

# Prevalence and factors associated with induced abortion among women of reproductive age at a rural faith-based district hospital in Northern Rwanda: a cross-sectional study

Cyprien Niyonsenga

niyonsengacyrien19@gmail.com

Ruli District Hospital

Walter Nsengiyumva

Mount Kigali University

Emmanuel Nizeyimana

Ruli District Hospital

Felix Habimana

Ruli Higher Institute of Health

Victorien Mbarushimana

Ruli District Hospital

Marie Chantal Mukamanzi

Ruli District Hospital

Jean de Dieu Ngirabega

Ruli Higher Institute of Health

Deogratias Kaneza

Ruli District Hospital

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## Research Article

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## Abstract

## Background

Induced abortion remains a significant contributor to maternal morbidity and mortality in sub-Saharan Africa, yet its prevalence and correlates are poorly characterized in Rwanda, particularly within faith-based healthcare settings where disclosure of abortion history may be especially sensitive. This study aimed to determine the prevalence of self-reported induced abortion and identify its associated factors among women attending Ruli District Hospital, a faith-based district level facility in Gakenke District, Rwanda.

## Methods

A Hospital-based cross-sectional study was conducted in 395 women aged 15–49 years attending Ruli District Hospital maternity department. Minimum required sample size was calculated using Cochran's formula. Bivariable and multivariable binary logistic regression were used to characterize the study population and examine crude associations. Given the limited number of outcome events ( $n = 52$ ), a parsimonious model was developed and a bias-reduced logistic regression analysis was conducted as a sensitivity analysis.

## Results

Among the 395 participants, 52 (13.2%) reported a history of abortion. In the adjusted analysis, women younger than 30 years had higher odds of reporting abortion than women aged 30 years or older (AOR 4.36, 95% CI 1.77–11.3,  $p = 0.002$ ). Women reporting two or more sexual partners had higher odds of reported abortion than those reporting one partner (AOR 5.26, 95% CI 1.89–14.6,  $p = 0.001$ ). Multigravida women had lower odds of reported abortion than primigravida women (AOR 0.21, 95% CI 0.07–0.63,  $p = 0.006$ ). The model demonstrated good apparent discrimination (AUC 0.856, 95% CI 0.791–0.921). Bias-reduced sensitivity analysis produced estimates with similar directions and magnitudes for the principal associations.

## Conclusion

In this facility-based sample, reported history of induced abortion was relatively common. Younger age, having two or more sexual partners, and primigravity were independently associated with reported abortion. Because of the cross-sectional design, facility-based recruitment, and potential underreporting of a sensitive outcome, these findings should not be interpreted as causal or generalized directly to the wider population. Strengthening confidential, non-judgmental reproductive health counselling and contraceptive services may be appropriate in similar rural healthcare settings.

## Background of study

Induced abortion remains an underrecognized but significant driver of maternal morbidity and mortality worldwide, particularly in low- and middle-income settings (1, 2). Global estimates suggest that around 56 million induced abortions occur annually, with roughly 22,800 women dying each year from complications of unsafe procedures (3). Of the approximately 210 million pregnancies occurring worldwide each year, about 80 million are unintended, and roughly 19 million end in unsafe abortion (3, 4). Analyses spanning 115 countries between 2003 and 2009 attributed close to 13% of maternal deaths to abortion, underscoring its role as one of the leading preventable causes of maternal mortality(2).

The burden falls disproportionately on Africa, where the annual abortion rate is estimated at 34 per 1,000 women and where nearly all abortion-related deaths occur, reflecting broader disparities in access to safe reproductive health services (3). One maternal death occurs for every 150 cases of unsafe abortions, which account for 99 percent of cases(1).

Within sub-Saharan Africa specifically, the pooled prevalence of abortion among women of reproductive age is estimated at 6.96%, and the subregion records the highest rate of abortion-related mortality worldwide is 37 deaths per 100,000 live births and 185 deaths per 100,000 abortions performed (5). and abortion remains among the top five causes of maternal death in low- and middle-income countries despite the Sustainable Development Goals' target of reducing maternal mortality below 70 per 100,000 live births by 2030 (6). East African countries mirror this pattern, with a pooled abortion prevalence of 7.79% and rates ranging from 12.51% in Uganda to 5.64% in Zambia (1, 7).

Rwanda reflects these regional trends whereby the National records point to a rising number of women seeking safe abortion services, from 2,525 cases recorded between 2019 and 2022, a substantial share following incest or rape (HDI, RBC, 2024). At Ruli District Hospital alone, a faith-based facility that does not provide abortion services — 350 abortion-related complications were managed during the 2023–2024 fiscal year (HMIS, 2024). Rwanda has taken deliberate steps to expand access to reproductive health services, including legislation on sexual and reproductive health that has contributed to improved service uptake and reduced maternal mortality (9). The country's 2012 reform of its previously restrictive abortion law followed sustained advocacy from groups such as the Rwandan Youth Action Movement, which drew attention to the punitive consequences young women faced for seeking abortion care (10). ). Even so, abortion-related complications remain a substantial burden: an estimated 24,000 women require emergency care annually for complications of unsafe abortion.

Despite this burden, facility-level evidence on the prevalence and correlates of abortion among women attending faith-based hospitals in Rwanda remains limited, particularly given how restrictive social norms and religious institutional context may shape both abortion behavior and its disclosure. This study addresses that gap by describing the prevalence of self-reported induced abortion and identifying its associated factors among women of reproductive age

attending Ruli District Hospital, a faith-based facility in Gakenke District and also responding to the recommendation from the hospital health committee that a research is needed to address the gap.

Guided by an individual, relational, and household-level determinant framework used in prior sub-Saharan African abortion research (6, 7, 11), which situates abortion risk within domains such as age and reproductive history, sexual and partnership behavior, and family composition; this study pursued two objectives: first, to estimate the prevalence of self-reported abortion among women attending Ruli District Hospital; and second, to identify the factors independently associated with reported abortion after adjusting for potential confounders, to inform targeted reproductive health interventions in this and similar faith-based settings.

## Methods

### Study design and setting and period

This hospital-based cross-sectional study was conducted at Ruli District Hospital in Gakenke District, Northern Province, Rwanda. Ruli District Hospital is a faith-based facility that provides maternal and obstetric care, including management of abortion-related complications, to the surrounding population. Data were collected between July 2026 and August 2026.

The faith-based nature of the study setting is methodologically significant and merits explicit consideration. Operating within a religious institutional framework, in a context where induced abortion remains legally restricted and carries considerable moral and social stigma, women attending Ruli District Hospital may have been less willing to disclose a history of abortion for fear of judgment inconsistent with the institution's religious values, even under conditions of guaranteed confidentiality. This dynamic is consistent with the predominantly Catholic and Christian composition of the study sample (Table 1) and Because abortion is a sensitive and potentially stigmatized subject, particularly in a faith-based healthcare setting, underreporting cannot be excluded and may have resulted in an underestimate of the proportion reporting a history of abortion. Conversely, the hospital's long-standing relationship with its catchment community, and its role as the principal provider of maternal, antenatal, and gynecological services in the district, positioned it as a suitable and pragmatic site for recruiting a broad cross-section of reproductive-age women who would not otherwise be reached through population-based sampling. This trade-off between potential disclosure bias and recruitment feasibility is addressed further in the Limitations section. Participants were women aged 15–49 years attending Ruli District Hospital maternity department during the study period.

### Study Population, eligibility and sampling Procedure

All women aged 15–49 years attending Ruli District Hospital' maternity service were eligible, those who were too ill, refused to participate and those with previous participation history were excluded. Minimum required sample size was calculated using Cochran's sample size formula (1977) as applied by Bartlett (12).

$$n = Z^2pq / d^2$$

Where:

- **n** = Minimum required sample size
- **Z** = Standard normal deviate corresponding to a 95% confidence level ( $Z = 1.96$ )
- **p** = Anticipated proportion of the population with the characteristic of interest (history of abortion)
- **q** =  $(1 - p)$ , the complementary proportion without the characteristic
- **d** = the desired margin of error, set at 0.05

considering the absence of the findings from other study, the prevalence of abortion among the women in reproductive age was set to 50%,  $p$  was set at 0.5. Substituting these values yielded a minimum required sample size of 384.16, rounded up to 384 participants.

Study participants were recruited using simple random sampling from the daily maternity admission register. Trained data collectors screened women for eligibility and invited eligible women to participate in a private setting. 432 women screened from whom 24 had been previously interviewed, 408 were eligible, 404 consented while 4 refused to consent, 9 withdrew due to competing events. The final analysis included **395 participants**, exceeding the minimum calculated sample size and thereby enhancing the precision of the study's prevalence and association estimates.

### Data collection instruments and outcome variables

A structured interviewer-administered questionnaire adapted from previous studies and contextualized for Rwanda was used to collect the data, (13, 14). The questionnaire covered sociodemographic characteristics, reproductive history, gravidity and parity, sexual history, gender-based violence, family composition, and medical history, the data was collected by trained data collectors who use the local language. The English-language instrument was translated into Kinyarwanda and back-translated to ensure semantic equivalence, then pretested on 23 women attending a different ward of Ruli Hospital, after which wording of sensitive items was simplified and the recall period for sexual history was made explicit. Interviews were conducted in Kinyarwanda by 3 trained female data collectors in a private room, lasting approximately 12 minutes per a single participant. To reduce social desirability bias on sensitive items,

interviewers used neutral, non-judgmental wording, and participants were reminded that the study was not affiliated with any decision about their care and that responses would not affect services received.

The primary outcome was self-reported history of induced abortion. Participants were first asked about the total number of pregnancies they had ever had and the outcome of each pregnancy. The outcome item read “At any time, have you ever had a pregnancy that you deliberately ended, for example by taking medicines or other means? (Yes/No)”. where Yes was coded as induced abortion and no otherwise. We acknowledge that self-reported induced abortion is susceptible to underreporting in this faith-based, legally restrictive context; the expected direction of any misclassification is toward the null, meaning the observed prevalence of 13.2% is best interpreted as a lower bound.

Regarding the missingness, item level missingness was negligible hence complete case analysis was conducted.

## Statistical analysis

All statistical analyses were conducted using R version 4.5.1 (2025-06-13) (R Foundation for Statistical Computing, Vienna, Austria). Data management, cleaning, descriptive analyses, regression modelling, model diagnostics, and presentation of results were performed using the tidyverse, janitor, flextable, here, rio, gtsummary, car, ResourceSelection, pROC and brglm2 packages. Package versions correspond to those installed and used during the analysis. Descriptive analyses were performed to summarize the participant characteristics. Categorical variables were summarized using frequencies and percentages.

The primary outcome was self-reported history of abortion, coded as a binary variable with participants reporting no abortion as the reference category and those reporting an abortion as the outcome category. The prevalence of reported abortion was calculated as the proportion of participants who reported an abortion with corresponding 95% confidence intervals. Bivariable binary logistic regression was initially performed to examine crude association between each explanatory variable and reported abortion.

Crude odds ratios (CORs), 95% confidence intervals (CIs), and corresponding p-values were estimated. Variables considered epidemiologically important based on the study objectives, conceptual framework, and/or evidence from previous research were considered for multivariable analysis, rather than relying exclusively on bivariable statistical significance.

Candidate variables were carried forward into the full multivariable model if they met a bivariable significance threshold of  $p < 0.25$  a deliberately liberal cutoff recommended for variable-building in exploratory logistic regression, since a stricter  $p < 0.05$  threshold risks excluding variables that behave as important joint confounders despite non-significant individual associations(15) or if they were established in prior sub-Saharan African literature as recognized determinants of abortion regardless of their bivariable significance in this sample, consistent with the individual, relational, and household-level determinant framework applied in comparable multi-country analyses (6, 7, 16). Occupation (cOR 1.07, 95% CI 0.48–2.72,  $p = 0.9$ ) and pregnancy complication (cOR 0.79, 95% CI 0.33–1.68,  $p = 0.6$ ) did not meet this threshold and were not retained. Alcohol use was summarized descriptively (Table 1) but not carried into the regression models, as it lacked bivariable significance and, given the limited number of outcome events, its inclusion would have further reduced the events-per-parameter ratio without a strong a priori rationale specific to this population. Parity was excluded in favor of gravidity because the two variables capture substantially overlapping reproductive history information, parity is mechanically constrained by whether a given pregnancy, including a reported abortion, resulted in a live birth and their joint inclusion risked collinearity and definitional redundancy; gravidity was retained as the primary reproductive-history covariate, consistent with its use in comparable facility-based abortion studies(11).

Binary logistic regression model was initially specified using the prespecified explanatory variables. Because the study identified 52 abortion events, consideration was given to the number of outcome events relative to the number of estimated regression parameters to minimize the risk of model overfitting and unstable estimates. A more parsimonious reduced model was therefore considered. The full and reduced models were compared using a likelihood-ratio test, Akaike information criterion (AIC), and Bayesian information criterion (BIC), while also considering epidemiological relevance and potential confounding. Variables were not removed solely on the basis of a p-value greater than 0.05.

The final reduced model included age group, marital status, number of family members, age at first sexual intercourse, experience of gender-based violence, number of sexual partners, and gravidity. In the final multivariable model, adjusted odds ratios (AORs) and 95% CIs were reported. An AOR greater than one was interpreted as higher odds of reported abortion relative to the reference category, whereas an AOR less than one was interpreted as lower odds. Because the study used a cross-sectional design, associations were interpreted as statistical associations rather than causal effects.

Model adequacy was assessed using several complementary diagnostics. Successful model convergence was assessed from the fitted logistic regression model. Potential complete or quasi-complete separation was assessed using a separation-detection procedure. Multicollinearity was assessed using the generalized variance inflation factor (GVIF), with adjusted GVIF values examined across predictors. The model was also examined for extreme predicted probabilities.

Model discrimination was evaluated using the area under the receiver operating characteristic curve (AUC), with a 95% CI estimated using the DeLong method. Calibration was assessed by comparing mean predicted probabilities with observed proportions of abortion across five groups of participants defined according to their predicted risk. Calibration-in-the-large and calibration slope were also examined. Because these measures were estimated using the development dataset, they were interpreted as measures of apparent rather than external calibration.

A specification diagnostic was additionally performed by examining whether inclusion of a squared term for the model linear predictor improved the model. A statistically significant squared term was considered an indication that further assessment of model specification might be warranted.

Because only 52 abortion events were observed, corresponding to 6.5 events per estimated regression parameter in the reduced model, a bias-reduced logistic regression analysis using mean bias-reducing adjusted score equations were performed as a sensitivity analysis. Estimates from the conventional maximum-likelihood logistic regression and bias-reduced model were compared in terms of the direction and magnitude of associations and their confidence intervals. Consistency between the two approaches was considered supportive of the robustness of the primary findings.

All statistical tests were two-sided, and a p-value < 0.05 was considered statistically significant. Effect estimates were reported with 95% confidence intervals.

## **Ethical Considerations**

Because the questionnaire addressed sensitive topics (abortion history, sexual behavior, gender-based violence) in a faith-based institutional setting, interviews were conducted only in private, and participants were explicitly informed that responses would never be shared with clinical staff or religious personnel and would not affect the care they received. A referral pathway to psychosocial support was established before data collection, however there was no participant that needed such support. No incentives were provided. Ethical approval was obtained from the Ruli Higher Institute of Health Ethical Review Committee (Ref. 270/RHIH/RERC/June/2026) in compliance with Rwanda National Ethics Committee requirements.

## **Results**

A total of 395 women were included in the final analysis. Table 1 summarizes the sociodemographic, reproductive, and behavioral characteristics of participants, stratified by self-reported history of abortion. Overall, 52 women (13.2%) reported a prior abortion, while the remaining 343 (86.8%) reported no such history. Notable differences between the two groups were observed for age category, marital status, gravidity, parity, number of family members, and age at first sexual intercourse, suggesting these variables warranted further evaluation in regression analysis.

Table 1  
Sociodemographic characteristics of the study participants

| Characteristic                                | Overall<br>N = 395 <sup>1</sup> | No<br>N = 343 <sup>1</sup> | Yes<br>N = 52 <sup>1</sup> |
|-----------------------------------------------|---------------------------------|----------------------------|----------------------------|
| <b>Age category</b>                           |                                 |                            |                            |
| >=30 Years                                    | 256 (65%)                       | 247 (72%)                  | 9 (17%)                    |
| < 30 Years                                    | 139 (35%)                       | 96 (28%)                   | 43 (83%)                   |
| <b>Marital status</b>                         |                                 |                            |                            |
| Married                                       | 346 (88%)                       | 314 (92%)                  | 32 (62%)                   |
| Single                                        | 49 (12%)                        | 29 (8.5%)                  | 20 (38%)                   |
| <b>Religion</b>                               |                                 |                            |                            |
| Catholics                                     | 260 (66%)                       | 220 (64%)                  | 40 (77%)                   |
| Other christian                               | 135 (34%)                       | 123 (36%)                  | 12 (23%)                   |
| <b>Occupation</b>                             |                                 |                            |                            |
| Unemployed                                    | 56 (14%)                        | 49 (14%)                   | 7 (13%)                    |
| Employed                                      | 339 (86%)                       | 294 (86%)                  | 45 (87%)                   |
| <b>Gravidae</b>                               |                                 |                            |                            |
| Primigravidae                                 | 86 (22%)                        | 50 (15%)                   | 36 (69%)                   |
| Multigravidae                                 | 309 (78%)                       | 293 (85%)                  | 16 (31%)                   |
| <b>Number of Family members</b>               |                                 |                            |                            |
| One                                           | 43 (11%)                        | 26 (7.6%)                  | 17 (33%)                   |
| Two                                           | 59 (15%)                        | 40 (12%)                   | 19 (37%)                   |
| Three and more                                | 293 (74%)                       | 277 (81%)                  | 16 (31%)                   |
| <b>Parity</b>                                 |                                 |                            |                            |
| Parous                                        | 298 (75%)                       | 282 (82%)                  | 16 (31%)                   |
| Nulliparous                                   | 97 (25%)                        | 61 (18%)                   | 36 (69%)                   |
| <b>Unplanned pregnancy</b>                    |                                 |                            |                            |
| No                                            | 304 (77%)                       | 273 (80%)                  | 31 (60%)                   |
| Yes                                           | 91 (23%)                        | 70 (20%)                   | 21 (40%)                   |
| <b>Complication on pregnancy</b>              |                                 |                            |                            |
| No                                            | 323 (82%)                       | 279 (81%)                  | 44 (85%)                   |
| Yes                                           | 72 (18%)                        | 64 (19%)                   | 8 (15%)                    |
| <b>Alcohol use</b>                            |                                 |                            |                            |
| Yes                                           | 142 (36%)                       | 119 (35%)                  | 23 (44%)                   |
| No                                            | 253 (64%)                       | 224 (65%)                  | 29 (56%)                   |
| <b>Age at first Sexual intercourse</b>        |                                 |                            |                            |
| < 19Years/Early_sex                           | 51 (13%)                        | 34 (9.9%)                  | 17 (33%)                   |
| >=20 Years                                    | 344 (87%)                       | 309 (90%)                  | 35 (67%)                   |
| <b>Ever experienced Gender Based Violence</b> |                                 |                            |                            |
| No                                            | 360 (91%)                       | 317 (92%)                  | 43 (83%)                   |
| Yes                                           | 35 (8.9%)                       | 26 (7.6%)                  | 9 (17%)                    |
| <sup>1</sup> n (%)                            |                                 |                            |                            |

## Proportion of Abortion

The proportion of abortion among women attending Ruli District Hospital was 13.2% (95% CI 10.0%–16.9%).

## Bivariable logistic regression

To identify factors independently and crudely associated with reported abortion, bivariable binary logistic regression was performed for each candidate explanatory variable. Table 2 presents the crude odds ratios (CORs), 95% confidence intervals, and corresponding p-values. Several variables including age category, marital status, number of family members, unplanned pregnancy, age at first sexual intercourse, gender-based violence, and number of sexual partners showed statistically significant crude associations with reported abortion and were carried forward for consideration in the multivariable model, guided by both statistical evidence and epidemiological relevance.

Table 2  
Bivariable analysis of factors associated with abortion

| Characteristic                                           | N   | OR   | 95% CI     | p-value |
|----------------------------------------------------------|-----|------|------------|---------|
| <b>Age category</b>                                      | 395 |      |            |         |
| >=30 Years                                               |     | Ref  | —          |         |
| < 30 Years                                               |     | 12.3 | 6.03, 27.8 | < 0.001 |
| <b>Marital status</b>                                    | 395 |      |            |         |
| Married                                                  |     | Ref  | —          |         |
| Single                                                   |     | 6.77 | 3.43, 13.3 | < 0.001 |
| <b>Religion</b>                                          | 395 |      |            |         |
| Catholics                                                |     | Ref  | —          |         |
| Other christian                                          |     | 0.54 | 0.26, 1.03 | 0.074   |
| <b>Occupation</b>                                        | 395 |      |            |         |
| Unemployed                                               |     | Ref  | —          |         |
| Employed                                                 |     | 1.07 | 0.48, 2.72 | 0.9     |
| <b>Number of Family members</b>                          | 395 |      |            |         |
| One                                                      |     | Ref  | —          |         |
| Two                                                      |     | 0.73 | 0.32, 1.65 | 0.4     |
| Three and more                                           |     | 0.09 | 0.04, 0.19 | < 0.001 |
| <b>Unplanned pregnancy</b>                               | 395 |      |            |         |
| No                                                       |     | Ref  | —          |         |
| Yes                                                      |     | 2.64 | 1.42, 4.86 | 0.002   |
| <b>Complication on pregnancy</b>                         | 395 |      |            |         |
| No                                                       |     | Ref  | —          |         |
| Yes                                                      |     | 0.79 | 0.33, 1.68 | 0.6     |
| <b>Age at first sexual intercourse</b>                   | 395 |      |            |         |
| < 19Years/Early_sex                                      |     | Ref  | —          |         |
| >=20 Years                                               |     | 0.23 | 0.12, 0.45 | < 0.001 |
| <b>Ever experienced Gender Based Violence</b>            | 395 |      |            |         |
| No                                                       |     | Ref  | —          |         |
| Yes                                                      |     | 2.55 | 1.07, 5.64 | 0.026   |
| <b>Number of Sexual partners</b>                         | 395 |      |            |         |
| One                                                      |     | Ref  | —          |         |
| Two and more                                             |     | 5.39 | 2.56, 11.1 | < 0.001 |
| <b>Gravidae</b>                                          | 395 |      |            |         |
| Primigravidae                                            |     | Ref  | —          |         |
| Multigravidae                                            |     | 0.08 | 0.04, 0.14 | < 0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio |     |      |            |         |

# Multivariable Logistic Regression

The full multivariable model initially included age category, marital status, religion, number of family members, unplanned pregnancy, age at first sex, gender-based violence (GBV), number of sexual partners, and gravidity. Religion and unplanned pregnancy were not retained in the reduced model. Model reduction was based on epidemiological relevance, parsimony, comparative model fit, and the limited number of outcome events, rather than statistical significance alone. The reduced model showed no significant loss of fit compared with the full model (likelihood-ratio test:  $\chi^2=4.44$ ,  $df = 4$ ,  $p = 0.350$ ), while having lower AIC (231.95 vs. 235.51) and BIC (267.76 vs. 287.24) and improving the events-per-parameter ratio from 4.3 to 6.5. Therefore, the reduced model was selected as the final primary model to minimize overfitting and improve model stability.

Table 3 presents the adjusted odds ratios (AORs) from the final reduced multivariable model. In the adjusted analysis, women younger than 30 years had higher odds of reported abortion than older women (AOR 4.36, 95% CI 1.77–11.3). Women reporting two or more sexual partners had higher odds than women reporting one partner (AOR 5.26, 95% CI 1.89–14.6). Multigravida women had lower odds than primigravida women (AOR 0.21, 95% CI 0.07–0.63). Marital status, number of family members, age at first intercourse, and gender-based violence were not statistically significant after adjustment.

The model showed apparent discrimination with an AUC of 0.856 (95% CI 0.791–0.921). Calibration appeared satisfactory across the five predicted-risk groups. The model converged successfully, no extreme predicted probabilities were identified, and adjusted GVIF values ranged from approximately 1.14 to 1.74. A squared-linear-predictor diagnostic was statistically significant ( $p = 0.038$ ), suggesting possible residual model misspecification. The bias-reduced analysis produced estimates broadly consistent with conventional logistic regression: approximately 4.09 versus 4.36 for age below 30 years, 5.02 versus 5.26 for two or more sexual partners, and 0.23 versus 0.21 for multigravidity.

In particular, the direction and magnitude of the associations for age group, number of sexual partners, and gravidity were similar between the two approaches. The bias-reduced estimates for age below 30 years, two or more sexual partners, and multigravidity were approximately 4.09, 5.02, and 0.23, respectively, compared with 4.36, 5.26, and 0.21 in the conventional model. This consistency supports the robustness of the principal findings despite the limited number of outcome events.

Table 3  
Multivariable table of factors independently associated with abortion

| Characteristic                                           | aOR  | 95% CI     | p-value      |
|----------------------------------------------------------|------|------------|--------------|
| <b>Age category</b>                                      |      |            |              |
| >=30 Years                                               | Ref  | —          |              |
| < 30 Years                                               | 4.36 | 1.77, 11.3 | <b>0.002</b> |
| <b>Marital status</b>                                    |      |            |              |
| Married                                                  | Ref  | —          |              |
| Single                                                   | 0.91 | 0.23, 3.45 | 0.9          |
| <b>Number of Family members</b>                          |      |            |              |
| One                                                      | Ref  | —          |              |
| Two                                                      | 2.06 | 0.48, 9.40 | 0.3          |
| Three and more                                           | 1.13 | 0.25, 5.58 | 0.9          |
| <b>Age at first sexual intercourse</b>                   |      |            |              |
| < 19Years/Early_sex                                      | Ref  | —          |              |
| >=20 Years                                               | 0.55 | 0.19, 1.66 | 0.3          |
| <b>Experience of Gender Based Violence</b>               |      |            |              |
| No                                                       | Ref  | —          |              |
| Yes                                                      | 0.90 | 0.26, 2.98 | 0.9          |
| <b>Number of Sexual_patners</b>                          |      |            |              |
| One                                                      | Ref  | —          |              |
| Two and above                                            | 5.26 | 1.89, 14.6 | <b>0.001</b> |
| <b>Gravidae</b>                                          |      |            |              |
| Primigravidae                                            | Ref  | —          |              |
| Multigravidae                                            | 0.21 | 0.07, 0.63 | <b>0.006</b> |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio |      |            |              |

## Discussion

This cross-sectional study examined the prevalence and correlates of self-reported abortion among women attending Ruli District Hospital, finding a prevalence of 13.2% (52/395). This falls within the range reported across comparable African settings; for example, a South African facility-based study among parturient women living with HIV reported an induced abortion prevalence of 19%, which varied by sociodemographic characteristics such as age and marital status(11), and is broadly consistent with national modelled estimates suggesting that roughly one in five unintended pregnancies in Rwanda ends in an induced abortion, with young, sexually active, unmarried women identified as particularly vulnerable(16). After multivariable adjustment, younger age, having two or more sexual partners, and prim gravidity remained the dominant correlates of reported abortion, while marital status, family size, early sexual debut, and gender-based violence lost independent significance once these factors were accounted for.

Women younger than 30 years had four times the adjusted odds of reporting an abortion compared with older women (AOR 4.36, 95% CI 1.77–11.3). This aligns with the broader regional literature: a pooled multi-country analysis across sub-Saharan Africa identified age, alongside marital status, and education as significantly associated with induced abortion, and recommended prioritizing sexual and reproductive health education for young and unmarried women(17). Guttmacher's regional synthesis similarly notes that because childbearing outside marriage remains strongly stigmatized across sub-Saharan Africa, attributes this partly to strong stigma around childbearing outside marriage, which can push unmarried women with unintended pregnancies toward abortion; since most women in the region eventually marry, unmarried women tend to be concentrated in younger age brackets(18). Rwanda-specific national data reinforce this pattern directly, describing the country's growing population of young, sexually active, unmarried women as a group with especially elevated abortion risk(16). Notably, this contrasts with the South African HIV-cohort study cited above, where younger age was protective against induced abortion while being ever-married or cohabiting increased risk(11) a reminder that the direction of the age–marital status relationship with abortion is shaped by population and context (e.g., women in stable HIV care versus a general facility population) rather than being universal.

The strong association between multiple sexual partners and reported abortion (AOR 5.26, 95% CI 1.89–14.6) was the strongest in the reduced model, though this specific relationship is less consistently documented than the age association, and evidence from other settings is mixed: some studies report that women reporting more than one sexual partner are more likely to report an abortion, plausibly reflecting reduced partner commitment to an unplanned pregnancy, while other studies, such as one among female drug users, have found the reverse pattern(19). This inconsistency suggests that the sexual-partners–abortion relationship may function partly as a marker of relationship instability rather than a direct behavioral cause, and that the association observed here is context-specific and warrants further site-level investigation before generalization.

Contrary to what might be expected if cumulative reproductive exposure alone drove risk, multigravida women had substantially lower adjusted odds of reported abortion than primigravid women (AOR 0.21, 95% CI 0.07–0.63). This diverges from some international evidence: a population-based European study found that the odds of induced abortion increased progressively with number of children, rising steadily with each additional child to roughly 5.3 among women with three or more, an interaction most pronounced among younger women(20). Differences in age structure, partnership patterns, fertility preferences, contraceptive use, pregnancy intention, and other contextual factors may contribute to this discrepancy, but these mechanisms could not be evaluated directly in the present study.

Although GBV showed a significant crude association with abortion (COR 2.55, 95% CI 1.07–5.64) that was attenuated after adjustment, this is broadly consistent with a substantial regional evidence base linking intimate partner violence (IPV) to pregnancy termination. A 25-country analysis of DHS data among adolescent girls and young women in sub-Saharan Africa found that adolescent girls and young women who had ever experienced IPV had greater odds of terminating a pregnancy than those who had not, an association that persisted after adjustment for confounders, and this analysis specifically identified Rwanda among the East African countries where the IPV–pregnancy termination association was statistically significant (8). Similarly, a Cameroonian study found that the elevated abortion risk associated with IPV remained for physical and sexual violence after adjustment, though the association with emotional violence alone did not persist(21). The attenuation of the GBV association in the present study after adjustment for age, gravidity, and number of sexual partners is therefore plausible: GBV, younger age, and multiple partnerships often co-occur and may share upstream drivers such as relationship instability and limited female autonomy, such that GBV's apparent bivariable effect may operate substantially through these correlated pathways. This does not diminish the public health importance of GBV screening in reproductive health services; rather, it suggests GBV should be understood as embedded within a broader constellation of vulnerability rather than as an isolated risk factor.

The loss of significance for marital status and family size after adjustment is consistent with regional evidence that marital status effects on abortion are frequently confounded by, or interact with, age. A population-based analysis found that the effect of partnership status on abortion probability was strongest at younger ages and narrowed progressively with age, with the gap between partnered and unpartnered women predicted abortion probabilities shrinking substantially from adolescence to the late reproductive years(20). This age-dependence of the marital status effect offers a plausible explanation for why marital status did not retain independent significance once age was included in the present multivariable model.

## Model performance and robustness

The reduced model demonstrated good apparent discrimination (AUC 0.856, 95% CI 0.791–0.921) and adequate calibration, with no evidence of important multicollinearity (GVIF 1.14–1.74) or convergence problems. Given the modest number of events (6.5 per parameter), a bias-reduced sensitivity analysis produced materially consistent estimates with the conventional model (e.g., AOR for age < 30 years: 4.09 bias-reduced versus 4.36 conventional), supporting the stability of the principal findings despite the limited sample size. The statistically significant squared linear-predictor term ( $p = 0.038$ ) suggested a possibility of residual model misspecification, though this should be interpreted cautiously given the predominantly categorical nature of the predictors and the in-sample nature of the diagnostic

## Public health implications

Collectively, these findings point to a subgroup of younger, primigravid women with multiple sexual partners as being at elevated risk of abortion in this setting, resonating with regional calls for sexual and reproductive health education targeted at young and unmarried women(17). Given the well-documented burden of unsafe abortion complications in Rwanda with national estimates indicating that a substantial share of induced abortions lead to complications requiring treatment, and that many affected women, particularly poorer and rural women, do not receive needed care(16, 22) integrating confidential assessment of reproductive intentions and psychosocial vulnerability into routine antenatal, postnatal, and youth-friendly health services at facilities such as Ruli District Hospital could meaningfully reduce both unintended pregnancy and its downstream consequences.

## Limitations

This study has several limitations. First, the cross-sectional design limits the ability to establish temporality between explanatory variables and reported abortion, and associations should not be interpreted as causal. Second, abortion history was based on self-report and may be affected by recall bias and underreporting, given that abortion remains a sensitive and stigmatized subject. Third, information on sexual behavior, GBV, and reproductive history was self-reported and may be subject to social desirability bias. Fourth, the study had a relatively small number of outcome events (52 of 395 participants), yielding 6.5 events per estimated parameter in the reduced model, which increases the potential for imprecise estimates and limits statistical power; a bias-reduced sensitivity analysis was performed to partially mitigate this concern. Fifth, the study was conducted among women attending a single health facility, limiting generalizability to the wider district or national population. Finally, selection bias may have occurred because inclusion depended on facility attendance and willingness to participate.

## Conclusion

In this facility-based sample, 13.2% of women in the study reported a history of abortion. Younger age, multiple sexual partnerships, and primigravity were the strongest independent correlates of reported abortion, while marital status, family size, early sexual debut, and gender-based violence were not independently associated after adjustment, likely reflecting confounding through these dominant factors. These findings support targeted comprehensive sexuality education for younger and primigravid women, and the integration of confidential assessment of reproductive intentions and psychosocial vulnerability.

## Abbreviations

### **LMIC**

Low- and Middle-Income Countries

### **SDGs**

Sustainable Development Goals

### **IPV**

Intimate Partner Violence

### **CI**

Confidence Interval

### **AUC**

Area Under the Receiver Operating Characteristic Curve

### **GVIF**

Generalized Variance Inflation Factor

### **GBV**

Gender Based Violence

### **HIV**

Human Immune Virus

### **HMIS**

Health Management Information System

### **LMICs**

Low and Middle-Income Countries

### **NISR**

The National Institute of Statistics of Rwanda

### **RHIH**

Ruli higher institute of health

### **WHO**

World Health Organization

## Declarations

### **Ethics approval and consent to participate**

The study protocol was reviewed and approved by the Ruli Higher Institute of Health ethical review board with reference number: Ref: 270/RHIH/RERC/June/2026. Written informed consent was obtained from all adult participants and written assent together with parental/guardian consent was obtained for minors, in accordance with the Declaration of Helsinki.

## Consent for publication

Not applicable (no individual persons' data, images, or identifying details are presented).

## Competing interests

The authors declare that they have no competing interests.

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This research received no specific grant from any funding agency.

## Author Contribution

CN conceived and designed the study; CN, MM and WN led data collection; CN, WN, EN, DK conducted the statistical analysis; CN and WN drafted the initial manuscript; FH, VM, MM, JN and DK reviewed the initial manuscript; JN and DK supervised the research activities and all authors critically reviewed and approved the final manuscript and agrees to be accountable for the work.

## Data Availability

The de-identified dataset analyzed in this study is available from the corresponding author on reasonable request.

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# Figures

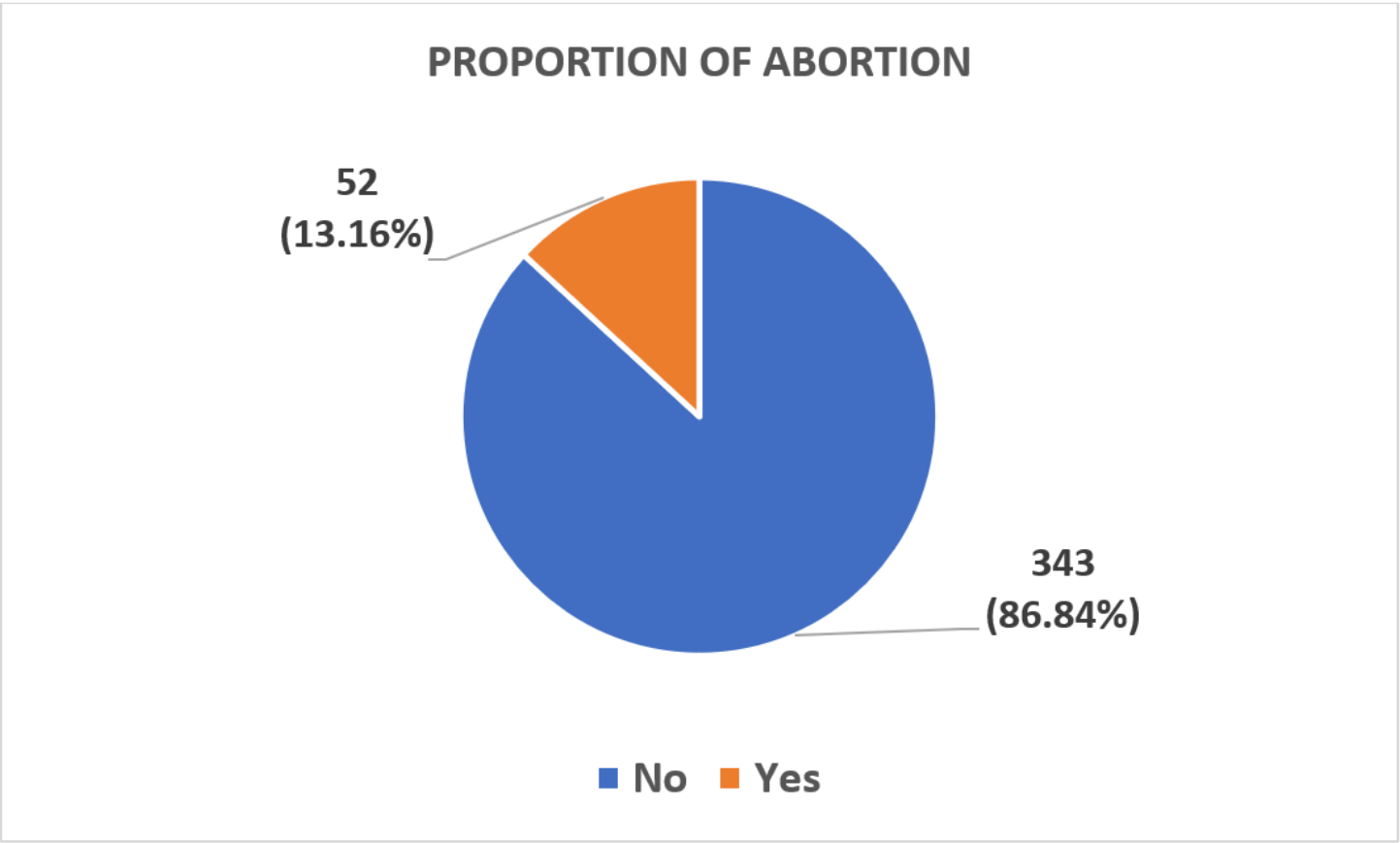


Figure 1

Legend not included with this version.