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Factors associated with marital status of women with genital fistula: A retrospective review in nine African countries

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Obstetric fistula; marriage; separation; divorce; sub-Saharan Africa

Abstract

Introduction

The narrative is that husbands abandon women with fistula following childbirth. We examine features that predict whether women with fistula remain married.

Methods

This retrospective review focuses on 5,942 women who developed fistula during childbirth (1975-2017) and sought treatment (1994-2017) in Tanzania, Uganda, Kenya, Malawi, Zambia, Rwanda, Ethiopia, Somalia, and South Sudan. Frequencies and logistic regression assessed attributes associated with remaining married, including country, education, age and parity at fistula development, type and duration of incontinence, and repair attempts.

Results

Over half of the women lived with their husbands at the time of fistula treatment (57.2%, 3,397/5,942). Remaining married with fistula was most common in Zambia (68.6%, 105/153), Malawi (62.0%, 390/629), and Kenya (61.1%, 513/840) and least common in Somalia (49.5%, 142/287). The strongest predictor of remaining married with fistula was parity at fistula development (AOR 1.5-4.3). Predicted probability of remaining married declined sharply over the first two years of leaking, leveling out thereafter. The woman's education was not a statistically significant predictor, but the odds of remaining married were 26% higher if the husband had any formal schooling.

Conclusion

Most husbands do not abandon wives with fistula following childbirth. Treatment, counselling, social support, and rehabilitation must consider the circumstances of each woman, engaging men as partners where appropriate. Communities and facilities offering fistula repair services should stress the importance of early intervention.

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Strengths and limitations of this study

► Size and geographic breadth of data set.

► Detail of collected information.

► Retrospective observational nature of the study design.

► Reliance on self-reported data at the time of fistula repair without subsequent follow-up.

► Data not collected on explicit reasons for marriage or separation. Many possibilities are beyond the available variables.

Introduction

Genital fistula following childbirth results from prolonged, obstructed labour, injuries during Caesarean section, and limited access to quality emergency obstetric care. Twentieth-century improvements in obstetric care eliminated obstetric fistula in well-resourced settings. Proper monitoring of labour with timely intervention in low-resource settings could similarly eliminate fistula worldwide.[1] At present, however, fistula following childbirth remains a devastating maternal morbidity affecting marginalised women.

Genital fistula is characterised by continuous urinary and/or faecal incontinence. The chronic morbidity of fistula following childbirth is associated with long-term physical, medical, emotional, psychological, social, and economic consequences.[2,3] Associated injuries from obstructed labor may include vaginal stenosis, bladder calculi, and neurological damage. Some women with fistula develop infection and amenorrhea. The leaking of urine produces painful rashes and a bad smell.

Fistula exacerbates the vulnerability of poor women living in remote areas of sub-Saharan Africa. Women with fistula are no longer able to fulfill their societal roles as wives and mothers. They commonly will have lost a baby during prolonged, obstructed labor.[4] The shame, smell, and physical challenges of fistula-related incontinence constrain their daily lives. Women with fistula may avoid public gatherings and social events.[5,6] Stigma may prevent them from cooking food, performing household chores, participating in religious rituals, and engaging in income-generating activities.[7,8] Depression is not uncommon among women presenting for fistula repair surgery, with reported frequencies of 36.5%, 45.8%, and 72.9%.[9–11]

Women with fistula express concern about marital discord and their fistula affecting sexual intercourse.[12] Most married women with fistula do not have sexual intercourse, and those who do may experience pain or infertility.[6,13] Women with fistula are more likely to have experienced

domestic violence (56%) than women without fistula (38%).[14] Recent sexual violence is twice as common among women with fistula (16%, compared with 8% among women without fistula symptoms).[14]

Specialised surgery can restore women's anatomy and dignity. Over 95,000 obstetric fistula repairs took place globally between 2010 and 2018, for an annual average of more than 10,500 fistula repair surgeries.[15] This figure is greater than the estimated incidence of 6,000 new cases per year, but there is an estimated backlog of one million women who have fistulas in sub-Saharan Africa and South Asia.[16] A meta-analysis of national household surveys suggested that approximately 1 per 1000 women of reproductive age in sub-Saharan Africa have fistula symptoms and need access to surgery in order to regain their health and well-being.[17]

A dominant narrative is that stigmatised, incontinent women are abandoned by their husbands. Often, support for this narrative comes from interviews with women themselves[7,18] and from international organisations conveying the gravity of fistula following childbirth.[19] Quantitative data have been mixed, often drawing conclusions from small sample sizes. A 2007 meta-analysis found that 36% (95% CI 27%-46%) of women with fistula were divorced or separated, with substantial heterogeneity across geographies and authors.[8]

Our objective with this study was to examine the factors that affect the likelihood that women remain married after developing fistula in order to inform policies and practices for fistula treatment and rehabilitation.

Methods

Data

This cross-sectional retrospective record review considers women seeking fistula repair surgery at 83 facilities between June 1994 and December 2017 in Tanzania, Uganda, Kenya, Malawi, Zambia, Rwanda, Ethiopia, Somalia, and South Sudan. Women consented to fistula repair surgery in their respective hospitals, following each hospital's counselling and informed consent process. Data were collected by the second author (TR) and colleagues between June 1994 and December 2017. Included women developed fistula during childbirth between 1975 and 2017. We excluded women with perineal tears from fast delivery.

Each woman was interviewed by one of the surgeons who performed her fistula repair. Surgeons recorded the women's demographic information and obstetric history on a standard form,[20] including age, kind and duration of incontinence, parity at fistula development, previous fistula repair surgeries, education, and husband's education.

Each woman reported whether she was living with her husband, living with family, living alone, living in a rehabilitation centre, remarried, never married, or widowed. We excluded 452 women who had never married and 20 records with missing data on relationship status. Women were grouped according to whether they were living with their original husbands at the time of fistula repair. Due to our focus on the issue of abandonment, widows were counted as "living with husband" if they were together at the time of the husband's death.

Data were entered into an Excel database, with names changed to unique identification numbers to protect patient privacy. Data were analysed using Stata 16. This record review conforms to the principles embodied in the Declaration of Helsinki and was approved by the African Medical and Research Foundation Ethics and Scientific Review Committee (AMREF-ESRC P88/2013). There was no patient or public involvement in the design of this analysis.

Statistical analysis

Data exploration included descriptive statistics and bivariate comparisons using chi-squared tests. To determine the most parsimonious logistic regression model we collapsed predictor variables into different categories, relying on the Akaike information criteria (AIC) to focus on the variables that would best predict the outcome of remaining married with fistula. We tested possible interactions between duration and age at fistula development, duration and types of fistula, and repair attempts and types of fistula. We reviewed variance inflation factor (VIF) scores to assess possible correlations between covariates. The threshold for statistical significance was $p<0.05$.

Our dichotomous outcome was whether women with fistula remained married to their original husbands. The logistic regression model included dichotomous variables for the woman's education level (any formal schooling compared with none) and two types of fistula (both vesico-vaginal and recto-vaginal fistula as compared to just one type). We included several categorical variables: duration of leaking due to fistula (compared to 0-3 months), age at fistula development (compared to age 11-19), parity at fistula development (compared to para 1), and previous repair attempts (compared to none). We applied factor-variable operators to the country as a categorical variable without a base.

Logistic regression of the subgroup of women whose records included information about their husband's education included all of the above variables and a dichotomous variable for husband's education (any formal schooling compared with none).

We used the Stata *marginsplot* command to graph statistics from our model, with a specific focus on the predicted probabilities associated with duration of leaking, parity, and previous repair attempts.

Role of the funding source

RTI International provided support to cover time from the first author (CN) on this analysis and writing. RTI International was not involved in the collection or interpretation of the data.

Results

More than half of the 5,942 women with fistula following childbirth were living with their husbands at the time they sought treatment (57.2%, 3,397/5,942), with statistically significant geographic variation (p<0.0001). Remaining married with fistula was most common in Zambia (68.6%, 105/153), Malawi (62.0%, 390/629), and Kenya (61.1%, 513/840). It was least common in Somalia (49.5%, 142/287; Table 1).

Duration of leaking strongly predicted whether a woman would remain married with fistula (Table 2). We found a sharp decline in women with fistula living with their husbands over the first two years of leaking. As shown in Figure 1, the predicted probability of remaining married with fistula declined by >20 percentage points within three months. It declined by another ~20 percentage points by the end of the first year, and a further ~10 percentage points by the second anniversary of fistula development. The predicted probability of remaining married with fistula levelled off thereafter, such that roughly half of women remained married with fistula, irrespective of how much longer than two years they had been leaking.

Women who developed fistula at higher parities were likely to remain married. Just over 80% of women with parity of six or more at fistula development remained married with fistula (80.1%, 746/931), compared to 43.9% of women who developed fistula at their first pregnancy (1,269/2,892). The modeled adjusted odds of remaining married with fistula rose 48% at para 2 (95% CI 1.24-1.77), 120% at para 3-5 (95% CI 1.82-2.65), and 334% at para 6 or more (95% CI 3.29-5.72, Figure 2).

Previous unsuccessful repair attempts decreased the adjusted odds of remaining married with fistula as follows: by 33% for the first attempt (95% CI 0.58-0.78), by 42% for the second attempt (95% CI 0.45-0.74), and by 54% for three or more repair attempts (95% CI 0.33-0.64, Figure 3). In comparison to one fistula type alone, concurrent vesico-vaginal and recto-vaginal fistulas decreased the odds of remaining married with fistula by 37% (95% CI 0.51-0.78).

Women who developed fistula in their 20s or early 30s were more likely to remain married than those who developed fistula as adolescents (age 11-19), although age at fistula development was not as strongly predictive as other variables.

Women's education levels were low: 41.8% of the women had never attended school (2,458/5,885), while 58.2% had attended at least some primary school (3,427/5,885). We did not find a relationship between any formal schooling and remaining married with fistula. Although it proved not to be statistically significant, we kept the woman's education variable in the model because it helps to explain the variance in the data.

A subgroup analysis of the 4,791 women whose records included information about their husband's education level revealed that, in contrast to the statistically non-significant effect of the woman's education level, a husband's experience of any formal schooling increased the adjusted odds of continued marriage despite fistula (by 26%, 95% CI 1.09-1.47; Table S1).

Discussion

Fistula rightly inspires advocacy: It is unconscionable that women continue to endure a childbirth injury that was eliminated in well-resourced settings more than a century ago. To capture this injustice, advocates may be tempted to focus on the most dramatic patient stories.[21] Vivid examples of abandonment create generalisations about women with fistula, masking the variability of

women's experiences. There is a danger of telling a single story about the abandonment of women with fistula after childbirth.[22] The true picture is more nuanced.

At times the single story about abandonment reflects a lack of scientific evidence, which has long been an issue.[23] But the allure may also persist in the face of contrary data. One meta-analysis of 14 publications between 1985 and 2005 reported that 36% (95% CI 27%-46%) of women with fistula were divorced or separated, yet it concluded that women with fistula "are usually deserted by their husbands."[8] Such assertions have prompted others to refute explicitly the idea that all women with fistula are abandoned by husbands and family.[1]

While some husbands separate from wives with fistula after childbirth, they are not the majority. This large and geographically varied dataset presents an opportunity to explore the diversity of women's experiences.

Divorce rates across sub-Saharan Africa are estimated to have remained stable over the past 20 years, albeit without reliable data from civil registration systems.[24] The estimated percentage of first unions that dissolved within 15-19 years is 43.8% in Malawi, 39.6% in Ethiopia, 39.1% in Zambia, 37.5% in Uganda, 37.2% in Rwanda, 37.0% in Tanzania, and 24.2% in Kenya.[24] Combined with our findings, these point estimates suggest that the excess separation rate for women with obstetric fistula is up to 15%, depending on the country.

Women with fistula following childbirth are less likely to have their husband's support as time goes on, but the association is not a simple straight line. If abandonment is to happen, it typically occurs in a woman's first two years with fistula. The connection between marital separation and duration of leaking was first documented in the early 1980s in northern Nigeria, where the share of women with fistula who remained with their husbands was 42% of new fistula patients and 11% of women with

long-term fistula (>2 years).[25] Our modelling indicates that husbands who stay with their wives through two years of incontinence are likely to remain married.

Historically, obstetric fistula surgeons were advised to wait three months for tissues to heal before surgery.[26] This often-repeated position has been challenged by the success of immediate catheterisation and surgical repair of fresh fistulas.[27] Beyond clinical considerations, early intervention clearly helps women to avoid the social consequences of living with fistula, including stigma and marital separation. Communities and facilities that offer fistula repair services should stress the importance of early intervention.

Women's educational attainment is often celebrated for its positive associations with nutrition, healthcare access, delayed marriage, and contraceptive use.[28] Yet the better educated women in this study did not have statistically significantly better odds of remaining married with obstetric fistula. Rather, it was the husband's exposure to any formal schooling that was positively associated with remaining married through the ordeal of fistula following childbirth. The school experience may not have included tacit instruction about the curability of obstetric fistula, but perhaps it enhanced men's compassion for others, familiarity with gender issues, and ability to understand fistula and its effects, thereby leading to a greater ability to navigate challenges and stand against negative cultural pressures.

Information about the availability of fistula treatment must target men as well as women. Where appropriate, facilities offering fistula repair should seek to engage men as partners, enabling women's rehabilitation and reintegration after fistula surgery.

Childlessness has been identified as an important factor in marital breakdown. It is a particular challenge in contexts where women are valued for their reproductive ability. Counsellors and religious

leaders should acknowledge the pressures. Access to fistula repair surgery can restore reproductive function to most women with fistula. Adoption can be an option for others. Girls and women who develop fistula with their first pregnancy and birth may be particularly in need of counselling and social support.

The predictive value of women's age at fistula development reflects complicated interplay among multiple factors. Adolescents are more likely than older women to develop severe, complicated fistula and two types of incontinence, whether due to an underdeveloped pelvis or to the unique challenges of prolonged, obstructed labour at first pregnancy. Surgery for complex fistulas is difficult, and poorer surgical outcomes translate to a higher need for repeat repair attempts. These factors help explain the situation seen among adolescents as compared with women in their 20s and early 30s. Fistula attributable to surgical error accounts for a share of fistulas following childbirth, and such iatrogenic fistulas are more common at higher parities.[20] Although women with iatrogenic fistula may have earlier access to treatment, their greater likelihood of remaining married does not make up for the overall observed decline in remaining married over age 35. It is possible that men's perceived value for women declines with women's age, particularly for childless women whose remaining reproductive years are numbered.

This large, multicountry retrospective review has limitations. People remain married for a host of diverse reasons, many of them unknowable. It is likely that some women separated from their husbands for reasons unrelated to their fistulas. We did not collect explicit data on why couples were together or apart.

Women provided self-reported data on their living situations. We did not document their partners' perspectives. In many cases, years passed between when women gave birth and when they presented for fistula repair surgery. Women's recollections of childbirth may differ from how providers

diagnose obstetric problems.[29] Parity at fistula development can overestimate the number of living children, given stillbirths and child deaths. Some fistulas following childbirth can be attributed to surgical error rather than prolonged, obstructed labour. Access to treatment may be more prompt in such cases,[20] which may inflate the proportion of women remaining married with fistula.

The validity of self-reported data on marital separation is unknown. Even when accurately reported, marital status may not be an accurate reflection of women's experience, particularly in polygamous unions.[23] Our modelling did not include information about whether husbands had or married additional wives after the women developed fistula.

Inherent selection bias is possible, as the sample includes only women who sought fistula treatment. Evidence is not available to determine whether the included women are representative of all women seeking fistula treatment in the nine countries. Country sample size varies by where the second author and colleagues conducted repairs. We did not follow up with the women after the time of their fistula repairs.

Conclusion

Counselling and social support significantly improve the physical and mental health of women who develop fistula.[8] Rehabilitation services must consider the unique circumstances of each woman with fistula. Psychological assessments and targeted support help to identify and respond appropriately to each woman's needs. Counselling from health professionals can also provide valuable support to significant others who may be feeling vulnerable, including husbands.[30]

Policymakers and communities play an important role in ensuring that women with fistula have the social support that they need. Awareness of the factors that affect the separation of women with fistula can inform context-specific tailoring of psychosocial approaches. When fistulas develop, health

providers must refer women for treatment as soon as possible, encouraging husbands to support their wives on the journey back to health.

Declarations

Ethics approval:

AMREF Ethics and Scientific Review Committee P88/2013

Patient consent for publication:

Not applicable

Patient and public involvement

This retrospective record review relied on deidentified data collected over 23 years of fistula repair surgeries. Patients were not involved in the design and conduct of the study or the choice of outcome measures.

Data sharing statement

Data generated and analysed during the current study are not publicly available during a period of analysis and dissemination but will be available from the corresponding author on reasonable request. No additional data are available.

Competing interests

None declared.

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Contributorship statement:

CJN and TJIPR formulated the study and wrote the paper. TJIPR collected the data. LL entered the data, with verification from TJIPR and curation by CJN. CJN analysed the data with statistical advice from DB and CB. LL, DB, and CB reviewed and edited the paper.

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Table 1. Remaining married with fistula: Associations with demographic variables

Duration of leaking (n=5903)	Women with fistula	Living with husbands	% Married with fistula
0-3 months	667	536	80.4%
4-6 months	895	632	70.6%
7-12 months	892	521	58.4%
1-2 years	771	389	50.5%
3-5 years	887	426	48.0%
6-10 years	861	418	48.5%
>10 years	930	450	48.4%
Age at fistula development (n=5903)			
11-19	2115	911	43.1%
20-24	1526	853	55.9%
25-29	958	639	66.7%
30-34	644	480	74.5%
35+	660	489	74.1%
Parity (n=5939)			
1	2892	1269	43.9%
2	780	453	58.1%
3-5	1336	927	69.4%
6+	931	746	80.1%
Fistula repair attempts (n=5937)			
0	4381	2725	62.2%
1	1051	486	46.2%
2	314	124	39.5%
3+	191	61	31.9%
Vesico-vaginal and recto-vaginal fistula (n=5942)			
One fistula type only	5493	3218	58.6%
Both types	449	179	39.9%
Wife's education (n=5885)			
None	2458	1382	56.2%
Any school attendance	3427	1981	57.8%
Husband's education (n=4831)			
None	1477	799	54.1%
Any school attendance	3354	2038	60.8%
Country (n=5942)			
Tanzania	1951	1129	57.9%
Uganda	1374	741	53.9%
Kenya	840	513	61.1%
Malawi	629	390	62.0%
Zambia	153	105	68.6%
Rwanda	396	209	52.8%
Ethiopia	97	51	52.6%
Somalia	287	142	49.5%
South Sudan	215	117	54.4%

Table 2. Logistic regression of remaining married with fistula

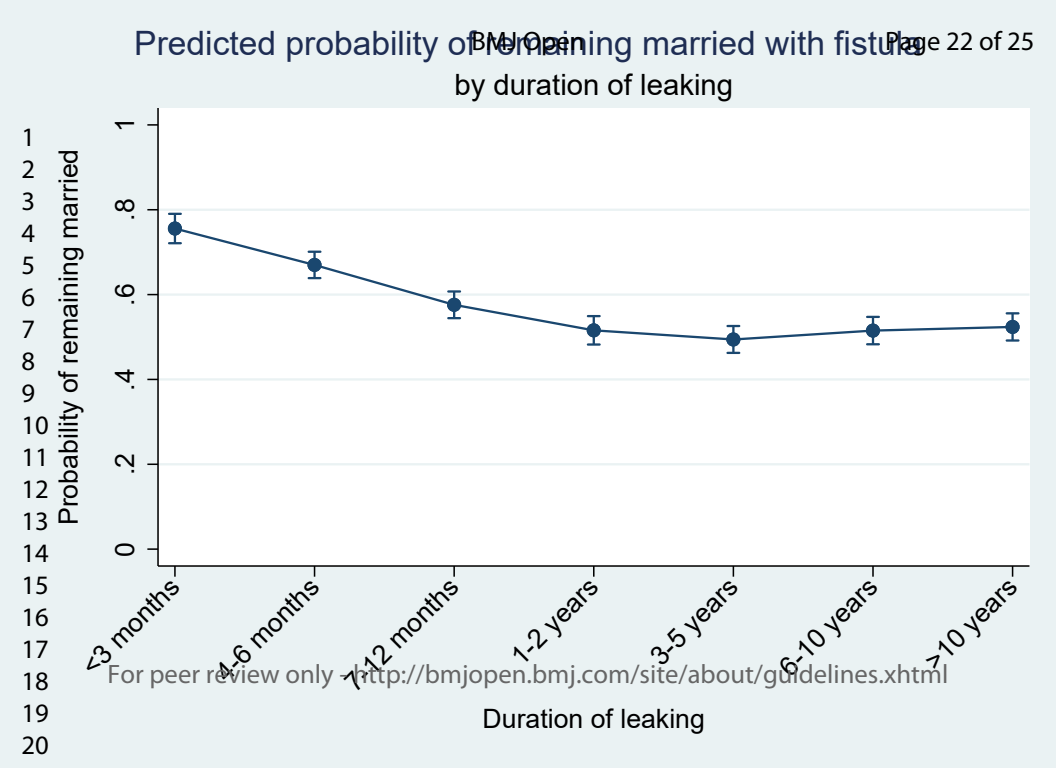
	Odds ratio	95% confidence interval	
Duration of leaking			
0-3 months	(Ref)	(Ref)	
4-6 months	0.63	0.49	0.81
7-12 months	0.41	0.32	0.52
1-2 years	0.31	0.24	0.40
3-5 years	0.28	0.22	0.36
6-10 years	0.31	0.24	0.40
>10 years	0.32	0.25	0.41
Age at fistula development			
11-19	(Ref)	(Ref)	
20-24	1.31	1.13	1.53
25-29	1.34	1.09	1.65
30-34	1.45	1.11	1.90
35+	1.05	0.79	1.41
Parity			
1	(Ref)	(Ref)	
2	1.48	1.24	1.77
3-5	2.19	1.81	2.64
6+	4.31	3.27	5.69
Fistula repair attempts			
0	(Ref)	(Ref)	
1	0.67	0.58	0.78
2	0.58	0.45	0.74
3+	0.46	0.33	0.64
Vesico-vaginal and recto-vaginal fistula			
One fistula type only	(Ref)	(Ref)	
Both types	0.63	0.51	0.78
Education			
None	(Ref)	(Ref)	
Any school attendance	1.07	0.95	1.21
Country			
Tanzania	2.03	1.60	2.58
Uganda	1.71	1.34	2.20
Kenya	2.47	1.89	3.23
Malawi	2.70	2.02	3.62
Zambia	3.41	2.23	5.19
Rwanda	2.17	1.57	3.00
Ethiopia	2.42	1.48	3.94
Somalia	1.80	1.30	2.49
South Sudan	2.54	1.78	3.62

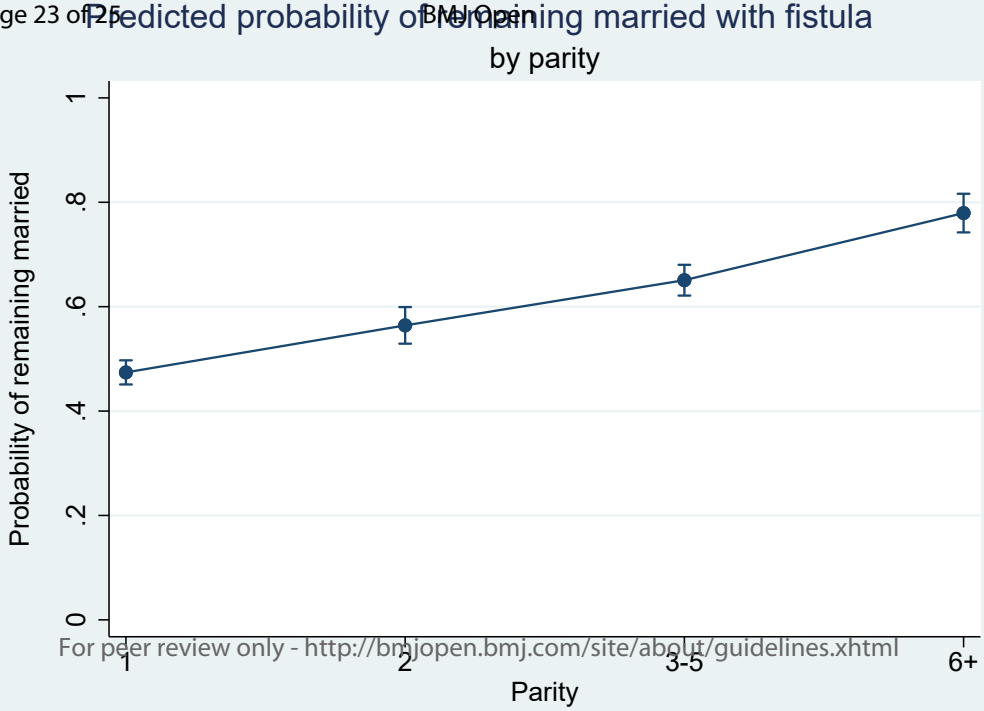
Observations used in regression = 5,842

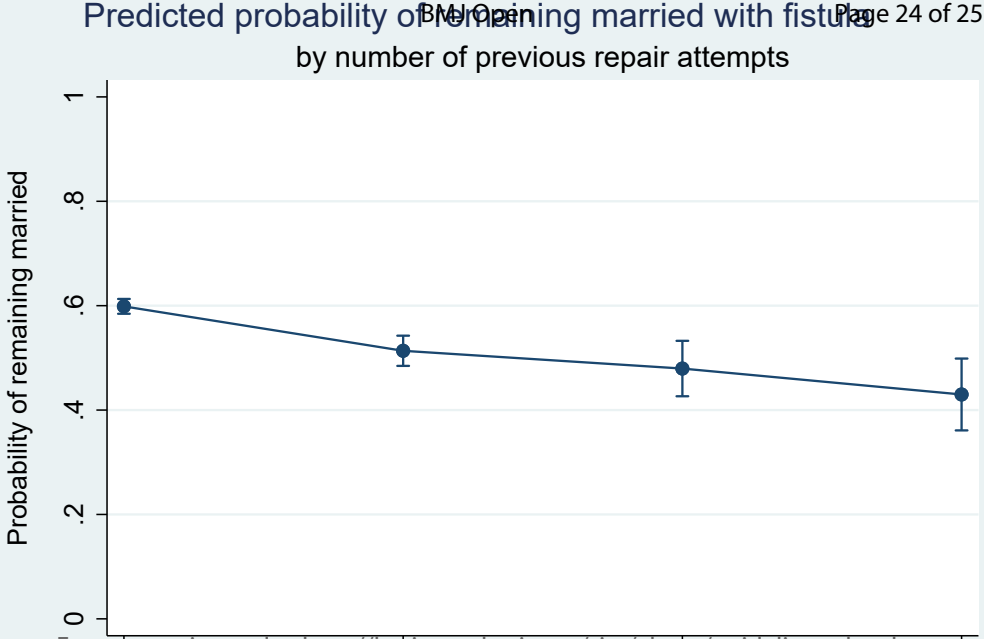
Table S1. Logistic regression of remaining married with fistula: subgroup analysis including husband's education level

	Odds ratio	95% confidence interval	
Duration of leaking			
0-3 months	(Ref)	(Ref)	
4-6 months	0.59	0.45	0.77
7-12 months	0.42	0.32	0.55
1-2 years	0.31	0.23	0.41
3-5 years	0.29	0.22	0.38
6-10 years	0.29	0.22	0.39
>10 years	0.33	0.25	0.44
Age at fistula development			
11-19	(Ref)	(Ref)	
20-24	1.30	1.10	1.53
25-29	1.36	1.08	1.72
30-34	1.39	1.03	1.86
35+	1.13	0.82	1.56
Parity			
1	(Ref)	(Ref)	
2	1.54	1.26	1.87
3-5	2.29	1.85	2.82
6+	4.28	3.16	5.79
Fistula repair attempts			
0	(Ref)	(Ref)	
1	0.63	0.54	0.75
2	0.55	0.42	0.72
3+	0.47	0.33	0.66
Vesico-vaginal and recto-vaginal fistula			
One fistula type only	(Ref)	(Ref)	
Both types	0.57	0.45	0.73
Wife's education			
None	(Ref)	(Ref)	
Any school attendance	1.02	0.89	1.17
Husband's education			
None	(Ref)	(Ref)	
Any school attendance	1.26	1.09	1.47
Country			
Tanzania	1.86	1.40	2.46
Uganda	1.65	1.23	2.22
Kenya	2.15	1.56	2.97
Malawi	2.50	1.80	3.49
Zambia	3.25	2.05	5.17
Rwanda	2.11	1.47	3.02
Ethiopia	2.51	1.48	4.27
Somalia	1.84	1.27	2.67
South Sudan	2.07	1.38	3.11

Observations used in regression = 4,791







STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*7*
Bias	9	Describe any efforts to address potential sources of bias	6; 12-13
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	6
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A

		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6, 18
		(b) Indicate number of participants with missing data for each variable of interest	18
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	18
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	18, 19, 20
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7, 20
Discussion			
Key results	18	Summarise key results with reference to study objectives	8-9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors associated with marital status of women with genital fistula after childbirth: A retrospective review in nine African countries

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Factors associated with marital status of women with genital fistula after childbirth: A retrospective review in nine African countries

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Keywords:

Obstetric fistula; marriage; separation; divorce; sub-Saharan Africa

Abstract

Objective

To examine characteristics associated with remaining married with fistula.

Design

Retrospective record review and logistic regression.

Setting

Tanzania, Uganda, Kenya, Malawi, Zambia, Rwanda, Ethiopia, Somalia, and South Sudan.

Participants

Women who developed fistula during childbirth (1975-2017) and sought treatment (1994-2017).

Outcome measure

Self-reported status of living with original husband at time of presentation for fistula repair.

Results

Over half of the women lived with their husbands at the time of fistula treatment (57.2%, 3,375/5,903). The strongest predictor of remaining married with fistula was either parity

at fistula development (AOR 1.5-4.4) or living kids at fistula repair [among women who had not given birth between fistula development and repair] (AOR 1.7-4.9). Predicted probability of remaining married declined sharply over the first two years of leaking, levelling out thereafter. Predicted probability of remaining married was lower for women with both urinary and faecal incontinence (AOR 0.68) as compared to women with urinary incontinence alone. Probability of remaining married with fistula declined over time (AOR 1.03-0.57). The woman's education was not a statistically significant predictor, but the odds of remaining married were 26% higher if the husband had any formal schooling.

Conclusion

Most husbands do not abandon wives with fistula following childbirth. Treatment, counselling, social support, and rehabilitation must consider the circumstances of each woman, engaging men as partners where appropriate. Communities and facilities offering fistula repair services should stress the importance of early intervention.

Strengths and limitations of this study

► Size and geographic breadth of data set.

► Detail of collected information.

► Retrospective observational nature of the study design.

► Reliance on self-reported data at the time of fistula repair without subsequent follow-up.

► Data not collected on explicit reasons for marriage or separation. Many possibilities are beyond the available variables.

Introduction

Genital fistula following childbirth results from prolonged, obstructed labour, injuries during caesarean section, and limited access to quality emergency obstetric care. Twentieth-century improvements in obstetric care mostly eliminated obstetric fistula in well-resourced settings. Proper monitoring of labour with timely intervention in low-resource settings could similarly eliminate fistula worldwide.[1] At present, however, fistula following childbirth remains a devastating maternal morbidity affecting women.

Genital fistula is characterised by continuous urinary and/or faecal incontinence. The chronic morbidity of fistula following childbirth is associated with long-term physical, medical, emotional, psychological, social, and economic consequences.[2,3] Associated injuries from obstructed labour may include vaginal stenosis, bladder calculi, and neurological damage. Some women with fistula develop infection and amenorrhea. The leaking of urine produces painful rashes and a bad smell.

Fistula exacerbates the vulnerability of women living in remote areas of sub-Saharan Africa. Women with fistula commonly will have lost a baby during prolonged, obstructed labor.[4] The shame, smell, and physical challenges of fistula-related incontinence constrain their daily lives. Some women with fistula may avoid public gatherings and social events.[5,6] Stigma may prevent them from cooking food, performing household chores, participating in religious rituals, or engaging in income-generating activities.[7,8] Depression is not uncommon.[9]

Some women with fistula express concern about marital discord.[10] Women with fistula may experience infertility or pain in sexual intercourse.[6,11] Women with fistula are more likely to have experienced domestic violence (56%) than women without fistula (38%).[12] Recent sexual violence is twice as common among women with fistula (16%, compared with 8% among women without fistula symptoms).[12]

Specialised surgery can restore women's anatomy and dignity. Over 95,000 obstetric fistula repairs took place globally between 2010 and 2018, for an annual average of more than 10,500 fistula repair surgeries.[13] This figure is greater than the estimated incidence of 6,000 new cases per year, but there is an estimated backlog of one million women who have fistulas in sub-Saharan Africa and South Asia.[14] A meta-analysis of national household surveys suggested that approximately 1 per 1000 women of reproductive age in sub-Saharan Africa have fistula symptoms and need access to surgery in order to regain their health and well-being.[15]

A dominant narrative is that stigmatised, incontinent women are abandoned by their husbands. Often, support for this narrative comes from interviews with women themselves[7,16] and from international organisations conveying the gravity of fistula following childbirth.[17] In contrast, a 2007 meta-analysis found that 36% (95% CI 27%-46%) of women with fistula were divorced or separated, with substantial heterogeneity across geographies and authors.[8] A report from Nigeria found that 66% of women with fistula were married to their original husbands at the time that they presented for fistula repair, while 18% were divorced, separated, or remarried.[18] A review of nearly 15,000

women with fistula in Ethiopia found that 44.6% of primiparous women with fistula were separated or divorced at admission, in contrast to 24.1% of multiparous women with fistula.[19]

Our objective with this study was to examine the factors that affect the likelihood that women remain married after developing fistula in order to inform policies and practices for fistula treatment and rehabilitation.

Methods

Data

This cross-sectional retrospective record review considers women seeking fistula repair surgery at 83 facilities between June 1994 and December 2017 in Tanzania, Uganda, Kenya, Malawi, Zambia, Rwanda, Ethiopia, Somalia, and South Sudan. Women consented to fistula repair surgery in their respective hospitals, following each hospital's counselling and informed consent process. Data were collected by the second and third authors (TR and MM) and colleagues between June 1994 and December 2017. Included women developed fistula during childbirth between 1975 and 2017. We excluded women with perineal tears from fast delivery.

Each woman was interviewed by one of the surgeons who performed her fistula repair. Surgeons recorded the women's demographic information and obstetric history on a standard form,[20] including age, country, year and mode of delivery, foetal outcome, kind and duration of incontinence, parity at fistula development, subsequent delivery

(between fistula development and fistula repair), living children at fistula repair, previous fistula repair surgeries, education, and husband's education.

Each woman reported whether she was living with her husband, living with family, living alone, living in a rehabilitation centre, remarried, never married, or widowed. We excluded 452 women who had never married and 20 records with missing data on relationship status. Women were grouped according to whether they were living with their original husbands at the time of fistula repair. Due to our focus on the issue of abandonment, widows were counted as "living with husband" if they were together at the time of the husband's death.

Data were entered into an Excel database, with names changed to unique identification numbers to protect patient privacy. Data were analysed using Stata 16. This record review conforms to the principles embodied in the Declaration of Helsinki and was approved by the African Medical and Research Foundation Ethics and Scientific Review Committee (AMREF-ESRC P88/2013).

Statistical analysis

Data exploration included descriptive statistics and bivariate comparisons using chi-squared tests. To determine the most parsimonious logistic regression model we collapsed predictor variables into different categories, relying on the Akaike information criteria (AIC) to focus on the variables that would best predict the outcome of remaining married with fistula. We tested possible interactions between duration and age at fistula

development, duration and types of fistula, and repair attempts and types of fistula. We reviewed variance inflation factor (VIF) scores to assess possible correlations between covariates. The threshold for statistical significance was $p<0.05$.

Our dichotomous outcome was whether women with fistula were living with their original husbands at the time that they presented for fistula repair, which is used synonymously with "remaining married." The logistic regression model included dichotomous variables for the woman's education level (any formal schooling compared with none), foetal outcome at the delivery leading to fistula (alive compared with stillbirth), mode of delivery (caesarean compared with vaginal). We included several categorical variables: age at fistula development (compared to age 11-19), parity at fistula development (compared to para 1), duration of leaking due to fistula (compared to 0-3 months), previous repair attempts (compared to none), leakage (compared to urinary alone), and date of fistula development (compared to 1975-1989). We preferred a categorical approach to the date of fistula development to facilitate interpretation and avoid assuming that the rate of change was consistent over time. We applied factor-variable operators to the country as a categorical variable without a base.

Logistic regression of the subgroup of women whose records included information about their husband's education included all of the above variables and a dichotomous variable for husband's education (any formal schooling compared with none).

Our initial analysis included parity at fistula development, as parity is routinely collected and is an indicator unaffected by the births that occur between fistula development and fistula repair. Recognizing that living children at fistula repair could also be a predictor of interest, we conducted a subgroup analysis using "living children at fistula repair" in place of "parity at fistula development." This regression excludes the 673 women who gave birth between fistula development and fistula repair, as we hypothesised that women who remained with their husbands would be more likely to give birth with fistula.

We used the Stata *marginsplot* command to graph statistics from our model, with a specific focus on the predicted probabilities associated with parity, year, duration of leaking, and previous repair attempts.

Patient and public involvement

This retrospective record review relied on de-identified data collected over 23 years of fistula repair surgeries. Patients were not involved in the design and conduct of the study or the choice of outcome measures.

Role of the funding source

RTI International provided support to cover labour of the first author (CN) on this analysis and writing. RTI International was not involved in the collection or interpretation of the data.

Results

More than half of the 5,903 women with fistula following childbirth were living with their husbands at the time they sought treatment (57.2%, 3,375/5,903), with statistically significant geographic variation (Table 1). Separated women included 1,202 who were living with family at the time of repair (20.4%), 1,161 who were living alone (19.7%), and 165 who remarried (2.8%).

Women who developed fistula at higher parities were likely to remain with their husbands. Just over 80% of women with parity of six or more at fistula development remained married with fistula (80.1%, 732/909), compared to 43.9% of women who developed fistula at their first pregnancy (1,271/2,894). The modelled adjusted odds of remaining married with fistula rose 45% at para 2 (95% CI 1.21-1.74), 118% at para 3-5 (95% CI 1.80-2.65), and 336% at para 6 or more (95% CI 3.28-5.79, Table 2, Figure 1). The modelled adjusted odds of remaining married with fistula were 41% higher for women who gave birth to a live baby at the time of fistula development as compared to those who had a stillbirth (95% CI 1.20-1.65).

Giving birth between fistula development and fistula repair was not uncommon: 12.1% (407/3,375) of women living with husbands reported a subsequent birth, and 10.5% (266/2,528) of separated women reported a subsequent birth (Table S1). A subgroup analysis excluding these women revealed that the number of living children at the time of presentation for fistula repair predicted the likelihood of remaining married with fistula even more strongly than parity (Table S2, Figure S1).

Duration of leaking strongly predicted whether a woman would remain married with fistula (Table 2). We found a sharp decline in women with fistula living with their husbands over the first two years of leaking. As shown in Figure 2, the predicted probability of remaining married with fistula declined by >20 percentage points within three months. It declined by another ~20 percentage points by the end of the first year, and a further ~10 percentage points by the second year after fistula development. The predicted probability of remaining married with fistula levelled out thereafter, such that roughly half of women remained married with fistula, irrespective of how much longer than two years they had been leaking.

Previous unsuccessful repair attempts decreased the adjusted odds of remaining married with fistula as follows: by 31% for the first attempt (95% CI 0.60-0.81), by 38% for the second attempt (95% CI 0.48-0.81), and by 52% for three or more repair attempts (95% CI 0.34-0.67, Figure 3). In comparison to urinary incontinence alone, the modelled adjusted odds of remaining married with fistula were 32% lower for women leaking both urine and faeces (95% CI 0.55-0.84).

Women who developed fistula in their 20s or early 30s were more likely to remain married than those who developed fistula as adolescents (age 11-19) (AOR 1.32-1.43, 95% CI 1.07-1.87), although age at fistula development was not as strongly predictive as other variables. The modelled adjusted odds of remaining married with fistula declined over the study period, particularly after the year 2000 (Figure 4).

The modelled adjusted odds of remaining married with fistula were marginally higher for women who had given birth by caesarean section (as compared to vaginal birth) and for women with faecal incontinence only (as compared with urinary incontinence), but these findings were not statistically significant (Table 2). The adjusted odds for caesarean section did achieve statistical significance in the alternate model using living children at the time of fistula repair, however. (Table S2).

Women's education levels were low: 41.4% of the women had never attended school, while 57.7% had attended at least some primary school (Table 1). We did not find a relationship between any formal schooling and remaining married with fistula. Although it proved not to be statistically significant, we kept the woman's education variable in the model because it helps to explain the variance in the data.

A subgroup analysis of the 4,800 women whose records included information about their husband's education level revealed that, in contrast to the statistically non-significant effect of the woman's education level, a husband's experience of any formal schooling increased the adjusted odds of continued marriage despite fistula (by 26%, 95% CI 1.08-1.47; Table S3).

Discussion

Fistula rightly inspires advocacy: It is alarming that women continue to endure prolonged labours and childbirth injuries in situations that were essentially eliminated in

well-resourced settings more than a century ago. To capture this inequality, advocates may be tempted to focus on the most dramatic patient stories.[21] Vivid examples of abandonment create generalisations about women with fistula, masking the variability of women's experiences. There is a danger of telling a single story about the abandonment of women with fistula after childbirth.[22] The true picture is more nuanced.

At times the single story about abandonment reflects a lack of scientific evidence, which has long been an issue.[23] But the allure may also persist in the face of contrary data. One meta-analysis of 14 publications between 1985 and 2005 reported that 36% (95% CI 27%-46%) of women with fistula were divorced or separated, yet it concluded that women with fistula "are usually deserted by their husbands."[8]

While some husbands separate from wives with fistula after childbirth, they are not the majority in our dataset. Consistent with other reports,[18,19] this large and geographically varied dataset presents an opportunity to explore the diversity of women's experiences.

Parity and living children most strongly predict whether a woman will remain married with fistula. Health providers may use parity as a proxy to identify those at particular risk. Parity at fistula development can overestimate the number of living children, however, given stillbirths and child deaths. Our analysis demonstrates that the number of living children may be a better indicator. Despite documented challenges with

amenorrhea, dyspareunia, and infertility in women with fistula,[6,10,11] over 10% of women with fistula in our dataset gave birth between fistula development and presentation for fistula repair, irrespective of whether they were living with their husbands. The group that remained married had a greater likelihood of subsequent birth than those who separated, but with only marginal statistical significance. To avoid skewing the analysis, we excluded women with subsequent births from our models when we substituted the number of living children for parity.

Childlessness has been identified as an important factor in marital breakdown, including among women with fistula.[18,24] It is a particular challenge in contexts where women are valued for their reproductive ability. Counsellors and religious leaders should acknowledge the pressures. Access to fistula repair surgery can restore reproductive function to most women with fistula. Adoption can be an option for others. Girls and women who develop fistula with their first pregnancy and birth may be particularly in need of counselling and social support.

Women with fistula following childbirth are less likely to have their husband's support as time goes on, but the association is not a simple straight line. If abandonment is to happen, in this dataset it typically occurs in a woman's first two years with fistula. The connection between marital separation and duration of leaking was first documented in the early 1980s in northern Nigeria, where the share of women with fistula who remained with their husbands was 42% of new fistula patients and 11% of women with

long-term fistula (>2 years).[24] Our modelling indicates that husbands who stay with their wives through two years of incontinence are likely to remain married.

Historically, obstetric fistula surgeons were advised to wait three months for tissues to recover before surgery.[25] This often-repeated position has been challenged by the success of immediate catheterisation and surgical repair of fresh fistulas.[26] Beyond clinical considerations, early intervention clearly helps women to avoid the social consequences of living with fistula, including stigma and marital separation. Communities and facilities that offer fistula repair services should stress the importance of early intervention.

Women's educational attainment is often celebrated for its positive associations with nutrition, healthcare access, delayed marriage, and contraceptive use.[27] Women's education was found to be protective of marriage among women with fistula in Nigeria.[18] Yet the better educated women in this study did not have statistically significantly better odds of remaining married with obstetric fistula. Rather, it was the husband's exposure to any formal schooling that was positively associated with remaining married through the ordeal of fistula following childbirth. The school experience may not have included tacit instruction about the curability of obstetric fistula, but perhaps it enhanced men's compassion for others, familiarity with gender issues, and ability to understand fistula and its effects, thereby leading to a greater ability to navigate challenges and stand against negative cultural pressures.

The predictive value of women's age at fistula development reflects complicated interplay among multiple factors. Adolescents are more likely than older women to develop severe, complicated fistula and leaking of both urine and faeces, whether due to an underdeveloped pelvis or to the unique challenges of prolonged, obstructed labour at first pregnancy. Surgery for complex fistulas is difficult, and poorer surgical outcomes translate to a higher need for repeat repair attempts. These factors may help explain the situation seen among adolescents as compared with women in their 20s.

This dataset includes only women with fistula following childbirth, unlike those who combine fistulas of diverse aetiologies.[18] Fistula attributable to surgical error accounts for a share of fistulas following childbirth, and such accidental fistulas are more common at higher parities.[20] Although women with accidental fistula may have earlier access to treatment, their greater likelihood of remaining married does not make up for the overall observed decline in remaining married over age 35. It is possible that men's perceived value for women declines with women's age, particularly for childless women whose remaining reproductive years are numbered.

In this dataset separation has become more common over time, particularly since 2000. It is possible that this trend reflects increasing acceptability of separation and divorce at population level, although others have estimated that divorce rates across sub-Saharan Africa have remained stable over the past 20 years.[28] It is difficult to judge in the absence of reliable data from civil registration systems. It would seem, however, that marriage rates for women with fistula have declined despite increases in public

awareness about fistula. We recognize significant geographical variation when holding all other variables constant (Figure S2).

This large, multicountry retrospective review has limitations. People remain married for a host of diverse reasons, many of them unknowable. It is likely that some women separated from their husbands for reasons unrelated to their fistulas. We did not collect explicit data on why couples were together or apart.

Women provided self-reported data on their living situations. We did not document their partners' perspectives. In many cases, years passed between when women gave birth and when they presented for fistula repair surgery. Women's recollections of childbirth may differ from how providers diagnose obstetric problems.[29] Some fistulas following childbirth can be attributed to surgical error rather than prolonged, obstructed labour. Access to treatment may be more prompt in such cases,[20] which may inflate the proportion of women remaining married with fistula.

The validity of self-reported data on marital separation is unknown. We cannot comment on whether women would have had a different comfort level disclosing personal information about their living situation to non-surgeon interviewers. Even when accurately reported, marital status may not be an accurate reflection of women's experience, particularly in polygamous unions.[23] Our modelling did not include information about whether husbands had or married additional wives after the women developed fistula.

Inherent selection bias is possible, as the sample includes only women who sought fistula treatment. Evidence is not available to determine whether the included women are representative of all women seeking fistula treatment in the nine countries. Country sample size varies by where the second author and colleagues conducted repairs. We did not follow up with the women after the time of their fistula repairs. Finally, retrospective reviews cannot determine causation in their documentation of variable relationships. Future prospective studies could help to confirm the identified correlations.

Conclusion

Counselling and social support significantly improve the physical and mental health of women who develop fistula.[8] Rehabilitation services must consider the unique circumstances of each woman with fistula. Psychological assessments and targeted support help to identify and respond appropriately to each woman's needs. Counselling from health professionals can also provide valuable support to significant others who may be feeling vulnerable, including husbands.[30] Information about the availability of fistula treatment must target men as well as women. Where appropriate, facilities offering fistula repair should seek to engage men as partners, enabling women's rehabilitation and reintegration after fistula surgery.

Policymakers and communities play an important role in ensuring that women with fistula have the social support that they need. Awareness of the factors that affect the

separation of women with fistula can inform context-specific tailoring of psychosocial approaches. When fistulas develop, health providers must refer women for treatment as soon as possible, encouraging husbands to support their wives on the journey back to health.

Declarations

Ethics approval:

AMREF Ethics and Scientific Review Committee P88/2013

Patient consent for publication:

Not applicable

Patient and public involvement

This retrospective record review relied on de-identified data collected over 23 years of fistula repair surgeries. Patients were not involved in the design and conduct of the study or the choice of outcome measures.

Data sharing statement

Data generated and analysed during the current study are not publicly available during a period of analysis and dissemination but will be available from the corresponding author on reasonable request. No additional data are available.

Competing interests

None declared.

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Contributorship statement:

CJN and TJIPR formulated the study and wrote the paper. TJIPR and MM collected the data. LL entered the data, with verification from TJIPR and curation by CJN. CJN analysed the data with statistical advice from DB and CB. LL, MM, DB, and CB reviewed and edited the paper.

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Figure captions

1. Predicted probability of remaining married with fistula, by parity
2. Predicted probability of remaining married with fistula, by duration of leaking
3. Predicted probability of remaining married with fistula, by number of previous repair attempts
4. Predicted probability of remaining married with fistula, by date of fistula development

S1. Predicted probability of remaining married with fistula, by living children at fistula repair

S2. Predicted probability of remaining married with fistula, by country

Table captions

1. Comparison of fistula patient characteristics by marriage status
2. Logistic regression of remaining married with fistula

S1. Association between marital status and subsequent birth between fistula development and repair

S2. Logistic regression of remaining married with fistula: subgroup analysis including living children at time of repair

S3. Logistic regression of remaining married with fistula: subgroup analysis including husband's education level

Table 1. Comparison of fistula patient characteristics by marriage status

Characteristic	Separated group (n=2528)		Married group (n=3375)		Total (n=5903)	
Age at fistula development (n=5865)						
11-19	1201	47.8%	910	27.2%	2111	36.0%
20-24	671	26.7%	848	25.3%	1519	25.9%
25-29	317	12.6%	637	19.0%	954	16.3%
30-34	162	6.4%	476	14.2%	638	10.9%
35+	164	6.5%	478	14.3%	642	10.9%
Parity at fistula development (n=5903)						
1	1623	64.2%	1271	37.7%	2894	49.0%
2	325	12.9%	452	13.4%	777	13.2%
3-5	403	15.9%	920	27.3%	1323	22.4%
6+	177	7.0%	732	21.7%	909	15.4%
Mode of delivery (n=5903)						
Vaginal	1353	53.5%	1471	43.6%	2824	47.8%
Cesarean	1175	46.5%	1904	56.4%	3079	52.2%
Foetal outcome at delivery leading to fistula (n=5896)						
Stillbirth	2212	87.6%	2667	79.1%	4879	82.8%
Alive	312	12.4%	705	20.9%	1017	17.2%
Living children at time of presentation for repair (n=5897)						
0	1633	64.7%	1148	34.0%	2781	47.2%
1	391	15.5%	607	18.0%	998	16.9%
2	206	8.2%	461	13.7%	667	11.3%
3	117	4.6%	358	10.6%	475	8.1%
4+	178	7.0%	798	23.7%	976	16.6%
Duration of leaking (n=5865)						
0-3 months	131	5.2%	533	15.9%	664	11.3%
4-6 months	262	10.4%	630	18.8%	892	15.2%
7-12 months	370	14.7%	516	15.4%	886	15.1%
1-2 years	382	15.2%	385	11.5%	767	13.1%

3-5 years	459	18.3%	422	12.6%	881	15.0%
6-10 years	439	17.5%	416	12.4%	855	14.6%
>10 years	472	18.8%	448	13.4%	920	15.7%
Fistula repair attempts prior to presentation (n=5899)						
0	1641	65.0%	2704	80.1%	4345	73.7%
1	564	22.3%	483	14.3%	1047	17.7%
2	190	7.5%	126	3.7%	316	5.4%
3+	130	5.1%	61	1.8%	191	3.2%
Leakage (n=5903)						
Urine	2239	88.6%	3163	93.7%	5402	91.6%
Feces	10	0.8%	24	1.0%	34	0.9%
Urine and feces	279	11.0%	188	5.6%	467	7.9%
Woman's education (n=5849)						
None	1069	42.7%	1376	41.2%	2445	41.4%
Any school attendance	1437	57.3%	1967	58.8%	3404	57.7%
Husband's education (n=4800)						
None	673	34.0%	793	28.1%	1466	24.9%
Any school attendance	1308	66.0%	2026	71.9%	3334	56.5%
Country (n=5903)						
Tanzania	820	32.4%	1120	33.2%	1940	32.9%
Uganda	630	24.9%	739	21.9%	1369	23.2%
Kenya	322	12.7%	512	15.2%	834	14.1%
Malawi	235	9.3%	384	11.4%	619	10.5%
Zambia	48	1.9%	105	3.1%	153	2.6%
Rwanda	186	7.4%	205	6.1%	391	6.6%
Ethiopia	46	1.8%	51	1.5%	97	1.6%
Somalia	143	5.7%	144	4.3%	287	4.9%
South Sudan	98	3.9%	115	3.4%	213	3.6%
Date of fistula development (n=5897)						
1975-1989	220	8.7%	209	6.2%	429	7.3%
1990-1994	262	10.4%	267	7.9%	529	9.0%
1995-1999	488	19.3%	649	19.3%	1137	19.3%

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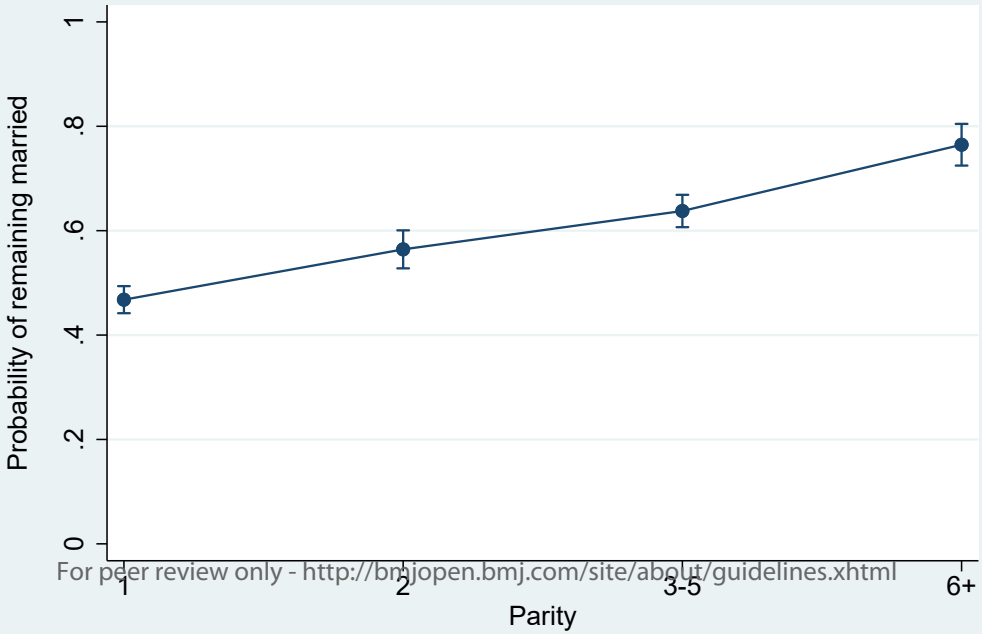
2000-2004	721	28.5%	984	29.2%	1705	28.9%
2005-2009	505	20.0%	690	20.5%	1195	20.3%
2010-2014	286	11.3%	490	14.5%	776	13.2%
2015-2017	46	1.8%	80	2.4%	126	2.1%

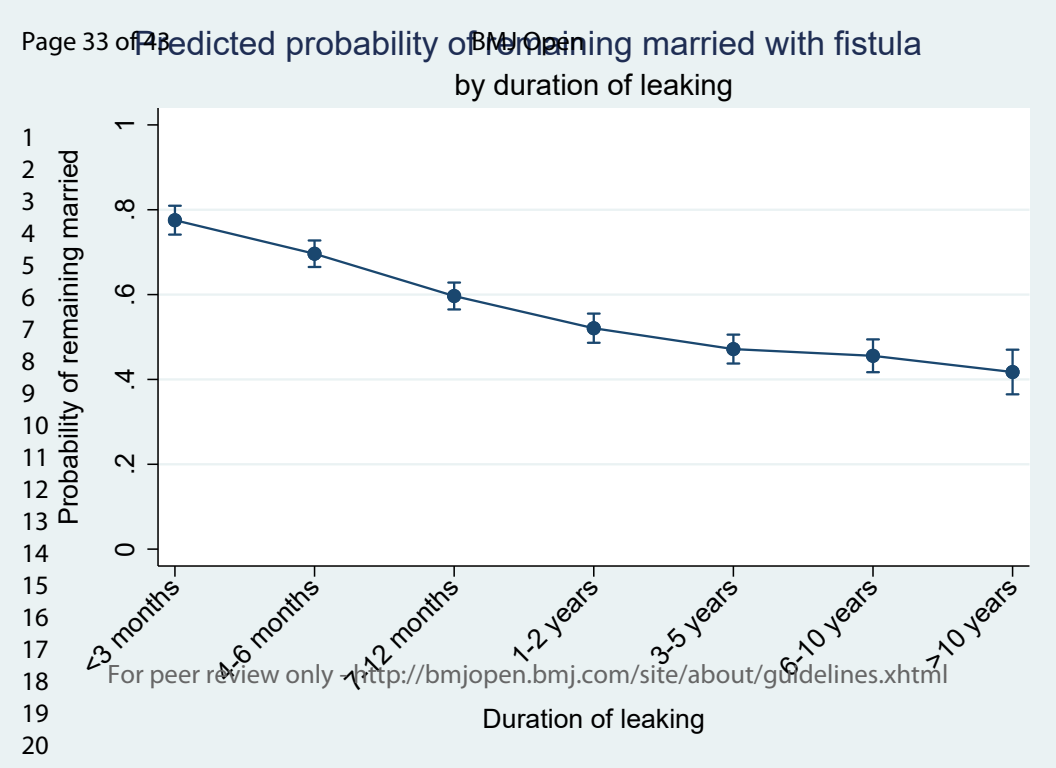
Table 2. Logistic regression of remaining married with fistula

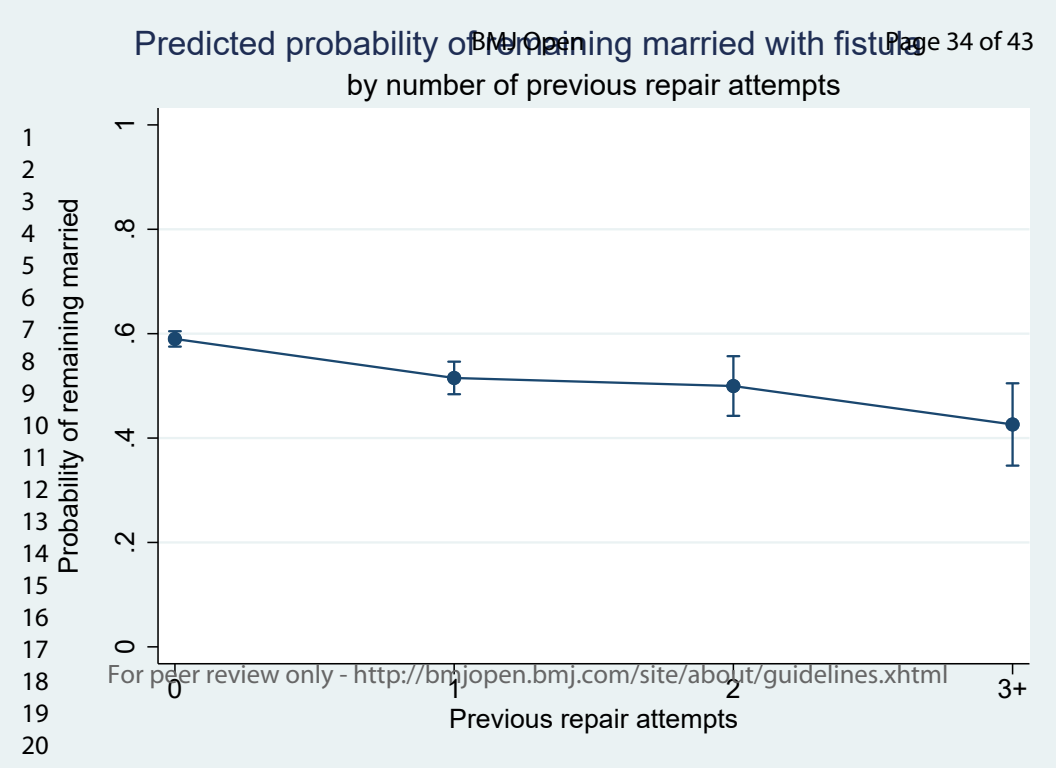
	Odds ratio	95% confidence interval	
Age at fistula development			
11-19	(Ref)	(Ref)	
20-24	1.30	1.12	1.51
25-29	1.32	1.07	1.62
30-34	1.43	1.09	1.87
35+	1.06	0.79	1.43
Parity			
1	(Ref)	(Ref)	
2	1.45	1.21	1.74
3-5	2.18	1.80	2.65
6+	4.36	3.28	5.79
Mode of delivery			
Vaginal	(Ref)	(Ref)	
Cesarean	1.04	0.93	1.18
Fetal outcome at delivery leading to fistula			
Stillbirth	(Ref)	(Ref)	
Alive	1.41	1.20	1.65
Duration of leaking			
0-3 months	(Ref)	(Ref)	
4-6 months	0.63	0.49	0.81
7-12 months	0.39	0.30	0.50
1-2 years	0.29	0.22	0.37
3-5 years	0.25	0.19	0.32
6-10 years	0.25	0.19	0.33
>10 years	0.23	0.17	0.32
Fistula repair attempts prior to presentation			
0	(Ref)	(Ref)	

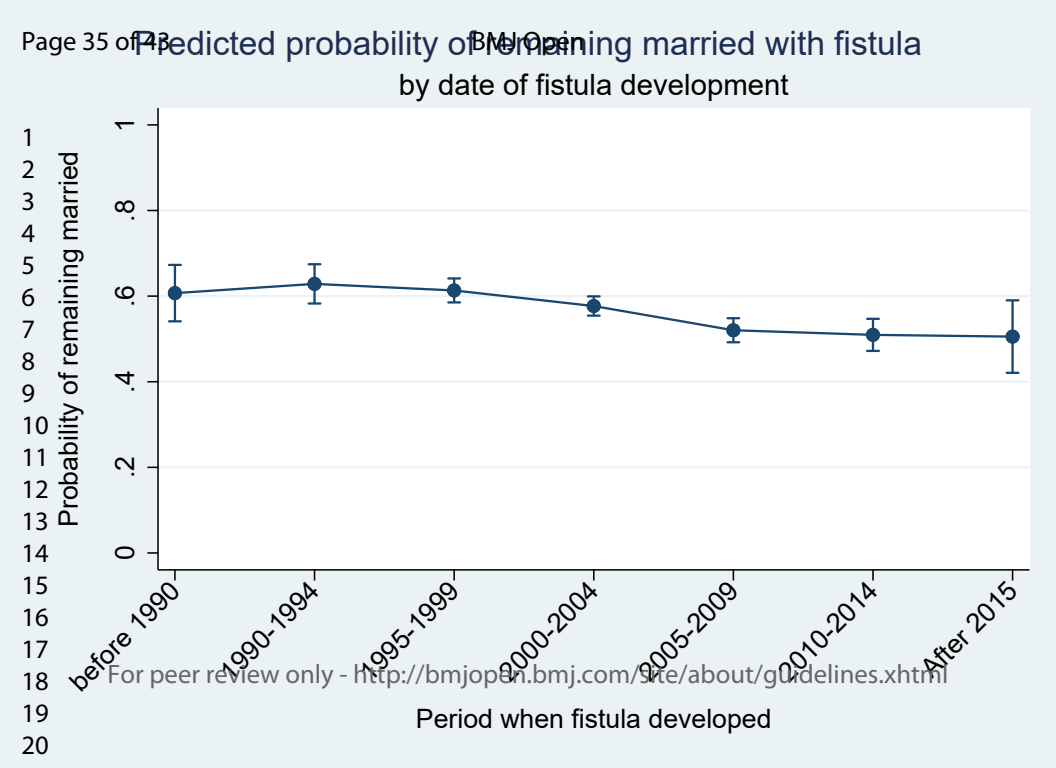
1	0.69	0.60	0.81
2	0.62	0.48	0.81
3+	0.48	0.34	0.67
Leakage			
Urine	(Ref)	(Ref)	
Feces	1.90	0.87	4.15
Urine and feces	0.68	0.55	0.84
Education			
None	(Ref)	(Ref)	
Any school attendance	1.07	0.95	1.21
Country			
Tanzania	2.61	1.77	3.85
Uganda	2.15	1.45	3.19
Kenya	2.89	1.95	4.29
Malawi	4.08	2.56	6.51
Zambia	5.20	2.96	9.15
Rwanda	2.95	1.83	4.75
Ethiopia	3.66	2.01	6.66
Somalia	2.49	1.57	3.96
South Sudan	3.51	2.15	5.73
Date of fistula development			
1975-1989	(Ref)	(Ref)	
1990-1994	1.03	0.76	1.39
1995-1999	0.98	0.73	1.32
2000-2004	0.81	0.59	1.10
2005-2009	0.64	0.46	0.89
2010-2014	0.60	0.41	0.86
2015-2017	0.57	0.34	0.97

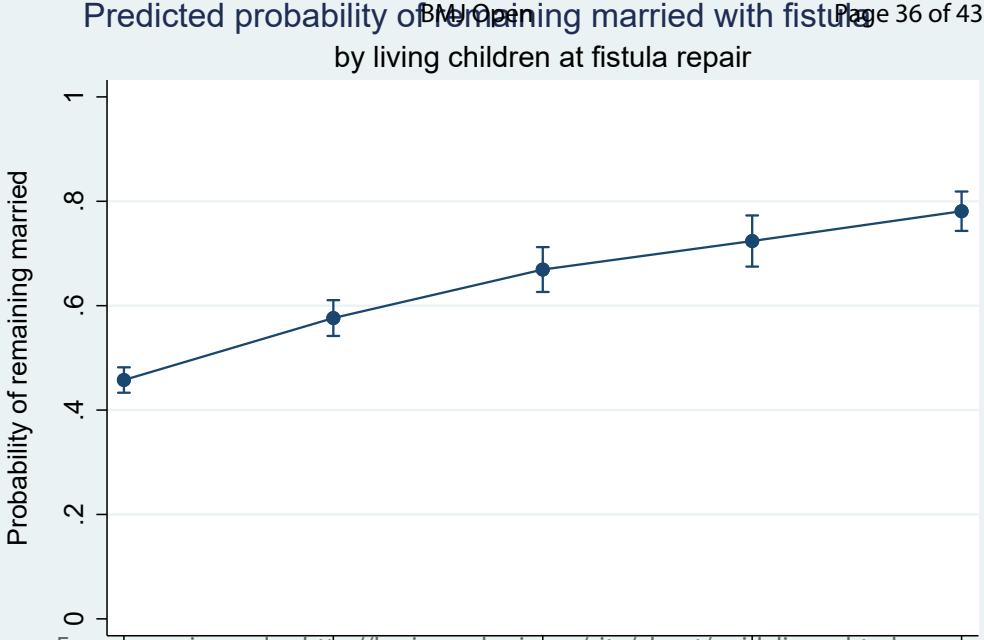
Observations used in regression = 5,803











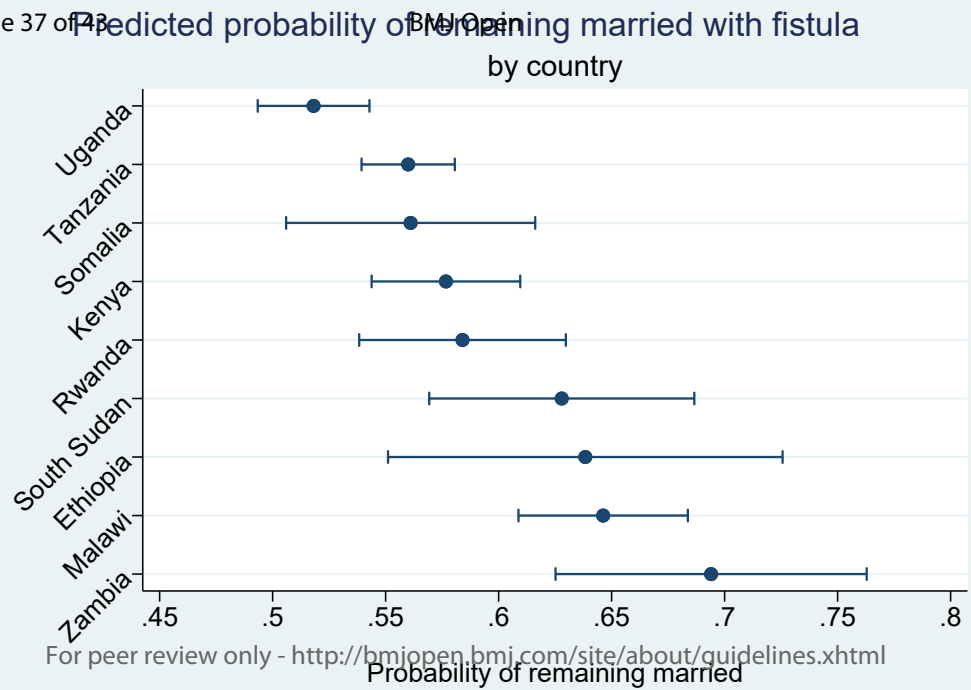


Table S1. Association between marital status and subsequent birth between fistula development and repair

	Separated	Married	Total
No subsequent birth between fistula development and repair	2,262 89.5%	2,698 86.9%	4,960 88.1%
Subsequent birth between fistula development and repair	266 10.5%	407 13.1%	673 11.9%
Total	2,528	3,105	5,633

Table S2. Logistic regression of remaining married with fistula: subgroup analysis including living children at time of repair

	Odds ratio	95% confidence interval	
Age at fistula development			
11-19	(Ref)	(Ref)	
20-24	1.38	1.17	1.62
25-29	1.42	1.14	1.77
30-34	1.56	1.18	2.06
35+	1.17	0.86	1.59
Living children at time of fistula repair			
0	(Ref)	(Ref)	
1	1.70	1.41	2.05
2	2.63	2.05	3.38
3	3.49	2.57	4.73
4+	4.86	3.64	6.49
Mode of delivery			
Vaginal	(Ref)	(Ref)	
Cesarean	1.18	1.04	1.35
Fetal outcome at delivery leading to fistula			
Stillbirth	(Ref)	(Ref)	
Alive	1.16	0.97	1.38
Duration of leaking			
0-3 months	(Ref)	(Ref)	
4-6 months	0.64	0.50	0.83
7-12 months	0.39	0.31	0.50
1-2 years	0.27	0.21	0.36
3-5 years	0.22	0.17	0.29
6-10 years	0.21	0.15	0.28
>10 years	0.17	0.12	0.25
Fistula repair attempts prior to presentation			
0	(Ref)	(Ref)	
1	0.72	0.61	0.86
2	0.65	0.48	0.86
3+	0.46	0.31	0.68
Leakage			
Urine	(Ref)	(Ref)	
Feces	1.12	0.46	2.74
Urine and feces	0.76	0.60	0.94
Education			
None	(Ref)	(Ref)	

Any school attendance	1.03	0.90	1.17
Country			
Tanzania	2.16	1.39	3.37
Uganda	1.76	1.12	2.76
Kenya	2.42	1.55	3.78
Malawi	3.39	2.00	5.74
Zambia	4.92	2.57	9.43
Rwanda	2.44	1.41	4.23
Ethiopia	2.95	1.53	5.68
Somalia	2.18	1.30	3.66
South Sudan	2.98	1.72	5.15
Date of fistula development			
1975-1989	(Ref)	(Ref)	
1990-1994	1.14	0.79	1.63
1995-1999	1.06	0.74	1.52
2000-2004	0.88	0.61	1.28
2005-2009	0.65	0.44	0.97
2010-2014	0.62	0.40	0.94
2015-2017	0.61	0.34	1.09

Observations used in regression = 5,143

Table S3. Logistic regression of remaining married with fistula: subgroup analysis including husband's education level

	Odds ratio	95% confidence interval	
Age at fistula development			
11-19	(Ref)	(Ref)	
20-24	1.28	1.09	1.52
25-29	1.33	1.06	1.68
30-34	1.35	1.01	1.83
35+	1.13	0.81	1.57
Parity			
1	(Ref)	(Ref)	
2	1.49	1.22	1.82
3-5	2.27	1.83	2.80
6+	4.33	3.17	5.90
Mode of delivery			
Vaginal	(Ref)	(Ref)	
Cesarean	1.05	0.92	1.20
Fetal outcome at delivery leading to fistula			
Stillbirth	(Ref)	(Ref)	
Alive	1.39	1.17	1.66
Duration of leaking			
0-3 months	(Ref)	(Ref)	
4-6 months	0.60	0.45	0.79
7-12 months	0.41	0.31	0.54
1-2 years	0.29	0.22	0.39
3-5 years	0.26	0.19	0.35
6-10 years	0.25	0.18	0.33
>10 years	0.26	0.18	0.38
Fistula repair attempts prior to presentation			
0	(Ref)	(Ref)	
1	0.65	0.55	0.78
2	0.59	0.45	0.78
3+	0.49	0.34	0.69
Leakage			
Urine	(Ref)	(Ref)	
Feces	1.94	0.78	4.82
Urine and feces	0.62	0.49	0.79
Education			
None	(Ref)	(Ref)	
Any school attendance	1.02	0.89	1.18
Husband's education			
None	(Ref)	(Ref)	

Any school attendance	1.26	1.08	1.47
Country			
Tanzania	2.14	1.35	3.38
Uganda	1.87	1.17	2.99
Kenya	2.39	1.47	3.86
Malawi	3.28	1.90	5.64
Zambia	4.33	2.29	8.19
Rwanda	2.50	1.45	4.30
Ethiopia	3.33	1.71	6.47
Somalia	2.26	1.32	3.87
South Sudan	2.61	1.47	4.62
Date of fistula development			
1975-1989	(Ref)		(Ref)
1990-1994	1.08	0.76	1.52
1995-1999	1.05	0.74	1.48
2000-2004	0.93	0.65	1.34
2005-2009	0.73	0.49	1.08
2010-2014	0.68	0.45	1.05
2015-2017	0.61	0.34	1.10

Observations used in regression = 4,758

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*7*
Bias	9	Describe any efforts to address potential sources of bias	6; 12-13
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	6
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A

		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6, 18
		(b) Indicate number of participants with missing data for each variable of interest	18
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	18
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	18, 19, 20
		(*b*) Report category boundaries when continuous variables were categorized	7
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7, 20
Discussion			
Key results	18	Summarise key results with reference to study objectives	8-9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	12-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.