

BMJ Open Is there a relationship between female genital mutilation/cutting and fistula? A statistical analysis using cross-sectional data from Demographic and Health Surveys in 10 sub-Saharan Africa countries

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ABSTRACT

Objectives Literature on associations between female genital mutilation/cutting (FGM/C) and fistula points to a common belief that FGM/C predisposes women to developing fistula. This study explores this association using nationally representative survey data.

Design A secondary statistical analysis of cross-sectional data from Demographic and Health Surveys was conducted to explore the association between FGM/C and fistula.

Setting Sub-Saharan Africa.

Participants Women aged 15–49 years in Burkina Faso (n=17 087), Chad (n=17 719), Côte d'Ivoire (n=10 060), Ethiopia (n=14 070), Guinea (n=9142), Kenya (n=31 079), Mali (n=10 424), Nigeria (n=33 385), Senegal (n=15 688) and Sierra Leone (n=16 658).

Main outcome measures Fistula symptoms.

Results Multivariate logit modelling using pooled data from 10 countries showed that the odds of reporting fistula symptoms were 1.5 times (CI 1.06 to 2.21) higher for women whose genitals were cut and sewn closed than those who had undergone other types of FGM/C. Women who attended antenatal care (ANC) (adjusted odds ratio (AOR) 0.51, CI 0.36 to 0.71) and those who lived in urban areas (AOR 0.62, CI 0.44 to 0.89) were less likely to report fistula symptoms than those who did not attend ANC or lived in rural areas.

Conclusions Severe forms of FGM/C (infibulation) may predispose women to fistula. Contextual and socioeconomic factors may increase the likelihood of fistula. Multisectoral interventions that concurrently address harmful traditional practices such as FGM/C and other contextual factors that drive the occurrence of fistula are warranted. Promotion of ANC utilisation could be a starting point in the prevention of fistulas.

INTRODUCTION

The WHO defines female genital mutilation/cutting (FGM/C) as all procedures that involve partial or total removal of external female genitalia, or any form of injury to

Strengths and limitations of this study

- The study used nationally representative samples from 10 African countries to investigate associations between female genital mutilation/cutting (FGM/C) and fistula.
- Demographic and Health Survey data is inherently hierarchical rendering itself suitable for investigating associations between FGM/C and fistula while considering other contextual and socioeconomic correlates.
- Questions asked during surveys about sensitive events such as fistula and FGM/C are not as accurate as the gold standard of a gynaecological examination.
- Due to sample size limitations, this study was not able to run country specific multivariate logistic regression analyses for all the 10 countries. Multivariate logistic regression was nonetheless conducted on a pooled dataset for the 10 countries.
- This study analyses self-report data that is subject to recall bias.

female genital organs for non-medical reasons.¹ The practice of FGM/C is categorised into four types: type I—total or partial removal of the clitoris and/or the prepuce (clitoridectomy), type II—total or partial removal of the clitoris and labia minora with or without excision of the labia majora (excision), type III—narrowing of the external genitalia and stitching together the edges of the vulva (infibulation) and type IV—any kind of non-therapeutic procedures to the female genitalia including pricking, piercing, incising, scraping and cauterisation.²

The practice of FGM/C is globally recognised as a human rights violation because of its negative impact on women's health. It violates the UN Convention on

the Elimination of all forms of Discrimination Against Women, UN Convention on the Rights of the Child and the Universal Declaration of Human Rights.^{3–5} In recognition of the negative effects of FGM/C, the WHO has published clinical guidelines on managing complications resulting from FGM/C and strategies to stop healthcare providers from performing FGM/C.^{6,7} Immediate consequences of FGM/C to the health and well-being of girls and women include severe pain, excessive bleeding, urine retention and genital tissue swelling.^{2,8–10} Documented long-term effects of FGM/C range from urinary tract infections to obstetric complications such as perineal tearing and obstructed/prolonged labour to surgical childbirth procedures such as caesarean section and episiotomy to elevated postpartum risks such as haemorrhage, extended maternal hospital stay and perinatal death.^{2,11–14} FGM/C has also been linked to women's sexual functioning^{4,15,16} and long-lasting adverse effects on women's mental health.^{2,17–20} Analysis using nationally representative surveys showed that over 200 million girls and women in just 30 countries have been subject to FGM/C. Over 70 million girls younger than 15 years have either been cut or are at risk of being cut.²¹ Global estimates are likely higher because of under-reporting and unavailable data from countries known to practice FGM/C such as Indonesia, India, Pakistan, Oman, Malaysia, Iran and Colombia.²¹

Fistula, a condition in which a hole between the vagina and the rectum or bladder causes a woman to continuously leak urine, faeces or both, is a distressing morbidity. Fistulas can be caused by obstetric, traumatic or iatrogenic complications.²² Globally, approximately one to two million women are living with fistula with a majority residing in sub-Saharan Africa and South Asia.^{23,24} Using 19 surveys from countries in sub-Saharan Africa, Maheu-Giroux *et al*, estimated a lifetime and point prevalence of fistula of three and one case per 1000 women of reproductive age.²² The common cause of fistula in sub-Saharan Africa is the obstetric complication of inadequately managed prolonged obstructed labour.^{25–27} Generally, women with fistula suffer extensive psychosocial consequences such as isolation, divorce, stigma, shame, loss of social roles, and diminished self-esteem.^{1,13,28,29} There may also be economic consequences if women's ability to work is limited.³⁰

FGM/C and fistula present complex conditions with adverse health consequences to women and the society at large.³¹ Limited evidence exists of an indirect association between FGM/C and obstetric fistula, mediated by obstructed/prolonged labour.^{11,29,32} Some researchers have argued that the different types of FGM/C encompass a range of procedures that damage and alter women's external genitalia with significant effects on women's health, especially during pregnancy and delivery.^{1,33} Comparing delivery outcomes for women who have undergone FGM/C to those who have not, study findings from six African countries showed that women who had undergone FGM/C were significantly more likely to undergo

caesarean section, experience postpartum haemorrhage, episiotomy, extended maternal hospital stay, resuscitation of the infant and inpatient perinatal death—though it did not describe obstetric fistula outcomes.¹ A meta-analysis on the obstetric consequences of FGM/C demonstrated that despite methodologically low quality studies, effect sizes of exposure to FGM/C show elevated associated risk of childbirth complications including prolonged labour, obstetric lacerations, instrumental delivery, obstetric haemorrhage and difficult delivery.¹¹ Some studies have suggested that the pathway through which FGM/C is linked to fistula is through its association with prolonged/obstructed labour, particularly types I, II and III where FGM/C-induced scarring can cause obstructed labour.^{32,34–36}

Despite the widespread belief that FGM/C predisposes women to the development of obstetric fistulas,^{37–39} there is limited evidence showing a causal relationship between these two conditions.^{40,41} Studies conducted in Europe that compared cut African immigrants to uncut European women delivering at the same health facility found no differences between the two groups regarding delivery outcomes such as prolonged labour, need for forceps or caesarean delivery, foetal distress, or perinatal deaths.^{34,41} It is important to note the large differences in availability of and level of care between Africa and Europe and therefore data from deliveries in Europe cannot be extrapolated to deliveries in Africa. In Africa, studies have shown increases in obstetric complications among women who have undergone FGM/C.^{14,42} A prospective analysis by the WHO of delivery outcomes among 28 393 women with singleton pregnancies in 28 obstetric centres in Burkina Faso, Ghana, Kenya, Nigeria, Senegal and Sudan showed that adverse outcomes increased with increasing severity of the genital cutting.¹ Notwithstanding the existence of independent literature on FGM/C^{1,43} and fistula,^{24,44,45} there is limited research on the association between the two conditions. This study contributes to the existing limited literature on associations between FGM/C and fistula by conducting a statistical analysis using nationally representative data in 10 sub-Saharan Africa countries to explore associations between FGM/C and fistula.

METHODS

The aim of this study was to assess associations between FGM/C and fistula among women of reproductive age^{15–49} using Demographic and Health Survey (DHS) data from 10 sub-Saharan Africa countries with data on both FGM/C and fistula. DHS are periodic nationally representative cross-sectional health surveys conducted in low-income and middle-income countries (<https://dhsprogram.com/>). DHS collects data on demographics and household wealth, fertility, reproductive health, maternal and child health, nutrition and HIV/AIDS. Data are collected from adult women aged 15–49 years and men aged 15–59 years from nationally representative probability samples of households. In certain surveys,

there are additional series of questions about FGM/C and fistula that are added to the women's questionnaire.⁴⁶ The module on FGM/C includes three sections: (1) whether the woman underwent FGM/C or not, and details about the event, (2) whether one daughter underwent FGM/C or not, and details about that event, and (3) the woman's opinion about the continuation of the practice. DHS includes a series of questions on fistula. All women are asked whether they have heard of fistula and, if they have, whether they themselves had experienced fistula-like symptoms (ie, involuntary leakage of urine and/or faeces from the vagina). While questions asked during surveys about sensitive events such as fistula and FGM/C are not as accurate as the gold standard of a gynaecological examination, previous studies comparing self-reported status and clinical observation data^{47 48} have shown that self-reported measures of FGM/C status are a suitable proxy measure for FGM/C prevalence but not for the type of cut. Further, DHS data are nationally representative and because they are inherently hierarchical are suitable for investigating associations between FGM/C and fistula while considering other contextual and socioeconomic correlates.

Countries included in the analysis are: Burkina Faso (DHS 2010), Chad (DHS 2014–2015), Côte d'Ivoire (DHS 2011–2012), Ethiopia (DHS 2005), Guinea (DHS 2012), Kenya (DHS 2014), Mali (DHS 2012–2013), Nigeria (DHS 2008), Senegal (DHS 2010–2011) and Sierra Leone (DHS 2013). These countries we selected based on availability of data on FGM/C and fistula in the various DHS datasets. The lack of data on both FGM/C and fistula symptoms in certain surveys means that certain countries that could still be experiencing the burden of these conditions are excluded. It is equally important to note that due to lack of consistency in collecting data on both fistula and FGM/C, some of the latest DHS data were excluded (eg, data on fistula were not collected in the 2011 Ethiopia DHS and 2013 Nigeria DHS). We computed cross-tabulations to estimate bivariate associations between fistula and FGM/C status. Due to sample size limitations, we conducted country-specific multivariate analyses for only five countries (Chad, Côte d'Ivoire, Ethiopia, Kenya and Sierra Leone) that had at least 100 cases of fistula. Results of multivariate analysis for country specific data are not shown in this paper. For details, please see online supplementary file 1—likelihood of reporting fistula symptoms among women of reproductive age (15–49 years) in Chad, Côte d'Ivoire and Ethiopia; and online supplementary file 2—likelihood of reporting fistula symptoms among women of reproductive age (15–49 years) in Kenya and Sierra Leone.

In addition, we conducted a multivariate logistic regression analysis using pooled data from the 10 focus countries. Multivariate logistic regression was used to assess associations between fistula and FGM/C, adjusting for other possible covariates. The choice of independent variables (possible covariates of fistula) was informed by an extensive literature review that identified underlying

socioeconomic and contextual factors, including gender and sociocultural norms that affect both FGM/C and fistula.³² The review, for instance, showed that poverty, unemployment, living in a rural area, limited access to health services and malnutrition (stunting) increased the likelihood of women undergoing FGM/C and developing fistula. In addition, the level of education has been associated with a family's choice to continue or abandon FGM/C and improves awareness about the importance of antenatal care (ANC) and facility delivery to prevent fistula.³²

The dependent variable in the multivariate logistic regression analysis is fistula symptoms whereby women were categorised either as having reported involuntary leakage of urine and/or faeces from the vagina or not. The main independent variable is FGM/C status—women categorised either as cut or uncut. Although there are validity concerns about self-reported type of cut in the DHS,^{47 48} we also examined differences by type of FGM/C—women categorised as cut with genitals sewn closed or cut but genitals not sewn closed. Due to sample size limitations, we examined differences by type of cut using pooled data from the 10 countries. Other independent variables included in the analysis were categorised as follows:

Maternal age at first birth—categorised into four groups (below 15 years, 15–19 years, 20–24 years, and 25 years and above); region—categorised by area of residence according to each country's geographical/administrative boundaries; urban/rural residence—categorised based on whether a woman lived in an urban or rural setting; maternal education—categorised based on the highest level of education attained (no education, primary, and secondary and higher education); religion—categorised based on women's religious affiliation, either as Christians (Catholic, Protestant and other Christians) or non-Christians (Muslim, traditionalist, animist and those with no religion); ethnicity—categorised according to a woman's reported ethnic background which varied from country to country; wealth—women were grouped in one of five wealth quintiles (poorest, poorer, middle, richer and richest) generated through principal component analysis using household assets and amenities data; number of ANC visits—women were categorised depending on the number of ANC visits they undertook when they were pregnant (0 visits, 1–3 visits and four and more visits); and place of delivery—categorised based on whether a woman gave birth at a health facility or at home. Home deliveries also included births outside the homestead; for example, on the way to the health facility.

Based on the literature review conducted by Sripad *et al*³² exploring the association between FGM/C and fistula,³² we conducted multivariate logistic regression analysis to explore the relationship between FGM/C and fistula symptoms using data from DHS. We hypothesised that FGM/C status predisposes women to fistula symptoms (Logit Model I), but that this relationship can be confounded by socioeconomic factors (Logit Model II)

and a woman's geographical context and access to health services (Logit Model III). Results from cross-tabulations between FGM/C and fistula symptoms are presented as percentages while those from multivariate analyses are presented as unadjusted ORs and adjusted odds ratios (AOR) with 95% CIs. Estimates with *p* values of less than 0.05 were considered statistically significant. All analyses were conducted using IBM SPSS V.20 and were weighted taking into account the DHS sampling strategy. Missing data was handled by pairwise deletion.

Patient and public involvement

The study used publicly available secondary data from DHS (<https://dhsprogram.com/>). Patients and the public were not involved.

RESULTS

Background characteristics

A summary of the background characteristics of women who participated in the 10 surveys is shown in [table 1](#). Compared with other age at first birth categories, the highest proportion of women gave birth to their first child at the age of 15–19 years. In nine out of the 10 focus countries, majority of women resided in rural areas and had no education. Across the 10 countries, FGM/C was nearly universal in Guinea (97.1%) and Mali (93.0%). Kenya had the lowest FGM/C prevalence at 21.7%. The proportion of women reporting fistula symptoms was less than 4% in all the countries. The highest prevalence was reported in Côte d'Ivoire (3.6%) and Ethiopia (3.4%) while the lowest was in Senegal (0.1%) and Burkina Faso (0.1%). Sample characteristics for pooled data bringing together the 10 focus countries is shown in [table 2](#).

Bivariate association between FGM/C status and fistula

Bivariate associations between FGM/C status and fistula in the 10 sub-Saharan Africa countries are summarised in [table 3](#). The difference in the proportion of women reporting fistula symptoms by FGM/C status was statistically significant in Chad and Senegal only. In Senegal, a significant proportion of women who had undergone FGM/C reported fistula symptoms than uncut women (*p*=0.002). In Chad, the opposite was true where a significant proportion of uncut women reported fistula symptoms compared with cut women (*p*<0.001).

Results of multivariate analysis: pooled data

[Table 4](#) summarises results from the pooled dataset for the 10 focus countries. The multivariate logistic regression analysis explored the relationship between FGM/C status (cut and uncut women) and fistula symptoms (scenario A) and the relationship between the type of FGM/C (cut women) and fistula symptoms (scenario B).

Results under scenario A showed that the relationship between FGM/C status and fistula symptoms was statistically significant in Model 1 (unadjusted effects) and Model II (adjusted for socioeconomic factors) where cut

women were less likely to experience fistula symptoms as compared with uncut women. This association was nonetheless not statistically significant after adjusting for women's geographical context and access to health services. Independent variables that showed a statistically significant association with fistula symptoms in the fully adjusted model included maternal age at first birth, religion, household wealth index, utilisation of ANC and area of residence. The odds of reporting fistula symptoms were lower for women aged 20–24 years (AOR=0.64, *p*=0.047) compared with those aged 25 years and older; Christian women (AOR=0.64, *p*=0.000) compared with non-Christian; women in the poorer wealth quintile (AOR=0.61, *p*=0.002) compared with those in the richest quintile; women who had attended four or more ANC visits (AOR=0.64, *p*=0.000) compared with those who did not attend ANC; and women living in urban areas (AOR=0.74, *p*=0.016) compared with those living in rural areas.

Results under scenario B showed that the significant association between type of FGM/C and fistula persisted even after controlling for socioeconomic factors, geographical context and access to health services. In the fully adjusted model (Model III), the odds of reporting fistula symptoms were 1.5 times higher for women who had undergone FGM/C and their genitals sewn closed (AOR=1.53, *p*=0.023) compared with those who had been cut but genitals not sewn closed. Other independent variables that showed a statistically significant association with fistula symptoms in the fully adjusted model included household wealth index, utilisation of ANC, and area of residence. Women in the poorer wealth quintile (AOR=0.60, *p*=0.013), those who had attended four or more ANC visits (AOR=0.51, *p*=0.000), and women living in urban areas (AOR=0.62, *p*=0.010) were less likely to report fistula symptoms compared with those in the richest wealth quintile, those who did not attend ANC and those living in rural areas, respectively.

DISCUSSION

The study aimed to provide evidence using nationally representative data on associations between FGM/C and fistula. Study findings from bivariate analysis at the national level suggest an increased likelihood of fistula development among cut than uncut women in Senegal and a decreased likelihood of fistula development among cut than uncut women in Chad. The association between fistula and FGM/C status was not statistically significant in the other eight countries. Multivariate logit modelling using pooled data from 10 countries showed that the odds of reporting fistula symptoms were significantly higher for women whose genitals were cut and sewn closed than those who had undergone other types of FGM/C. Women who attended ANC and those who lived in urban areas were less likely to report fistula symptoms than those who did not attend ANC or lived in rural areas.

Table 1 Sample characteristics, country specific DHS data

	Burkina Faso DHS 2010		Chad DHS 2014-2015		Côte d'Ivoire DHS 2011-2012		Ethiopia DHS 2005		Guinea DHS 2012		Kenya DHS 2012		Mali DHS 2012-2013		Nigeria DHS 2008		Senegal DHS 2010-2011		Sierra Leone DHS 2013		
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	
FGM/C status																					
Cut	76.1	12 949	47.9	4433	40.9	3843	76.4	10 448	97.1	8857	21.7	3066	93.0	9531	48.8	9890	28.1	4025	89.8	14 917	
Uncut	23.9	4068	52.1	4830	59.1	5562	23.6	3236	2.9	267	78.3	11 087	7.0	712	51.2	10 393	71.9	10 295	10.2	1703	
Fistula experience																					
Yes	0.1	20	2.1	246	3.6	361	3.4	111	0.6	59	1.0	150	0.6	62	0.4	135	0.1	19	0.7	114	
No	99.9	17 047	97.9	11 271	96.4	9625	96.6	3150	99.4	9078	99.0	14 472	99.4	10 362	99.6	33 181	99.9	15 669	99.3	16 426	
Maternal age at first birth																					
Below 15	3.0	399	14.1	1991	9.1	669	10.3	1000	12.6	872	5.2	1204	12.2	1040	10.1	2354	8.8	904	11.6	1445	
15-19	60.3	8005	60.4	8541	55.6	4101	56.6	5496	57.8	4005	49.4	11 339	52.0	4448	47.9	11 204	45.6	4664	53.0	6616	
20-24	30.8	4081	20.4	2886	27.7	2039	26.9	2610	22.6	1566	35.9	8250	26.4	2262	29.1	6815	32.1	3284	27.4	3426	
≥25	5.9	785	5.1	725	7.6	561	6.2	606	7.0	486	9.5	2181	9.4	803	12.9	3031	13.4	1371	8.0	1003	
Residence																					
Urban	27.1	4624	23.8	4209	51.4	5170	17.8	2499	36.3	3322	40.8	12 690	24.8	2583	35.7	11 934	49.3	7738	35.6	5933	
Rural	72.9	12 463	76.2	13 510	48.6	4890	82.2	11 571	63.7	5820	59.2	18 389	75.2	7841	64.3	21 451	50.7	7950	64.4	10 725	
Maternal education																					
No education	74.0	12 633	62.4	11 060	53.2	5351	65.9	9271	67.0	6123	7.0	2179	75.8	7903	35.8	11 942	57.9	9079	55.8	9293	
Primary	13.6	2329	22.7	4020	25.4	2552	22.2	3123	13.9	1270	50.3	15 626	9.3	965	19.7	6566	21.8	3414	14.0	2331	
Secondary+	12.4	2116	14.9	2639	21.4	2157	11.9	1675	19.1	1749	42.7	13 277	14.9	1556	44.6	14 878	20.4	3195	30.2	5034	
Total sample	100.0	17 087	100.0	17 719	100.0	10 060	100.0	14 070	100.0	9142	100.0	31 079	100.0	10 424	100.0	33 385	100.0	15 688	100.0	16 658	

Secondary +: secondary and/or higher education attained.
DHS, Demographic and Health Survey; FGM/C, female genital mutilation/cutting.

Table 2 Sample characteristics, pooled DHS data for 10 countries

	%	N
FGM/C status		
Cut	61.1	81 960
Uncut	38.9	52 154
FGM/C type		
Sewn closed	8.4	5925
Not sewn closed	91.6	64 442
Fistula experience		
Yes	0.9	1277
No	99.1	140 281
Maternal age at first birth		
Below 15	9.2	11 878
15–19	53.0	68 420
20–24	28.8	37 220
≥25	9.0	11 553
Residence		
Urban	34.6	60 703
Rural	65.4	114 609
Maternal education		
No education	48.4	84 832
Primary	24.1	42 196
Secondary +	27.5	48 275
Total sample	100.0	175 312

Secondary +: secondary and/or higher education attained.
DHS, Demographic and Health Survey; FGM/C, female genital mutilation/cutting.

Beginning with bivariate findings, we note contrasting results where FGM/C status seems to be a risk factor for fistula in one context (Senegal) and at the same time protective against fistula in another context (Chad). One of the possible explanations relates to the relationship between fistula and the severity of FGM/C. Similar to our results showing greater odds of fistula among women who have had their genitals cut and sewn closed, a large prospective study conducted by WHO to investigate the effect of FGM/C on obstetric outcomes showed that women who had undergone FGM/C were more likely to experience adverse pregnancy outcomes with a higher risk among those with severe cuts (type III).¹ DHS reports from Chad and Senegal indicate that in Chad, 43% of women were cut with flesh removed, 39% were cut without removing the flesh and 9% had infibulation,⁴⁹ while in Senegal, 53% were cut with flesh removed, 10% were cut without removing the flesh and 14% underwent infibulation.⁵⁰ The higher prevalence of infibulation in Senegal compared with Chad may explain the higher probability of fistula among cut women in Senegal compared with Chad. It is also possible that detection of FGM/C in antenatal patients led to precautions taken against fistula developing during labour. Due to sample size limitations, we were

unable to examine differences in the likelihood of fistula by the type of cut using country specific data. Further research at country level to investigate this nuance is required—perhaps in populations with high prevalence of FGM/C and fistula, and in communities practicing different types of FGM/C.

Noteworthy in this study is the lack of significant associations between FGM/C status and fistula symptoms in the fully adjusted regression models. A review of the existing evidence on the association of FGM/C and fistula reported mixed evidence with studies showing direct, indirect and no relationships.³² The review further noted that the three studies that confirmed no association were carried out in contexts of predominantly FGM/C types I and II, while those that confirmed positive associations covered all or focused on FGM/C types III and IV. Our findings using pooled data from the 10 focus countries align to some degree with the notion that the risk of fistula increases with cut severity. Therefore, it is plausible that there exist other factors confounding the relationship between FGM/C status and fistula. Methods to further investigate this association are warranted and could include using alternative and complementary data collection approaches and analysis techniques.³²

Some of our multivariate analysis findings contrast with those from previous studies. For instance, groups identified in the literature as higher risk for fistula include younger women who undergo early marriage/pregnancy, lack education, live in poor households, reside in rural areas, do not visit health facilities for ANC and deliver at home in the hands of unskilled attendants.^{22 24 51 52} Our findings showed no main effects of maternal age at first birth, educational attainment and place of delivery on fistula symptoms experience. Pooled data analysis supported the view that women living in rural areas and those not attending ANC were at a higher risk of fistula than those living in urban areas and attending ANC. It is evident that within country inequities exist and that there are systemic/underlying factors that predispose women to poor delivery outcomes such as fistula in specific countries.^{52 53} One of the pathways through which women end up with negative delivery outcomes such as obstetric fistulas and sometimes maternal or perinatal mortality result from delay in obtaining adequate emergency obstetric care.^{25 54} Delay in deciding to seek care, delay in arriving at a suitable healthcare facility, and delay in receiving appropriate care influence the formation of fistulas by prolonging the time that a woman remains in obstructed labour.⁵⁴ It is likely that women living in rural areas where health seeking behaviours are poor and access to adequate emergency obstetric care is limited experienced significantly higher cases of fistula. These findings bring to the fore the need for targeted research in key populations to better understand contextual factors that put women at risk of fistula and subsequently tailor interventions to the local context, preferably at the areas of residence (urban/rural) or even lower geographical/administrative areas.

Table 3 Bivariate association between FGM/C and fistula in 10 sub-Saharan Africa countries

Country	FGM/C status	Fistula symptoms (%)		P value
		Yes	χ^2	
Burkina Faso, DHS 2010	Uncut (n=4062)	0.1	0.17	0.683
	Cut (n=12 940)	0.1		
Chad, DHS 2014–2015	Uncut (n=4830)	2.7	14.54	<0.001
	Cut (n=4427)	1.6		
Côte d'Ivoire, DHS 2011–2012	Uncut (n=5530)	3.5	2.62	0.106
	Cut (n=3813)	4.1		
Ethiopia, DHS 2005	Uncut (n=822)	3.6	0.06	0.814
	Cut (n=2303)	3.5		
Guinea, DHS 2012	Uncut (n=267)	0.0	1.79	0.181
	Cut (n=8852)	0.7		
Kenya, DHS 2014	Uncut (n=11 086)	1.0	0.01	0.933
	Cut (n=3066)	1.0		
Mali, DHS 2012–2013	Uncut (n=712)	0.3	1.40	0.237
	Cut (n=9531)	0.6		
Nigeria, DHS 2008	Uncut (n=10 383)	0.4	0.45	0.503
	Cut (n=9876)	0.4		
Senegal, DHS 2010–2011	Uncut (n=10 296)	0.1	9.72	0.002
	Cut (n=4025)	0.3		
Sierra Leone, DHS 2013	Uncut (n=1694)	0.4	3.03	0.082
	Cut (n=14 816)	0.7		

DHS, Demographic and Health Survey; FGM/C, female genital mutilation/cutting.

This study has strengths and limitations. The major strength is the use of nationally representative samples from 10 African countries to investigate associations between FGM/C and fistula. DHS data is inherently hierarchical rendering itself suitable for investigating associations between the two conditions while taking into account other contextual and socioeconomic factors that may influence the relationship. One of the limitations is the use of self-report data that is subject to recall bias, challenging the validity of certain responses. Though self-reporting is a generally acceptable social science research strategy and conducting gynaecological examination may be ethically challenging,^{55–57} responses on such sensitive topics should be interpreted with caution given that disclosure of FGM/C, which has been criminalised in many countries, and fistulas, a condition associated with shame and ostracisation, may have influenced responses through social desirability. Given the challenges in the use of household surveys to estimate prevalence of rare and sensitive events such as fistula and FGM/C,^{58 59} this study possibly underestimates prevalence of FGM/C and fistula.⁶⁰ Questions asked during surveys are not as accurate as the gold standard of a gynaecological examination. Furthermore, DHS restrict their samples to women of reproductive age^{15–49} and yet fistulas can be found in both younger and older females.⁶¹

Due to sample size limitations, we conducted country specific multivariate analysis in only five countries (Kenya, Ethiopia, Côte d'Ivoire, Sierra Leone and Chad) that had at least 100 cases of fistula (results provided as online supplementary files S1 and S2). A regression analysis using data from all the 10 countries would have been desirable to enable comparison of associations across different geographical contexts. While multivariate logistic regression analysis allows detailed understanding of associations within sociodemographic groups, it is sensitive to sample size. Associations in certain groups may fail to reach statistical significance, not necessarily due to lack of changes in prevalence, but rather to limited sample size. In DHSs wherein, the sampling design has not included sampling strata at the level of sociodemographic subgroups, it is difficult to overcome limitations associated with variable sample size, especially co-occurrence of rare and sensitive issues such as fistula and FGM/C. We have provided 95% CIs around estimates to enable the reader to gauge the reliability of estimates with reference to sample size.

CONCLUSIONS

The type of FGM/C, in this case severe forms of FGM/C where a woman's genitalia was cut and sewn closed other than FGM/C status (cut vs uncut) increased the odds of

Table 4 Likelihood of reporting fistula symptoms among women of reproductive age, ¹⁵⁻⁴⁹ pooled DHS data for 10 countries

Variable	A: Considering the effect of FGM/C status (cut and uncut women aged 15-49)			B: Considering the effect of type of FGM/C (cut women aged 15-49)		
	Model I OR, 95% CI	Model II AOR, 95% CI	Model III AOR, 95% CI	Model I OR, 95% CI	Model II AOR, 95% CI	Model III AOR, 95% CI
FGM/C status (Ref=Uncut)						
Cut	0.81* (0.72 to 0.91)	0.82* (0.72 to 0.94)	0.93 (0.77 to 1.12)	1.37* (1.04 to 1.79)	1.40* (1.06 to 1.86)	1.53* (1.06 to 2.21)
FGM/C type (Ref=Not sewn closed)						
Sewn closed						
Maternal age at first birth (Ref =≥25)						
Below 15	0.92 (0.75 to 1.12)	0.91 (0.73 to 1.13)	0.98 (0.73 to 1.33)	0.92 (0.75 to 1.12)	0.88 (0.65 to 1.18)	0.93 (0.62 to 1.39)
15-19	0.91 (0.73 to 1.13)	0.87 (0.69 to 1.10)	0.86 (0.62 to 1.19)	0.91 (0.73 to 1.13)	0.86 (0.62 to 1.19)	0.84 (0.54 to 1.31)
20-24	0.72* (0.54 to 0.96)	0.66* (0.49 to 0.90)	0.64* (0.41 to 0.99)	0.72* (0.54 to 0.96)	0.74 (0.48 to 1.15)	0.62 (0.33 to 1.18)
Religion (Ref=Non-Christian)						
Christian	0.67* (0.61 to 0.77)	0.70* (0.61 to 0.81)	0.64* (0.52 to 0.78)	0.67* (0.61 to 0.77)	0.92 (0.74 to 1.15)	0.87 (0.65 to 1.16)
Wealth quintile (Ref=Richest)						
Poorest	0.92 (0.76 to 1.11)	0.88 (0.71 to 1.08)	0.92 (0.69 to 1.21)	0.92 (0.76 to 1.11)	0.75 (0.57 to 1.00)	0.75 (0.52 to 1.09)
Poorer	0.83 (0.69 to 1.01)	0.76* (0.61 to 0.94)	0.61* (0.45 to 0.84)	0.83 (0.69 to 1.01)	0.64* (0.48 to 0.86)	0.60* (0.40 to 0.90)
Middle	1.13 (0.95 to 1.35)	1.07 (0.88 to 1.31)	0.93 (0.70 to 1.25)	1.13 (0.95 to 1.35)	0.83 (0.63 to 1.10)	0.81 (0.55 to 1.20)
Richer	1.15 (0.97 to 1.36)	1.30* (1.06 to 1.60)	0.84 (0.59 to 1.18)	1.15 (0.97 to 1.36)	1.17 (0.88 to 1.54)	0.64 (0.39 to 1.04)
Maternal education (Ref=No education)						
Primary	1.07 (0.94 to 1.23)	0.91 (0.77 to 1.08)	1.15 (0.91 to 1.44)	1.07 (0.94 to 1.23)	1.16 (0.91 to 1.48)	1.23 (0.88 to 1.70)
Secondary and higher	0.86* (0.75 to 0.99)	0.78* (0.64 to 0.95)	0.98 (0.74 to 1.30)	0.86* (0.75 to 0.99)	0.88 (0.65 to 1.19)	0.97 (0.64 to 1.46)
Number of ANC visits (Ref=0)						
1-3	0.67* (0.54 to 0.82)		0.64* (0.49 to 0.82)	0.67* (0.54 to 0.82)		0.44* (0.31 to 0.63)
≥4	0.62* (0.51 to 0.74)		0.64* (0.50 to 0.82)	0.62* (0.51 to 0.74)		0.51* (0.36 to 0.71)
Place of delivery (Ref=Home)						
Health facility	0.74* (0.65 to 0.83)		0.83 (0.68 to 1.00)	0.74* (0.65 to 0.83)		0.83 (0.63 to 1.09)
Residence (Ref=Rural)						
Urban	0.81* (0.72 to 0.90)		0.74* (0.58 to 0.95)	0.81* (0.72 to 0.90)		0.62* (0.44 to 0.89)
Cox and Snell R ²	0.000	0.001	0.002	0.000	0.001	0.002
Nagelkerke R ²	0.001	0.007	0.016	0.001	0.006	0.021

*p<0.05.

ANC, antenatal care; AOR, adjusted OR; DHS, Demographic and Health Survey; FGM/C, female genital mutilation/cutting; OR, unadjusted OR; Ref, reference group.

women reporting fistula symptoms. Contextual factors, here defined as urban/rural residence and socioeconomic factors may underpin fistula experience. These study findings call for greater contextual understanding of factors driving occurrence of fistula. For example, it is evident that there exist geographical (urban/rural residence) inequities within countries that perpetuate fistula experience. There is need for further research to unravel contextual, socio-economic and health systems challenges specific to urban/rural residence in order to inform integrative programming. Multisectoral interventions that concurrently address harmful traditional practices such as FGM/C and other contextual factors that drive the occurrence of fistula may be warranted. Promotion of ANC utilisation could be a starting point in the prevention of fistulas.

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Ethics approval The study questionnaires and protocols were reviewed and approved by the local ethical review committees of the various countries and the Macro Institutional Review Board. Since the study utilised secondary data, we applied for an exemption from a full ethical review and was granted permission by the Population Council's institutional ethics review board.

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Data availability statement Data used in the analysis are publicly available and can be accessed online through application to MEASURE DHS. Analysis syntaxes and outputs generated for the study can be made available upon request to the corresponding author.

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