Evaluation of data completeness of Client Intake Form (CIF) before and after Data Quality Audit (DQA) of a Voluntary Medical Male-Circumcision (VMMC) program in Zimbabwe

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Abstract

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Purpose

To evaluate and compare the data completeness of Client Intake Forms (CIFs) collected both before and after a Data Quality Audit (DQA) in February 2015 and to identify the factors contributing to incompleteness of CIFs used for the Voluntary Medical Male Circumcision (VMMC) procedure in Zimbabwe.

Methods

Four out of ten sites that received a DQA in February 2015 were selected based on convenience sampling. Secondary data analyses were conducted using data from CIFs, which were filled out by the staff during the VMMC procedures at the sites. Two-levels of completeness were evaluated in two months (November 2014 and May 2015). The record availability of CIFs was assessed by measuring the percentage of VMMC clients whose CIF was on file at each site. Then, a data completeness evaluation tool was used to measure the completeness of 34 key variables on the CIF, and a comparison of the performance on pre- and post- data-completeness in each sampled site was conducted.

Results

Record availability at the Norton and Mutoko sites were generally maintained in high standard (around 100%); the record availability in site Muvonde was 88.0% before the DQA and then improved 8.0% after the DQA; the record availability in site Gokwe South was 79.8% before the DQA and than improved 9.7% after the DQA. The average monthly completeness rate on CIFs prior to the DQA studied for site Muvonde, Gokwe South, Mutoko and Norton is 88.0%, 95.6%, 94.6% and 95.3%, respectively. The average monthly completeness rate after the DQA for site Muvonde, Gokwe South, Mutoko and Norton is 96.6%, 98.3%, 98.3% and 93.6%, respectively. Three of the four sites had statistically significant improvements in data completeness across 34 key indicators, with mean improvement of 8.6%, 2.7%, 3.8%, respectively ($p<0.05$). For one site, Norton, the data completeness of CIFs in May 2015 decreased 1.7% ($p<0.05$) compared to November 2014.

Conclusion

Our findings suggest that the data quality of CIFs in terms of record availability and data completeness were good and generally improved after the DQA. However, there were still some remaining gaps pertaining to the completeness of certain key indicators. Further study should confirm the gaps and offer possible solutions to improve data completeness and to assist quality program implementation. Furthermore, the results suggest the evaluation of data accuracy and authenticity should be integrated into routine data information system in VMMC program in the future.

Keywords: data quality; data completeness, quality improvement, circumcision

Introduction

Zimbabwe, a country of 14.15 million population (2013) [1], has a generalized heterosexually driven HIV epidemic with adult prevalence of 15% and around 1.5 million of people living with HIV [2]. It is one of the sub-Saharan African countries most severely affected by the HIV/AIDS epidemic. Voluntary Medical Male Circumcision (VMMC), with the positive evidence following three randomized trials [3-5] that demonstrated its effect to reduce risk of HIV acquisition among males by up to 60%. As a one-time basic procedure, VMMC has low

rates of adverse events reported [6] and proved to be cost-effective based on several studies in African settings [7]. These factors make VMMC a promising strategy for HIV prevention. Shortly after these randomized control trials [2-5], WHO/UNAIDS recommended VMMC as a supplemental strategy for HIV prevention in combination with the existing HIV Prevention Packages. VMMC programs are particularly suited for countries with a generalized HIV epidemic and relatively low male circumcision rates. Zimbabwe is one of the 14 priority countries which set a target of achieving 80% male circumcision coverage among HIV-negative men 15-49 years old over five years (From 2011 to 2016). By promoting VMMC, Zimbabwe seeks to reduce the incidence of HIV by 25-30% [8]. The task for Zimbabwe was ambitious as Zimbabwe had the lowest male circumcision prevalence of 10.3% in the Southern African region before the national VMMC program was initiated [1].

In 2013, ZAZIC consortium was founded as a collaboration between International Training and Education Center for Health (I-TECH), Zimbabwe Association of Church related Hospitals (ZACH) and Zimbabwe Community Health Intervention Research Project (ZICHIRE). With the cooperation of Ministry of Health and Child Care (MOHCC) of Zimbabwe, ZAZIC began implementing a 5-year, integrated VMMC program in 21 districts in Zimbabwe in March 2013. Through July 2015, 83,706 MCs were conducted [9]. Data collection for the purpose of procedure quality control is of great importance to ensure implementing standardized procedures and to guide decision-making. The VMMC CIF is a brief, multidimensional, staff-administered questionnaire developed jointly by Zimbabwe MOHCC and I-TECH for the purpose of data collection. As the most detailed data resource at client level, the CIF was designed to measure seven dimensions of MC procedure including client's social

demographics, vital signs record, pre-procedure indicators, procedure quality control records, adverse events records, post-procedure surveillance and follow-up. Onsite staff were trained to fill out the CIFs within the process of MC procedure and every MC site were obliged to complete and file the CIFs.

Since CIFs serve as the primary data source for procedure quality control, the availability and quality of data is of great importance. Data quality, according to ISO 14005, was defined as the "characteristic of data that bears on their ability to satisfy stated requirements" [10]. There were concerns in South Africa that VMMC programs decreased in the quality of services after rapid scale-up [11].Data Quality Auditing (DQA), as an effective way to evaluate the program quality and documented data quality, was conducted by I-TECH in February 2015. During this DQA, 10 sites were selected and the data quality of CIFs and registries was assessed. It was reported that the completeness of CIFs was concerning at some sites because of the unsatisfactory overall completeness and frequent failure to fill out several key indicators in CIFs. Report findings were quickly shared with sites. For sites having large data quality challenges, ZAZIC scheduled a follow-up visit about a month after the DQA visit to assess improvement.

We hypothesize that targeted feedback given immediately after this data quality audits would lead to improvements in data completeness. While there were examples of DQA or interventions tailored to improve data quality in VMMC programs [12] or other HIV prevention strategies [13,14] in African settings, to our best knowledge, no formal assessment of effects and impacts of DQA in terms of improvement in data completeness on VMMC

program exist. To test our hypothesis, we conducted a retrospective field-based, implementation-oriented, cross-sectional quantitative study of existing CIFs to assess the improvement of data quality and data completeness after DQA and to identify the factors contributing to incompleteness.

Methods:

Overall Strategy:

A cross-sectional, quantitative comparison evaluation of data completeness of CIFs between pre DQA and post DQA were conducted by using a self-developed data completeness evaluation tool.

Study Design:

Among 36 sites participating in the VMMC program, there were ten sites selected as DQA sites in February 2015. Among which, four sites, Muvonde, Gokwe South, Mutoko, and Norton, were selected by convenience due to unsatisfactory performance in last DQA and data availability. The CIFs from November 2014 and May 2015 were selected to represent one month before and after the previous DQA, respectively. Selected CIFs were manually reviewed in the I-TECH Harare office in August 2015. We used the data completeness evaluation tool to score overall completeness for every CIF and to examine 34 key variables on each CIF to identify incompleteness of specific variables. A comparison of data completeness between pre-DQA and post-DQA data at each selected site was conducted.

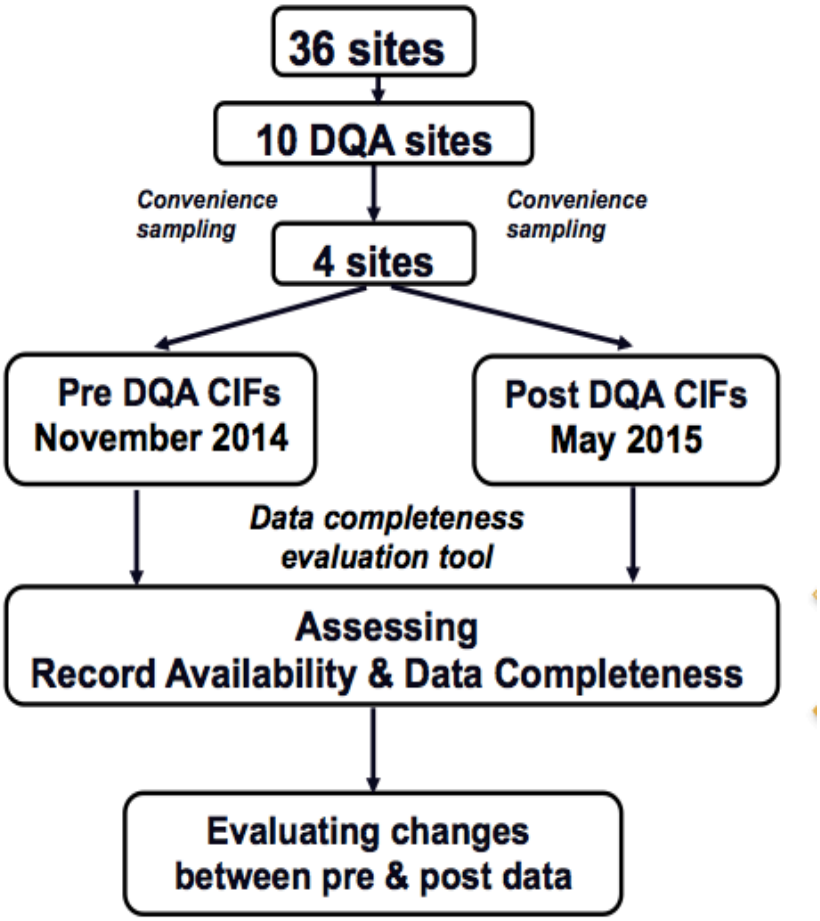

Figure1: Flow chart of study

Data completeness evaluation tool

This tool is aimed to identify incomplete key variables and assess the overall completeness of every CIF. Among all of the information in the CIF, we considered 34 variables to be key indicators for the purpose of procedure quality control (**Appendix 1**). If a key variable was

correctly recorded, we defined this variable "fully completed" and one point was awarded on evaluation tool. Otherwise, no point was awarded for the specific variable. By assigning a value of 0 or 1 for the completeness of each of the 34 key variables and summing the total score, every CIF received a completeness score (out of 34), with higher scores indicating better overall completeness.

Data collection and processing

This analysis reviewed a total of 1400 paper-based CIFs from four sites, Muvonde, Gokwe South, Mutoko and Norton. All of the CIFs were retrieved by site staffs from sites and reviewed in the I-TECH Harare office. For record availability, Monthly Return Form (MRF), a MOHCC form containing aggregated data on monthly VMMC program outputs for each sites, were used to retrieve the amount of VMMCs conducted in relevant months. For all data sources mentioned, client name and client VMMC number were de-identified and information related to completeness was extracted from CIFs. A pre- and post- data quality comparison study was administered using the data completeness evaluation tool. Average score and median percentage of completeness were measured, and quantified performance on data completeness of CIFs was compared between November 2014 and May 2015. The assessment focused mainly on one dimension of data quality, which is data completeness, however, notes regarding other dimensions of data quality were taken when the reviewer manually reviewed the CIFs.

Ethics Statement:

Before the evaluation initiated, ZAZIC reviewed and approved all related evaluation protocols and there was no human subject's research involved in site visit and evaluation activity. This evaluation was part of routine VMMC services in partnership with the MoHCC and therefore was a program evaluation activity, is not generalizable and does not constitute individual patient level research. This VMMC program provides routine VMMC services in partnership with the MOHCC and does not constitute human subjects research. The Medical Research Council of Zimbabwe, the U.S. Centers for Disease Control and Prevention (CDC) and University of Washington's Internal Review Board provided non-research determination for this routine program implementation. All patient-level data was de-identified when evaluation were conducted in I-TECH Harare office. Registers and CIF forms are the property of the MoHCC and are stored by implementing partners in accordance with MoHCC standards for the routine care of data.

Data analysis

All data were originally collected and documented using Microsoft Excel and were analyzed using STATA version 12 [15]. Socio-demographic characteristics of CIFs, such as age and procedure-conducted sites, were examined using descriptive statistics such as count, percent, median with Interquartile range and mean with standard deviation. T-tests were conducted for comparison of data completeness between pre and post DQA pertain to overall completeness and completeness of each variable.

Results:

Study Population characteristics:

According to eight monthly reports from four sites, Muvonde, Gokwe South, Mutoko and Norton, a total of 1461 MCs were conducted in the month of November 2014 and May 2015. For our study, 1400 paper-based CIFs were collected in total. The demographics of VMMC clients are listed in Table 1. The median age of clients is 17 years old (IQR: 18, 20) ranging from 10 to 47 years old. 35.2% of the procedures were performed in static hospitals and 64.8% of the procedures were performed in outreach sites.

Characteristics		Pre DQA		Post DQA		Total	
		N**	%	N	%	N	%
Age (y)*	10-19	394	62.8	535	82.4	929	72.8
	20-47	203	32.3	100	15.4	303	23.7
Type of site conducted (Total n=1368)	Static	186	32.1	296	37.5	482	33.0
	Outreach	393	67.9	493	62.5	886	61.0
Referred Channel (Total n=1365)	School	164	27.9	30	3.9	194	13.3
	Community mobiliser	120	20.5	540	69.3	660	0.5
	HTC program	15	2.6	0	0	15	1.0
	Workplace	0	0	5	0.6	5	0.3
	Health worker	256	43.7	200	25.7	456	33.4
	Other	10	1.7	4	0.5	15	11.0

Table 1: Demographics of study population
**** The oldest client among samples was 47 years old. Our study included few clients age 9 years (n=4) contrary to the minimum age of 10 years according to the Zimbabwe Male Circumcision guidelines [16].***
***** For each indicator, the total number might vary due to different incompleteness rate.***

Record availability:

The monthly record availability reflects the percentage of CIFs that were not located at the sites. We calculated the monthly record availability for each site by comparing the number of CIFs located to the amount of procedures reported in MRFs. The results are shown in Table 2. The record availability for two out of four sites already achieved near 100% before DQA and the other two were less satisfactory (92.0% in Muvonde and 79.8% in Gokwe South). The record availability for four sites generally achieved a high standard after DQA (over 90% in general). For sites with good performance at baseline, high record availability was maintained (almost 100%); for sites Mutoko and Gokwe South, with lower performance before DQA, their record availability increased by 8.0% and 9.7% respectively.

Site	Time frame	Total procedure conducted*	CIFs located	Percentage of clients with CIF on file (%)	Improvement by site (%) ***
Muvonde	November, 2014	237	218	92.0	+8.0, p=0.001
	May, 2015	161	161	100	
Gokwe South	November, 2014	104	83	79.8	+9.74 p=0.02
	May, 2015	220	197	89.6	
Mutoko	November, 2014	221	223	100**	0 p=0
	May, 2015	183	183	100	
Norton	November, 2014	74	73	98.7	-1.3 p=0.22
	May, 2015	262	262	100	
Total	November, 2014	636	597	Cannot compare	
	May, 2015	825	803		

Table 2: The composition of CIF reviewed and their record availability
**As reported on Monthly Return Forms*
*** CIFs located surpassed the total number of procedures due to rare occasions of duplicated cases.*
****Results from Chi square test*

Overall changes of data completeness:

Results of our analyses suggested that sites achieved high overall data completeness across sites after DQA visit. These results show that the data completeness of CIFs in three out of four

sites improved. The monthly completeness rate of CIFs prior to the DQA for Muvonde, Gokwe South, Mutoko and Norton is 88.0%, 95.6%, 94.6% and 95.3% respectively. The monthly completeness rate after the DQA for Muvonde, Gokwe South, Mutoko and Norton is 96.6%, 98.3%, 98.3% and 93.6% respectively. Besides Norton, the other three sites showed statistical improvement of data completeness on CIFs across 34 key indicators with the mean percentage of improvement of 8.6 % in Muvonde (p-0.001), 2.7 %(p=0.003) in Gokwe South, 3.8% (p=0.001) in Mutoko. For Norton, the completeness of CIFs in May 2015 dropped by 1.7% (p=0.01) comparing with November 2014. The percentages of completeness for key variables are listed in **Table 3**:

Site	**Time frame**	**Overall score (34 for full score)**	**Overall completeness Percentage (%)**	**Improvement by sites (%)**		
				Mean different	**P value** (95% CI)	**Confident Interval**
Muvonde	November, 2014	29.9	88.0	+8.6%	<0.001	(7.7%, 9.5%)
	May, 2015	32.8	96.6			
Gokwe South	November, 2014	32.5	95.6	+2.7%	0.003	(1.0%, 4.5%)
	May, 2015	33.4	98.3			
Mutoko	November, 2014	32.2	94.6	+3.8%	<0.001	(2.9%, 4.7%)
	May, 2015	33.4	98.3			
Norton	November, 2014	32.4	95.3	-1.7%	0.001	(-2.6%,-0.7%)
	May, 2015	31.9	93.6			

Table 3: Comparison of pre- and post-DQA data completeness by sites

Changes of data completeness across 34 key variables:

By using the data completeness evaluation tool, we examined seven domains of data completeness on CIFs: records on demographics, vital signs, eligibility, pre-procedure assessment, procedure quality, post-procedure assessment and documentation of adverse

events. Their performance over time is listed in **Table 4**.

Domains	Muvonde (%)		Gokwe South (%)		Mutoko (%)		Norton (%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1.Demographics	94.2	92.8	99.6	99.4	97.9	99.9	99.8	99.7
2.Vital Signs	74.9	99.1	94.0	98.2	87.9	100	86.6	77.1
3.Eligibility	45.6	89.1	88.6	93.9	97.1	80.3	97.3	96.2
4.Pre-Procedure Assessment	98.3	97.0	98.9	99.3	98.0	98.4	98.0	99.3
5.Procedure Quality	79.1	97.4	91.0	97.0	97.8	99.9	96.8	98.3
6.Post procedure Records	96.0	98.8	94.4	98.6	91.3	100	91.8	83.7
7. Adverse events (AEs) records	96.4	98.2	94.0	97.0	69.5	97.3	85.0	97.7

Table 4: The percentage of data completeness by categories

Muvonde had the lowest overall completeness of CIFs before the DQA and had the largest improvement in completeness after the DQA. Muvonde has large improvements in the domains of vital signs, eligibility and procedure quality after the DQA (**Table 4**). As shown in Table 4, the site improved 43.5% ($p<0.001$) on eligibility records; 24.2% on vital signs records ($p<0.001$); 18.3% on procedure quality records ($p=0.001$).

For **Gokwe South**, almost every domain slightly improved after the DQA (Less than 6% improvement, **Table 4**). However, the record keeping in terms of CIFs was sub optimal with missing CIFs at 20.2% (before DQA) and 10.5% (after DQA) ($p=0.003$) raising questions on whether the results are credible.

For **Mutoko**, The documentation of adverse events (AEs) was not completed for 59 consecutive CIFs prior to the DQA, however, there is no missing AE documentation in CIFs in May 2015 and improvement was significant (from 69.5% to 97.3%, $p<0.001$). In addition, the completeness of vital signs improved from 87.8% to 100%, $p<0.001$.

Although **Norton** is the only site that decreased at a statistically significant level in overall data completeness with a drop of 1.7%, its **overall completeness of CIFs** at both time points were high and maintained across time. Even though the overall decrease was small, the completeness on vital sign records and post-procedure records were concerning with decrease of 9.5% (P<0.001) and 8.1% (P<0.001), respectively.

Changes on selected key variables:

Since the completeness of several key variables influenced the overall completeness and their changes from site to site, we discuss results of key variables below.

Vital signs:

As we can see in **Table 5** below, improvements were made for most key variables under vital signs among Muvonde, Mutoko and Gokwe South. The overall completeness of vital signs records in Muvonde and Mutoko increased with the average improvement of 24.2% (95% CI: 20.0%-28.0%, p<0.05) and 12.2% (95% CI: 9.0%-15.0%, p<0.05) respectively. Gokwe South showed no statistically significant change in vital signs records after the DQA (p>0.05). However, the results from Norton found that completeness decreased after DQA by 9.6% (95% CI: 6.0%-13.0%, p<0.05). Norton's blood pressure (BP) record were unsatisfactory at both time points and decreased after DQA (49.3% in November 2014 and 8.4% in May 2015). In post-DQA CIFs, 97.2% of all incomplete fields on post-procedure records were due to lack of post BP records.

Among a total of 1400 CIFs reviewed, for clients ≤ 19 years old, only 62.97% of their CIFs had complete BP records compared to 91.79% completeness among clients ages 20 to 40 years old. The difference of the completeness on blood pressure between across age is of statistical significance (95%, $p<0.05$) and suggested possible gaps in measurement of adolescent blood pressure.

Variable	Muvonde (%)		Gokwe South (%)		Mutoko (%)		Norton (%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Vital Signs	74.9	99.1	94.0	98.2	87.8	100	86.6	77.1
Blood Pressure	92.2	99.4	94.0	98.5	72.7	100	49.3	8.4
Pulse	87.6	99.4	92.8	98.0	97.8	100	98.6	100
Temp	38.5	98.1	90.4	97.5	77.1	100	98.6	100
Weight	81.7	99.4	98.8	99.0	99.1	100	100	100

Table 5: The percentage of completeness by vital signs

Eligibility:

Among CIFs reviewed, 26.1% (n=356) of CIFs didn't have the clinician's signature; 2.4% (n=34) of the CIFs neither checked informed consent granted checkbox nor have the clinicians' signature prior to MC. The eligibility section generally improved to above 80% completeness after the DQA (**Table 4**). Among which, Muvonde improved 43.5% after DQA (95% CI: 39.7%-47.3%, $p<0.05$). For Norton, the completeness of the eligibility section decreased by 16.8% after DQA (95% CI: -21.0%,-12.8%, $p<0.05$).

Adverse Events (AEs):

Documenting any AEs is of great important to achieve optimal outcomes. Among a total of 1400 CIFs reviewed, 112 CIFs (7.7%) had incomplete AE information. The completeness of AE records in Mutoko and Norton improved after DQA with improvements of 27.8% (95% CI:

21.2%, 34.3%, p<0.05) and 12.8% (95% CI: 4.2%, 21.4%, p<0.05), respectively. The reviewer noted that there were 29 AEs documented in CIFs reviewed and all of 29 cases were recorded with same symptoms (mild pain and bleeding after procedure) in the same month (May 2015) and same site (Mutoko).

Pre-procedure assessment:

Table 6 lists the questions that would be routinely asked before MCs. The overall score of pre-procedure assessment was better than any other categories at the two time points. The question on bleeding history had the lowest completeness among the pre-procedure questions, and also showed no meaningful improvement after the DQA (three out of four sites showed no statistically significant improvement) (p>0.05).

Variable	Muvonde (%)		Gokwe South (%)		Mutoko (%)		Norton (%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Allergy	99.5	99.4	100	99.5	96.9	98.9	98.6	99.2
Medication	99.5	98.8	98.8	99.5	99.1	98.9	100	99.6
Operation	99.1	100	98.8	99.5	98.7	98.9	100	99.6
HIV test	100	99.4	100	100	98.7	100	98.6	100
Other disease	98.6	95.7	100	99.5	98.2	100	100	99.6
Bleeding	89.0	80.1	92.8	95.9	91.9	88.5	90.4	95.4
General Condition	98.6	100	100	100	99.6	100	97.3	100
Complaints	100	100	100	100	99.6	100	97.3	100
Genital exam	100	100	100	100	99.1	100	100	100

Table 6: The percentage of completeness by key variables in Pre Procedure Assessment

Discussion:

Meaningful Improvement

Overall, three out of four sites (Mutoko, Gokwe South and Muvonde) showed statistically significant improvements after the DQA. Although the changes are small in scale across sites ranging from -1.7% to +8.6 % (**Table 3**), we believe meaningful improvements after the DQA were observed. For record availability and record keeping, the previous low performing sites improved around 10% (Muvonde and Gokwe South) and the high performing sites maintained (Mutoko and Norton). For data completeness of CIF reviewed, quantitative evidence supported that Muvonde, the lowest performing site among the four sites, improved to the greatest extent (from 88.0% to 96.6%). Their overall score improved from 29.9 to 32.8, which means about three more questions were completed per CIF form on average after the DQA. However, the other three sites which already achieved over 95% overall completeness before DQA showed little changes after DQA.

In addition, several attitudinal barriers improved after the DQA. The facts that the sites improved the AEs records and eligibility records suggest that the staff in sites learned lessons from the feedback from last DQA, increasing their attention to data quality. The gaps remaining after the DQA may be due to more technical and supply reasons and may need to be solved at the program-level. For example, one main reason for Norton's decline in data completeness in May 2015 is that most of their clients are adolescents and the facility had an insufficient number of adolescent blood pressure cuffs.

Whereas several data quality assessments of VMMC program [12] or other HIV prevention

programs [13, 14] have been conducted, to our best knowledge, little has been done to examine the effects of DQAs and identify specific gaps in incompleteness of client-level data in VMMC programs around the world. Our findings demonstrate that the DQA had positive impacts on the data completeness for three out of four selected sites. Specifically, the DQA helped to improve different gaps of data completeness in different site, such as the improvement in the documentation of vital signs and pre-procedure signature at Muvonde. Besides evaluating the effects of the DQA, this comparison study also identified remaining gaps that need to be improved in the future, such as the unsatisfactory performance for Norton on BP records among adolescent male clients' CIFs. These results extend previous DQA reports and guide to further movement.

Other data quality concerns:

Data quality has been defined as "a set of data quality attributes that represents a single aspect or construct of data quality" [17]. In Chen's paper [17], several important dimensions of questionnaire data quality can be assessed, such as accessibility, believability, completeness, free-of-error, etc. Unfortunately, several factors led our evaluation to mainly focus on one element of data quality-the completeness of CIFs. First, we consider high data completeness rate is the prerequisite of good data quality and unsatisfactory data completeness of CIFs across 10 sites selected was a primary problem observed in the previous DQA. Thus, the main focus on data quality improvement for our team lay on data completeness. Secondly, our study relied on the CIFs collected by site teams and the reviewer did not have permission to access the sites studied. Therefore, other dimensions of data quality could not be assessed, including whether the data recorded on CIFs are real (authenticity) and whether the data captured in CIFs are

correctly transmitted to aggregated data resource (accuracy), etc. However, since CIFs provide the most detailed client-level data, data quality problems exposed during the process of manual CIF review may indicate additional problems in data quality of CIFs and in data information systems in the overall VMMC program.

Although progress has been made regarding data completeness, other potential challenges were identified. Data authenticity was concerning. During the CIF review we noticed that among 395 CIFs from one site, over 60% of clients had identical BP records in pre-procedure assessment and post procedure records (67.0% in November, 2014; 64.6% in May, 2015). These coincidences cannot be ignored nor attributed to random chance. It indicated that there was probably no BP measurement around procedures for these 60% clients or they measured one BP and then repeated for other patients. If this was true, the actual data completeness on both vital signs records and post-procedure records would be lower than what we found.

In addition, there are responses that indicate MC contraindications among all pre-procedure questions among a total of 1400 CIFs. The reviewer gathered anecdotal information from staff in programme offices and partner institutions that suggest that some sites may circumcise clients without assessing client's pre-procedure status. The most important reason for pre-procedure assessment is to exclude any contraindications before and to prevent every possible AEs during and after MCs with preparation. Failure to evaluate contraindications will add more procedure risk and jeopardize clients' lives. In the widely-used manual for adult MC procedure [16], the absolute contraindications for MC includes anatomical abnormality, chronic paraphimosis, genital ulcer disease, urethral discharge, penile cancer, chronic disorders

of the penis and bleeding disorder [16]. Some of these contraindications are easily identified on physical examination.

However, some of them, such as a bleeding disorder, cannot be identified without taking a careful medical history. Thus, among all of the pre-procedure assessments listed in Zimbabwe's CIFs including history of bleeding disorder, anemia, hypertension, diabetes mellitus, kidney and thyroid disease, the confirmation of no bleeding disorder history or relative family history before circumcision is likely the most vital to prevent adverse events. Failure to identify critical contraindications like bleeding disorder before procedures, may lead clients to be exposed to potential complications. Moreover, the score of this variable on data completeness was the worst among all pre-procedure questions. 128 out of 1400 CIFs failed to complete the question "Do you have any family history of abnormal bleeding or clotting" (**Table 6**). One in 10,000 males worldwide suffered from hemophilia, a lifelong chronic bleeding disorder [18]. Although the incidence and prevalence rate of hemophilia are not well known, Stonebreaker's paper [19] concluded that the prevalence of hemophilia was 6.6+6.8 in (mean+SD) 100,000 among non-high income countries. In South Africa, around 71% of bleeders is due to hemophilia (2004-2007) [18]. As 83,706 MCs were conducted by July, 2015, theoretically, about six cases of hemophilia could have been shown up in our routine practice, however we didn't identify any suspected patient in pre-procedure assessment. This is a serious reminder to us to emphasize the quality of data as well as the quality of the whole procedure for every client.

Due to the limitation of secondary data analysis, we have no way to determine the real reasons

no clients with bleeding disorders were identified among all CIF reviewed. However, we should be cautious that pressure to improve data completeness does not compromise data authenticity.

Limitations:

Our analysis has several limitations. First, due to limited time and human resources, the study populations were restricted to four convenience sites. The record availability either improved or were maintained at a high level after the DQA. Three of four sites had a relatively good performance on data completeness before the DQA (around 95%). Thus, analysis can only be conducted separately for each site and conclusions may not be generalizable to all of 36 sites. Second, there were several factors that confounded interpreting evaluation results, such as different client volumes in different months and different compositions of clients in different months. Furthermore, due to ethical considerations and restriction of secondary data analysis, we were unable to confirm the barriers that gave rise to low data completeness by interviewing relevant personnel. Finally, we had no chance to assess data reliability (consistency between data documented in site registries and data documented in CIFs) and accuracy (consistency between actual figures and records on CIFs), which are also important dimensions in data quality evaluation.

Conclusion:

In conclusion, our study indicates that following a DQA, the record availability either maintained a high level or improved. Moreover, there were improvements for three sites out of four regarding the data completeness of CIFs. Furthermore we identified several gaps remaining in chart completion. We recommend maintaining and expanding these assessments of data completeness and adding other data quality assessments, such as data accuracy and authenticity to following data quality auditing, which can help to evaluate the improvement of every DQA over time. By integrating these assessments into routine practice, we believe overall CIF data quality will improve and more CIFs data will be viewed as reliable resources of data. We also hope these findings will allow funders and researchers to have more confidence in using CIFs data to inform VMMC program decision-making in Zimbabwe.

Competing interests:

None declared.

Conflict of interest and funding:

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Appendix1:

Code	Documentation of Variable	Sub-Category	Total
1	Name	**Demographics (6 points)**	**34 points if all listed variables are recorded**
2	Age		
3	Type of Sites		
4	Referred channel		
5	Address		
6	Tel-number		
7	Weight	**Vital Signs (4 points)**	
8	Temperature		
9	Blood Pressure		
10	Pulse		
11	Allergy	**Pre Procedure Assessment (Besides vital signs) (9 points)**	
12	Medications		
13	Operation History		
14	HIV test		
15	Other diseases history		
16	Bleeding history		
17	General condition		
18	Complaints		
19	Genital exam		
20	Informed Consent Granted	**Eligibility Records (2 points)**	
21	Clinician Initials		
22	Date	**Procedure Records (6 points)**	
23	Circumciser's name		
24	Assistant's name		
25	Procedure type		
26	Anesthesia records		
27	Procedure time		
28	Adverse events	**Adverse events Records (1 point)**	
29	Post Blood pressure	**Post procedure Records (6 points)**	
30	Post pulse		
31	Analgesia given record		
32	Post general condition		
33	Next visit schedule		
34	Signature for discharge		

Table 8: Self-developed Evaluation tool: list of key variables and their classification.

Appendix 2:
List of acronyms:

AE	Adverse Event
CIF	Client Intake Form
MRF	Monthly Return Form
DQA	Data Quality Audit
HIV	Human immunodeficiency virus
I-TECH	International Training and Education Center for Health
MC	Male circumcision
MoH	Ministry of Health
MoHCC	Ministry of Health and Child Care
VMMC	Voluntary medical male circumcision
WHO	World Health Organization