Pregnancy outcomes following surgical repair of female genital fistula in Uganda

Abner P. Korn, MD; Justus K. Barageine, PhD; Hadija Nalubwama, MPH; Jaffer Okiring, PhD; Florence Nalubega, MMed; Shane Ian Asiimwe, MMed; Alphonsus Matovu, MMed; Alison M. El Ayadi, ScD

BACKGROUND: Women developing genital fistula and undergoing fistula repair in sub-Saharan Africa and South Asia are largely of reproductive age, and fistula prevalence is highest in countries with high fertility and where social values are placed on childbearing. Optimizing women's health following female genital fistula and surgical repair requires further understanding of the risks to subsequent pregnancies and how to mitigate them, to enable women to achieve their desired family size without additional morbidity.

OBJECTIVE: We sought to contribute to the postfistula repair evidence base through estimating rates of spontaneous abortion and stillbirth as well as the associated risk factors of these adverse outcomes in pregnancies following fistula repair.

METHODS: We captured data on sociodemographic characteristics, obstetric and fistula history, and pregnancy and childbirth care and experiences, and outcomes for the first postrepair pregnancy from 302 women who became pregnant within 10 years following genital fistula repair, recruited from six fistula repair facilities in Uganda. We described sociodemographic characteristics, spontaneous abortion (pregnancy loss <20 weeks gestational age), and stillbirth (intrauterine fetal death at ≥20 weeks gestational age) and determined factors associated with these outcomes using logistic regression. We compared outcomes to two external data sources: a meta-analysis and propensity-score matched Ugandan women of reproductive-age.

RESULTS: Overall, 14% (43/302) of the participants had spontaneous abortions and 5% (12/255) had stillbirths in postrepair pregnancies. The spontaneous abortion rate in our study was higher compared to a recent meta-analysis; however, the stillbirth rate was not. The stillbirth rate in our study was 2.5 percentage-points higher compared to the general population (95% CI 0.2−4.9, *P*=.036). Factors independently associated with increased risk of spontaneous abortion included fistula type, vaginal bleeding during pregnancy, any urine leakage, and educational attainment. Vesicovaginal fistula (VVF)-high (VVF types I and III) vs VVF-low (VVF type II Aa Ab Ba Bb) had significantly reduced odds of spontaneous abortion (adjusted odds ratios [aOR] 0.11, 95% CI 0.03−0.45, *P*=.002) and rectovaginal fistula and VVF-other (other or not indicated) had marginally reduced odds (aOR 0.38, 95% CI 0.012−1.14, *P*=.083 and aOR 0.26, 95% CI 0.05−1.25, *P*=.093, respectively). In bivariate analyses, any urine leakage, assisted vaginal delivery, and emergency cesarean section were highly correlated with stillbirth. Stillbirth risk was over-10-fold higher among individuals reporting urine leakage (OR 10.5, 95% CI 2.75−20.43, *P*=.001). Assisted vaginal birth and emergency cesarean birth were both associated with 17-fold increased odds of stillbirth (OR 16.93, 95% CI 1.45−198.08, *P*=.024 and 16.56, 95% CI 1.65−166.28, *P*=.017, respectively).

CONCLUSION: Our results demonstrate that in the study setting, greater attention to high-quality, comprehensive pregnancy care and birth planning are critical for improving outcomes among women who have undergone fistula repair, including facilitation of elective cesarean section which is recommended for postrepair births. Additional investments must be made to strengthen women's health access and knowledge that supports their postfistula repair reproductive goals.

Key words: female genital fistula, miscarriage, obstetric fistula, postrepair, reproductive outcome, spontaneous abortion, stillbirth, Uganda

From the Department of Obstetrics, Gynecology and Reproductive Sciences, University of California San Francisco, San Francisco, CA (Korn and El Ayadi); Department of Obstetrics and Gynaecology, College of Health Sciences, Makerere University, Kampala, Uganda (Barageine and Nalubwama); Department of Obstetrics and Gynaecology, Kampala International University, Kampala, Uganda (Barageine); Department of Urogynaecology, Mulago Specialized Women and Neonatal Hospital, Kampala, Uganda (Barageine); Infectious Disease Research Collaboration, Kampala, Uganda (Okiring); Kitovu Hospital, Masaka, Uganda (Nalubega); Arua Regional Referral Hospital, Arua, Uganda (Asiimwe); Mubende Regional Referral Hospital, Mubende, Uganda (Matovu); Department of Epidemiology and Biostatistics, University of California San Francisco, San Francisco, CA, USA (El Ayadi)

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Corresponding author: Alison M. El Ayadi, ScD alison.elayadi@ucsf.edu

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AJOG Global Reports at a Glance

Why was this study conducted?

Optimizing women's health following female genital fistula and surgical repair requires further evidence on risks to postrepair pregnancies and mitigation opportunities, yet the evidence base is limited.

Key findings

At 5%, stillbirth rates are higher in pregnancies following fistula repair than among the general population. Social and clinical risk factors were identified for spontaneous abortion risk, and fistula severity and birth mode were important for stillbirth risk.

What does this add to what is known?

Our study contributes to the limited evidence on risk factors for adverse postrepair pregnancy outcomes through expanding the breadth of factors evaluated, sample size, and comparing with external controls.

Introduction

Female genital fistula is a debilitating injury affecting an estimated 500,000 women, mostly in sub-Saharan Africa and South Asia, with up to 100,000 annual incident cases.[1] In lower-resource settings, fistula is primarily due to neglected prolonged obstructed labor, iatrogenic or traumatic etiologies. Affected women experience uncontrollable leakage of urine and/or feces, which result in genital sores and infection.[2,3] Other fistula symptoms and consequences include pain and weakness,[4] nerve damage, cervical injuries and pelvic bone trauma, secondary infertility, and gait disorders.[5] Many fistula-causing births end in fetal death.[6] Women with fistula are stigmatized, unable to participate in social, economic, or religious activities[4,6]; and report high psychiatric morbidity including depression.[7–9]

Improved surgical access has reduced women's suffering from the severe physical, psychosocial, and economic consequences of fistula, with clinical success rates ranging from 65% to 95%.[10,11] However, research and clinical follow-up emphasizes that the fistula continuum of care cannot end at surgery, even where surgery is successful, as women continue to face adverse outcomes following repair including some evidence of poor perinatal outcomes in postrepair pregnancies.[12]

Research on pregnancy outcomes following fistula repair suggests increased rates of pregnancy loss and stillbirth. A scoping review and meta-analysis of 16 articles published between 1978 and 2016 reporting on 494 pregnancies following genital fistula repair with known outcome identified miscarriage or abortion occurred in 5.9% (n=29, range 0% −70% across studies).[12] Among 459 neonates with data, 7.6% were stillborn (range 0%−33% across studies). However, these studies were mostly small (range 15−246 participants), had limited follow-up, and lacked robust characterization of factors influencing postrepair pregnancy outcome that could inform interventions to improve women's health following fistula repair.[13–15] For example, the review noted that stillbirth, fistula recurrence, and maternal death were more frequently reported with vaginal delivery and emergency cesarean section than with elective cesarean section, consistent with fistula community recommended postrepair birth mode,[5,6,15] yet no studies included formally tested this association.[16–20]

Elevated risk of adverse postrepair pregnancy outcomes could be influenced by structural factors such as genital tract damage resulting from the fistula and associated repair,[21] biochemical factors from urinary tract or other genital infections,[22] or poor intrapartum care access or quality,[23] which may have also contributed to fistula development. Further research into the incidence and risk factors associated with these outcomes are key to understanding any elevated risks that women may experience during postrepair reproduction as well as identify key risk factors which could be targeted to reduce this risk.

We sought to expand this evidence base through evaluating miscarriage and stillbirth rates in the first pregnancy following fistula repair within a cohort of Ugandan women and analyzing the potential contributions of diverse factors influencing women's risk of adverse pregnancy outcomes to inform intervention priorities to optimize postrepair health.

Materials and methods

Study design and setting

We conducted a sequential explanatory mixed methods study including a retrospective quantitative cohort of 302 women who became pregnant in the 10 years following genital fistula repair and nested qualitative work among 30 women selected for variability in pregnancy outcome. This analysis focuses on the quantitative cohort for which data were collected from February 2020 to January 2023. Participants were recruited from six fistula repair facilities located in south, central, and eastern Uganda including Mulago National Teaching and Referral Hospital (Kampala), Kamuli Mission Hospital, Kitovu Mission Hospital (Masaka), Mubende Regional Referral Hospital, Jinja Regional Referral Hospital and Hoima Regional Referral Hospital.

Study participants and sample size

Inclusion criteria for the study was: undergone fistula surgery in the prior 10 years and experienced one or more pregnancies following fistula repair. Trained research assistants reviewed fistula surgical registries to identify individuals who had undergone surgery in the prior 10 years who met the following inclusion criteria: phone contact listed; female genital fistula of obstetric, iatrogenic, or traumatic etiology; age 18 to 49 or emancipated minor; and potential for pregnancy (no history of hysterectomy or tubal ligation recorded). Listed individuals' name, telephone

number, surgical date, age, fistula etiology, and classification were recorded and they were screened by phone regarding their postrepair pregnancy history. Those with one or more pregnancies were invited to participate in the study and scheduled for interviewer-administered survey at a proximate fistula repair facility if they agreed. Information for 1387 individuals was listed, 520 (37.5%) were reached via phone, and 346 (66.5%) reported any postrepair pregnancies. Six eligible individuals did not agree to participation and 38 had not completed data collection by the time we met our target sample size, leaving an analytic sample of 302 participants.

Our target sample size was established at 300 minimum quantitative participants to estimate our primary outcome of stillbirth with 5% precision and 95% confidence interval,[24] with an expected stillbirth prevalence of 8%, informed by a recent scoping review.[12]

Study procedures

Following a thorough informed consent process, we obtained written or thumbprint confirmation prior to survey administration with each participant. Trained research assistants administered surveys to study participants in a private location in their local language. These took 1 hour to complete on average. We provided participants with refreshments and round-trip transportation reimbursement in addition to payment for their time. Data were directly entered via study tablets into Research Electronic Data Capture (REDCap) software, preprogrammed with logical and consistency checks, and stored on a secure cloud-based server.[25,26]

Study measures

Our quantitative survey captured data on participant sociodemographic characteristics (ie, age, relationship status, educational attainment, religion, income, and household assets), food insecurity (using the Coping Strategies Index comparative version,[27] and categorized into none/minimal, moderate/"stressed", and severe/"crisis" using the Integrated Food Security Phase Classification[28]), obstetric history (ie, pregnancies, pregnancy care access and pregnancy outcomes across the prefistula, during fistula, and postsurgical periods), fistula experiences (ie, fistula development, etiologies, symptoms, fistula repair access), social support and resources (social support and household decision-making capacity), contraceptive use, and pregnancy attitudes and intent. The first postfistula repair pregnancy was assessed in detail to understand care factors (ie, antenatal care [ANC] initiation, ANC frequency, birth planning), pregnancy-related complications and challenges, labor and delivery care seeking and receipt, pregnancy outcomes (maternal and neonatal), and impact of pregnancy outcome (ie, physical and psychological status, subsequent care needs) and future fertility intentions. Pregnancy-related complications were categorized into hypertensive disorders (headache, blurred vision, hypertension), diabetes, pregnancy-risk infection (sexually transmitted infection, lower abdominal pain, fever, and foul-smelling vaginal discharge), and other infection (tetanus, malaria, and respiratory infection), and vaginal bleeding. We also collapsed any complication reported into a composite indicator for our descriptive analysis.

The current analysis focused on adverse pregnancy outcomes of spontaneous abortion and stillbirth in the first postrepair pregnancy. We operationalized these outcomes using the American College of Obstetricians and Gynecologists definitions of spontaneous abortion as pregnancy loss under 20 weeks gestational age and stillbirth as intrauterine fetal death at 20 weeks gestational age or above.[29,30]

Statistical analysis

Data management and analysis employed Stata version 14.1 (College Station, TX). We described participant sociodemographic characteristics, fistula, and obstetric history, and outcome prevalence using descriptive statistics including frequencies and percentages, medians, and interquartile ranges (IQR). Outcome prevalence was calculated among the full sample for our spontaneous abortion outcome, but only among study participants who had not experienced spontaneous or induced abortion for the stillbirth outcome. We assessed relationships between each outcome and sociodemographic characteristics (age, educational attainment, relationship status, food insecurity severity), fistula type according to Waaldijk's classification[31] (reclassified into vesicovaginal fistula (VVF)-low (ie, VVF type II (Aa, Ab, Ba, Bb), VVF—high (ie, VVF types I and III), rectovaginal fistula (RVF)/chronic obstetric anal sphincter injury (OASIS) only, VVF and RVF, and VVF-other or not indicated, Table S1), number of fistula surgeries, time to first postrepair pregnancy from surgery, pregnancy complications (ie, hypertensive disorders, diabetes, pregnancy-risk infection, other infection, or vaginal bleeding), current urine leakage, intimate partner violence (ie, any, physical, physical to the abdomen, forced sex, emotional), and other physical trauma. We tested for statistically significant bivariate differences using chi-square tests for categorical variables and two-sample Wilcoxon rank-sum tests for continuous variables. We then built logistic regression models for both outcomes including variables with P value ≤ 0.2 in bivariate analyses to minimize negative confounding, removing the most insignificant variables one at a time. Best model fit was determined using the Akaike information criterion. Logistic regression modeling with robust standard errors was used to determine factors associated with spontaneous abortion and a penalized maximum likelihood estimation logistic regression model was used to determine factors associated with stillbirth. The penalized method helps to overcome the "separation" problem in logistic regression due to the rarity of stillbirth outcomes. Measures of association are presented as adjusted odds ratios (aOR). Multivariate analysis was not performed for our stillbirth outcome due to the small number identified. Sensitivity analyses were conducted for spontaneous abortion outcomes limited to occurrence in

TABLE 1
Sociodemographic characteristics of Ugandan study participants with at least one pregnancy following female genital fistula repair (*n*=302)

Characteristic	*N* (%)
Age[a]	31 (27−36)
Educational attainment	
None	21 (6.9)
Some primary	107 (35.3)
Completed primary	76 (25.1)
Some secondary	66 (21.8)
Completed secondary or higher	32 (10.6)
Relationship status	
Single, never married	23 (7.6)
Married or domestic partnership	228 (75.5)
Widowed, divorced, or separated	51 (16.9)
Household income, monthly (*N*=294)[b]	
Below World Bank poverty line	277 (93.9)
Above World Bank poverty line	18 (6.1%)
Individual/household Assets	
Participate in savings/investment groups (*N*=289)	84 (29.1)
Has a business (*N*=289)	66 (22.8)
Has a health insurance (*N*=286)	6 (2.1)
Household owns a car/motorcycle	267 (88.4)
Household has land (*N*=285)	205 (71.7)
Household has animals (*N*=285)	177 (62.0)
Household Food Insecurity Severity	
None/minimal	164 (54.3)
Moderate food insecurity	100 (33.1)
Severe food insecurity	38 (12.6)

[a] Median (interquartile range); [b] Using World Bank pre-2022 threshold of $1.90 per person in household per day.[34]

Korn. Pregnancy outcomes following surgical repair. AJOG Glob Rep 2025.

the second-trimester (ie, excluding all first-trimester spontaneous abortion cases; Table S2). We used a two-sample confidence interval for proportions to test whether prevalence of spontaneous abortion and stillbirth from our study differed from Delamou et al's[12] meta-analysis. Finally, we compared the stillbirth rate between our study participants with the general reproductive age population from the 2016 Uganda Demographic and Health Survey using nearest neighbor algorithm propensity score matching based on age, educational attainment, parity, and rural/urban status.[32,33] *P* values <.05 were considered statistically significant.

Ethical approval

Study procedures were reviewed and approved by the University of California San Francisco Institutional Review Board (IRB# 19-27901), the Mulago Hospital Research and Ethics Committee (MHREC# 1674), and Uganda National Council for Science and Technology (HS 2706). All participants provided written confirmation of informed consent.

Results

Participant sociodemographic characteristics, fistula and obstetric history

Among the 302 participants (Table 1), median age was 31 years (IQR: 27−36). Just over half had completed primary education (58%) and 11% had completed secondary or higher education. Three-quarters of participants were married or in domestic partnership (76%). Most households' current income fell below the prevailing World Bank poverty line of $1.90 per person per day (94%).[34] However, many reported household ownership of a motorcycle or car (88%) and land (72%). Many participants reported some form of household food insecurity (33.1% moderate and 12.6% severe).

Fistula type was classified as 26% VVF-low, 19% VVF-high, 35% RVF/chronic OASIS, 2% VVF and RVF, and 19% as other VVF (other VVF/NI; Table 2). Common self-reported fistula etiologies included prolonged obstructed labor without surgical intervention (46%) and prolonged obstructed labor with surgical intervention (45%). Half of fistula-causing births resulted in stillbirth (49%). Most participants had had just one fistula surgery (88%). Median time was 19 months (IQR: 5−68) from fistula development to surgery, 28 months (IQR: 15−40) from index fistula surgery to pregnancy, and 34 months (IQR: 14−56) from pregnancy outcome to interview.

Median parity was 4 (IQR: 3−6) with most (59%) reporting 3 to 5 live births. Most (83%) participants did not have history of spontaneous abortion, 14% had one, and 3% had 2 or more. History of stillbirth was reported by 53% of the participants (47% with one stillbirth and 6% having 2 or more stillbirths). Slightly above two-thirds (70%) of the participants had had a prior cesarean section, with 45% who had one prior cesarean and 25% two or more.

For the first postrepair pregnancy, most had achieved the minimum recommended 4 or more visits (69.3%) and reported high ANC content quality. Pregnancy complications were reported by just under half (43.1%) including

TABLE 2
Fistula and obstetric history among Ugandan study participants with at least one pregnancy following female genital fistula repair (*n*=302)

Characteristic	*N* (%)
Fistula history	
Fistula type (*N*=302)	
VVF-low	78 (25.8)
VVF-high	58 (19.2)
RVF	105 (34.8)
VVF/RVF	5 (1.7)
VVF-other/NI	56 (18.5)
Self-reported fistula etiology	
Prolonged obstructed labor *without* surgical intervention	139 (46.0)
Prolonged obstructed labor *with* surgical intervention	135 (44.7)
Childbirth-related surgery—no prolonged obstructed labor	24 (8.0)
Other	4 (1.3)
Infant outcome of fistula-causing birth (*N*=299)	
Stillborn	147 (49.2)
Liveborn	152 (50.8)
Number of fistula surgeries	
1	267 (88.4)
2	25 (8.3)
3 or more	10 (3.3)
Months from fistula development to surgery (*N*=286)	19.4 (4.8–68.2)[a]
Months from index fistula surgery to pregnancy	27.5 (15.3–39.5)[a]
Months from pregnancy outcome to interview	34 (14–56)[a]
Parity (*N*=302)	4 (3–6)[a]
1–2	43 (14.2)
3–5	178 (58.9)
6 or more	81 (26.8)
Obstetric history	
History of spontaneous abortion	
None	251 (83.1)
1	42 (13.9)
2 or more	9 (3.0)
History of stillbirth	
None	142 (47.0)
1	142 (46.7)
2 or more	19 (6.3)
Number of prior cesarean surgeries	
None	92 (30.5)
1	136 (45.0)
2 or more	74 (24.5)

Korn. Pregnancy outcomes following surgical repair. AJOG Glob Rep 2025. *(continued)*

other infections (36.4%), pregnancy-risk infections (31.5%), and hypertensive disorders (26.2%). Intimate partner violence was reported by about one-fifth (19.9%), including forced sex (11.9%), emotional IPV (12.9), and physical IPV (10.3%). Birth mode was just over half elective cesarean (51.2%), followed by vaginal unassisted (31.6%), emergency cesarean (10.4%) and vaginal assisted (6.8%).

Outcomes of first postfistula repair pregnancy

Overall, 14% (43/302) of the participants had spontaneous abortions and 5% (12/255) had stillbirths (Table 3).[1] Most spontaneous abortions (70%) were reported during the second-trimester of pregnancy (12–20 weeks gestational age), reflecting a first-trimester spontaneous abortion rate of 4.3% and second-trimester spontaneous abortion rate of 10.4%. Half of the stillbirths were reported to have occurred before 36 weeks gestational age and half at 36 or more weeks of gestation.

Factors associated with spontaneous abortion

In bivariate analysis, we identified significant differences in spontaneous abortion in the first postrepair pregnancy by number of fistula surgeries, overall pregnancy complications, vaginal bleeding, pregnancy-risk infections, and urine leakage (Table 4). In multivariable analysis, factors independently associated with increased risk of spontaneous abortion included food insecurity, fistula type, vaginal bleeding, urine leakage, and educational attainment (Table 4). Compared to participants with VVF-low, those with VVF-high had significantly reduced odds of spontaneous abortion (aOR 0.08, 95% CI 0.02–0.31, *P*<.001) for VVF-high, and RVF (aOR 0.27, 95% CI 0.09–0.79, *P*=.016). Those reporting vaginal bleeding had significantly greater odds of spontaneous abortion (aOR 43.04, 95% CI 13.59–136.26, *P*<.001) as did those

[1] Four individuals reported induced abortion and were excluded from birth outcome analyses.

TABLE 2
Fistula and obstetric history among Ugandan study participants with at least one pregnancy following female genital fistula repair (n=302) *(continued)*

Characteristic	*N* (%)
First postrepair pregnancy characteristics	
Time to pregnancy from fistula surgery	
<6 mo	22 (7.3)
6–12 mo	32 (10.6)
12–18 mo	49 (16.2)
18–24 mo	24 (8.0)
>24 mo	175 (58.0)
Number of ANC visits (*N*=300)	
3 or less visits	92 (30.7)
4 or more visits	208 (69.3)
ANC quality[a,b]	11 (10–11)
Pregnancy complications	
Any complication	130 (43.1)
Hypertensive disorders	79 (26.2)
Diabetes	8 (2.7)
Infection, pregnancy-risk[c]	95 (31.5)
Infection, other[d]	110 (36.4)
Vaginal bleeding	38 (12.6)
Any urine leakage	23 (7.6)
Intimate partner violence	
Any IPV	60 (19.9)
Physical	31 (10.3)
Physical to abdomen	8 (2.7)
Forced sex	36 (11.9)
Emotional	36 (11.9)
Other physical trauma	4 (1.3)
Birth mode (*n*=250)	
Vaginal—unassisted	79 (31.6)
Vaginal—assisted	17 (6.8)
Cesarean—elective	128 (51.2)
Cesarean—emergency	26 (10.4)

ANC, antenatal care; *NI*, no information; *RVF*, recto-vaginal fistula; *VVF*, vesico-vaginal fistula.

[a] Median (IQR); [b] Number of ANC components received (range 0–11); [c] Pregnancy-risk infection includes sexually transmitted infection, lower abdominal pain, fever, and foul-smelling vaginal discharge; [d] Other infection includes tetanus, malaria, and respiratory infection.

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reporting current urine leakage vs not (aOR 4.28, 95% CI 1.28–14.84, *P*=.022). Compared to participants with no education, those with some secondary education had lower odds of spontaneous abortion (aOR 0.20, 95% CI 0.07–0.96, *P*=.046). Factors trending toward association with decreased spontaneous abortion odds which did not meet our threshold for statistical significance include some primary education vs no education (aOR 0.21, 95% CI 0.04–1.29, *P*=.057), being married or having a partner (aOR 0.29, 95% CI 0.07–1.17, *P*=.083), and VVF/NI (aOR 0.19, 95% CI 0.03–1.14, *P*=.070) vs VVF-low fistula.

In sensitivity analyses focused on second-trimester spontaneous abortions only (*n*=288), odds of spontaneous abortion differed significantly by food insecurity, VVF type, vaginal bleeding, and marginally by hypertensive disorders (Table S2). Compared to those with no food insecurity, those with marginal or severe food insecurity had significantly higher 12.1-fold and 7.6-fold odds of spontaneous abortion (aOR 12.12, 95% CI 1.72–85.51 and aOR 7.55, 95% CI 1.07–53.40), respectively. Compared to VVF-low, VVF-high and RVF were protective of spontaneous abortion (aOR 0.24, 95% CI 0.08–0.73 and aOR 0.34, 95% CI 0.12–0.99). Presence of vaginal bleeding was associated with a large increased odds of spontaneous abortion (aOR 45.78, 95% CI 13.64–153.68) whereas hypertensive disorder appeared to be marginally protective (aOR 0.22, 95% CI 0.05–1.01).

Factors associated with stillbirth

In bivariate analyses, we found that any urine leakage, assisted vaginal delivery, and emergency cesarean section to be highly correlated with stillbirth (Table 5). Individuals reporting urine leakage had over 10-fold increased odds of stillbirth (OR 10.5, 95% CI 2.75–20.43, *P*=.001) compared to those with no urine leakage. Assisted vaginal birth and emergency cesarean birth were associated with 17-fold increased odds of stillbirth (OR 16.93, 95% CI 1.45–198.08, *P*=.024 and 16.56, 95% CI 1.65–166.28, *P*=.017, respectively) compared to elective cesarean. Factors trending toward association with increased odds of stillbirth but which did not meet our threshold for statistical significance included two or more fistula surgeries vs one (OR 3.74, 95% CI 0.82–17.11, *P*=.090), vaginal bleeding vs none (OR 4.22, 95% CI 0.82–21.62, *P*=.084), and physical intimate partner violence vs none (OR 3.74, 0.82–17.11, *P*=.090). Multivariate analysis was not

TABLE 3
Pregnancy outcomes and timing of first pregnancy following female genital fistula repair

Pregnancy outcome	*N* (%)
Spontaneous abortion: (*n*=302)	**43 (14.2)**
Gestational age at time of spontaneous abortion	
4−12 wk	13 (30)
12−20 wk	30 (70)
Stillbirth: (*n*=255[a])	**12 (4.7)**
Gestational age at time of stillbirth	
20−27 wk	4 (33)
28−35 wk	2 (17)
36+ wk	6 (50)

[a] 4 individuals who reported induced abortion were included within the spontaneous abortion analysis denominator but excluded from the live/stillbirth analysis denominator.

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performed due to the small number of stillbirths identified within the study.

Among the stillbirths occurring at 36 weeks or higher, only one was delivered via elective cesarean section.

Further characterization of study participants with ongoing urine leakage

Ongoing urine leakage, identified as a significant risk factor for both outcomes, was reported by 23 individuals (7.6%; Table S3). It did not differ significantly by age or self-reported fistula etiology. It was reported most frequently among those with prolonged labor both without (9.4%) and with surgery (6.7%) fistula etiology, and also among one individual (4.2%) reporting childbirth-related surgery etiology (*P*=.584). Ongoing urine leakage differed significantly by fistula type and birth mode. Ongoing leakage was reported by 20% for combined VVF/RVF, followed by 13.8% among VVF-high, 10.3% among VVF low, 8.9% among VVF-other and 1.0% among RVF only (*P*=.003). By birth mode, it was also most commonly reported by those with emergency cesarean section (14.8%) and unassisted vaginal birth (8.4%) vs those with assisted vaginal birth (5.6%) and elective cesarean (2.2%; *P*=.023).

External comparisons of postrepair pregnancy outcomes

Compared to the meta-analysis presented by Delamou et al,[12] we found a significantly higher rate of spontaneous abortion among our cohort at 14.2% compared with 5.4% (difference 8.8%, 95% CI 4.0−13.1, *P*<.001; Table 6). We found a lower rate of stillbirth than Delamou et al; however, the difference did not reach statistical significance (4.8% vs 7.6%, difference 2.8%, 95% CI −0.6 to 0.01, *P*=.153). After matching our cohort study participants to similar individuals within the Uganda Demographic and Health Survey 2016 cohort, those in the current study had a 2.5 percentage-point-higher risk of stillbirth compared to the general population (average difference 2.5%, 95% CI 0.2 −4.9, *P*=.036).

Discussion

Principal findings

Among a cohort of Ugandan women who became pregnant within 10 years of female genital fistula repair, our study identified that 14.2% of first postrepair pregnancies ended in spontaneous abortion, and 4.7% of the infants from pregnancies lasting beyond 20 weeks gestational age were stillborn. Compared to other literature among women with fistula, the spontaneous abortion rate in our study was significantly higher although the difference in stillbirth rate was not significant.[12] However, participants in our study had a significantly higher stillbirth rate compared to the general Ugandan population, matched on key sociodemographic characteristics and parity.[32] Our assessment of a limited set of risk factors suggests some areas for mitigation of these outcomes, possibly through targeting women at higher risk and increasing access to elective cesarean section.

Results in the context of what is known

The spontaneous abortion rate following fistula repair in our study (14.2%) was significantly higher than a meta-analysis of eight studies reporting on 555 postrepair pregnancies (5.4%)[12] but falls within the pooled range from a meta-analysis of nine large cohort studies from Europe and North America reporting on over 4.6 million pregnancies at 15.3% (95% CI 12.5−18.7).[35] This finding may reflect known measurement challenges.[36] We found fistula type, urine leakage, vaginal bleeding, food insecurity and educational attainment to be associated with risk of spontaneous abortion following fistula repair. Prior literature has identified a positive association between spontaneous abortion rates and acute and chronic psychological and physical stress.[37−39] The inverse relationship we observed between spontaneous abortion risk and food insecurity, educational attainment, and marriage or partnership (marginal) is consistent with mechanisms of adversity experience and social support influencing or buffering the impact of stress on health. The association we identified between vaginal bleeding and spontaneous abortion has been reported elsewhere, where heavy vaginal bleeding in the first-trimester associated with a three-fold risk of miscarriage, although vaginal bleeding may also have been reported as a clinical sign of spontaneous abortion.[40] The association of spontaneous abortion with fistula type and urine leakage, both likely representing fistula severity, is interesting although less easily explained. The fistula classification

TABLE 4
Prevalence and risk factors of spontaneous abortion in first pregnancy following female genital fistula repair (*n*=302)

	Spontaneous abortion		Univariable models		Multivariable model	
Characteristic	Yes (*N*=43) *N* (%)	No (*N*=259) *N* (%)	OR (95% CI)	*P*	OR (95% CI)	*P*
Age	30 (24–37)[a]	31 (27–36)[a]	0.98 (0.93–1.03)	.425	0.97 (0.91–1.04)	.386
Educational attainment						
None	4 (19.1)	17 (80.1)	Reference		Reference	
Some primary	13 (12.2)	94 (87.9)	0.59 (0.17–2.02)	.399	0.21 (0.04–1.04)	.057
Completed primary	12 (15.8)	64 (84.2)	0.80 (0.23–2.79)	.722	0.30 (0.07–1.29)	.106
Some secondary	6 (9.1)	60 (90.9)	0.43 (0.11–1.68)	.223	0.20 (0.04–0.96)	.044
Completed secondary	8 (25.0)	24 (75.0)	1.42 (0.37–5.47)	.613	1.68 (0.34–8.27)	.525
Relationship status						
Single, never married	6 (26.1)	17 (73.9)	Reference		Reference	
Married/domestic partner	28 (12.3)	200 (87.7)	0.40 (0.14–1.09)	.073	0.29 (0.07–1.17)	.083
Widowed/divorced/Sep.	9 (17.7)	42 (82.4)	0.61 (0.19–1.97)	.406	0.87 (0.18–4.19)	.865
Food insecurity severity						
None/minimal insecurity	138 (84.2)	26 (15.8)	Reference	-	Reference	-
Marginal food insecurity	87 (87.0)	13 (13.0)	0.79 (0.39–1.63)	.527	22.35 (2.52–198.17)	.005
Severe food insecurity	34 (89.5)	4 (10.5)	0.62 (0.20–1.91)	.409	11.44 (1.34–97.82)	.026
Self-reported fistula etiology						
Prolonged obstructed labor *without* surgical intervention	20 (14.4)	119 (85.6)	Reference	-		
Prolonged obstructed labor *with* surgical intervention	19 (14.1)	116 (85.9)	0.97 (0.49–1.92)	.941		
Childbirth-related surgery—no prolonged obstructed labor	3 (12.5)	21 (87.5)	0.85 (0.23–3.12)	.807		
Other	1 (25.0)	3 (75.0)	1.98 (0.20–20.10)	.562		
Fistula type						
VVF-low	17 (21.8)	61 (78.2)	Reference		Reference	
VVF-high	6 (10.3)	52 (89.7)	0.41 (0.15–1.13)	.084	0.08 (0.02–0.31)	<.001
RVF	13 (12.4)	92 (87.6)	0.51 (0.23–1.12)	.093	0.27 (0.09–0.79)	.016
VVF/RVF	2 (40.0)	3 (60.0)	2.39 (0.37–15.49)	.360	2.75 (0.21–36.60)	.445
VVF-other/NI	5 (8.9)	51 (91.1)	0.35 (0.12–1.02)	.054	0.19 (0.03–1.14)	.070
Number of fistula surgeries						
One	33 (12.4)	234 (87.6)	Reference	-		
Two	6 (24.0)	19 (76.0)	2.24 (0.83–6.01)	.110		
Three or more	4 (40.0)	6 (60.0)	4.73 (1.27–17.64)	.021		
Time to pregnancy[b]						
<6 mo	1 (4.6)	21 (95.5)	Reference			
6–12 mo	7 (21.9)	25 (78.1)	5.88 (0.67–51.71)	.110		
12–18 mo	8 (16.3)	40 (83.3)	4.10 (0.48–34.98)	.197		
18–24 mo	4 (17.4)	22 (84.6)	4.42 (0.45–43.11)	.201		
>24 mo	23 (13.1)	151 (86.8)	3.16 (0.41–24.61)	.273		

Korn. Pregnancy outcomes following surgical repair. AJOG Glob Rep 2025. *(continued)*

TABLE 4
Prevalence and risk factors of spontaneous abortion in first pregnancy following female genital fistula repair (n=302)
(continued)

Characteristic	Spontaneous abortion		Univariable models		Multivariable model	
	Yes (*N*=43) *N* (%)	No (*N*=259) *N* (%)	OR (95% CI)	*P*	OR (95% CI)	*P*
Pregnancy complications						
Any complication	33 (25.4)	97 (74.6)	5.51 (2.60−11.68)	<.001		
Hypertensive disorders	11 (13.9)	68 (86.1)	0.97 (0.46−2.02)	.926		
Diabetes	2 (25.0)	6 (75.0)	2.06 (0.40−10.54)	.387		
Infectious, preg-risk[c]	23 (24.2)	72 (75.8)	2.99 (1.55−5.77)	.001	0.98 (0.31−3.08)	.973
Infectious, other[d]	20 (18.2)	90 (81.8)	1.63 (0.85−3.13)	.140		
Vaginal bleeding	25 (65.8)	13 (34.2)	26.3 (11.5−59.9)	<.001	43.04 (13.59−136.26)	<.001
Any urine leakage	8 (34.8)	15 (65.2)	3.72 (1.47−9.41)	.006	4.28 (1.23−14.84)	.022
Intimate partner violence						
Any IPV	12 (20.0)	48 (80.0)	1.70 (0.81−3.55)	.157		
Physical	6 (19.4)	25 (80.7)	1.52 (0.58−3.95)	.392		
Physical to abdomen	2 (25.0)	6 (75.0)	2.06 (0.40−10.54)	.387		
Forced sex	7 (19.4)	29 (80.6)	1.54 (0.63−3.78)	.344		
Emotional	8 (22.2)	28 (77.8)	1.89 (0.80−4.47)	.149		
Other physical trauma	1 (25.0)	3 (75.0)	2.03 (0.21−19.99)	.543		

ANC, antenatal care; *NI*, no information; *RVF*, recto-vaginal fistula; *VVF*, vesico-vaginal fistula.

[a] Median (interquartile range); [b] From fistula surgery; [c] Pregnancy-risk infection includes sexually transmitted infection, lower abdominal pain, fever, and foul-smelling vaginal discharge; [d] Other infection includes tetanus, malaria, and respiratory infection.

Korn. Pregnancy outcomes following surgical repair. AJOG Glob Rep 2025.

system we used describes damage to the urethra and its closure mechanism. The fistula types most highly associated with spontaneous abortion in our study were VVFII (Aa, Ab, Ba, Bb), all of which involve the continence mechanism (proximal urethra). Unfortunately, we do not know which of these cases also had cervical damage. It is likely that cervical damage occurring during fistula-causing births would increase the subsequent risk of spontaneous abortion due to ascending infection or cervical incompetence.[41] It is also possible that damage to the urethral sphincter led to increased rates of urinary tract infection which influenced the risk of spontaneous abortion. Further characterization of individuals with ongoing urinary incontinence in our study also identified significant association with birth mode, reflecting existing literature reporting lower stress urinary incontinence after cesarean vs spontaneous vaginal birth.[42]

Unlike other literature,[43] we did not identify an increased risk of spontaneous abortion associated with malaria during pregnancy, although this was modeled within a composite other infection group.

The stillbirth rate we identified (4.7%) is high and significantly higher than among the general Ugandan population matched on key sociodemographic characteristics and parity. Our study's rate was lower than reported by Delamou et al[12] in a scoping review and meta-analysis of 16 studies (7.8%, range 0%−50%; *N*=459) and a larger Guinean cohort (24%; *N*=67).[20] We also observed stillbirth in a small cohort study in Uganda, where 4 of 7 pregnancies occurring in the year following surgery resulted in stillbirth. Recent estimates suggest that stillbirth rates in eastern and southern Africa are among the highest globally, second only to west and central Africa, at 20.5 (95% CI 18.7 −23.6) per 1000 births.[44] This comparative estimate using the WHO definition of 28 weeks gestational age or above is more conservative than our estimate using the ACOG definition due to the exclusion of stillbirths occurring at earlier gestational ages.

Our assessment of factors associated with stillbirth was limited due to the low prevalence combined with our relatively small sample size; however, in bivariate analyses, we found any urine leakage, assisted vaginal delivery, and emergency cesarean section to be highly correlated with stillbirth, and marginal associations with number of prior fistula surgeries and vaginal bleeding. It is likely that our findings on current urine leakage are associated with fistula severity. Our findings on the association of stillbirth with birth mode are consistent with prior work identifying that elective cesarean section for postfistula births results in the best maternal and

TABLE 5
Prevalence and risk factors of stillbirth in first pregnancy following female genital fistula repair (*n*=255)

Characteristic	Stillbirth		Univariable models	
	Yes (*N*=12) *N* (%)	No (*N*=243) *N* (%)	OR (95% CI)	*P*
Age[a]	29 (25–37)	31 (27–36)	0.94 (0.84–1.05)	.264
Educational attainment				
None	0 (0.0)	17 (100.0)	Reference	
Some primary	7 (7.5)	86 (92.5)	2.25 (0.12–42.60)	.589
Completed primary	3 (4.8)	60 (95.2)	1.47 (0.07–32.09)	.806
Some secondary	2 (3.4)	57 (96.6)	0.93 (0.04–23.85)	.965
Completed secondary	0 (0.0)	23 (100.0)	0.74 (0.01–39.40)	.884
Relationship status				
Single, never married	1 (6.3)	15 (93.8)	Reference	
Married/domestic partner	9 (4.6)	188 (95.4)	0.36 (0.06–2.30)	.282
Widowed/divorced/Sep.	2 (4.6)	40 (95.2)	0.38 (0.04–3.96)	.421
Household assets				
Car or motorcycle	0 (0.0	63 (100.0)	0.36 (0.08–1.64)	.188
Land	8 (4.6)	166 (95.4)	0.51 (0.12–2.11)	.351
Animals	7 (4.7)	143 (95.3)	0.79 (0.19–3.26)	.740
Food security severity				
None/minimal food insecurity	9 (6.6)	127 (93.4)	Reference	
Marginal food insecurity	3 (3.5)	82 (96.5)	0.57 (0.16–2.00)	.380
Severe food insecurity	0 (0.0)	34 (100.0)	0.19 (0.01–3.43)	.263
Self-reported fistula etiology				
Prolonged obstructed labor *without* surgical intervention	6 (5.1)	111 (94.9)	Reference	
Prolonged obstructed labor *with* surgical intervention	4 (3.5)	111 (96.5)	0.69 (0.20–2.37)	.558
Childbirth-related surgery—no prolonged obstructed labor	2 (10.0)	18 (90.0)	2.32 (0.50–10.81)	.284
Other	0 (0.0)	3 (100.0)	2.45 (0.11–52.63)	.567
VVF classification				
VVF-low	4 (6.8)	55 (93.2)	Reference	
VVF-high	3 (5.8)	49 (94.2)	1.12 (0.24–5.20)	.881
RVF	1 (1.1)	90 (98.9)	0.26 (0.04–1.80)	.172
VVF/RVF	1 (33.3)	2 (66.7)	3.11 (0.12–78.18)	.490
VVF-other/NI	3 (6.0)	47 (94.0)	0.50 (0.07–3.3.54)	.489
Number of fistula surgeries				
One	9 (3.9)	221 (96.1)	Reference	
Two or more	3 (12.0)	22 (88.0)	3.74 (0.82–17.11)	.090
Time taken after fistula repair to become pregnant				
<6 mo	0 (0.0)	21 (100.0)	Reference	
6–12 mo	1 (4.0)	24 (96.0)	0.96 (0.02–50.34)	.982
12–18 mo	2 (5.3)	36 (94.7)	2.87 (0.13–62.52)	.503
18–24 mo	0 (0.0)	22 (100.0)	1.10 (0.02–58.28)	.962
>24 mo	9 (6.0)	140 (94.0)	1.98 (0.11–36.33)	.647

Korn. Pregnancy outcomes following surgical repair. AJOG Glob Rep 2025. *(continued)*

TABLE 5
Prevalence and risk factors of stillbirth in first pregnancy following female genital fistula repair (n=255) *(continued)*

Characteristic	Stillbirth		Univariable models	
	Yes (*N*=12) *N* (%)	No (*N*=243) *N* (%)	OR (95% CI)	*P*
Number of ANC visits (*N*=246)				
3 or less visits	2 (5.0)	38 (95.0)	Reference	
4 or more visits	6 (2.9)	201 (97.1)	0.50 (0.11–2.23)	.364
ANC quality of ANC[a,b]	11.0 (9.5–11.0)	11.0 (10.0–11.0)	0.95 (0.76–1.20)	.680
Pregnancy complications				
Any complication	4 (4.4)	86 (95.6)	1.79 (0.47–6.77)	.392
Hypertensive disorders	3 (4.5)	64 (95.5)	1.74 (0.44–6.85)	.428
Diabetes	0 (0.0)	6 (100.0)	2.12 (0.11–40.82)	.618
Infectious, preg-risk[c]	7 (10.0)	63 (90.0)	1.33 (0.41–4.31)	.637
Infectious, other[d]	5 (5.6)	85 (94.4)	1.33 (0.41–4.31)	.637
Vaginal bleeding	2 (15.4)	11 (84.6)	4.22 (0.82–21.62)	.084
Any urine leakage	4 (26.7)	11 (73.3)	10.5 (2.75–40.43)	.001
Intimate partner violence				
None	6 (3.0)	195 (97.0)	0.61 (0.14–2.70)	.510
Any IPV	2 (4.3)	44 (95.7)	1.70 (0.38–7.57)	.487
Physical	2 (8.3)	22 (91.7)	3.74 (0.82–17.11)	.090
Physical to abdomen	0 (0.0)	5 (100)	2.52 (0.13–49.33)	.543
Forced sex	1 (3.5)	28 (96.5)	1.49 (0.25–8.99)	.663
Emotional	0 (0.0)	26 (100.0)	0.48 (0.03–8.49)	.614
Other physical trauma	0 (0.0)	3 (100)	3.99 (0.19–83.54)	.372
Birth mode				
Vaginal—unassisted	3 (3.8)	76 (96.2)	5.01 (0.51–49.06)	.166
Vaginal—assisted	2 (11.8)	15 (88.2)	16.93 (1.45–198.08)	.024
Cesarean—elective	1 (0.8)	127 (99.2)	Reference	
Cesarean—emergency	3 (11.5)	23 (88.5)	16.56 (1.65–166.28)	.017

NI, no information; *RVF*, recto-vaginal fistula; *VVF*, vesico-vaginal fistula.

[a] Median (IQR); [b] Number of ANC components received (range 0–11); [c] Pregnancy-risk infection included sexually transmitted infection, lower abdominal pain, fever, and foul-smelling vaginal discharge; [d] Other infection included tetanus, malaria, and respiratory infection.

Korn. Pregnancy outcomes following surgical repair. AJOG Glob Rep 2025.

neonatal outcomes. Delamou et al[12] found more stillbirths associated with vaginal delivery (21.3%) than emergency (6.8%) or elective cesarean section (3.4%) and within the Guinean cohort identifying a 24% stillbirth rate, few women delivered via elective cesarean (18%). In our study, uptake of elective cesarean section was also low (51.2%), and only one of six who experienced stillbirth at 36 weeks gestational age or above had an elective cesarean section, which suggests that these stillbirths may have been related to intrapartum care factors.

Clinical implications

Our study results confirm that improving postrepair pregnancy outcomes and experiences among women with fistula requires substantial investments in maternity care quality and networked care approaches to ensure early and appropriate engagement in high-quality comprehensive pregnancy care, birth planning, and effective linkage to guideline-aligned postrepair childbirth care. For example, identifying and overcoming barriers to elective cesarean rates for postrepair births will require improvements in clinical counseling and identification of structural strategies to mitigate barriers to care. While systems factors were not assessed in the current study, expanding telemedicine integration and developing functional

TABLE 6
Comparison of spontaneous abortion and stillbirth outcomes with external controls

Pregnancy outcome	Study	Proportion	Sample size	Difference (95% CI)	*P*
Spontaneous abortion	Current study	0.142	302	0.088 (0.04, 0.131)	<.001
	Delamou	0.054	539		
Stillbirth	Current study	0.048	248	−0.028 (−0.064, 0.008)	.153
	Delamou	0.076	459		
	Current study vs Uganda DHS 2016				
	Average difference			0.025 (0.002, 0.049)	.036
	Average treatment effect (current study)			0.047 (0.021, 0.074)	<.001
	Average treatment effect (DHS)			0.022	

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maternity care networks are other interventions which are likely to contribute to successful care linkage for individuals with higher-risk pregnancies.[45,46] Furthermore, Uganda's maternity care fee exemption policy should cover all maternity care[47]; however, costs of cesarean surgery are often catastrophic.[48] Furthermore, other research on female genital fistula confirms the important role of stigma as a barrier to fistula care[49–52]; while the extent to which persistent fistula stigma anticipations influence future healthcare-seeking behaviors, it is possible that fistula stigma may play a role in influencing postrepair pregnancy care decisions as is seen for other stigmatized conditions such as HIV.[53,54] Efforts to reduce fistula-related stigma in both community and clinical environments and bolstering privacy and confidentiality in the maternity care setting through improved patient-centered care could shift this dynamic.[55–57]

Research implications

Our study contributes to the limited evidence on spontaneous abortion and stillbirth in pregnancies following fistula repair. Combined with the literature, our research findings and design limitations suggest important areas for subsequent research. For example, due to sample size limitations, concerns regarding participant burden, and our retrospective design, the full range of factors known to influence risk of spontaneous abortion such as age, partner age, body mass index, and lifestyle and environmental risk factors were not able to be evaluated within our study. Comparison of rates from our relatively small study to other literature is limited without this standardization, thus more robust research can inform whether the risk of spontaneous abortion following genital fistula repair differs from the general population. Similarly, larger sample sizes would improve the robustness of our stillbirth risk factor estimates. Finally, as the prevalent guideline and counseling recommendation at fistula repair is for subsequent births to occur via elective cesarean section and uptake of elective cesarean section is low in our study and others, research to understand facilitators and barriers of elective cesarean section birth and intervention strategy development to increase access is needed.

Strengths and limitations

While we identified and interviewed a relatively large retrospective cohort of women who had pregnancies following repair of obstetric fistula within this study, our study has several significant limitations. We were unable to reach many potential study subjects by telephone, potentially biasing our sample to those with higher socioeconomic status or more economic or residential stability. Indeed, in comparison to unpublished data from a 800-participant cohort study of Ugandan women accessing fistula repair, our study sample was similar in age and relationship status, yet our participants had higher educational attainment, and higher proportions owned land or animals.[58] The medical records used to capture information regarding the type of fistula sometimes had limited details or missing information. We included patients of multiple fistula care providers (data not captured) and it is possible that a fistula would have been differentially classified by different providers. The commonly used fistula classification systems do not indicate whether there is damage to the cervix which would have been particularly informative for our analysis of pregnancy outcomes. Recall bias may have influenced our evaluation, as we relied on patient recall of the outcomes of their pregnancies and the timing of those outcomes. Report of early pregnancy losses may be limited due to the retrospective nature of our study employing self-reporting and the lack of prospective biospecimen-based assessment.[59] While the fistula community recommendation is for elective cesarean birth following fistula repair, we did not obtain data on how study participants were counseled. We were unable to perform multivariate analysis for our stillbirth outcome due to the rarity of this outcome which limits our ability to account for confounders. Finally, we did not include a control group from the same hospital systems from which the cohort members were recruited.

Conclusions

Our results confirm that women who have undergone fistula experience greater risk of stillbirth than the general obstetric population and have identified a range of influencing factors for the two adverse outcomes examined in this study. Strengthening women's health access and knowledge to support their achievement of their postfistula repair reproductive goals will require systems which are capable of ensuring high-quality comprehensive pregnancy care, targeted birth planning within the ANC

setting, and networks to link women to the appropriate levels of care for this higher-risk population. ■

CRediT authorship contribution statement

Abner P. Korn: Writing – original draft, Funding acquisition, Conceptualization. **Justus K. Barageine:** Writing – review & editing, Supervision, Conceptualization. **Hadija Nalubwama:** Writing – review & editing, Project administration, Investigation. **Jaffer Okiring:** Writing – original draft, Formal analysis. **Florence Nalubega:** Writing – review & editing. **Shane Ian Asiimwe:** Writing – review & editing. **Alphonsus Matovu:** Writing – review & editing. **Alison M. El Ayadi:** Writing – original draft, Software, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization.

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Supplementary materials

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