Differences in Adverse Events Related to Voluntary Male Medical Circumcision Between Civilian and Military Health Facilities in Uganda

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Abstract

**Background:** Voluntary medical male circumcision (VMMC) significantly reduces the risk of acquiring HIV in men. Despite the percentage of circumcised men (15-49 years) in Uganda increasing over time, some populations are not taking up the surgical procedure. The government of Uganda and implementing partners have responded to this lack of VMMC coverage among key populations by intensifying introducing innovative strategies that increase demand particularly among military personnel using the WHO’s MOVE strategy. As a surgical intervention, it is critical that VMMC services are safe for clients and that adverse events or complications are minimized. This paper describes the prevalence and trends of adverse events reported among military mobile camps in comparison to civilian sites in Uganda.

**Methods:** A prospective study conducted in eighteen (18) public health facilities between March and August 2019. Of these nine (9) were providing care to civilian populations while nine (9) served the military population and catchment areas. Descriptive statistics, Chi-square test and trends analysis were carried out to describe profile of adverse events among civilian and military facilities over the study period.

**Results:** The highest proportions of VMMC were done among persons aged 15 to 19 years whereas among military camps the highest proportions of circumcision among males aged 20 to 24 years. Regarding site of circumcision, the highest proportions of VMMC were done at outreaches, with higher levels in military camps compared to civilian camps. For the proportions of adverse events reported, higher proportions were reported in civilian camps compared to military camps (Total – 1.3% vs 0.2%; p-value<0.05). For trends analysis, results indicate that there was no statistically significant trend for both civilian and military number of adverse events reported for the four quarters in 2020 (P-value =0.315 for civilian and P=0.094 for the military).
Conclusions: The MOVE model is great for scaling up VMMC in specialized populations such as military. Can also be adapted in other populations if contextual bottlenecks are identified and collectively addressed by key stakeholders – leadership, community engagement and using a largely horizontal approach offer promising possibilities and outcomes.

Key words: Voluntary Male Circumcision, Military camps, Civilian, Adverse events
Voluntary medical male circumcision (VMMC) significantly reduces the risk of acquiring HIV in men (1-9) and for every circumcision there is a reduction of male to female sexual transmission of HIV by approximately 60% (10, 11). VMMC is associated with several health benefits such as reducing the risk of contracting genital ulcers, syphilis, penile cancer, human papillomavirus (HPV), herpes simplex virus (HSV) and cancroid (12, 13).

Given that the Southern and Eastern African countries have been severely affected by the HIV epidemic, prevention and treatment services remain significant public health priorities [19].

Uganda is a priority country for VMMC scale-up, with HIV prevalence among adults at 6.2%, 7.6% among women and 4.7% among men in 2016; corresponding to approximately 1.2 million adults living with HIV (14). Despite, the percentage of circumcised men (15-49 years) in Uganda increasing from 24% in 2006 to 27% in 2011 and 46% in 2016 (15, 16); of these, 18% are circumcised by traditional practitioners or family friends and 22% by a health professional (15, 16) so there is still need to scale up VMMC (12) to reduce new infections.

The Government of Uganda and implementing partners have responded to this lack of VMMC coverage by intensifying introducing innovative strategies that increase demand especially for previously unreached populations or hard-to-reach people (6). The Ministry of Health (MOH) formally endorsed VMMC as an effective HIV prevention strategy in 2010 and set a goal of circumcising 4.2 million Ugandans by 2015.

Health systems in developing countries, Uganda inclusive, are fragile and faced with multiple bottlenecks which constrain their ability to provide optimum quality VMMC services or their scale up. To cover the unmet need and cognizant of LMIC health system challenges the WHO, in 2010, recommended the model of optimizing volume and efficiency (MOVE) of male circumcision services (17). The MOVE model advocates for a task-shifting and task-sharing approach; whereby task-shifting refers to the use of non-physician providers to complete all
steps of male circumcision surgery. This allows the operator (or surgeon) to focus on the most technically complex components of the surgery. In task-shifting and task-sharing models, surgical activities are reassigned, where appropriate, from those providers qualified for such interventions, e.g. physicians, to other appropriately trained and competent healthcare providers, e.g. clinical officers and nurses (17).

The Uganda military was targeted for VMMC scale-up utilizing the MOVE model because they are characterized as a key population due to the mobile nature of their work. Although the exact HIV prevalence rate for the military is unknown, it is estimated that key populations have a high prevalence between 15% - 37%, much higher than that of the general population at 6.2% (18). World Health Organization (WHO) and Joint United Nations Programme on HIV/AIDS (UNAIDS) recommend that regions with high prevalence rates must implement voluntary medical male circumcision (VMMC) to scale down the transmission of HIV (10, 13). This clearly indicated the military as a key population to target for VMMC programs.

As a surgical intervention, it is critical that VMMC services are safe for clients and that adverse events or complications are minimized. There is limited information on adverse events following VMMC for Uganda; however, various studies have shown the rate of adverse events to be in the range of 2.1% (19) to 3.6% (20). Adverse events rates as high as 7.5% have been reported among clients actively followed up after circumcision in Kenya (21). Even with a skilled surgical team, adverse events occur and when they do, it is essential that they are quickly identified and properly managed (22). The Ministry of Health (MOH) in Uganda has developed a scale to guide male circumcision surgical teams in grading the severity of various types of adverse events (23) in addition to data capture tools in which to record adverse events.

Management of voluntary medical male circumcision by surgery or device adverse events requires knowledge of classification and adverse events may be classified according to type, timing of their occurrence since male circumcision surgery and severity (22). The adverse
events may be managed locally on site of the VMMC service delivery or referred to a higher-level health facility or to a specialist for further management for adverse events related to partial or complete amputation of the glans or shaft; resulting in permanent disability; and resulting in permanent anatomic deformity.

Timely and proper management of VMMC adverse events is very crucial for the attainment of the set goals of VMMC to prevent HIV and STI. There is little is known about adverse rates reported among the various projects implementing VMMC programs in different populations and contexts. This paper describes the prevalence and trends of adverse events reported among military mobile camps in comparison to civilian sites in Uganda.

Methods

Study aim:

To describes the prevalence and trends of adverse events reported among military mobile camps in comparison to civilian sites in Uganda.

Study Sites

The study took place in eighteen (18) public health facilities. Of these nine (9) were providing care to civilian populations while nine (9) served the military population and catchment areas. The health facilities are located in all regions of Uganda. These sites were selected for the scale-up because they met the minimum standards for providing safe VMMC including that appropriate VMMC outreach/mobile sites must: be co-located or close to a health facility; have sufficient space for comprehensive VMMC services; have water, electricity, and sewerage systems; have an unmet need for HIV prevention and population interest in VMMC; be geographically distributed and accessible; have normal transit patterns; located on a public transportation route, within 45 minutes of healthcare team accommodations and have reasonable security (17, 24).
Civilian health facilities: Just like the military facilities, nine facilities were picked from the civilian facilities - three (3) from each of the regions and at the same level as the military facilities. Data was picked from three regions of the country - Central, Northern and Western regions. In each region three facilities were picked based on Uganda's hierarchical health system arrangement. They consisted of one Health Centre III, one Health Centre IV and one hospital.

**Study Population**

Participants included in this study were males aged 10 years and above. All persons included in the VMMC program provided consent prior to being circumcised. Parental assent was provided for all children aged less than 18 years.

**Definitions**

**Adverse event:** Any injury, harm, or undesired outcome that occurred during or following a clinical procedure, such as the male circumcision procedure, that would not have occurred if the client had not undergone the procedure at that time.

**Voluntary Medical Male Circumcision:** Surgical removal of the foreskin of the penis.

**The Intervention**

This paper is based on the University Research Council - Department of Defence HIV/AIDS Prevention Program (URC-DHAPP) implemented in military populations between March and June 2019. URC-DHAPP is providing technical assistance and direct support to the Uganda People’s Defence Forces (UPDF) to scale-up the military ART program and achieve the UNAIDS 90-90-90 goals (90% of people with HIV diagnosed, 90% of those diagnosed on antiretroviral treatment (ART), and 90% of those on ART virally suppressed by 2020). The program involves HIV testing, treatment and care services to reduce the HIV burden and ensure
a healthy Ugandan military. The program adapted the MOVE model in its implementation of interventions to scale up VMMC services among soldiers, their families and neighbouring communities (17). The target was to reach 20,200 males within the catchment populations. The Uganda Peoples Defence Forces (UPDF) were selected because they are mobile populations with higher HIV prevalence; also with less likelihood to be linked and adhere to antiretroviral therapy (ART) (17, 25).

The leaders and VMMC teams systematically targeted areas previously without VMMC services, including locations of recently recruited personnel. The military men were identified systematically through assistance from military commanders who mobilized their teams. Military men or clients eligible for VMMC were then mobilized by commanders and voluntarily participated in the circumcision exercises.

We implemented a military-centered, persistently high-frequency community mobile VMMC service which catered for soldiers, their families and surrounding communities. We adopted the WHO models for optimizing the volume and efficiency (MOVE) for male circumcision services (13) which outlines considerations for improving efficiency while ensuring safety taking into account the Uganda VMMC local national policy. Interventions were designed to last two weeks at a time per month with a break to permit change/rotation and debrief of fresh teams. Every team served a maximum period of two weeks at a time in a location.

**The Mobile VMMC Logistic Package**

The mobile VMMC logistic package – exclusive of consumables included in 3 16-seater vans, 3 lorry tracks. Each equipped with a tent, generator and conditioner units constituting 3 mobile VMMC teams that delivered mobile VMMC services at 3 different selected outreach posts at a time. Initiatives to scale up services were later adopted where innovatively; static health facility sites were occasionally transformed into semi-mobile outreach sites to expand on the volume of VMMC conducted. After three static health facilities with a functional theatre were
identified, a mobile VMMC team would be dispatched with all the required supplies to provide services based on the MOVE model. Mobilisation efforts around the community served by the clinic were increased to ensure clients sought services during that period. After the camps, these facilities were expected to continue offering post-operation services to clients such as follow up and managing of adverse events while they continued to offer routine static VMMC services.

UPDF commanders requested for the services through their medical leadership which in turn also requested VMMC programs from URC. In the end, several soldiers accessed preventive services without needing them to move from their operation sites except during recovery periods. The mobile nature of the VMMC program also increases coverage in line with universal health coverage goals that cater for equity through the availability of service to those who are in need irrespective of the population or geographical location (24).

Composition and roles of team members

We adopted the Aravind eye clinic (26) method to gain efficiency in the delivery of VMMC surgical intervention for national public health impact on a large scale. The VMMC surgical teams typically comprised of 12 military medical personnel. In locations where, mobile camps were set up, the resident troop commanders in various parts of the country constituted the surgical teams as jurisdiction leads for their territories. They were encouraged to mobilise their troops, families and surrounding civilian community for the two-week long military led VMMC surgical camps within their command areas.

Circumcision Process

The operational mobile tent surgical theatre move model was adopted: each theatre tent had a minimum of three/four surgical beds for the two surgeons in each team, two surgical assistants per surgical bed with a total of 10 lower cadres per team. The program adopted the forceps-
guided dorsal slit surgical method (ref) with each surgeon assisted by two assistants. After the main operation, the surgeon inserted three sutures at 12, 3, 6 and 9 o’clock position, achieved haemostasis and moved on to the next vacant surgical table. The surgical assistants completed the incision sutures while monitoring clients for achievement of immediate post-surgical haemostasis and moved on to the next surgeon while the patient was assisted to the immediate post-operation observation area outside the surgical tent. Each surgical camp was linked to the nearest MOH health facility for data reporting and referral of participants of any medium to long term post-operative complications. Participants were given mobile phone numbers of participating surgeons to report any immediate side effects while the team was in session and referred to linked MOH health facility for medium- and long-term post-operation side effects. All post-operative follow-up was patient initiated.

Sampled three sites for both civilian and military sites within the three regions of the country. Each region consisted of three sites which are H/C III, H/C IV and a general or referral hospital. Each for both civilian and military

**Extraction of Data**

Between March and August 2019, various records capturing the execution of mobile VMMC in military settings were collected and stored at supporting health facilities with tertiary aggregates stored at URC DHAPP program offices. Primary patient level data were collected using Ministry of Health (MOH) data collection forms, aggregated and submitted to the linked MOH health facility. Daily staff performance data in terms of number of males mobilised and circumcised was collected, aggregated by the surgical team leads and delivered to the URC-DHAPP program officer. The utility of micro-level program data in informing program interventions in the current program was adopted from PEPFER 3.0 strategy (27) referred to as “granular programming” within URC-DHAPP Uganda. The current paper uses data from
these multiple sources to describe the VMMC methods adopted at military health facilities and served surrounding communities to assess the effectiveness of a military health service driven mobile VMMC program in accelerating VMMC coverage.

Using the military and local government reporting systems, adverse events were identified, and locally managed at military health facilities even after the circumcision camps close was collected. The military leadership applies robust follow up mechanism at all administrative levels. National VMMC data was extracted from (dhis2) for 14 military health facilities and was compared with similar data from civilian health facilities over the period of October 2018 to September 2019.

**Statistical Analysis**

Descriptive statistics including frequencies and percentages, medians and interquartile ranges (IQRs) for categorical and continuous variables respectively. Chi-square test or Fishers’ exact tests were used to test for associations between categorical variables, while Student’s T-test was used for assessing differences between normally distributed continuous variables. Chi square tests for trend were used to test for trends. Statistical significance will set at the \( P < .05 \) level and all analyses were performed using Stata version 14 (StataCorp, College Station, TX, USA).

**Results**

Results from Table 1 indicate that there were differences in age by region between civilian and military camps in proportions of men circumcised. Overall and by region, in civilian camps, the highest proportions of VMMC were done among persons aged 15 to 19 years whereas among military camps the highest proportions of circumcision are among males aged 20 to 24 years, with significant camp differences noted by age (\( p\)-value<0.05).
Table 1: Comparison of characteristics between participated in VMMC at Civilian and Military facilities by region

| AGE         | CENTRAL (N = 9266) | WESTERN (N = 5158) | P-value | NORTHERN (N = 2283) | WESTERN (N = 3202) | P-value | TOTAL (N = 14527) | NORTHERN (N = 2978) | P-value | TOTAL (N = 11306) | Military (N = 3202) | P-value |
|-------------|---------------------|---------------------|---------|---------------------|---------------------|---------|-------------------|---------------------|---------|-------------------|---------------------|---------|
| 15-19Yrs    | 4406(47.6)          | 1573(30.5)          | 0.000   | 1091(47.8)          | 471(14.7)           | 0.000   | 1938(65.1)        | 506(17.2)           | 0.000   | 7435(51.2)        | 2550(22.6)          | 0.000   |
| 20-24Yrs    | 2018(21.8)          | 1380(26.8)          |         | 645(23.3)          | 1011(31.6)          |         | 477(16.0)         | 1168(39.6)         |         | 3140(21.6)        | 3559(31.5)          |         |
| 25-29Yrs    | 1330(14.4)          | 1098(21.3)          |         | 346(15.2)          | 1051(32.8)          |         | 297(10.0)         | 850(28.9)           |         | 1973(13.6)        | 2999(26.5)          |         |
| 30-34Yrs    | 750(8.1)            | 610(11.8)           |         | 96(4.2)            | 417(13.0)           |         | 126(4.2)          | 300(10.2)          |         | 972(6.7)          | 1327(11.7)          |         |
| 35-39Yrs    | 396(4.3)            | 314(6.1)            |         | 63(2.8)            | 147(4.6)            |         | 62(2.1)           | 73(2.5)            |         | 521(3.6)          | 534(4.7)            |         |
| 40-44Yrs    | 220(2.4)            | 131(2.5)            |         | 28(1.2)            | 63(2.0)             |         | 43(1.4)           | 28(1.0)            |         | 291(2.0)          | 222(2.0)            |         |
| 45-49Yrs    | 102(1.1)            | 41(0.8)             |         | 12(0.5)            | 34(1.1)             |         | 23(0.8)           | 15(0.5)            |         | 137(0.9)          | 90(0.8)             |         |
| 50+Yrs      | 44(0.5)             | 11(0.2)             |         | 2(0.1)             | 8(0.2)              |         | 12(0.4)           | 6(0.2)             |         | 58(0.4)           | 25(0.2)             |         |

Adverse events

| Yes         | 120(1.3)            | 4(0.1)              | 0.000   | 14(0.5)             | 15(0.5)              | 0.728   | 84(2.1)           | 2(0.1)              | 0.000   | 218(1.3)          | 21(0.2)              | 0.000   |
| No          | 9506(98.7)          | 5652(99.9)          |         | 2679(99.5)          | 3267(99.5)           |         | 3845(97.9)        | 2988(99.9)          |         | 16030(98.7)       | 11907(99.8)          |         |

Site

| Facility    | 2408(26.0)          | 973(18.9)           | 0.000   | 743(32.5)           | 325(10.1)           | 0.000   | 144(5.5)          | 75(4.9)             | 0.000   | 3295(22.7)        | 1373(12.1)           | 0.000   |
| Outreach    | 6858(74.0)          | 4185(81.1)          |         | 1540(67.5)          | 2877(89.9)           |         | 2834(94.5)        | 2871(95.1)          |         | 11232(77.3)       | 9933(87.9)           |         |
Regarding site of circumcision, overall and by region, the highest proportions of VMMC were
done at outreaches, with higher levels in military camps compared to civilian camps (Total –
87.9% vs 77.3%; Central- 81.1% vs 74.0%; West – 89.9% vs 67.5%; and North – 95.1% vs
94.5%) with significant camp differences noted by site (p- value<0.05) (Table 1).

For the proportions of adverse events reported, overall and by region, higher proportions were
reported in civilian camps compared to military camps (Total – 1.3% vs 0.2%; Central- 1.3%
vs 0.1%; and North – 2.1% vs 0.1%) with significant camp differences noted (p- value<0.05)
in all regions apart from western region where no difference in the proportions of adverse
events reported was noted (West – 0.5% vs 0.5%; p-value>0.05) (Table 1).

**Table 2: Comparison of characteristics between participated in VMMC at Civilian and
Military facilities**

| AGE          | Facility (Civilian: N = 3295) | Military (N = 1373) | p-value | Outreach (Civilian: N = 11232) | Military (N = 9933) | P-value |
|--------------|--------------------------------|--------------------|---------|--------------------------------|--------------------|---------|
| 15-19Yrs     | 1085(32.9)                     | 264(19.2)          | 0.000   | 6350(56.5)                     | 2286(23.0)         | 0.000   |
| 20-24Yrs     | 864(26.2)                      | 465(33.9)          |         | 2276(20.3)                     | 3094(31.1)         |         |
| 25-29Yrs     | 656(19.9)                      | 325(23.7)          |         | 1317(11.7)                     | 2674(26.9)         |         |
| 30-34Yrs     | 292(8.9)                       | 184(13.4)          |         | 680(6.1)                       | 1143(11.5)         |         |
| 35-39Yrs     | 212(6.4)                       | 94(6.8)            |         | 309(2.8)                       | 440(4.4)           |         |
| 40-44Yrs     | 106(3.2)                       | 32(2.3)            |         | 185(1.6)                       | 190(1.9)           |         |
| 45-49Yrs     | 56(1.7)                        | 4(0.3)             |         | 81(0.7)                        | 86(0.9)            |         |
| 50+Yrs       | 24(0.7)                        | 5(0.4)             |         | 34(0.3)                        | 20(0.2)            |         |
| Region       |                                |                    |         |                                |                    |         |
| Central      | 2408(73.1)                     | 973(70.9)          | 0.161   | 6858(61.1)                     | 4185(42.1)         | 0.000   |
| West         | 743(22.5)                      | 325(23.4)          |         | 1540(13.7)                     | 2877(29.0)         |         |
| North        | 144(4.4)                       | 75(5.7)            |         | 2834(25.2)                     | 2871(28.9)         |         |
| Adverse events |                               |                    |         |                                |                    |         |
| Yes          | 141(4.1)                       | 8(0.5)             | 0.000   | 70(0.6)                        | 11(0.1)            | 0.000   |
| No           | 3311(95.9)                     | 1519(99.5)         |         | 12726(99.4)                    | 10390(99.9)        |         |

Aggregating the data by site of circumcision, the results show that there was significant
difference by age of number of males circumcised between civilian and military camps for both
outreach and facility-based circumcisions (p-value=0.000). On the other hand, for region, the
differences between males circumcised was noted for only outreach sites (p=0.000) with no
significant difference noted between civilian and military camps among facility-based
circumcisions (p-value=0.655). The results show that there was significant difference between
civilian and military camps for both outreach and facility-based circumcisions (p-value=0.000)
regarding the number of adverse events reported (Table 2).

**Figure 1: Proportions of Advance Events reported in civilian and military camps by 2020 quarter**

Trends analysis was carried out for the year 2020 quarterly, to assess the if there were any
significant trends in the number of AEs reported, results indicate that there was no statistically
significant trend for both civilian and military number of adverse events reported for the four
quarters in 2020 (P-value =0.315 for civilian and P=0.094 for the military) Fig 1.

**Discussion**

This study assessed the incidence of adverse events and any differences between the
proportions of adverse events reported among civilian and military males circumcised in
outreach and facility centres in Uganda. Results from this study indicate that the proportion of
adverse events reported in military camps was lower than that reported among the civilian
camps (0.2% vs 1.3%). The civilian total prevalence of adverse events of 1.3% is lower when compared to other studies in Uganda, which show prevalence of 2.1- 5.47% in Kampala (19, 28) and 0.6% - 1.4% from a study in Rakai (29). Further, our rates are still lower when compared to studies which were published in other African countries that recorded prevalence of adverse events ranging from 0-24% (30) and 0.70 to 37.36% with an overall pooled prevalence of 2.31% (31). In a review of randomised clinical trials (RCTs), which provided safe male circumcision services in a clinical trial setting, adverse event rates of 3.8%, South Africa; 1.5% in Kisumu, Kenya; and 3.6% in Rakai, Uganda (9, 32, 33) were reported.

The prevalence of adverse events reported in military centres was 0.2%, a low figure similar to a study carried out in Rwanda regarding follow-up and outcomes after circumcision at the Rwanda Military Hospital, where 28 adverse events among 570 men that received MC were recorded (four cases of diffuse edema, four of bleeding, five of wound infection, three of productive exudate and eleven others) (34).

The adverse events reported in facilities were higher compared to outreach (civilian -4.1% vs 0.6% and military- 0.5% vs 0.1%). In a facility-based setting, field studies in other sub-Saharan African settings report low AE rates (< 2%) (35-39), and these low rates could be due to the fact that some AEs may not be identified, in part as clients may seek care outside of routine VMMC settings. Also, it is important to note that the men circumcised from outreaches may find it hard to return to their camps of circumcision for follow up thus the low rates of reporting adverse events in outreaches.

Although younger boys ages 10–14 represent the majority of program VMMCs, they are not more likely, overall, to have an AE than their older peers (40). However, younger boys are 3 times more likely to have infections than older peers, aged 20 and above (40). Younger VMMC patients warrant targeted attention to prevent, promptly identify, and manage AEs. A previous, multicounty study on adolescent wound care knowledge and practices found that adolescent
VMMC clients reported multiple obstacles to proper post-operative wound care (41). Providers also noted concerns that younger patients, especially those ages 10–14, may be less able to understand post-VMMC instructions or independently adhere to proper wound care (42), potentially putting them at increased risk of an AE. Alternatively, younger men may not identify AEs early or may not report abnormal healing early enough, possibly increasing the severity of AEs among this youngest age group. Therefore, improved, age-appropriate, post-operative counselling would likely help ensure that younger clients comprehend and recall correct information regarding VMMC procedures and postoperative care.

This study’s VMMC program employed the WHO’s model for optimizing volume and efficiency for male circumcision services (MOVE) (43) to assist facilities and outreach programs to rapidly scale up their ability to perform circumcisions. The model promotes workforce efficiencies, including task shifting, where some medical responsibilities are transferred from doctors and nurses to lower-level military personnel, but fully capable, health workers. Community involvement and participation using VHTs and satisfied clients in planning for outreach and mobilisation of peers was integral to achieving high numbers of men accessing VMMC services. Military and uniformed services were involved in MC service provision so that the population, mostly male, sexually active, 18 years and older are targeted for MC. The military setting is very easy for scheduling provision of MC services, in addition to easy for follow up. Also, a substantial portion of civilians can be reached through military services as they often serve also the surrounding community. One thing to note is that, much as the MOVE principles are great, the preparation of people in advance of surgery is a huge task. With organized outreach campaigns, much of the counselling is moved out of the clinic to the community; and further follow-up and referral mechanisms is very complicated to handle.
This study fills gaps in the literature. Although many previous studies report on AEs, these data come from controlled trials and pilot programs with active surveillance, conditions that are largely dissimilar to the routine program implementation setting discussed here. Also, there is scanty data on military populations compared to civilian population in circumcision programs. Therefore, the findings of this study fill a gap in the literature as a starting point regarding reporting of AEs comparing military and civilian populations. Further, in a setting with resource constraints, this study gives information on the advantages of MOVE for male circumcision interventions.

This study has several limitations. First, men who sought follow-up care for AEs outside of the program context in other private or public facilities are not recorded potentially leading to underreporting of AEs. Potential underreporting of AEs noted in the study, however, is not unique to field settings in Uganda, just like other African countries such as other large-scale VMMC program in Zimbabwe (44), and other studies in field settings in Kenya confirm the likelihood of underreporting of AE cases through routine systems (21, 40, 45). Another limitation is the use of aggregate data and failure to model individual level factors associated with AEs. Despite these limitations, we believe the results present informative findings from a large-scale VMMC program for priority populations under routine implementation conditions.

**Recommendations**

The MOVE model is great for scaling up SMC in specialized populations such as military. It is important to monitor adverse events identified by the provider as well as those perceived by the client, since satisfied clients are the most effective mobilizers for the national VMMC programme. Active surveillance should be integrated into the minimum package program of MOVE to allow active follow-up of circumcised men and avert any negative outcomes associated with non-reported AEs. A VMMC programme that plans to rely solely on passive surveillance for monitoring must promote attendance at follow-up visits. Capacity building for
frontline health workers as the local service providers will need to be prioritized to enable them effectively manage AEs. Further study is warranted to determine root causes for AE underreporting, leading to improved AE identification, management and documentation.

**Conclusions**

The MOVE model is great for scaling up VMMC in specialized populations such as military. Can also be adapted in other populations if contextual bottlenecks are identified and collectively addressed by key stakeholders – leadership, community engagement and using a largely horizontal approach offer promising possibilities and outcomes.

**List of abbreviations**

AE Advance Events  
ART Antiretroviral Therapy  
HPV Human Papillomavirus  
HSV Herpes Simplex Virus  
IQRs Interquartile Ranges  
IRB Institutional Review Board  
MOH Ministry of Health  
MOVE Model of Optimizing Volume and Efficiency  
RCT Randomised Clinical Trials  
TASO The AIDS Support Organisation  
URC-DHAPP University Research Council - Department of Defence HIV/AIDS Prevention  
UPDF Uganda People’s Defence Forces  
UNCST Uganda National Council of Science and Technology  
VMMC Voluntary Medical Male Circumcision  
WHO World Health Organization

**Declarations**

**Ethics approval and consent to participate**

The implementation of both program and research activities adhered to required ethical standards. We obtained research approval for the study from The AIDS Support Organisation
(TASO) Institutional Review Board (IRB); Uganda National Council of Science and Technology (UNCST), The Ministry of Health and Uganda People’s Defense Forces (UPDF).

Consent for publication

Consent was obtained from all males before undergoing VMMC.

Competing interests

The authors declare that they have no competing interests.

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The funder had no role in design, data collection, analysis, interpretation, or writing of this manuscript. The authors designed and executed the study, had full access to the raw data, performed all analyses, wrote the manuscript, and had final responsibility for the decision to submit for publication.

Availability of data and materials

The dataset collected, used and/or analysed during this study following ethical approval may be made available, from the corresponding author upon request.

Authors’ contributions

LOO, GS, EL, AN and SL conceived and designed the study; AK, MSN, GS, TR and DB provided manuscript writing and guidance; MSN and AK analysed the study results. All listed authors contributed to the manuscript.

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Figures

**Figure 1**

Proportions of Advance Events reported in civilian and military camps by 2020 quarter