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# Reducing Iatrogenic Female Genitourinary Fistula: Impact of Short-Term Obstetric Training for Lower Cadre Surgeons in Uganda

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**Background:** In Uganda, almost 50% of genitourinary fistulae are iatrogenic, primarily resulting from inadvertent urinary tract injuries during obstetric and gynecologic surgeries. Cesarean sections (CS), often performed by less experienced providers at lower-level facilities, account for 70% of these cases. In 2022, the Essential Training in Operative Obstetrics (ETOO) program was introduced to improve surgical skills among lower cadre surgeons. This study evaluated the program's impact on iatrogenic fistula incidence at a tertiary teaching hospital in southwestern Uganda.

**Methods:** A retrospective review was conducted on women who underwent fistula repair at a tertiary teaching hospital in southwestern Uganda between January 2020 and December 2024. Data from the pre-training period (2020–2021) were compared with post-training data (2022–2024). Fistulae were classified as iatrogenic if caused by surgical error rather than obstructed labor. Anatomical subtypes included ureteric injuries, vault fistulas, and vesico-[uterus]/-cervico-vaginal fistulas. The primary outcome was the annual number and proportion of iatrogenic fistula cases.

**Results:** Among 102 fistula cases post-training, 57 (55.9%) were iatrogenic. Most followed CS (66.7%) and involved ureteric injuries (54.3%). A significant portion (34.8%) originated from private facilities. Following ETOO implementation, annual iatrogenic cases declined from 39 in 2020 to 19 in 2024. A marked drop occurred in late 2022, aligning with program rollout. The trend slope of  $-5.4$  suggests a steady annual decline.

**Conclusion:** The ETOO program is associated with a notable reduction in iatrogenic fistula incidence. Expansion to private and lower-level facilities is recommended to enhance nationwide surgical safety.

**Plain Language Summary:** In Uganda, some women develop urine leakage after an operation during childbirth, especially after cesarean section. This can happen when the urinary tract is accidentally injured during surgery. These injuries can cause serious physical, emotional, and social problems for women. Because of this, improving the safety of childbirth surgery is very important.

This study looked at whether a short practical training program for doctors, called Essential Training in Operative Obstetrics (ETOO), was linked to fewer of these injuries. The training was designed to improve skills in safe cesarean section and other emergency childbirth operations.

We reviewed records of women who had fistula repair surgery at a teaching hospital in southwestern Uganda between 2020 and 2024. We then looked at the pattern of cases before and after the ETOO program started.

The study found encouraging results. After the training program was introduced, the number of women treated for these surgery-related fistulas went down over time. Most of the injuries were linked to cesarean section, showing why safe surgical training is so important. The findings suggest that practical, hands-on training can help improve surgical safety and may help prevent avoidable harm to women.



A key strength of this study is that it used real hospital data collected over several years, and all cases were diagnosed by experienced specialists. Overall, the results support continued investment in surgical training, supervision, and safer maternity care to protect women during childbirth.

**Keywords:** iatrogenic genitourinary fistula, cesarean section, essential training in operative obstetrics

## Introduction

Iatrogenic genitourinary fistula resulting from accidental injury to the urinary tract during obstetric and gynecologic surgeries is becoming more prevalent in Uganda.<sup>1–4</sup> The close proximity that the female urinary system has with the genital tract coupled with the complexity of the surgery and the limited skill of the surgeon poses a risk of injury.<sup>5,6</sup>

There has been a rising trend of iatrogenic fistulae in Uganda in the last 15 years, from 9.6% in 2009 to 49% of all the genitourinary fistulae in 2025.<sup>2–4,7</sup> The rising trends could be due to improved access to CS but with limited skilled human resource capable of performing safe CS and variation in medical training. The majority of these injuries are associated with cesarean sections, obstetric hysterectomies, and gynecological hysterectomies. The leading indications for Cesarean sections include labour dystocia and repeat cesarean sections. For obstetric hysterectomies, uterine rupture is the predominant condition necessitating the procedure preceding the injury.<sup>2,3,6,8,9</sup> While these obstetric procedures are often life-saving, the rapid rise in cesarean section rates in resource-limited settings, compounded by inadequate training of personnel, contributes to preventable surgical injuries and long-term maternal health complications.<sup>3,6,8–10</sup>

Difficult cesarean sections, such as those performed for obstructed labor or repeat procedures, as well as obstetric hysterectomies for complications like uterine rupture, can be particularly challenging when undertaken by less experienced surgeons or in lower-level facilities lacking senior or specialized obstetricians.<sup>2,9,10</sup> To address this skills gap, a short-term in-service training program—Essential Training in Operative Obstetrics (ETOO)—was introduced in 2022. The program targets junior doctors, including interns, general practitioners, and obstetrics and gynecology residents, with the aim of ensuring safer cesarean delivery. ETOO is currently being implemented in public health facilities across southwestern Uganda and comprises five days of theoretical instruction and simulation, followed by six supervised cesarean sections under the guidance of an experienced obstetrician/gynecologist. Such short-term in-service training initiatives have demonstrated effectiveness in strengthening obstetric care and reducing maternal morbidity and mortality.<sup>11–14</sup> Nevertheless, their effect on the incidence of morbidities like iatrogenic fistula remains unknown.

Although similar training interventions have demonstrated improvements in surgical safety and reduction in morbidities like maternal post-operative sepsis, there are no studies that support the evidence regarding their effectiveness in reducing the incidence of iatrogenic fistula. Considering the profound physical, psychological, and social consequences of fistula for affected women, as well as the burden it places on already constrained health systems, generating evidence on preventive strategies is a public health imperative. This study therefore evaluated the impact of the ETOO program on the incidence of iatrogenic fistula over a five-year period at a tertiary hospital in southwestern Uganda, with the aim of providing critical evidence to guide integration of targeted surgical training into maternal health strategies in resource-limited settings, ultimately contributing to the reduction of preventable morbidity.

## Methods

### Study Setting, Study Population and Study Design

This study was conducted at a tertiary teaching hospital in southwestern Uganda among women who had surgery for genitourinary fistula between January 2020 and December 2024. We retrospectively reviewed the clinical charts of all women who managed during this period, covering two phases: the pre-training period from 2020 to 2021 and the post training initiation period from 2022 to 2024. All genitourinary fistula cases identified during the study period were first reviewed to describe the overall burden and proportion of iatrogenic fistula. Thereafter, cases were classified by etiology and anatomical type, and the temporal trend analysis focused specifically on iatrogenic genitourinary fistula cases. The surgeries were performed during scheduled fistula repair camps and on a routine basis by a urogynecology team from the institution.

## Intervention

Launched in at the beginning of 2022, and continued as an in-service training every year, the ETOO program is a short-term, in-service initiative in southwestern Uganda at Mbarara University of Science and Technology and Mbarara Regional Referral Hospital, that strengthens surgical safety and equips junior doctors to manage complex obstetric procedures and hence reduce iatrogenic fistula. It targets junior doctors—including interns, general practitioners, and obstetrics and gynecology (O&G) residents—who frequently perform cesarean sections and obstetric hysterectomies in lower-level health facilities where senior specialists are often unavailable. The curriculum comprises five days of intensive theoretical instruction and simulation-based learning, covering core aspects of safe operative obstetrics such as the management of obstructed labor, decision-making in repeat cesarean sections, and emergency obstetric hysterectomy. Specific topics include fundamental surgical principles, application of the WHO Labour Care Guide, vacuum-assisted vaginal delivery, technique of cesarean section, cesarean hysterectomy, postpartum hemorrhage management, and knot tying techniques. This theoretical phase is followed by a minimum of two weeks of practical training, during which participants are required to perform at least six cesarean sections under direct supervision of an obstetrician/gynecologist.

Since its inception, the ETOO program has trained a total of 131 healthcare providers from 2022 to 2024, categorized by cadre as obstetrics and gynecology (O&G) residents, general practitioners, intern doctors, and midwives. Over this period, trainees collectively completed 738 supervised cesarean sections, demonstrating progressive skill acquisition and hands-on surgical experience as shown in [Table 1](#).

## Data Collection and Study Variables

We retrospectively collected data from the clinical charts of all women who presented and underwent surgery for the genitourinary fistula from January 2020 to December 2024 using a standardized data abstraction tool. The tools were completed by attending urogynecologists, who had performed the surgeries at the institution. After identification of all fistula repair cases, each case was reviewed and classified according to etiology (iatrogenic or ischemic).

Patient charts were reviewed to extract key information across several domains. This included socio-demographic and clinical characteristics such as age at fistula development, area of residence, occupation, marital status at the time of evaluation, duration of symptoms, and the year of diagnosis. Obstetric history was also captured, including parity at the time of fistula formation and mode of delivery—whether vaginal, caesarean section, or instrumental—if the fistula occurred following childbirth. Clinical details of the fistula, including anatomical site (urethrovaginal, vesicovaginal, vesico-uterine, vaginal vault, or ureteric) and etiology (ischemic or iatrogenic), were also extracted.

Fistulae were classified as iatrogenic if the genitourinary fistula was considered to result from the provider-related surgical injury during obstetric or gynecological surgery, rather than by pressure necrosis from prolonged obstructed labor and involved the ureter, cervix, uterus, or vaginal vault.<sup>7</sup> All vaginal vault and ureteric fistulas resulting from a hysterectomy for an obstetric procedure like ruptured uterus were classified as iatrogenic. Similarly, fistulas high in the genital tract (vesico-cervical, vesico-uterine fistulas, and ureteric) following Cesarean Section were considered iatrogenic irrespective of the outcome of the delivery (live birth or still birth).<sup>2,7</sup> Use of predefined etiological criteria, together with specialist chart review by urogynecologists, helped standardize classification and reduce misclassification.

**Table 1** ETOO Trainings and Supervised Cesarean Sections (2022–2024)

| Cadre                   | 2022 | 2023 | 2024 | Total |
|-------------------------|------|------|------|-------|
| O&G Residents           | 17   | 12   | 15   | 44    |
| General Practitioners   | 8    | 4    | 15   | 27    |
| Intern Doctors          | 16   | 20   | 16   | 52    |
| Midwives                | 0    | 5    | 3    | 08    |
| Total Trained           | 41   | 41   | 49   | 131   |
| Completed Supervised CS | 246  | 216  | 276  | 738   |

**Abbreviations:** ETOO, Essential Training in Operative Obstetrics; O&G, Obstetrics and Gynaecology; CS, Cesarean Sections.

All data were de-identified prior to entry into the REDCap database. Each patient was assigned a unique identification number, and no names or personal identifiers were stored electronically. Non-iatrogenic fistula cases were retained in the dataset to describe the overall case mix, but analyses assessing temporal change following the introduction of ETOO focused on iatrogenic genitourinary fistula cases.

## Data Management and Analysis

Data were analyzed using Stata version 17 (StataCorp, College Station, TX, USA). All records of women with genitourinary fistulas managed between 2020 and 2024 were reviewed. Data from the pre-intervention period (2020–2021) were compared with data from the intervention period (2022–2024), following the introduction of the Essential Training in Operative Obstetrics (ETOO) program. Descriptive statistics were used to summarize socio-demographic characteristics, obstetric history, and fistula features. Continuous variables were reported as means with standard deviations. Categorical variables were summarized as frequencies and percentages. The primary outcome for the intervention analysis was the annual number of iatrogenic fistula cases among women presenting for repair.

Trends in the case numbers of iatrogenic fistulae over the five-year period were assessed. Annual case numbers before and after implementation of the ETOO program were compared using Poisson regression to model changes in incidence over time. Because denominator data, such as the total number of cesarean sections or obstetric procedures performed in the referring facilities, were not available, the analysis was limited to case counts rather than true incidence rates. The annual reduction rate was estimated, and 95% confidence intervals were calculated. Subgroup analyses were performed to compare the types and causes of iatrogenic fistulas by surgical procedure, including cesarean section, repair of ruptured uterus, hysterectomy for ruptured uterus, and gynecological hysterectomy.

## Results

### Socio-Demographic Characteristics

A total of 102 women underwent surgical repair for genitourinary fistula over a three-year period post-introduction of the training. Of these, 57 (55.9%) had iatrogenic fistula and 45 (44.1%) had ischemic fistula. The average age of the affected women was 35.1 years (SD 10.1), and most of them lived in rural areas (93.0%). Perinatal outcomes were poor, with 25 women (50.0%) having stillbirths. More than one-third of the cases were referred from private health facilities (20/57, 35.0%) (Table 2).

### Etiology and Types of Iatrogenic Fistula

In terms of etiology, most iatrogenic fistulae followed cesarean section (38/57, 67%). Obstetric hysterectomy (12/57, 21%) and non-obstetric hysterectomy (7/57, 12%) accounted for the rest (Figure 1). Regarding fistula types, ureteric fistula was the most common (55%), followed by Vesico-cervical fistula (19%) and vault fistula (12%) (Figure 2).

### Trends of Iatrogenic Fistula for the 5-Year Period

Across the full five-year study period (2020–2024), a total of 131 women presented with iatrogenic genitourinary fistula. Trends during the study period showed a significant drop in the annual number of iatrogenic fistula cases. There was a sharp decline in iatrogenic fistulas after training started in 2022. Regression analysis showed a slope of  $-5.4$  cases per year, indicating an average annual decrease of more than five cases. The annual number of cases declined from 39 in 2020 to 19 in 2024, representing an overall reduction of 51% during the study period.

Poisson regression analysis demonstrated a statistically significant downward trend over time. Each additional year was associated with a 12% reduction in the number of cases (IRR = 0.88; 95% CI: 0.80–0.96;  $p = 0.019$ ). When comparing the periods before and after the introduction of the Essential Training in Operative Obstetrics (ETOO) program, case counts were reduced by 45% in the post-ETOO period (IRR = 0.55; 95% CI: 0.34–0.88;  $p = 0.013$ ) (Figure 3).

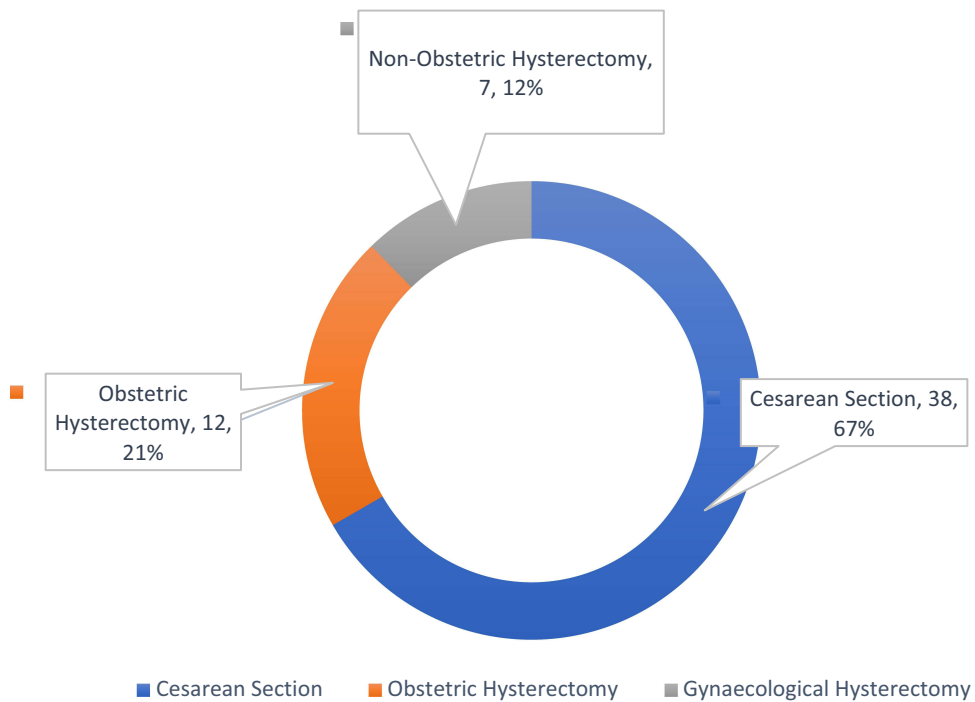
**Table 2** Socio-Demographic Characteristics of the Participants

| Characteristic                                      | Value                  |
|---|------------------------|
| Total patients                                      | 102                    |
| Iatrogenic fistula cases                            | 57 (55.9%)             |
| Ischemic fistula cases                              | 45 (44.1%)             |
| N=57 (Iatrogenic fistula cases only)                |                        |
| Mean age  | 35.12 years (SD 10.14) |
| Residence   |                        |
| Rural residence                                     | 53 (93.0%)             |
| Urban   | 4 (7.0%)               |
| Status of the baby at delivery N=50                 |                        |
| Live  | 20 (40.0%)             |
| Still born  | 25 (50.0%)             |
| Early neonatal death                                | 5 (10.0%)              |
| Facility where the antecedent surgery was performed |                        |
| Regional Referral Hospital                          | 8 (14.0%)              |
| Private Not for Profit                              | 13 (22.8%)             |
| Health Centers and District Hospitals               | 16 (28.1%)             |
| Private health facilities                           | 20 (35.0%)             |

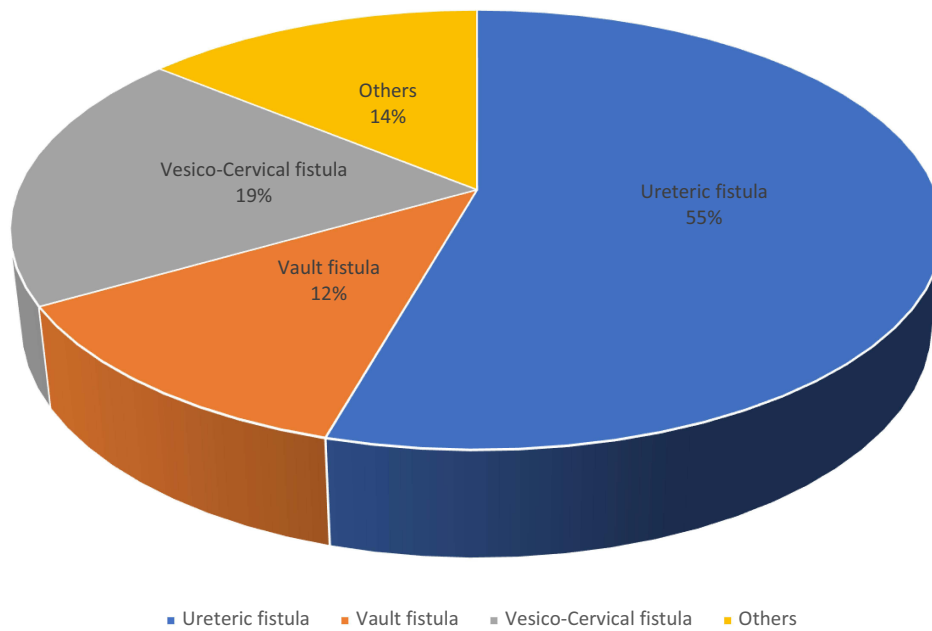
## Discussion

In this study, the introduction of the ETOO training program was linked to a significant drop in iatrogenic genitourinary fistula cases. The number decreased from 39 in 2020 to 19 in 2024, with the most noticeable decline occurring right after the 2022 rollout. This trend is consistent with other studies that training improves healthcare outcomes<sup>15</sup> and that the rising cesarean section rates in sub-Saharan Africa are linked to more cases of iatrogenic fistula.<sup>12</sup> This highlights the increasing role of surgery-related fistulas and the need to improve training and provider skills as key factors. Raassen et al also pointed out that women who have had cesarean deliveries before face a higher risk of iatrogenic injury.<sup>7</sup> This emphasizes the need for better surgical environments and staff training to improve skills.

While direct experimental evidence linking training to reduced iatrogenic fistula is limited, several studies support training's impact on surgical competence and outcomes. Trainings in emergency obstetric care improve providers' ability to manage obstetric complications, which is critical for preventing surgical errors.<sup>11</sup> More recently, a study evaluated a blended learning approach to obstetric surgery training in Kenya. They showed significant improvements in both knowledge and practical skills. These improvements support the fact that skills-based trainings are vital to reduce surgical errors like iatrogenic fistula.<sup>12</sup> Beyond training, many agree that strong surgical quality systems are necessary in reducing surgical complications and deaths in low- and middle-income settings by up to one-third.<sup>16</sup> These findings should be interpreted cautiously. Although the decline in iatrogenic fistula case numbers after introduction of the ETOO program suggests a possible beneficial association, the retrospective single-center design and absence of denominator data preclude definitive causal inference. In addition, other factors may have contributed to the observed trend, including changes in referral patterns, case detection, case mix, supervision, and broader improvements in obstetric practice over time. The higher proportion of antecedent surgeries from private facilities and the predominance of women from rural areas may reflect underlying disparities in access to specialist supervision, structured operative obstetric training, timely

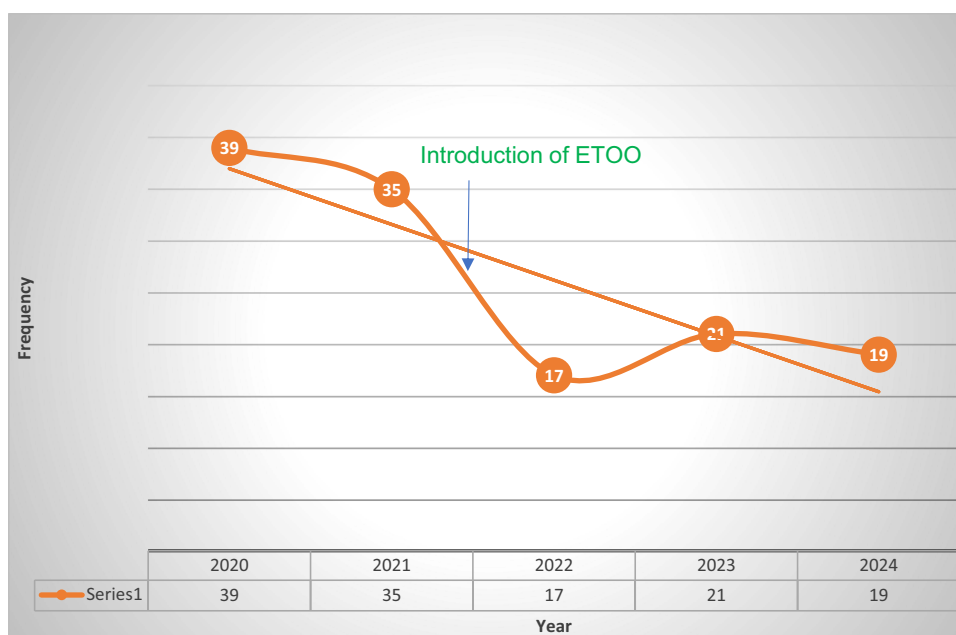


**Figure 1** Etiology of Iatrogenic Fistula.



**Figure 2** Types of Iatrogenic Fistula.

referral, and routine surgical quality-assurance systems. In many private and lower-level rural-serving facilities, emergency obstetric procedures may be performed with limited senior support and fewer opportunities for mentorship or audit, which may increase the risk of avoidable injury during difficult surgery. These findings highlight the importance of extending competency-based training, supportive supervision, and quality-improvement initiatives beyond public referral hospitals to private and rural-serving facilities. Further reduction in this complication will likely require a broader systems approach that combines competency-based operative obstetric training with structured supervision, refresher



**Figure 3** Trends of Iatrogenic Fistula at a Tertiary Institution in Uganda.

mentorship, timely referral pathways, access to specialist consultation for difficult procedures, and routine audit of urinary tract injury and iatrogenic fistula as indicators of surgical safety.

## Conclusions and Recommendations

In this study, most iatrogenic genitourinary fistulae were ureteric and followed cesarean section. Our study shows an overall decline in iatrogenic fistula cases after implementation of the ETOO program. The observed reduction in iatrogenic fistula cases over the study period was associated and is consistent with a possible benefit of short, competency-based supervised training. However, because of the retrospective design and the absence of the total number of cesarean sections in the region, this finding should be interpreted cautiously as an association rather than definitive evidence of causality. We recommend that health systems and professional bodies should (i) integrate competency-based operative obstetrics training (eg., ETOO) into internship, medical officer induction, and continuing professional development; (ii) ensure structured supervision and periodic refreshers, with deliberate inclusion of private sector and rural-serving facilities that contributed a large share of antecedent surgeries; and (iii) institute routine surveillance of iatrogenic genitourinary fistula as a quality indicator for obstetric surgery to support continuous improvement.

## Strengths and Limitations

This five-year, single-center review draws on specialist-confirmed diagnoses by urogynaecologists and clearly classified fistula types, enhancing internal validity. In addition, use of a standardized data abstraction tool and predefined etiological criteria helped improve consistency in case classification. The dataset also identifies the facilities where antecedent operations occurred—including many in the private sector—thereby informing targeted training. The pre-/post-ETOO comparison provides a pragmatic view of temporal change after implementation of the training program.

Nonetheless, our study has some limitations. Firstly, as a hospital-based series restricted to women who reached the center for repair, the findings are subject to referral and selection bias and may not represent the wider catchment. Secondly, because denominator data, such as the total number of cesarean sections or other relevant obstetric procedures performed across contributing facilities, were not available, we were unable to estimate incidence rates and instead analyzed annual case counts among women presenting for repair. Accordingly, the observed decline after ETOO implementation should be interpreted as an association rather than proof of causality. Finally, the retrospective design

relies on clinical records, with risks of incomplete documentation and misclassification although classification was standardized through specialist review and predefined criteria.

## Abbreviations

ETOO, Essential Training in Operative Obstetrics; CS, Cesarean Section; MRRH, Mbarara Regional Referral Hospital; MUST, Mbarara University of Science and Technology; WHO, World Health Organization; IUGA, International Urogynecological Association.

## Data Sharing Statement

Datasets will be made available from the corresponding author, upon request.

## Ethics Approval and Consent to Participate

The study received approval from the Ethics Committee of Mbarara University of Science and Technology (reference number – 17/08-18) and Uganda National Council for Science and Technology (reference number – HS368ES). The waiver of consent was obtained since this was a review of records. Participants' privacy and confidentiality were ensured by using codes during data entry and not the names. We respected the guidelines of Helsinki and CIOMS-2002 (Council for International Organizations of Medical Sciences) regarding research with humans, avoiding any type of physical or moral harm. The charts and research materials were kept in a lockable cupboard, only accessible to authorize research team members.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no competing interests with regard to publication of this work.

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