor is associated with perineal injury, potentially influenced by
480 increased obstetric interventions such as oxytocin augmentation, repeated vaginal
481 examinations, amniotomy, and operative vaginal birth, which can heighten mechanical
482 stress on the perineum. Operative vaginal delivery was rare in this study, but prolonged
483 labor is a key indicator of potential difficulties during vaginal birth, emphasizing the
484 need for prompt evaluation and management of abnormal labor progress.

485 Variations in defining active labor, thresholds for prolonged labor, parity distribution,
486 and adjustment for confounders like foetal birth weight, position, episiotomy, and
487 operative delivery may explain inconsistent findings on the association between the
488 duration of the first stage of labor and perineal trauma across studies(21). Therefore,
489 prolonged first-stage labor should be interpreted as part of a broader clinical risk profile
490 rather than an isolated predictor of perineal trauma.
491 These findings from Lira Regional Referral Hospital emphasize the need for precise
492 identification of active labor, structured monitoring of its progression, and timely
493 decisions during deviations from expected patterns. Implementing consistent labor
494 monitoring methods, such as the WHO Labor Care Guide, aids in early detection of
495 abnormal labor progression and promotes appropriate interventions, thereby
496 minimizing unnecessary mechanical stress on maternal tissues (22). Practical measures
497 to reduce preventable maternal birth trauma include ensuring adequate hydration,
498 encouraging proper positioning, maintaining bladder care, providing continuous labor
499 support, and timely augmentation or operative birth when necessary.
500 A prolonged second stage of labor was linked to an increased prevalence of birth-related
501 perineal tears, with women experiencing a second stage lasting over 60 minutes having
502 a 16% higher risk compared to those whose second stage lasted less than one hour. This
503 is consistent with existing evidence that suggests prolonged foetal descent and extended
504 mechanical pressure on pelvic and perineal tissues elevate the risk of maternal birth
505 trauma, including perineal lacerations (2,5).
506 The prolonged second stage of labor can lead to perineal injury due to the significant
507 stretching of vaginal and perineal tissues during the descent and crowning of the foetus.
508 Extended pressure from the foetal head may cause tissue oedema, impaired blood flow,
509 inflammation, and fatigue in the pelvic floor muscles, hindering the perineum's capacity
510 to stretch further without damage. Prolonged second stage of labor may indicate issues

511 like foetal malposition, macrosomia, cephalopelvic disproportion, or ineffective
512 maternal pushing, leading to increased mechanical stress on the perineum.
513 The findings support earlier studies indicating that a prolonged second stage of labor is
514 a significant predictor of perineal trauma. A prospective cohort study in Sweden among
515 first-time mothers highlighted the duration of the second stage and other labor-related
516 factors as key determinants of perineal and vaginal tears.(9). Studies from Uganda
517 highlight that prolonged labor is a significant factor contributing to perineal injury, with
518 findings from Kawempe National Referral Hospital linking prolonged labor and other
519 obstetric factors to a higher risk of perineal tears, while Ali et al. (2020) identified
520 prolonged second stage among factors associated with obstetric anal sphincter injuries
521 at a tertiary hospital in Southwestern Uganda(5).
522 The relationship between prolonged second stage labor and perineal trauma requires
523 careful evaluation. Current practices emphasize individualized care rather than strict
524 time constraints. In specific scenarios, particularly with epidural analgesia and stable
525 conditions, a longer second stage may decrease unnecessary interventions and
526 caesarean births. Conversely, prolonged labor can increase maternal fatigue and
527 intervention risks, possibly exacerbating perineal trauma. Clinical decisions should
528 weigh labor duration, fetal position, maternal health, descent progress, and birth
529 methods.
530 Evidence suggests several strategies to reduce perineal trauma during the second stage
531 of labor, including skilled perineal support, controlled delivery of the foetal head, warm
532 perineal compresses, and selective use of mediolateral episiotomy for women at higher
533 risk of severe perineal injury, especially during operative vaginal births (11,23). Recent
534 implementation studies have also demonstrated that structured perineal protection care
535 bundles, incorporating staff training, standardized techniques, and post-birth
536 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.

562 **Clinical and public health implications**

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

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

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

575 **Strengths and Limitations**

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

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

582 Minor first-degree tears may be under-documented, leading to an underestimation of
583 their prevalence. Additionally, findings from a single tertiary referral hospital may not
584 be applicable to lower-level health facilities or other regions in Uganda. There is also a
585 risk of residual confounding from unmeasured variables such as maternal body mass
586 index, foetal head circumference, maternal position during birth, provider experience,
587 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-

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

618 **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

619 **DECLARATIONS**

620 **Ethics approval and consent to participate**

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

626 **Consent for publication**

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

631 **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

Funding

The research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgment

The authors extend their appreciation to the Management and the Department of Obstetrics and Gynecology, Lira Regional Referral Hospital (LRRH), for their assistance in acquiring the necessary data for this study.

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All authors read and approved the final manuscript.

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