



THE AGA KHAN UNIVERSITY

eCommons@AKU

---

Obstetrics and Gynaecology, East Africa

Medical College, East Africa

---

10-2022

## A retrospective review of genital fistula occurrence in nine African countries

Carrie J. Ngongo

Thomas J. I. P. Raassen

Marietta Mahendeka

Ladeisha Lombard

Jos van Roosmalen

*See next page for additional authors*

Follow this and additional works at: [https://ecommons.aku.edu/eastafrica\\_fhs\\_mc\\_obstet\\_gynaecol](https://ecommons.aku.edu/eastafrica_fhs_mc_obstet_gynaecol)



Part of the [Obstetrics and Gynecology Commons](#)

---

---

**Authors**

Carrie J. Ngongo, Thomas J. I. P. Raassen, Marietta Mahendeka, Ladeisha Lombard, Jos van Roosmalen, and Marleen Temmerman

RESEARCH

Open Access



# A retrospective review of genital fistula occurrence in nine African countries

Carrie J. Ngongo<sup>1\*</sup>, Thomas J. I. P. Raassen<sup>2</sup>, Marietta Mahendeka<sup>3</sup>, Ladeisha Lombard<sup>4</sup>, Jos van Roosmalen<sup>5</sup> and Marleen Temmerman<sup>6,7</sup>

## Abstract

**Background:** Female genital fistulas are abnormal communications that lead to urinary and/or fecal incontinence. This analysis compares the characteristics of women with fistulas to understand how countries differ from one another in the circumstances of genital fistula development.

**Methods:** This retrospective records review evaluated demographics and circumstances of fistula development for 6,787 women who sought fistula treatment between 1994 and 2017 in Tanzania, Uganda, Kenya, Malawi, Rwanda, Somalia, South Sudan, Zambia, and Ethiopia.

**Results:** Most women developed fistula during childbirth, whether vaginal (3,234/6,787, 47.6%) or by cesarean section (3,262/6,787, 48.1%). Others had fistulas attributable to gynecological surgery (215/6,787, 3.2%) or rare causes (76/6,787, 1.1%). Somalia, South Sudan, and Ethiopia had comparatively high proportions following vaginal birth and birth at home, where access to care was extremely difficult. Fistulas with live births were most common in Kenya, Malawi, Rwanda, Uganda, Tanzania, and Zambia, indicating more easily accessible care.

**Conclusions:** Characteristics of women who develop genital fistula point to geographic differences in obstetric care. Access to care remains a clear challenge in South Sudan, Somalia, and Ethiopia. Higher proportions of fistula after cesarean birth and gynecological surgery in Kenya, Malawi, Rwanda, Uganda, Tanzania, and Zambia signal potential progress in obstetric fistula prevention while compelling attention to surgical safety and quality of care.

**Keywords:** Cesarean section, Injury, Obstetric fistula, Surgery, Access, Quality of care

## Background

Female genital fistulas include vesico-vaginal fistulas, recto-vaginal fistulas, and ureteric injuries: abnormal communications between the genital tract and the bladder, urethra, ureters, colon, or rectum that lead to urinary and/or fecal incontinence. Most genital fistulas are obstetric, arising from pressure necrosis during prolonged, obstructed labor. Obstruction occurs when the presenting part of the fetus cannot progress into the birth canal despite strong uterine contractions, due

to cephalo-pelvic disproportion, malpresentation, or malposition. Obstructed labor occurs in an estimated 4.6% of childbirths, causing 8% of maternal deaths [1]. Over 90% of women with obstetric fistula give birth to stillborn babies [2].

Obstetric fistula prevention requires appropriate labor monitoring and access to quality basic and comprehensive emergency obstetric care. High-income countries eliminated obstetric fistula by the mid-twentieth century [3]. These countries now report rare cases of genital fistula due to other causes, such as gynecological hysterectomy, radiotherapy, and cervical carcinoma [4, 5]. Iatrogenic fistula can occur as a complication of obstetric and gynecological surgery, especially cesarean section

\*Correspondence: cngongo@gmail.com; cngongo@rti.org

<sup>1</sup> Global Health Division, RTI International, Research Triangle Park, USA  
Full list of author information is available at the end of the article



[6–8]. Genital fistula remains a challenge in low-resource settings where women do not have sufficient access to quality emergency obstetric care.

The relative rarity of genital fistula makes prevalence estimation difficult. Pooled prevalence from population-based studies indicates that one million women may have fistulas in sub-Saharan Africa and South Asia, with over 6,000 new cases per year [9]. Demographic and Health Survey estimates from 2005–2011 include urinary fistula symptoms point prevalence of 10.0 per 1,000 women of reproductive age in Uganda, 5.6 in Ethiopia, 5.0 in Kenya, 2.1 in Tanzania, and 1.5 in Malawi, which translates to urinary fistula symptoms in approximately 1 per 1000 women of reproductive age in sub-Saharan Africa [10]. The prevalence of fistula following gynecological surgery, trauma, and other causes is not known.

The objective of this paper is to compare the characteristics of women with fistula to understand how countries differ from one another in the circumstances of genital fistula development. Documenting geographic differences can help policymakers to tailor appropriate strategies to reduce fistula incidence.

## Methods

This retrospective records review evaluated the circumstances of fistula development for women who sought fistula treatment in nine African countries. Women were interviewed in 89 facilities in Tanzania, Uganda, Kenya, Malawi, Zambia, Rwanda, Ethiopia, Somalia, and South Sudan. Women consented to fistula repair, following each hospital's counseling and informed consent process. The number of women in each country reflects the number of repairs conducted by the second and third author and colleagues in those countries. Data were collected between June 1994 and December 2017. We excluded women whose fistulas were of unclear origin or developed before 1980.

One of the surgeons interviewed each woman and recorded information on a standard form, documenting demographics, obstetric history, and duration of leaking [11]. Women who developed fistula during childbirth reported birth location and outcomes, including whether the baby lived more than two days ("alive"), died within two days ("early neonatal death"), or was stillborn. In case of multiples, births were counted "alive" if at least one baby was alive at birth. Most cesarean births in this series were emergency procedures; only five women had elective cesarean birth without labor. During fistula repair one of the surgeons noted the numbers of fistula and type(s), using the Waaldijk classification system [12]. The unit of analysis in Table 3 was fistulas; elsewhere the unit of analysis was women.

Data were entered into an Excel database, with names changed to unique identification numbers to protect women's privacy. Data were analyzed using Stata 16 software (StataCorp).

## Results

This review includes 6,787 women who sought treatment for genital fistula. Table 1 provides characteristics of the women with fistula by country. Most variables are reported for all women seeking genital fistula repair, including fistula number and type, age at fistula development, education, duration of leaking, maternal height, and relationship status. Previous abdominal surgery, place of birth, and stillbirth were applicable only to women who developed fistula during childbirth, whether vaginal or by cesarean birth.

Most women had a single fistula (5,738, 84.5%), while 1,049 (15.5%) presented with multiple fistulas, meaning a combination of fistulas in different locations. Ethiopia had the highest proportion of women incontinent of both urine and feces due to the combination of vesico- and recto-vaginal fistulas (30/110, 27.3%), followed by South Sudan (40/242, 16.5%) (Table 1).

More than 40% of women developed fistula during adolescence in Somalia (137/316, 43.4%), South Sudan (100/242, 41.3%), and Kenya (461/1,131, 40.8%), while the proportion of women developing fistula after age 30 was highest in Malawi (206/662, 31.1%) and Rwanda (128/418, 30.6%). More than one quarter of women with fistula had been incontinent for ten years or longer in Rwanda (126/417, 30.2%) and Zambia (46/168, 27.4%).

Most women with fistula had not completed primary school, and 39.2% (2,615/6,678) had not attended formal school at all. Low educational access was particularly pronounced in Somalia (270/314, 86.0%), South Sudan (190/241, 78.8%), and Ethiopia (80/105, 76.2%).

Women who developed fistula during labor and childbirth most commonly reported giving birth in health facilities (5,693/6,607, 86.2%), with proportions near or above 90% in Zambia (153/163, 93.9%), Tanzania (1,941/2,150, 90.3%), Rwanda (374/416, 89.9%), and Uganda (1,329/1,488, 89.3%). In contrast, between 60 and 70% of women with fistula had given birth in health facilities in South Sudan (147/240, 61.3%), Ethiopia (67/104, 64.4%), and Somalia (210/306, 68.6%). The proportion of women with fistula who gave birth to a live baby varied by country. While 5,216/6,490 (80.4%) women reported a stillbirth overall, the percentage varied from 94/102 (92.2%) in Ethiopia to 120/161 (74.5%) in Zambia (Table 1).

Table 2 groups women according to the circumstances of their fistula development, whether vaginal birth, cesarean birth, gynecological surgery, or other causes. "Cesarean birth" includes cesarean section, cesarean hysterectomy,

**Table 1** Demographics of women with genital fistula

	Tanzania	Uganda	Kenya	Malawi	Zambia	Rwanda	Ethiopia	Somalia	South Sudan	Total
Women	2213	1527	1131	662	168	418	110	316	242	6787
Fistulas	2439	1655	1233	703	182	456	134	345	281	7428
Incontinence										
Both urine and feces	185	98	79	31	5	23	30	28	40	519
Urine	1996	1368	1006	609	153	382	74	258	177	6,023
Feces	32	61	46	22	10	13	6	30	25	245
Place of birth										
Home	209	159	202	66	10	42	37	96	93	914
Health facility	1941	1329	893	579	153	374	67	210	147	5693
Baby condition										
Stillbirth	1777	1106	829	485	120	347	94	257	201	5216
Live birth	260	258	174	122	31	57	7	38	32	979
Early neonatal death	79	97	63	22	10	7	1	10	6	295
Age at fistula development										
<19	778	597	461	200	62	83	42	137	100	2460
20-29	916	599	423	256	67	207	44	118	109	2739
>30	519	331	247	206	39	128	24	61	33	1588
Education										
None	767	577	305	219	70	137	80	270	190	2615
Primary incomplete	1373	878	504	373	76	254	20	26	48	3552
Primary complete	54	39	274	69	22	27	5	18	3	511
Duration of leaking										
<6 months	745	408	343	119	54	42	30	58	50	1849
6-12 months	387	242	188	92	12	22	18	76	38	1075
1-5 years	591	439	357	165	35	98	30	114	94	1923
5-10 years	263	220	134	121	21	129	15	44	34	981
>10 years	222	209	102	148	46	126	15	24	26	918
Relationship status at time of repair										
Living with husband	1,151	765	546	408	115	218	55	157	132	3547
Living with family	386	304	114	159	34	125	40	52	70	1284
Living alone	409	319	212	55	9	57	10	97	29	1197
Remarried	50	29	14	38	9	13	-	4	5	162
Never married	183	61	216	-	1	3	3	1	4	472
Widowed	27	43	15	2	-	2	-	5	2	96
Previous abdominal surgery	166	156	134	60	15	54	3	14	11	613
Height (median, IQR)	151	147-155	154	150-158	146-155	147-151	148-152	150-155	150-160	148-157

**Table 2** Circumstantial origin of women's genital fistulas, by country

Circumstantial origin of genital fistula	Tanzania	Uganda	Kenya	Malawi	Zambia	Rwanda	Ethiopia	Somalia	South Sudan	Total
Vaginal birth	1047	620	520	291	73	204	87	232	160	3234
	47.3%	40.6%	46.0%	44.0%	43.5%	48.8%	79.1%	73.4%	66.1%	47.6%
Cesarean birth	1069	844	552	341	88	202	16	73	77	3262
	48.3%	55.3%	48.8%	51.5%	52.4%	48.3%	14.5%	23.1%	31.8%	48.1%
Gynecological surgery	78	52	41	22	5	10	2	2	3	215
	3.5%	3.4%	3.6%	3.3%	3.0%	2.4%	1.8%	0.6%	1.2%	3.2%
Other	19	11	18	8	2	2	5	9	2	76
	0.9%	0.7%	1.6%	1.2%	1.2%	0.5%	4.5%	2.8%	0.8%	1.1%
<b>Total</b>	<b>2213</b>	<b>1527</b>	<b>1131</b>	<b>662</b>	<b>168</b>	<b>418</b>	<b>110</b>	<b>316</b>	<b>242</b>	<b>6787</b>

and uterine rupture repair. “Other causes” include trauma (from accidents, traditional healers, or sexual violence), congenital fistula, and fistula related to abortion, HIV infection, or radiation, as further explored elsewhere [13].

Most genital fistulas followed childbirth, whether vaginal (3,234/6,786, 47.7%) or by cesarean section (3,262/6,787, 48.1%) (Table 2). Fistula following cesarean birth was most common in women in Uganda (844/1,527, 55.3%), Zambia (88/168, 52.4%), and Malawi (341/662, 51.5%). In contrast, high proportions of fistula followed vaginal births in Ethiopia (87/110, 79.1%), Somalia (232/316, 73.4%), and South Sudan (160/242, 66.1%) (Table 2).

Just over 3% of women developed fistula from gynecological surgery (215/6,787, 3.2%), while 1.1% of women developed fistula through other circumstances (76/6,787). The proportion of fistulas following gynecological surgery was highest in Kenya (41/1,131, 3.6%), Tanzania (78/2,213, 3.5%), Uganda (52/1,527, 3.4%) and Malawi (22/662, 3.3%), while fistulas following gynecological surgery constituted less than 2% of fistulas repaired in Somalia, South Sudan, and Ethiopia (Table 2).

Fistula types differ by circumstances of development. Iatrogenic ureteric injuries and vault fistulas occur after cesarean birth or gynecological surgery (Table 3) [11, 14]. The exceptions were “postrepair” ureteric injuries that arose during fistula surgery in women who had initially developed other fistulas during childbirth. Over one quarter of fistulas following cesarean birth were vesico-[utero]-/-cervico-vaginal (26.1%, 914/3,508), compared to just 6.8% (244/3,614) of fistulas following vaginal birth.

Previous abdominal surgery complicates cesarean section. Nearly all reported previous abdominal operations were cesarean sections (98.5%, 601/610). Others included two bilateral tubal ligations, two myomectomies, one myomectomy and salpingectomy, and four other laparotomies (for intestinal obstruction, abortion, ectopic pregnancy, or menorrhagia). In this series over 10% of women with fistula after childbirth reported previous abdominal surgery in Rwanda (54/417, 12.9%), Kenya (134/1,116, 12.0%), and Uganda (156/1,518, 10.3%) (Table 1). While just 4.1% (132/3,229) of women developing fistula after vaginal birth reported previous abdominal surgery, the frequency was much higher for those developing fistula after cesarean section (13.4%, 341/2,554), cesarean section/hysterectomy (13.9%, 83/598), uterine rupture repair (18.7%, 20/107), and gynecological surgery (16.3%, 34/209) (Table 4).

Country differences are evident in World Health Organization data on maternal deaths per 100,000 live births between 2000 and 2015 (Fig. 1). All countries have made progress in reducing maternal mortality ratios (MMRs) over the period, but with differing starting points and speed. MMRs in Somalia and South Sudan in 2015 were higher than in most other countries in 2000. Change was most rapid in Rwanda and Ethiopia, where MMRs fell from more than 1000 per 100,000 live births in 2000 to fewer than 500 by 2015.

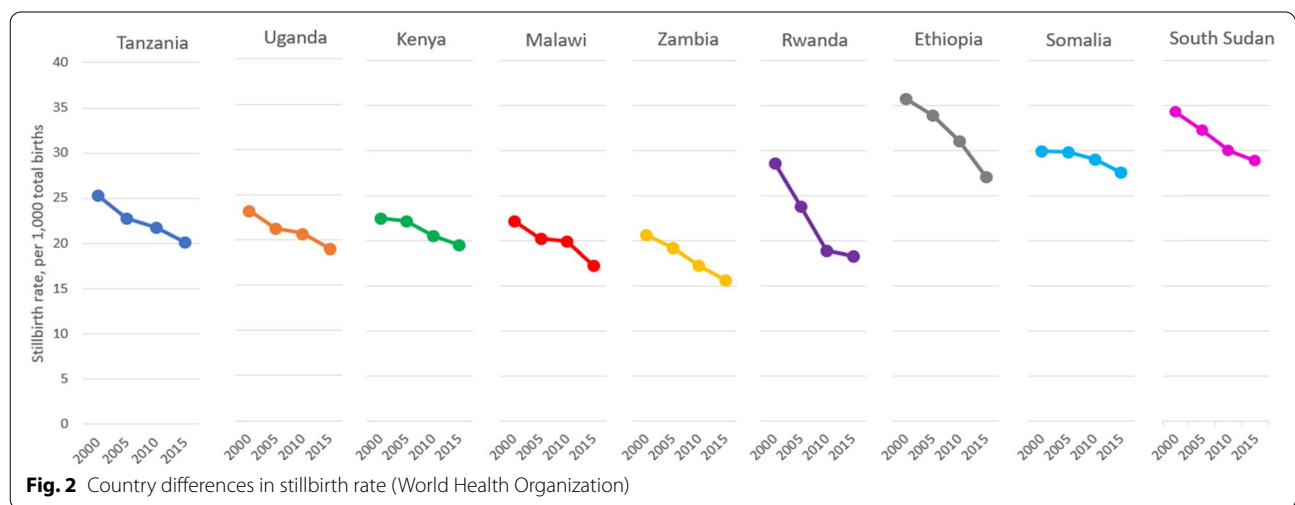
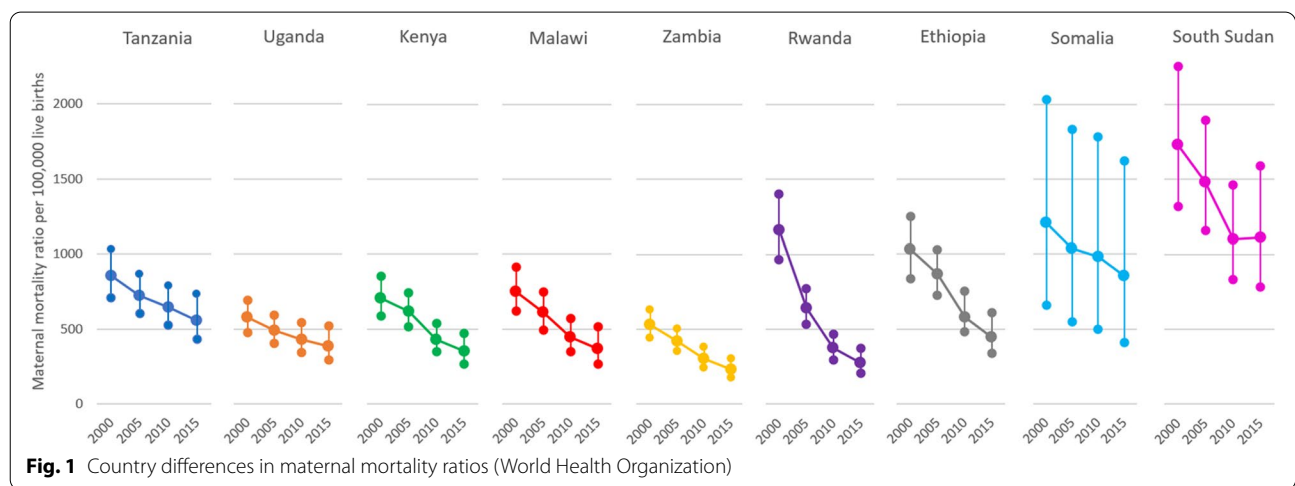
Stillbirth rates from the World Health Organization similarly give insight into country differences in care

**Table 3** Genital fistula type by circumstantial origin

Fistula Type	Vaginal birth		Cesarean birth		Gynecological surgery	
Vesico-[utero]-cervico-vaginal (Type I)	244	6.8%	914	26.1%	4	1.8%
Vault (Type I)	-	-	131	3.7%	129	58.1%
Ureteric (Type III)	30	0.8%	279	8.0%	70	31.5%
Involving closing mechanism:						
Type II Aa (without (sub)total urethra involvement, without circumferential defect)	1615	44.7%	1484	42.3%	5	2.3%
Type II Ab (without (sub)total urethra involvement, with circumferential defect)	464	12.8%	268	7.6%	-	-
Type Ba (with (sub)total urethra involvement, without circumferential defect)	343	9.5%	162	4.6%	7	3.2%
Type Bb (with (sub)total urethra involvement, with circumferential defect)	220	6.1%	65	1.9%	-	-
Recto-vaginal fistula	576	15.9%	130	3.7%	5	2.3%
Irreparable fistula	17	0.5%	10	0.3%	1	0.5%
Other (urethral incontinence, bladder stone, vaginal stenosis)	105	2.9%	65	1.9%	1	0.5%
<b>Total</b>	<b>3614</b>		<b>3508</b>		<b>222</b>	

**Table 4** Previous abdominal operation by circumstantial origin of genital fistula

Circumstantial origin of genital fistula	Previous abdominal operation				Total
	No	%	Yes	%	
Vaginal birth	3097	95.9%	132	4.1%	3229
Cesarean birth					
Cesarean section	2213	86.7%	341	13.4%	2554
Cesarean section/hysterectomy	515	86.1%	83	13.9%	598
Uterine rupture repair	87	81.3%	20	18.7%	107
Gynecological surgery	175	83.7%	34	16.3%	209



during childbirth (Fig. 2). All countries made progress in reducing stillbirth rates between 2000 and 2015, with Rwanda and Ethiopia experiencing the most dramatic change. Progress was most muted in Somalia. Stillbirth

rates were highest in Ethiopia, South Sudan, and Somalia. Stillbirth rates were lowest in Zambia and Malawi.



## Discussion

Policymakers and advocates have long emphasized access to care: women experiencing obstetric complications should be able to reach health facilities offering basic and comprehensive emergency obstetric care. This comparison reveals important country-level differences in the characteristics of women who develop genital fistula. The emerging story is not simple lack of access to health care, but of both lack of access and quality of care.

Some women experiencing prolonged, obstructed labor give birth at home without accessing a health facility, indicating comparative challenges in access to care. This was most common in South Sudan, Somalia, and Ethiopia, where a substantial share of genital fistulas followed childbirth at home. Women who developed fistula after birth at home are survivors; others in their circumstances might have died. The complexity of such cases is reflected in the high proportion of women with multiple fistulas who experience both urinary and fecal incontinence. The proportions of home birth and multiple fistulas reported by women with fistula in South Sudan, Somalia, and Ethiopia correspond to high MMRs and high stillbirth rates illustrated by World Health Organization data in Figs. 1 and 2.

Most women with genital fistula gave birth in health facilities. Although some women arrive late in health facilities, one report found that nearly three-quarters of women with fistula presented to hospitals or health centers during early labor [15]. Appropriate labor monitoring, decision-making, and referrals are crucial. The proportion of facility births and specifically cesarean births among women with fistula indicates greater comparative access to obstetric care in Kenya, Malawi, Rwanda, Tanzania, Uganda, and Zambia as compared to Ethiopia, South Sudan, and Somalia.

Cesarean section can be a lifesaving procedure for women experiencing prolonged, obstructed labor. Cesarean birth is increasingly common, both generally at population level and specifically among women who later present for fistula repair [16, 17]. Some of this increase is saving lives and preventing fistula, a positive outcome that is not captured in this population of women who developed fistula.

Despite its important place in enabling fistula elimination, however, rising numbers of cesarean births increase the risk of all associated complications, including iatrogenic fistula. Location and circumstances can indicate that a fistula is iatrogenic rather than attributable to pressure necrosis [7, 11]. Evidence has been mounting about the proportion of iatrogenic fistula amongst repaired fistulas [18–21]. In a separate analysis we reported that 26.8% (787/2,942) of women with fistula after cesarean section have injuries caused by surgery rather than

pressure necrosis from prolonged, obstructed labor [7]. This aligns with reports from others [6]. Iatrogenic vesico-[utero]/-cervico-vaginal, vault, and ureteric fistulas generally occur after cesarean birth and gynecological surgery, not after vaginal birth. In this series 80% of women with fistula following childbirth had stillbirths, in contrast to 90% reported by other investigators [2]. Together, these observations support a conclusion that some of these fistulas following childbirth are the result of surgical complications rather than unattended prolonged, obstructed labor.

One interpretation of these data is that countries are at different points on their developmental journeys toward fistula elimination. In South Sudan, Somalia, and Ethiopia, access to emergency obstetric care remains difficult. Widespread insecurity and danger in South Sudan and Somalia have created particular challenges for women experiencing obstetric complications. Ethiopia's population is largely rural and spread across difficult terrain.

In contrast, Kenya, Malawi, Rwanda, Uganda, Tanzania, and Zambia are likely further along on the journey toward reducing the incidence of obstetric fistula, witnessing higher proportions of fistula following cesarean birth and gynecological surgery (Table 2). Given the risk of iatrogenic fistula following cesarean birth, a less positive interpretation could be that these countries are providing increasing numbers of cesarean births without ensuring that surgeries are safely performed following the right indications. As women have greater access to health care, emphasis must be placed on its quality.

## Strengths and limitations

The strength of this study is the size and geographic breadth of its sample, which offers a unique opportunity to assess the circumstances of fistula development in nine African countries. We documented women's demographic information and circumstances of fistula development in detail. The study is not without limitations, however. Included countries have different sample sizes, reflecting variation in where the second and third author and colleagues repaired fistulas. While women sought repair in multiple hospitals with wide catchment areas in most countries, the countries with large sample sizes may be more representative of all women seeking fistula repair than those with smaller samples. This series includes women who sought surgical treatment for their fistula. It cannot include women who developed fistula but did not reach treatment centers. Overall fistula circumstances may be different among all women with fistula if particular women are more likely than others to reach treatment centers. Demographic information and data on birth experiences relied on women's accounts of past events.

Women know their obstetric history well, but in some cases many years passed between the original event and fistula treatment. We acknowledge that women's recollection of childbirth may differ from how providers diagnose obstetric complications. We did not have medical records information on the duration of labor or indications for cesarean birth (where applicable). Additional research is needed on surgical complications from cesarean birth.

## Conclusions

Continued progress toward fistula elimination requires countries to ensure adequate infrastructure and security for women to access basic and comprehensive emergency obstetric care. Providers should have the knowledge, experience, and environment to be able to provide quality care to all women, particularly those who experience labor complications. Facilities and providers should consider the quality of emergency obstetric care, including timing and decision-making for cesarean birth. Safe surgical care requires robust provider training, supervision, and mentoring, appropriate work environments, and clear safety standards. Fistula elimination will require a holistic systems approach that improves emergency obstetric care and surgical safety.

## Acknowledgements

Fistula repairs for the women in this series were made possible from the generous support of Amref Health Africa, EngenderHealth, the Fistula Foundation, the Freedom from Fistula Foundation, Gesellschaft für Technische Zusammenarbeit (GTZ; now GIZ), Johnson & Johnson, the Royal Netherlands Embassy of Tanzania, SOS East Africa, United Nations Population Fund (UNFPA), and Women and Health Alliance International (WAHA). The United States Agency for International Development (USAID), through EngenderHealth's Fistula Care project, funded part of the data entry. We thank Mackenzie Lamb for figure generation, Millicent Oundo for data entry support, and Elizabeth Bukusi and Steven Weyers for their reviews. We appreciate the specialists and staff in the hospitals, who operated on the women and managed them during their hospital stays. Last but not least, we thank the women. This analysis would not have been possible without their willingness to share their unforgettable stories.

## Authors' contributions

CJN and TJIPR designed the study, interpreted the data, and wrote the manuscript. TJIPR and MM collected data. CJN developed data coding, analyzed data, and developed tables and figures. LL conducted literature searches and entered data. MT and JvR provided guidance and editing. MT provided supervision. All authors read and approved the final manuscript.

## Funding

RTI International supported Carrie Ngongo's time to finalize the analysis and manuscript through professional development award 0291013.201.102.

## Availability of data and materials

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.

## Declarations

### Ethics approval and consent to participate

This research was performed in accordance with the Declaration of Helsinki and was approved by the African Medical and Research Foundation Ethics and Scientific Review Committee P88/2013, 17 February 2014, renewed 4 April 2022. Women consented to fistula repair following each hospital's counseling and informed consent process. All methods were carried out in accordance with relevant guidelines and regulations. There were no experimental protocols for this retrospective record review.

### Consent for publication

Not applicable.

### Competing interests

The authors declare that they have no competing interests, except for JvR who is a senior Board Member of BMC Pregnancy Childbirth.

### Author details

<sup>1</sup>Global Health Division, RTI International, Research Triangle Park, USA. <sup>2</sup>Nairobi, Kenya. <sup>3</sup>Bugando Medical Centre, Mwanza, Tanzania. <sup>4</sup>Cape Town, South Africa. <sup>5</sup>Leiden University Medical Centre and Athena Institute VU University, Amsterdam, Netherlands. <sup>6</sup>Centre of Excellence in Women and Child Health, Aga Khan University, Nairobi, Kenya. <sup>7</sup>Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium.

Received: 1 May 2022 Accepted: 13 September 2022

Published online: 04 October 2022

## References

- World Health Organization. The World Health Report 2005: Make Every Mother and Child Count. World Health Organization; 2005. <https://www.who.int/publications/i/item/9241562900>. ISBN 9241562900.
- Ahmed S, Anastasi E, Laski L. Double burden of tragedy: stillbirth and obstetric fistula. *Lancet Glob Health*. 2016;4:e80–2.
- Bangser M. Obstetric fistula and stigma. *Lancet*. 2006;367:535–6.
- Hillary CJ, Osman NI, Hilton P, Chapple CR. The aetiology, treatment, and outcome of urogenital fistulae managed in well- and low-resourced countries: a systematic review. *Eur Urol*. 2016;70:478–92.
- Hilton P. Urogenital fistula in the UK: a personal case series managed over 25 years. *BJU Int*. 2012;110:102–10.
- Onsrud M, Sjøveian S, Mukwege D. Cesarean delivery-related fistulae in the Democratic Republic of Congo. *Int J Gynaecol Obstet*. 2011;114:10–4.
- Ngongo CJ, Raassen TJ, Mahendeka M, Lombard L, van Roosmalen J. Iatrogenic genito-urinary fistula following cesarean birth in nine sub-Saharan African countries: a retrospective review. *BMC Pregnancy and Childbirth*. 2022;22(1):541.
- Hilton P. Trends in the aetiology of urogenital fistula: a case of "retrogressive evolution"? *Int Urogynecol J*. 2016;27:831–7.
- Adler AJ, Ronsmans C, Calvert C, Filippi V. Estimating the prevalence of obstetric fistula: a systematic review and meta-analysis. *BMC Pregnancy Childbirth*. 2013;13:246.
- Maheu-Gioux M, Filippi V, Samadoulougou S, Castro MC, Maulet N, Meda N, et al. Prevalence of symptoms of vaginal fistula in 19 sub-Saharan Africa countries: a meta-analysis of national household survey data. *Lancet Glob Health*. 2015;3:e271–8.
- Raassen TJ, Thomas JI, Ngongo CJ, Mahendeka MM. Iatrogenic genitourinary fistula: an 18-year retrospective review of 805 injuries. *Int Urogynecol J*. 2014;25:1699–706.
- Waldijk K. Surgical classification of obstetric fistulas. *Int J Gynaecol Obstet*. 1995;49:161–3.
- Ngongo CJ, Raassen TJ, Mahendeka M, Lombard L, van Roosmalen J, Temmerman M. Rare causes of genital fistula in nine African countries: A retrospective review. Under review at *BMC Women's Health*.
- Raassen TJ, Ngongo CJ, Mahendeka MM. Diagnosis and management of 365 ureteric injuries following obstetric and gynecologic surgery in resource-limited settings. *Int Urogynecol J*. 2018;29:1303–9.

15. Benfield N, Young-Lin N, Kimona C, Kalisya LM, Kisindja RM. Fistula after attended delivery and the challenge of obstetric care capacity in the eastern Democratic Republic of Congo. *Int J Gynaecol Obstet.* 2015;130:157–60.
16. Betrán AP, Ye J, Moller A-B, Zhang J, Gülmezoglu AM, Torloni MR. The Increasing Trend in Caesarean Section Rates: Global, Regional and National Estimates: 1990–2014. *PLoS ONE.* 2016;11:e0148343.
17. Ngongo CJ, Raassen T, Lombard L, van Roosmalen J, Weyers S, Temmerman M. Delivery mode for prolonged, obstructed labour resulting in obstetric fistula: a retrospective review of 4396 women in East and Central Africa. *BJOG.* 2020;127:702–7.
18. Mpunga Mafu M, Banze DF, Nembunzu D, Maroyi R, Paluku J, Kinja R, et al. Frequency and management of non-obstetric fistula in the Democratic Republic of Congo: experience from the Fistula Care Plus project. *Trop Med Int Health.* 2020;25:687–94.
19. Sanda G, Chipkao R, Harissou A, Soumana A, Tassiou EM. Les fistules urogénitales iatrogènes: à propos de 62 cas et revue de la littérature. *African J Urology.* 2016;22:55–60.
20. Wright J, Ayenachew F, Ballard KD. The changing face of obstetric fistula surgery in Ethiopia. *Int J Womens Health.* 2016;8:243–8.
21. Kopp DM, Sih AM, Tang JH, Rosenberg NE, Chipungu E, Chiudzu G, et al. 255: Delivery factors associated with fistula location among Malawian women. *Am J Obstet Gynecol.* 2016;214:5149–50.

### Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more [biomedcentral.com/submissions](https://biomedcentral.com/submissions)

