

## RESEARCH ARTICLE

# Factors associated with surgical repair success of female genital fistula in the Democratic Republic of Congo: Experiences of the Fistula Care Plus Project, 2017–2019

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## Abstract

**Objective:** We sought to document outcomes and factors associated with surgical success in hospitals supported by the Fistula Care *Plus* Project in the Democratic Republic of Congo (DRC), 2017–2019.

**Methods:** This was a retrospective cohort study analysing routine repair data on women with Female Genital Fistula. Univariate and multivariate analyses were conducted to determine factors associated with successful fistula repair.

**Results:** A total of 895 women were included in this study, with a mean age of 34 years ( $\pm 13$  years). The majority were married or in union (57.4%) and living in rural areas (82.0%), while nearly half were farmers (45.9%). The average duration living with fistula was 8 years ( $\pm 7$ ). Vesicovaginal (70.5%) and complex (59.8%) fistulas were the most common fistula types. Caesarean section (34.7%), obstructed labour (27.0%) and prolonged labour (23.0%) were the main aetiologies, with the causal deliveries resulting in stillbirth in 88% of cases. The vaginal route (74.9%) was the primary route for surgical repair. The median duration of bladder catheterization after surgery was 14 days (interquartile range [IQR] 7–21). Multivariate analysis revealed that Waaldijk type I fistula (adjusted odds ratio [aOR]:2.71, 95% confidence interval [CI]:1.36–5.40), no previous surgery (aOR:2.63, 95% CI:1.43–3.19), repair at Panzi Hospital (aOR: 2.71, 95% CI:1.36–5.40), and bladder catheterization for less than 10 days (aOR:13.94, 95% CI: 4.91–39.55) or 11–14 days (aOR: 6.07, 95% CI: 2.21–15.31) were associated with better repair outcomes.

**Conclusion:** The Fistula Care *Plus* Project in the DRC recorded good fistula repair outcomes. However, further efforts are needed to promote adequate management of fistula cases.

## KEYWORDS

Democratic Republic of Congo, female genital fistula, operational research, surgery

## INTRODUCTION

Female genital fistula (FGF) is a significant public health concern that affects up to 1 million women worldwide, with an annual incidence of thousands of cases [1–3]. Primarily

**Sustainable Development Goals:** Good Health and Wellbeing, No Poverty, Reduced Inequalities

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**TABLE 1** Characteristics of Fistula Care *Plus* supported facilities in the DRC, 2021

Hospitals	Overall capacity	Number of beds dedicated to fistula care	Fistula care team	Other facility characteristics
Panzi	450 beds	60 beds	14 surgeons (including 4 experts and 1 urologist), 17 nurses, 7 psychologists, 2 physiotherapists, 18 social workers and 2 data managers	A reintegration centre with 32 beds. Support for apprenticeships for fistula clients in specific trades.
HEAL Africa	220 beds	18 beds	4 surgeons, 5 nurses, 2 physiotherapists, 2 psychologists and 1 psychosocial counsellor	A reception centre with 38 places for women awaiting surgery and rest before returning home. Support to train fistula clients in different professions.
Saint Joseph	300 beds	17 beds	2 surgeons, 5 nurses, 1 psychologist, 1 physiotherapist	A reception centre with 12 places for women awaiting surgery. Support to train fistula clients in sewing.

caused by prolonged and obstructed labour in the absence of emergency obstetric care, FGF primarily affects women living in developing countries where health systems are inadequate [4, 5].

Women suffering from FGF experience continuous urine and/or faecal incontinence, which negatively influences their quality of life and commonly results in stigmatisation [1, 2]. The physical and psychological burden of FGF is associated with an increased risk of mental disorders such as anxiety, depression and post-traumatic stress disorder. Fistula-related stigma can result in social exclusion and reduced ability for economic participation [6].

Without surgery, the likelihood of fistula resolution is almost null, with exception of the rare cases of early fistula closure by immediate catheterization after fistula occurrence. Studies have reported a range of successful fistula repair from 42% to 86% [7, 8]. However, surgical repair outcomes are influenced by individual (type and location of fistula) and health system (staff training, surgical expertise) factors.

The prevalence and incidence of FGF in the Democratic Republic of Congo (DRC) are unknown. However, available estimates suggest that the DRC is one of the countries where fistula occurs most frequently in Africa, with an estimated lifetime prevalence of 1.8 per 1000 women of reproductive age [9]. At current population numbers, this translates to approximately 34,000 women of reproductive age having suffered from fistula in DRC. Several factors such as the low quality of obstetric care, financial and geographical barriers in accessing obstetric care, and insecurity in some areas of the country influence fistula occurrence in the DRC [10]. Relatively little information is available regarding access to and success of surgical repair of fistula in the DRC. Sjoveian et al. report an 87% success rate among 595 patients with fistula at Panzi Hospital in South Kivu [11]. Other authors in central, northern and southern Congo have reported surgical success rates ranging from 86% to 90% [12, 13]. However, national data on surgical success rates are lacking.

With diverse supportive initiatives for fistula repair programs in the DRC over the past decade, repair success rates may be increasing. Understanding current national success rates and differences in rates by sociodemographic, clinical,

medical and surgical characteristics of patients could contribute to the evidence base for improving the quality of care offered to women with fistula in the DRC, as well as support fistula-related policies and programs. Thus, this study aimed to analyse the outcomes of fistula surgical repair in the hospitals supported by the Fistula Care *Plus* project in DRC from 2017 to 2019, which accounted for a majority of the fistula repairs provided in the country during this period.

## METHODS

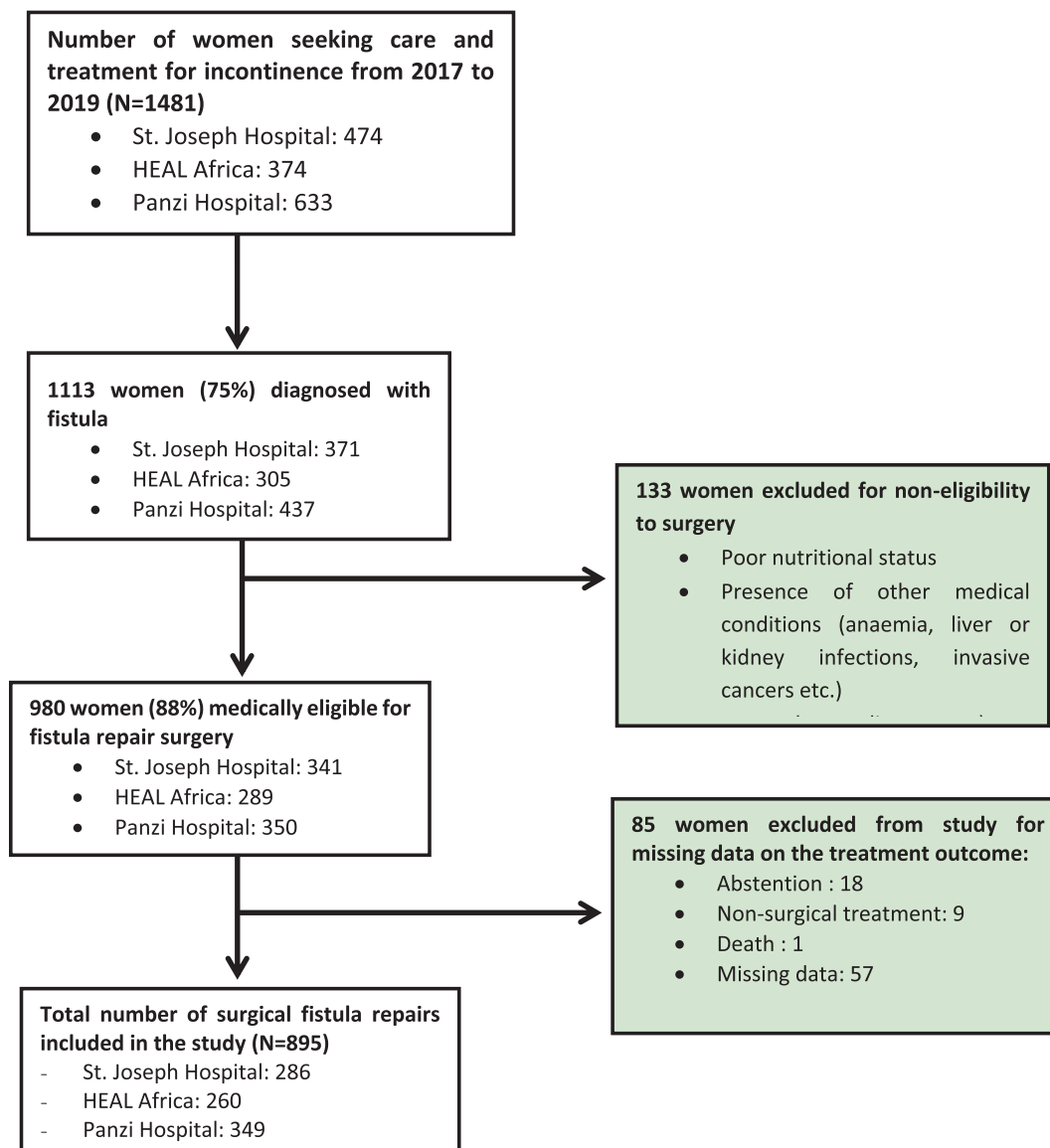
### Study design and duration

This retrospective cohort study analysed routine repair data on women with FGF in the DRC from January 1, 2017 to December 31, 2019. This period covers the introduction of the study data collection tool (client tracker) and the start of the study implementation.

### Study context

The DRC, located in Central Africa, has nearly 90 million inhabitants, 75% of whom live in rural areas [14]. FGF management is aligned with the World Health Organization (WHO) recommendations, taking into account the medical, psychological and socio-economic dimensions [15]. Since 2007, EngenderHealth, a US-based NGO, has been working in the DRC to support surgical repair of FGF through the USAID-funded Fistula Care (2007–2013) and Fistula Care *Plus* (2014–2021) projects.

The Fistula Care *Plus* (FC+) project subsidises the costs of fistula repair to provide free FGF care to patients. It also supports FGF prevention through voluntary family planning, clinical capacity building and community awareness and education. FC+ has focused on building health system capacity to provide safe surgery via both routine care and targeted outreach efforts. Furthermore, FC+ has made efforts to address the needs for the reintegration of women who have undergone fistula repair. FC+ supported six private faith-based



**FIGURE 1** Flow chart of fistula surgical repair patients in hospitals supported by the Fistula Care *Plus* project in the Democratic Republic of Congo, 2017–2019.

health facilities to provide fistula treatment (medical and surgical) and prevention in five provinces: Kinshasa, South Kivu, North Kivu, Maniema and Haut-Katanga. From 2014 to 2020, approximately 3000 women underwent surgical repair at project-supported sites.

Data for the current study were collected from the three health facilities providing fistula repair: Saint Joseph Hospital in Kinshasa, Panzi Hospital in Bukavu, South Kivu and HEAL Africa Hospital in Goma, North Kivu (Table 1). These health facilities, specialised in medical, psychosocial and surgical care, are the largest fistula repair sites in the DRC and serve women from diverse geographical regions of the country.

### Study population

The study population comprised 895 women who had undergone surgical repair for fistula from January 2017 to December 2019 at Panzi, HEAL Africa and Saint Joseph Hospitals,

through routine or outreach services (Figure 1). Figure 1 shows the flow of patients admitted and who received surgical treatment for fistula. Of the 1481 women who consulted for urinary and/or faecal incontinence in the three hospitals between 2017 and 2019, 980 (88%) had a fistula eligible for surgery and received surgical repair. However, due to missing data, only 895 women were eligible for the study.

### Measures

Data were collected on sociodemographic and clinical characteristics such as age, marital status, occupation, type of fistula, degree of complexity and fistula aetiology. Additional variables included medical and surgical care (approach, duration of catheterization following repair, duration of hospital stay); and outcome at discharge (fistula closed and continent, fistula closed but incontinent, and repair failure).

**TABLE 2** Sociodemographic and clinical characteristics of women repaired for fistula in hospitals supported by the fistula care *plus* project in the Democratic Republic of Congo, 2017 to 2019 (*N* = 895)

Variables	Number	Percentage
Age at admission (years)		
<17	27	3.02
17–24	172	19.2
25–49	562	62.8
≥ 50	114	12.7
Missing	20	2.2
Mean age (± SD)	34 (±13)	
Marital status		
Single	151	16.9
Married/in union	514	57.4
Divorced	122	13.6
Widow	83	9.3
Missing	25	2.8
Occupation		
None	74	8.
Students	46	5.14
Housewife	184	20.6
Farmers	411	45.9
Civil servant/employee	19	21.2
Informal activity	80	8.9
Missing	81	9.1
Education		
None	298	33.3
Primary	314	35.1
Secondary	221	24.7
University	15	1.7
Missing	47	5.3
Provenance		
Sud Ubangi	197	22.0
Nord kivu	175	19.6
Kwilu	146	16.3
Mongala	64	7.2
Equateur	48	5.4
Kongo central	41	4.6
Kinshasa	37	4.1
Tshop	36	4.0
Sud Kivu	26	2.9
Kwango	20	2.2
Tanganyika	19	2.1
Lomami	19	2.1
Nord Ubangi	18	2.0
Sankuru	17	1.9
Others	32	3.6
Residence Zone		
Rural	734	82.0

(Continues)

**TABLE 2** (Continued)

Variables	Number	Percentage
Urban	157	17.5
Missing	4	0.5
Parity		
0 births	19	2.1
1 birth	224	25.0
2–5 births	398	44.5
≥ 6 births	250	27.9
Missing	4	0.5
Median (interquartile range [IQR])	3 (1–6)	
Stillbirth at index fistula delivery		
Yes	335	37.4
No	146	16.3
Missing	414	46.3
Type of fistula		
Vessico-vaginal	631	70.5
Recto-vaginal	106	11.8
Vesico-uterine	91	10.2
Uretero-vaginal	49	5.5
Mixed	13	1.5
Vesico-cutaneous	5	0.6
Level of fibrosis		
None	232	25.1
Minimal	281	30.4
Moderate	280	30.3
Severe	65	7.0
Missing	65	7.0
Degree of complexity		
Simple	326	36.4
Complex	535	59.8
Missing	34	3.8
Type of fistula according to Waaldijk classification		
Type I	401	44.8
Type IIAa	82	9.2
Type IIAb	22	2.5
Type IIBa	51	5.7
Type IIBb	39	4.4
Type III	266	29.7
Missing	34	3.8
Type of fistula according to Panzi score		
0 (Simple)	55	6.2
1 (Simple)	156	17.4
2 (Moderate)	95	10.6
3 (Complex)	311	34.8
Missing	278	31.1
Aetiology of fistula <sup>a</sup>		
Associated with C-section	311	34.7
Obstructed labour	242	27.0

(Continues)

TABLE 2 (Continued)

Variables	Number	Percentage
Prolonged labour	206	23.0
Pelvic surgery	74	8.7
Other <sup>b</sup>	68	7.6
Fistula duration (in years)		
≤ 1	312	34.9
2–4	170	19.0
≥5	344	38.4
Missing	69	7.7
Mean (± SD)	8 (± 7)	
Previous surgeries		
0	516	57.7
1	249	27.8
2	74	8.3
≥3	53	5.9
Missing	3	0.3
Size of fistula (cm)		
Small (<2 cm)	272	30.4
Medium (2–3 cm)	374	41.8
Large (4–5 cm)	131	14.6
Spread (>5 cm)	7	0.8
Missing	111	12.4

<sup>a</sup>Modalities not mutually exclusive.

<sup>b</sup>Symphysiotomy (18), cancer (10), hysterectomy (9), congenital defect (7), sexual trauma (7), episiotomy (7), foetal macrosomia (4).

Two main classifications were used to define the degree of complexity: the Waaldijk classification and the Panzi score. Waaldijk classifies fistulas into three main groups according to their degree of complexity. Type I includes fistulas that do not involve a closure mechanism, type II includes fistulas involving closure mechanisms of the urethra and bladder neck, and type III includes other types of fistulas such as uterovaginal or recto-vaginal fistulas [16]. In practice, types II and III are considered to be complex fistulas [16]. Panzi scores range from zero to three and are defined as follows: score 0 when the fistula is of low severity; score 1 when the fistula is severe but in only one category (location, size or circumferential defect); score 2 or 3 when the fistula is severe and in two or more categories [17].

Successful repair was defined as fistula closed with no presence of urine and/or faecal incontinence at hospital discharge. Hospital discharge criteria included success fistula repair, and 8-week length stay. This implies that women with unsuccessful repair who had more than 8 weeks hospital stay was discharged and rescheduled 3 months later for another surgical repair.

## Data collection

Study variables were extracted from patients' medical records and the FC+ project District Health Information Software 2 (DHIS2) database by data coders using a

TABLE 3 Medical and surgical treatment of fistula patients in hospitals supported by the Fistula Care Plus project in the Democratic Republic of Congo, 2017–2019 (N = 895)

Variables	Number	Percentage
Surgical approach		
Vaginal	671	75.0
Abdominal	206	23.0
Combined vaginal/abdominal	13	1.5
Missing	5	0.6
Duration of bladder catheterization (in days)		
≤10 days	219	24.4
11–14 days	355	39.6
>14 days	62	7.0
Missing	259	28.9
Median (interquartile range [IQR])	14 (7–21)	
Length of stay in the health facility		
≤2 weeks	547	61.1
2–4 weeks	167	18.7
>4 weeks	181	20.2
Average length of stay in weeks (± SD)	3.1 (±2.6)	

questionnaire configured on KoBoCollect. The information collected covered patients socio-demographic (age, marital status, occupation, residence, etc.) and clinical (type and duration of fistula, level of fibrosis, degree of complexity, size of fistula, previous surgery, etc.); medical and surgical treatment (surgical approach, duration of bladder catheterization, length of stay in the health facility) and outcomes of surgery. Data were subsequently validated by a data manager and a second reviewer to check for inconsistencies during the data collection process.

## Data analysis

Data analysis was performed using Stata v. 13 software (Stata Corporation, College Station, TX, USA). Categorical variables were presented as proportions and continuous variables as mean ± SD or median with interquartile ranges (IQR). We explored factors associated with successful repair first using bivariate analyses (Student's *t*-test for continuous variables and the chi-square test for categorical variables) followed by logistic regression analyses. Variables included within the logistic regression models were selected a priori from the literature review. Differences were considered statistically significant at  $p \leq 0.05$ .

## Ethical considerations

The study protocol was approved by the Ethics Committee of the School of Public Health of the University of Kinshasa in DRC (ESP/CE/153/2020).

**TABLE 4** Factors associated with the successful surgical repair of fistula in hospitals supported by the Fistula Care *Plus* project in the Democratic Republic of Congo, 2017–2019 (*N* = 895)

Variables	Crude OR (95% CI)	<i>p</i> -Value	Adjusted OR (95% CI)	<i>p</i> -Value
Average age	1.01 (0.99–1.03)	0.118	1.04 (1.01–1.08)	0.006
Marital status				
Divorced/single	1		1	
Married/in couple	1.81 (1.16–2.83)	0.008	1.40 (0.79–2.50)	0.25
Type of fistula				
Vesico-vaginal	1		1	
Recto-vaginal	7.24 (1.75–30.01)	0.006	7.44 (0.78–71.73)	0.08
Vesico-uterine	3.01 (1.07–8.48)	0.036	3.45 (0.76–15.65)	0.11
Utero-vaginal	1.22 (0.47–3.19)	0.683	5.11 (0.54–48.70)	0.16
Mixed	0.57 (0.21–1.56)	0.273	0.84 (0.22–3.22)	0.80
Type of fistula according to the Waaldijk classification				
Type II	1		1	
Type I	2.37 (1.42–3.97)	0.001	2.71 (1.36–5.40)	0.005
Type III	2.55 (1.43–4.56)	0.002	1.25 (0.43–3.64)	0.68
Fistula size				
Large (>3 cm)	1		1	
Small (<1.5 cm)	1.37 (0.73–2.57)	0.34	1.47 (0.65–10.96)	0.36
Medium (1.5–3 cm)	1.59 (0.86–2.922)	0.14	1.21 (0.57–2.59)	0.62
Level of fibrosis				
Severe	1		1	
None	5.87 (2.63–13.09)	<0.001	3.30 (0.99–10.96)	0.05
Minimal	5.86 (2.73–12.59)	<0.001	1.79 (0.64–4.96)	0.267
Moderated	2.20 (1.13–4.27)	<0.001	1.85 (0.76–4.51)	0.175
Previous surgeries				
≥1	1		1	
0	2.04 (1.31–3.18)	0.002	2.63 (1.43–3.19)	0.002
Fistula duration				
≥5 years old	1		1	
2–4 years old	1.25 (0.71–2.20)	0.450	1.56 (0.76–3.19)	0.76
≤1 year	3.17 (1.73–5.79)	>0.001	2.88 (1.30–369)	1.30
Repair site				
Saint Joseph	1		1	
HEAL Africa	2.47 (1.46–5.19)	0.001	1.73 (0.81–3.69)	0.16
Panzi	5.21 (2.82–9.61)	<0.001	8.13 (3.19–13.24)	<0.001
Duration of bladder catheterization				
>14 days	1		1	
11–14 days	12.53 (6.73–23.33)	<0.001	6.07 (2.21–15.31)	<0.001
≤10 days	16.35 (7.92–33.76)	<0.001	13.94 (4.91–39.55)	<0.001

Abbreviation: CI, confidence interval.

## RESULTS

### Sociodemographic and clinical characteristics

Overall 895 women underwent surgical FGF repair in the three hospitals between 2017 and 2019. The demographic and clinical characteristics of these women are presented in Table 2.

The mean age at admission was 34 years (SD 13 years). The majority of women (57.4%) were married or in a relationship, nearly half were farmers (45.9%), and most lived in rural areas (82.0%) and had vesicovaginal fistula (70.5%). About one-third of women (35.5%) were from the four provinces of Grand Equateur.\* Of the 481 patients for whom

\*Equateur, Mongala, Nord et Sud Ubangi.

delivery-related information was available, over two-thirds (69.7%) had stillbirths during the delivery resulting in fistula.

Most women had a complex fistula (59.8%). Duration lived with fistula varied, with 34.9% of women have lived with fistula for less than 1 year while 38.4% had lived with it for five or more years. The majority of patients had had no prior surgeries (57.7%). Fistula aetiology was associated with Caesarean section (34.7%), followed by obstructed (27.0%) or prolonged labour (23.0%).

## Medical and surgical care

The surgical approach was vaginal for most patients (75.0%; Table 3). Among the 636 women who received bladder catheterization after surgery, the median duration was 14 days (IQRs of 7–21 days), with 11–14 days the most common range (39.6%).

## Repair outcomes

Among this study population, surgical success was achieved for 89.2% overall. At discharge, 92% of all women who had undergone surgery had a closed fistula, whereas fistula closure was unsuccessful for 79 women. Among those with closed fistula, (96.7%) had achieved continence, while 3.3% had residual incontinence.

## Factors associated with successful fistula repair

In unadjusted analyses, factors significantly associated with successful repair included marital status, fistula type, Waaldijk classification, level of fibrosis, history of previous surgery, repair site and duration of bladder catheterization, (Table 4).

In our adjusted model, significant independent associations were identified for age, Waaldijk classification, number of prior surgeries, repair site and duration of bladder catheterization. Each 1-year increase in age was associated with a 4% increased odds of successful fistula repair (adjusted odds ratio [aOR] 1.04; 95% confidence interval [CI] 1.01–1.08). Compared to Waaldijk classification Type II (involving closing mechanism), individuals with Type I fistula (not involving closing mechanism) had a nearly three-fold increased odds of surgical success (aOR: 2.71; 95% CI: 1.36–5.40). Compared to women who had had one or more prior surgeries, those having had no previous surgery had significantly increased odds of surgical success (aOR: 2.63; 95% CI: 1.43–3.19). Compared to patients repaired at Saint Joseph Hospital, those who were repaired at Panzi Hospital had an eight-fold increased odds of surgical success (aOR: 8.13; 95% CI: 3.19–13.24). In the contrary, there was no statistically significant difference between Saint Joseph and HEAL Africa treatment sites (aOR: 1.73; 95% CI: 0.81–3.69).

Finally, compared to those who underwent bladder catheterization for 14 days or more, duration of bladder catheterization of 10 days or less (aOR: 13.94; 95% CI: 4.91–39.55) or 11 to 14 days (aOR: 6.07; 95% CI: 6.73–23.33) remained significantly associated with successful fistula repair.

## DISCUSSION

Our study is the first to document fistula management and repair outcomes within the three largest surgical repair sites in DRC. We identified high rates of fistula closure and successful repair at discharge across the three facilities. We found fistula repair success to be independently associated with the patient surgical history, severity of fistula, site of surgical repair and duration of bladder catheterization after surgery. Fistula associated with Caesarean section represented a significant proportion of cases within our study. Finally, this study revealed a high rate of stillbirths at the index delivery resulting in fistula and a high proportion of fistula of new cases (less than 1 year lived with fistula) in DRC.

The high fistula closure rate of 92% identified in our study was higher than that reported by Diallo et al. (79%) and Delamou et al. (85%), both in Guinea, as well as Kayondo et al (80%) in Uganda [18–20]. The rate of successful surgical repair at discharge (88%) was higher than that reported by Mohr et al. (82%) in Switzerland but lower than Arrowsmith et al. (90%) in their literature review [21, 22]. Repair success depends on several factors, including the type and complexity of the fistula [23]. However, although complex fistula cases comprised more than half of our sample, our outcomes were significantly better than previous studies in DRC and some Central African countries [11, 24–26]. These results may reflect the expertise of the fistula surgeons and equipment in our study sites and the quality of post-surgical care. Also, it is possible that the exclusion of malnourished women and those presenting bad medical conditions such as anaemia, and infections explained this high rate of successful repair in our study sites. Such exclusion criteria are not reported from other settings in Africa [18–20]. This finding suggests that substantial attention should be paid to women's nutrition status and physical condition before surgical repair.

Our study revealed that successful fistula repair depends on the patients' surgical history, the severity of fistula, the surgical repair site, and the duration of bladder catheterisation. These findings are generally consistent with other studies investigating predictors of repair success, and may largely reflect different representations of fistula severity. Previous attempts at repair may be a predictor of surgical failure as this characteristic may be reflective of more complex fistula which could not be successfully repaired on the first attempt and the success of subsequent repairs may be impacted by the presence of scars resulting from prior surgeries [5, 27]. Similarly, our finding shows that fistulas classified as Waaldijk type I were twice as likely to have a positive outcome as type II which is reflective of the complexity of the fistula, given type I fistulas do not involve the closing mechanism, with bladder

neck and urethra intact. Finally, our adjusted analyses identified bladder catheterization time of fewer than 10 days and 11–14 days after surgery as significantly associated with fistula repair success compared to those catheterized for more than 14 days. This finding is likely to have been influenced by clinical care decisions resulting in greater length of catheterisation implemented for more severe fistula. Given findings from an eight-country randomised clinical trial by Barone et al., who reported no difference in outcome between patients who had the catheter for 7 days compared to 14 days for simple fistulas, it is likely that more simple fistulas received shorter-duration catheterisation, and were more likely to have successful repair outcomes [28]. Several authors have documented health systems benefits to early removal of the bladder catheter including increased care capacity and reduced care expenditures [29]. However, WHO now recommends shorter-duration bladder catheterisation for at least 14 days after surgery. [30]

Variation in surgical outcome has previously been identified by repair site; Delamou et al. also report that surgical outcomes varied by care sites in their study in Guinea [31]. While these results persisted within our adjusted analyses, they could be explained by differences in the individual, clinical and surgical characteristics of women admitted by repair site which were unaccounted for in our analysis. Another explanation for this difference could be related to the surgical procedures, expertise and equipment between the care sites. Further exploration of this finding was not possible within the current study, and should be explored in subsequent research (especially realist evaluation) to ensure optimal outcomes. In fact, sample size was not adequate for disaggregated analysis by the facility.

About one-third of the women in our study developed fistula within the prior year while 38% had lived with it for more than 5 years. Significant barriers to fistula care are reported in the literature, resulting in women living with fistula for extended periods [32]. However, the proportion of women with prior surgical repairs was 42%. These findings both provide evidence that some women are able to overcome barriers to rapidly access fistula care while calling into question the effectiveness of primary prevention measures for FGF. The relatively high proportion of new fistula cases in our study could be related to socio-cultural, geographic and economic barriers to essential obstetric care and low quality of care in health facilities. This implies that both maternal health services and fistula care must be geographically and financially accessible, acceptable and of good quality.

The incidence of the iatrogenic fistula is increasing in many African countries [33–35]; this was observed in our findings that 35% of cases were associated with Caesarean section in the absence of prolonged obstructed labour. These results are likely to be linked to poor-quality emergency obstetric care (e.g., lack of competent personnel, lack of adequate materials and equipment, etc.), and service data from DRC confirm insufficient availability of emergency obstetric and neonatal services in primary and secondary health facilities [36]. Quality improvement efforts to increase capability of surgeons and other health personnel in best practices for

Caesarean section and postoperative follow-up and to equip primary and secondary health structures is needed to reduce iatrogenic fistulas.

Finally, the rate of stillbirth in the delivery causing the fistula was 70%. Nonetheless, the proportion of missing data for this variable is very high (46%); suggesting that this finding should be taken with caution. This stillbirth rate is potentially due to the higher proportion of iatrogenic fistula related to caesarean section in our study. It is lower than previously reported by Delamou et al. in Guinea (91%) and Dennis et al. in Tanzania (95%), but not much lower than the 78% stillbirth rate reported in a meta-analysis by Tebeu et al. in 2009 [31, 37, 38]. Stillbirth is an aggravating factor in the psychological distress of women with fistula, and may indicate the need for targeted psychosocial support for women receiving fistula repair, particularly new (less than 1 year lived with fistula) cases [39].

This study's strength resides in its inclusion of data over a 3-year period from the three major fistula repair hospitals in DRC, making it the most extensive national study of women with fistula. This study's main limitation is related to its retrospective design with missing data on some key study variables due to dependence on medical record abstraction, and the inability to disaggregate analysis among sites. This had an impact on the sample size available for multivariable and subgroup analyses.

## CONCLUSION

Surgical repair of FGF across three major hospitals in DRC was highly successful in terms of fistula closure and incontinence resolution despite the frequency of complex fistulas in this context. Nevertheless, attention must be paid to reducing new cases of FGF, including through quality improvement efforts for caesarean section, and identifying further methods to improve surgical outcomes for women with very complex cases. Additional efforts remain to be made in communication strategies towards clients, training of medical staff in the best practices for Caesarean section and improving accessibility to emergency obstetric care in health facilities throughout the country.

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