



Accelerated Scale up of Voluntary Medical Male Circumcision within the Military Health Services in Uganda: The Race towards 2020 HIV Epidemic Control

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This work was carried out in collaboration among all authors. Author EL wrote the first manuscript draft. Authors BK, SL, AN and GS supported writing of the second draft. All the other authors provided critical input in subsequent versions while author FKK managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ISRR/2021/v10i230127

Editor(s):

(1) Dr. Kailash Gupta, NIAID, USA.

Reviewers:

(1) Okon Ubong Akpan, University of Maryland Baltimore Nigeria.

(2) Yan Li, Dalian university of technology, China.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/64502>

Original Research Article

Received 22 December 2020

Accepted 18 March 2021

Published 03 April 2021

ABSTRACT

Background: Scaling up Voluntary Medical Male Circumcision (VMMC) is a critical intervention in achieving HIV epidemic control by 2020. However, documentation of programmatic interventions to improve VMMC uptake among military populations, a population that is at high risk of HIV, is lacking. URC-Department of Defense HIV/AIDS Prevention Program (DHAPP) implemented a novel approach to accelerate VMMC uptake in the Ugandan military. We describe trends in VMMC uptake and associated operational costs following the intervention. We also contrast between military and civilian health facilities.

Program Description: We implemented monthly mobile VMMC services throughout the country targeting soldiers, their families and surrounding communities. Records gathered during implementation were used to describe the intervention. Quantitative methods were applied to compare VMMC post intervention rates with set targets and monthly VMMC trends country-wide between military and civilian facilities over a five months period. An operational VMMC service cost analysis was applied to determine per male circumcision unit cost, excluding cost of consumables.

Lessons Learnt: Command-driven mobilization, multiple stakeholder engagement, use of mobile VMMC teams and data-driven planning increased demand for and uptake of VMMC services among the military. By the first month of intervention, VMMC performance had surpassed set monthly targets of 1,474 by 1457 circumcisions, accounting for a 99% increase (n=2,931 circumcisions) from 31% to 62% uptake. Overall VMMC performance achieved within the military was 132% in excess of set targets (n=7,408) at six months. The scaled-up operational VMMC cost per circumcision performed dropped from \$15 to \$7, a 47% unit cost saving within six months. While a positive trend in VMMC uptake was observed in the military facilities, the opposite was seen in civilian facilities over the observation period.

Conclusion: It is feasible to rapidly scale up circumcision coverage in populations served by military health facilities through mobile short term episodic VMMC services which optimize volume and efficiency. Invoking *Command-led* mobilization and multiple stakeholder involvement is critical in demand creation and overcoming the mobile nature of the military.

Keywords: HIV prevention; VMMC; military; mobile health services; MOVE model.

1. INTRODUCTION

Rapidly scaling up evidence-based biomedical interventions is a critical component in achieving epidemic control by 2020 [1,2]. Consequently, scaling up of VMMC in combination with promotion of condom use, pre-exposure prophylaxis (PrEP), HIV testing and prompt initiation of antiretroviral therapy became a global priority since it could have a major impact on the HIV epidemic in high-prevalence settings [1,2]. Voluntary Medical Male Circumcision (VMMC) provides lifelong partial protection for men against HIV infection, reducing female-to-male sexual transmission of HIV by 60% [3] and the likelihood of genital ulcers [4-6], syphilis infection [4, 7] and penile cancers [8,9]. Models suggested that scaling up adult VMMC to reach 80% coverage in the 13 priority countries in Eastern and Southern Africa by 2015 would entail performing 20.34 million circumcisions between 2011 and 2015 and an additional 8.42 million between 2016 and 2025 (to maintain the 80% coverage). Such a scale-up would result in averting 3.36 million new HIV infections and a

net saving of US\$16.5 billion in treatment costs within 15 years [10,11]. VMMC currently remains the only one-off intervention that reduces the risk of HIV infection and is highly cost effective [12].

In 2007 WHO and UNAIDS recommended VMMC in high prevalent countries including Uganda [13]. In a 2012 – 2016 UNAIDS guiding document the VMMC goal was set to circumcise 20.8 million men in order to achieve 80% coverage among males aged 15–49 years in 14 priority countries [14]. By 2016 the United Nations General Assembly made a Political Declaration on Ending AIDS and committed to a global mandate to Fast-Track the AIDS response over the next five years, setting a new target to voluntarily circumcise 25 million men in high-incidence areas by 2020, or 5 million men per year [15]. Aligned with this UNAIDS fast track goal, the WHO/UNAIDS framework for VMMC set out to circumcise 90% of all males aged 10 – 29 years in priority settings in sub-Saharan Africa by 2021 [16].

VMMC for adolescent boys and men in the 14 priority countries in Eastern and Southern Africa expanded rapidly from 2008 to 2014, reaching 3.2 million circumcisions per year. However, progress slowed, and the number of circumcisions decreased to less than 3 million annually to 2.2 million in 2015 [17] and 2.8 million in 2016 [18]. The adoption of innovative approaches to address barriers to VMMC uptake - including the use of Geographic Information System (GIS) mapping, improved target setting, intensified demand creation, efficiency measures and increased staffing capacity and training accelerated annual progress. By the end of FY 2018 PEPFAR had cumulatively supported more than 18.9 million VMMC procedures in Eastern and Southern African countries [19]. In 2017, there were 4.04 million VMMCs performed for HIV prevention in the 14 priority countries [20], reaching over 18.5 million men in the priority countries with medical circumcision [21]. The most recent data from population-based surveys show that less than one third of adult men are circumcised in Botswana, Eswatini, Malawi, Namibia, Rwanda, Zambia and Zimbabwe [22].

Reports from Uganda regarding achievement of VMMC targets are inconsistent. A modeled scenario that assessed the likelihood of the 14 priority countries to increase the proportion of circumcision for 10- to 29-year-olds to 90% by the end of 2021, given their historical VMMC progress and current implementation options, indicated that Uganda was unlikely to meet that goal [23]. According to the WHO VMMC progress brief July 2018, Uganda was reported among 7 of 14 priority countries of East and Southern Africa that attained the 2017 country-specific VMMC target of 90% [20]. However, UNAIDS brief reports 847,633 male circumcisions were performed in 2017 falling short of the country's projected annual coverage target of 1 million [24]. In 2018 only 619,082 circumcisions were performed a decline from the 2017 performance widening the unmet need towards 2020 epidemic control annual targets of 1 million [22].

While male circumcision has the potential to prevent millions of new infections and save millions of lives and billions of dollars in averted HIV treatment costs; maintaining and surpassing the current momentum was desired to reach the target 25 million men by 2020. It was also necessary to achieve high rates of male circumcision and epidemic control within the 14 priority countries. Interventions to scale up VMMC uptake in new populations requires an

understanding of risk and enhancing factors of uptake of care. Strong leadership, country ownership, stakeholder engagement, along with effective demand creation, community mobilization, and human resource deployment were deemed essential for accelerating scale up of VMMC services [25].

We present the accelerated mobile VMMC intervention in Uganda Peoples Defense Forces (UPDF) in the realm of national HIV epidemic control matrix. We provide thick description of how medical services have supported an accelerated scale up of VMMC services within the military, their families and surrounding civilian communities served by the military health services in Uganda.

2. METHODS

2.1 Study Design

This was an intervention operations study in which VMMC programmatic activities were prospectively evaluated and improved during the implementation period with the aim of achieved the projected numbers (targets) of males to be circumcised in the military health facilities by September 2019 . These health facilities serve military, their family members, and civilian populations around the military bases; 55% of patients in treatment being military. We included data of all HIV uninfected males regardless of age that were circumcised as part of the VMMC activities in these facilities between October 2018 and September 2019. Data for the DHAPP VMMC activities was collected and entered in excel database.

2.2 Project Description

The Comprehensive HIV/AIDS Prevention, Care, Treatment and Support project with the UPDF is a 3-year US Department of Defense (DoD) HIV/AIDS Prevention Program (DHAPP) implemented by University Research council (URC). It is part of the military-specific HIV/AIDS programs for the US President's Emergency Plan for AIDS Relief (PEPFAR)-funded countries. The project commenced in October 2018 in 28 military managed health facilities across the country. The overall goal of the project is to reduce the number of new HIV infections and other sexually transmitted infections (STIs) and reduce associated mortality among members of the UPDF, their families and the civilian communities served by UPDF health services.

2.2.1 VMMC Services

VMMC services in Uganda are conducted by accredited health facilities. These carry out the VMMC at the facility (static sites) and in VMMC camps (mobile sites). At the beginning of the PEPFAR financial year, each region in the country is allocated a specified number (target) of males that are expected to be circumcised over the year. This number is broken down by quarters (three monthly) and by facility. Therefore, each health facility will have monthly, quarterly and annual targets. 15 of the 28 military facilities in Uganda were accredited to conduct VMMC, and these are the ones that participated in this study.

Because the static sites have a low return in numbers of males circumcised, the DHAPP-URC project focused on the mobile sites to achieve its targets. Each of the 15 VMMC accredited facilities conducted camps which covered all the regions and communities served by the 28 military health facilities.

2.3 The Intervention

We implemented a military-centered, persistently high frequency, community mobile VMMC service which targeted soldiers, their families and surrounding communities. We adopted the WHO "Model for Optimizing Volume and Efficiency for Male Circumcision Services (MOVE) [26] which outlines considerations for improving efficiency while ensuring safety. This was done in consideration of 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.

To generate an evidence-base which would guide decision making in implementing VMMC services within the armed forces health services, the URC-DHAPP program supported the UPDF HIV/AIDS Directorate to institute and implement monthly mobile VMMC services throughout the country. We instituted daily VMMC granular data collection, assessment, evaluation and management to inform the subsequent month VMMC strategy.

The intervention was implemented throughout all health facilities managed by the military in Uganda in the country.

2.3.1 The Mobile VMMC Logistical Package

The mobile VMMC logistical package - excluding consumables- included 3 16-seater vans, 3 lorry trucks, 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 theater were identified, a mobile VMMC team would be dispatched with all the require supplies to provide services based on the MOVE model [26]. Mobilization efforts around the community served by the clinic were increased to ensure clients sought services during that period. After the camps, these health 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.

2.3.2 Team Member Composition and Roles

We adopted the Aravind Eye Clinic [27] 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 mobilize their troops, families and surrounding civilian community for the two-week long military-led VMMC surgical camps within their command areas. (1) *Task-shifting*: we used paramedical personnel (2 clinical officers "the surgeons" per team) to perform repetitive surgeries; (2) *Task-sharing* of time-consuming tasks such as patient preparation, 4 VMMC assistants per team. In addition, each mobile team had 2 counselors, one team lead, one mobilizer, one records officer, a counselor, a laboratory officer and a vaccinator. The support team included a team leader, the van driver, the truck driver, a resident mobilizer and the commander. (3) *Pre-bundling of instruments prior to surgery*: we used pre-packed disposal VMMC surgical kits; and (4) *Use of multiple surgical bays*: 3 mobile mini-theater tents with 3 surgical tables each. While these practices increased output and gained efficiency they equally maintained the quality of care [27].

2.3.3 The Circumcision Process

The operational mobile tent surgical theater "MOVE model" [26] was adopted: each theater 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 [27, 28] 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 hemostasis 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 hemostasis and moved on to the next surgeon while the patient was assisted to the immediate post-operative observation area outside the surgical tent. Each surgical camp was linked to the nearest MOH health facility for data reporting and referral of participants in case 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 Ministry of Health (MOH) health facility for medium to long term post-operative side effects. All post-operative follow-up was patient-initiated.

2.3.4 Monthly Debriefing

Monthly pre-camp debrief meetings were promptly and routinely held. They focused on reviewing the performance of previous outreach camps in achieving set targets, safety and quality of previous operations, identified successes, challenges and possible solutions to avert untoward outcomes. These debriefs provided an opportunity for the program to appraise VMMC performance and work with the stakeholders to achieve the annual targets while maintaining quality operations.

2.4 Cost

We estimated VMMC service delivery components costs including logistics for delivery of mobile VMMC, waste management, per diem for the surgical teams (excluding monthly salaries), servicing and maintenance of all equipment used.

2.4.1 Comparison with National Non- Military VMMC Sites

We compared our data with the VMMC data from non-military health facilities in Uganda. These

are facilities that are also supported by PEPFAR but not managed by the Ugandan military forces, the Uganda People's Defense Forces (UPDF).

2.5 Data / Measures

Between March and August 2019, various records capturing the processes of 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 MOH data collection forms, aggregated and submitted to the linked MOH health facility. Daily staff performance data in terms of number of males mobilized and circumcised was collected, aggregated by the surgical team leads and delivered to the URC-DHAPP Program officer. The Program Officers analyzed these data and discussed high output/impact strategy for the next day with the surgical team leads. The Program Officer in turn compiled weekly performance summary teams' data, shared and discussed with the URC-DHAPP technical program lead. Based on these performance data, a decision to maintain or change strategy was always made in the course of the VMMC camp. The DHAPP Program Director was notified of the daily surgeon/patient and aggregated surgical teams' output. The utility of micro-level program data in informing program interventions in the current program, was adopted from PEPFAR 3.0 strategy [29] referred to as "granular programing" 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. Data for the non-military health facilities was extracted from the national VMMC database (the district health information system-DHIS2).

2.6 Analysis

Primary data extracted from Ministry of Health (MOH) forms was entered in excel spread sheets, aggregated and exported to SPSS version 22, for statistical analyses. Descriptive statistics (i.e. percentage changes) were used to compare program VMMC statistics with national VMMC targets. Data were

analyzed for statistical trends using linear regression.

3. RESULTS

3.1 Results

The total number of males circumcised during the intervention period was 27,141. More than 91% of the circumcised males were aged between 15-49 years. 67% (18,184) of the total circumcised were civilians from the community served by the military health facilities as shown in Table 1.

3.1.1 Demographic Characteristics

Majority VMMC attendants at the military facilities operated were in the age bracket 15-49 years (91.3%), constituting mainly civilians (67%) and from facility.

In the first quarter of the project (October to December 2018), the total number of men circumcised was 345 accounting for only 8% of the set target of 4425. After instituting the interventions in quarter two, the numbers of circumcised men increased to 1426, which 32% of the quarterly target between January and March 2019. This represented more than 300% increase in the numbers circumcised between quarter one and two. In quarter three (April to June 2019), there was 970% increase in the numbers circumcised compared to quarter two. These 15255 men represented a 345% achievement of the quarterly targets. In the last quarter (June to August 2019), 10,115 men were circumcised which reflected a 229% achievement of the quarterly targets of 4425. By the end of the financial year (FY) September 2018 to August 2019 the total number of men circumcised was 27141; this was 53% above the annual set target of 17700 as shown in Fig. 1.

Table 1. Characteristics of VMMC attendants at Military facilities

Age	No. Circumcised	Percent
Under 2 years	0	0.0%
2-<5 years	3	0.0%
5-15 years	2,325	8.6%
15-<49 years	24,783	91.3%
Over 49 years	30	0.1%
Patient Category		
Military	8,957	33.0%
Non-Military	18,184	67.0%

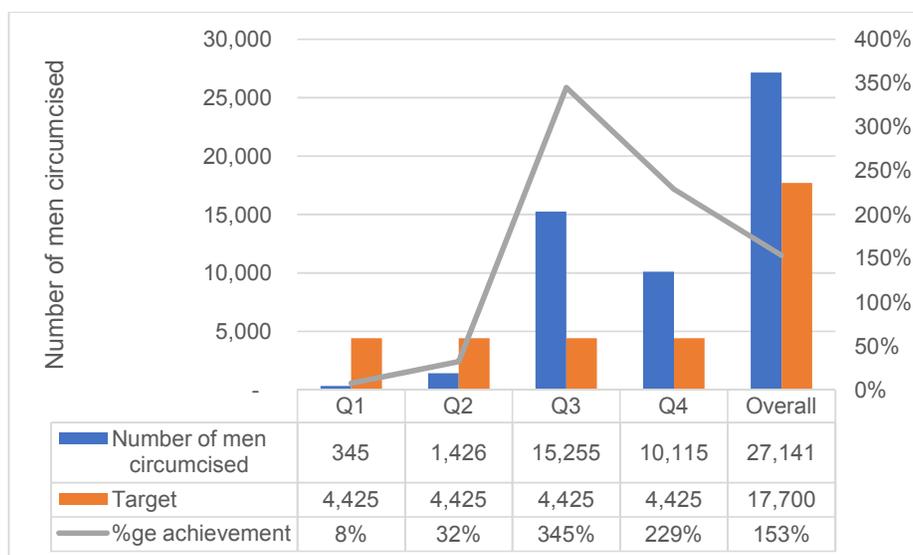


Fig. 1. Quarterly VMMC target achievements

Fig. 1 shows the total numbers of men circumcised per quarter and the percent achievement of the quarterly targets for the financial year 2018-2019. In quarter one and two, the project achieved less than the set targets, but following the interventions, percent achievement increased to 345% in quarter three and 229% in quarter four.

Table 2 shows low monthly numbers of VMMC achieved before the intervention, meeting only 21% of set targets (Oct -Dec) and 19% in Jan from commencement of financial year 2019 (FY19). However following URC-DHAPP programmatic interventions initiated in February, there was significant growth in the number of VMMC, covering the target by 77% in February and 731% by end of August 2019. The average increment per month in VMMC was 1,567 persons (Table 2).

Table 3. shows the monthly increase in the number circumcised by district. Average monthly

regional VMMC over the period March-July 2019 (Table 6) ranged in number from 98 in Kasese to 420 in Mbarara, representing a range of 245% - 1050% above of expected average numbers region-wise over the period.

In Fig. 2 VMMC monthly targets were set and monthly performance evaluated to inform the next month's strategy. In March a decision to increase the mobile camps from 3 to 6 was made nearly doubling the number of circumcisions performed per month by May. Further evaluation determined that in order to achieve the annual targets in the next three months, more circumcisions had to be performed. In June the number of mobile camps were doubled yet again from 6 to 12 nearly tripling the monthly performance. Observing that the annual targets were nearly met the number of camps were reduced with none conducted in September the last month of the fiscal year after surpassing the set annual targets.

Table 2. Number of Mobile VMMC implemented by Month vs. Targets

Period (Month)	No. of VMMC expected (target)	No. of VMMC achieved	% VMMC achieved
Oct-Dec 2018 (Pre-Intervention)	1,680	345	21%
Jan 2019 (Pre-Intervention)	560	106	19%
Feb 2019 (Post-Intervention)	560	433	77%
March 2019 (Post-Intervention)	560	887	158%
April 2019 (Post-Intervention)	560	2,574	460%
May 2019 (Post-Intervention)	560	5,086	908%
June 2019 (Post-Intervention)	560	7,595	1356%
July 2019 (Post-Intervention)	560	6,020	1075%
August 2019 (Post-Intervention)	560	4,095	731%

Table 3. Average monthly increase in VMMC between March-July 2019 by district

Region	Mean VMMC expected (Monthly)	Mean VMMC achieved	% VMMC achieved in respect to expected
Mbarara	40	420	1050%
Mubende	40	196	490%
Nakasongola	40	321	802%
Gulu	40	406	1015%
Moroto	40	361	902%
Muhoti	40	289	722%
Nakapiripit	40	218	545%
Wakiso	40	475	1187%
Acholi Pii	40	241	602%
Masindi	40	168	420%
Tororo	40	310	775%
Luwero	40	236	590%
Kasese	40	98	245%
Bombo	40	204	510%

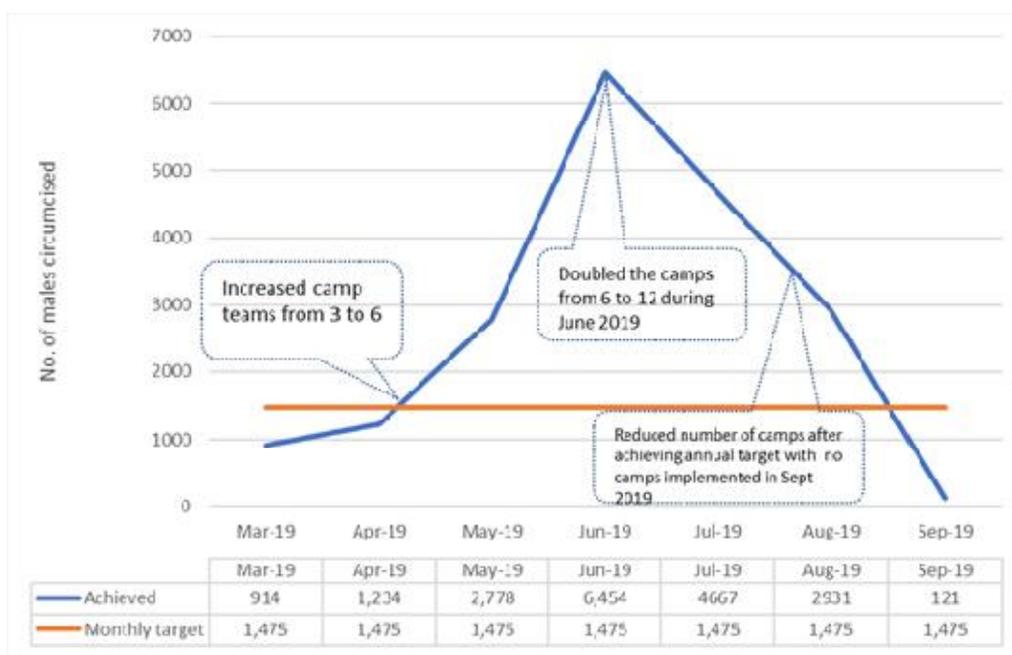


Fig. 2. VMMC monthly performance (March – Sep 2019)

3.1.2 Contrasting VMMC Trends between Military and Civilian facilities

Fig. 3 shows a significant linear increase in VMMC in military health facilities over the period March-July 2019, yet the reverse was observed in non-military health facilities over the same period (i.e. a significant decline in number of VMMC conducted over time within the same time period).

3.1.3 Adverse Events

With over 24,203 male circumcisions conducted within FY 19 no death or permanent injury attributable to adverse events was observed within the UPDF DOD program. However, one serious notifiable adverse event of tetanus infection occurred, the patient was immediately admitted in an intensive care unit, treated and discharged in three weeks, he made a complete recovery from the effects of tetanus after 45 days. A program performance audit was instituted internally and externally by the Ministry of Health, both attributed the tetanus event to the patient's social- environmental condition rather than a direct result of circumcision. Overall, there were 139 mild and moderate adverse events reported. The moderate events included 2 participants who were hospitalized for bleeding after circumcision, there were no reported cases

of injury to the penis or infection requiring admission. The total complication rate, including minor complications such as pain, bleeding, local infection and swelling, was 0.6%. Although the post 48 hours and 7 days VMMC follow up rates were suboptimal at only 66% and 18% respectively.

Fig. 3 Compares the rate of adverse events within the DOD-UPDF program compared to the rest of the country. The UPDF VMMC program registered adverse events were at less than 0.5% throughout FY19 compared to 0.5% - 1.6% for the rest of the country's VMMC programs.

3.1.4 Description of the VMMC method adopted in military health facilities Operation cost per outreach

The costs were mainly tagged to facilitation fees and per diems for officers, fuel for the vehicles, VMMC consumables, transport refund and motor vehicle hire.

3.1.4.1 Outreach VMMC output

The accelerated scale of VMMC services to achieve the annual targets required teams to reach targeted outputs. This therefore required setting a targeted number of VMMC outreaches – on daily, weekly and monthly basis. The daily

targets were assigned to the camp surgeons, and this helped in strengthening mobilization efforts and in some instances, deciding whether to close or shift the camps that were not yielding much. The weekly targets helped in monitoring

and supervising the program performance while monthly outputs were used in strategic planning. The table below presents the VMMC outputs by location.

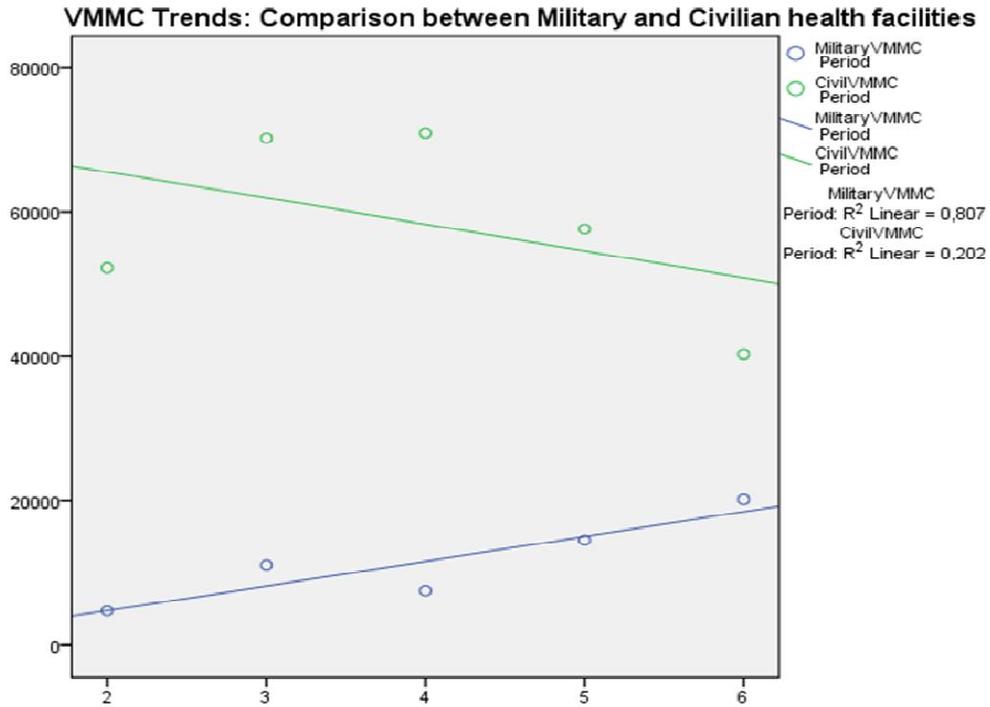


Fig. 3. VMMC trends: Comparison between military and civilian health facilities

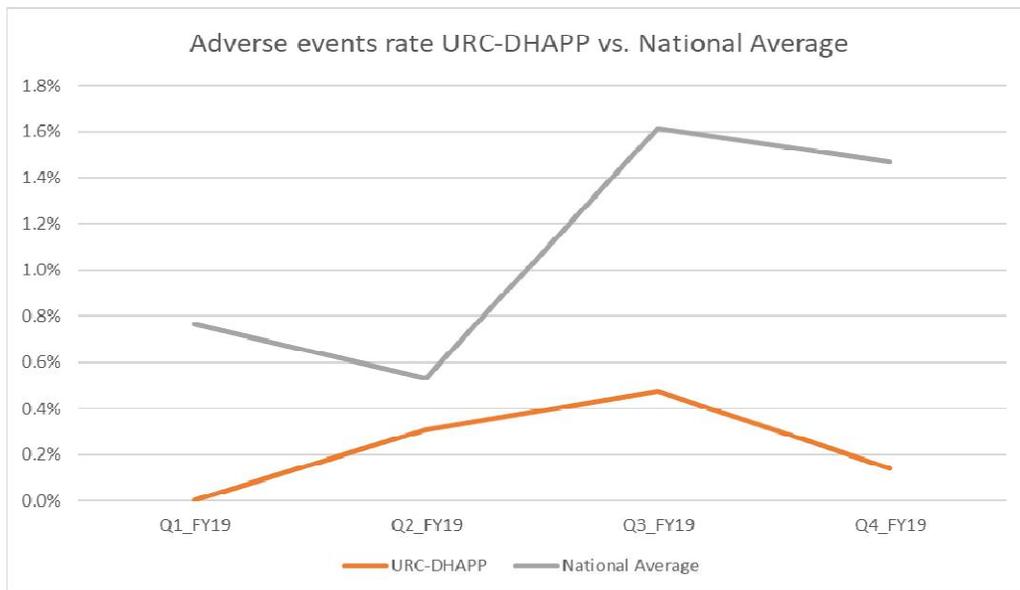


Fig. 4. Contrasting trends in VMMC between military and civilian facilities, March-July 2019

Table 4. Monthly cost per circumcised

Month	Cost per circumcised (\$)	Total number circumcised	Total cost (\$)
Dec'18	14	345	4,830
Jan-19	14	106	1,484
Feb-19	14	433	6,062
Mar-19	10.6	887	9,402
Apr-19	9.7	2,574	24,968
May-19	8.7	5,086	44,248
Jun-19	6.7	7,595	50,887
Jul-19	6.7	6,020	40,334
Aug-19	6.6	4,095	27,027
Total	7.7	27,141	209,242

Table 5. Monthly and period VMMC outreaches by region

District	Dec'18	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Luwero				0	0	0	1415	1,225	1,327	3,967
Mbarara	345	106		285	300	522	904	511	67	3,040
Gulu			433	0	793	462	612	572	0	2,872
Mubende				266	0	278	633	0	526	1,703
Kabarole				0	324	402	302	815	0	1,843
Nakasongola				336	0	0	476	919	0	1,731
Pader				0	353	526	0	571	0	1,450
Masindi				0	328	0	345	333	968	1,974
Moroto				0	476	0	1452	0	0	1,928
Wakiso				0	0	1,276	504	1,074	0	2,854
Rubongi				0	0	221	711	0	0	932
Nakapiripirit				0	0	1399	241	0	0	1,640
Kanungu				0	0	0	0	0	118	118
Budaka				0	0	0	0	0	266	266
Bulambuli				0	0	0	0	0	88	88
Mpigi				0	0	0	0	0	120	120
Kabale				0	0	0	0	0	615	615
Total	345	106	433	887	2,574	5,086	7595	6,020	4,095	27,141

3.2 Discussion

Current VMMC scale-up progress for HIV prevention in sub-Saharan Africa, mainly supported by PEPFAR through 2017, is truly impressive [30]. Millions of men and adolescent boys have come forward to receive VMMC in settings with high HIV prevalence and low male-circumcision prevalence [21]. However, questions on how to efficiently reach the levels of male circumcision coverage required to stem and sustain further reduction in HIV incidence toward the 2030 goal of a world in which AIDS is no longer a public health threat.

Although significant improvement in VMMC services have previously been noted in Uganda through the application of mobile units supported by PEPFAR since 2007; conflicting data regarding attainment of set targets still abound [20,23]. The data presented here seem to

suggest that VMMC uptake in Ugandan civilian settings followed a linear decline during the period March-July 2019, contrasting starkly with the linear increase noted in military driven VMMC services over the same period. This finding underscores the importance of an integrated package that – cognizant of mobility - invokes strong leadership structures, team cohesion through regular debriefing among others in achieving not only accelerated but also sustained VMMC uptake in communities. Significant changes in VMMC delivery methods such as scaled up mobile VMMC service provision, use of leadership driven mobilization initiatives, transforming static health facility theaters into occasional mobile type VMMC sites, and scaling up services to adolescent boys aged 10-19 yrs would need to be embraced to reach proportions of over 90% circumcised males by the end of 2021 [23].

Rethinking demand creation particularly community mobilization prior to VMMC by engaging appropriate traditional and community influencers such as the Uganda People's Defense Forces UPDF commanders and political commissars in this case enhanced increased VMMC uptake around health facilities and communities served by the military health services in Uganda achieving more than 138% of set target within just 6 months. Such scaled VMMC services associated with an exponential output from a military model has demonstrated that mobile VMMC units invoking an interplay between multiple stakeholders (i.e. different cadres of program staff, military personnel and community members), "command-driven"-leadership and mobilization, regular debriefing of staff can greatly accelerate VMMC coverage. The role of multiple stakeholder involvement [31] and respected community members [32] in driving HIV programs has previously been demonstrated, the current study presents for the first time the utility of military commanders, respected members of the community, at the forefront of mobilization of community members for HIV services, alongside healthcare providers, can greatly increase VMMC uptake in military settings and surrounding civilian populations. An in-depth qualitative analysis of the mobilization strategies applied by the military would potentially add additional insight regarding military personnel influence on uptake of public health services.

Global commitment to set targets global HIV targets has often yielded tremendous results. WHO target by commitment to enroll 3 million people on HIV treatment by 2005, although this was not achieved [33], target setting in HIV care was fully embraced as a positively reinforcing strategy. The follow on Joint United Nations Programme on HIV/AIDS's (UNAIDS's) 15 by (20)15 initiative aimed to scale up and sustain ART coverage for 15 million people, the target was reached ahead of schedule in March 2015 in fulfilment of the MDGs [34]. We emulated target setting and implemented a target driven VMMC operation where a set minimum number of men were circumcised per day to optimize efficiency and effectiveness of this mobile service. Prior to the program implementation, targets for VMMC coverage were set at 40 persons per month. While these targets may seem modest, in the pre-intervention period only one third of the targets were met. The methods applied to military facilities through the URC-DHAPP program demonstrated that VMMC could be

accelerated to a much greater extent than foreseen. Within the first month of interventions set targets were doubled and by the end of July VMMC uptake had grown exponentially to exceed set targets ten-fold. It's imperative to monitor the total number of operations performed each day at each mobile VMMC site, the number of operations performed each day per surgeon, the average time a surgeon spends on a surgical bay, the average time a patient spends in a surgical bay, and the surgical bay turnover time. We periodically evaluated these indicators for each VMMC round to gauge performance, identify areas for improvement, and refine next round performance targets. Strict target setting and increasing strategic targeting to achieve the goal of reducing HIV incidence that includes daily/surgeon target setting, reporting and monitoring of results largely contributed to the program's enhanced performance. At this rate, there was a high likelihood for meeting the HIV epidemic control stipulated for 2020 within military settings if VMMC coverage rates are to be sustained. It is, however, important to keep in mind that although community sensitization and mobilization to galvanize VMMC uptake as well as emphasizing the importance of protected sex remains significant alongside VMMC since it only affords a 60% protection against HIV transmission [33].

In order to optimize VMMC surgical efficiency and maximize output we deployed five surgical elements described by Rech et al [35] pioneered by the Aravind Eye Clinic in Madurai [27]. Task-shifting: clinical officers trained in the techniques of adult male circumcision and were the surgeons primarily responsible for implementing VMMC in the program. It has been demonstrated that trained and competent clinical officers can successfully and safely perform male circumcision [36]. Task-sharing: several steps in the circumcision process were delegated to lower cadres, freeing the surgeon's time to focus on the most technically challenging components of circumcision such as the cut, achieving hemostasis and inserting anchor sutures. We achieved enhanced efficiency by combining task-sharing and task-shifting, we deployed two roving surgeon's pre team and one assistant per bed of three in each team which greatly reduce the overall staff need compared to one operator and one assistant per bed. Multiple surgical bays and rotation among surgical beds: each surgical team was allocated at least three surgical bays in each mobile VMMC tent. Each of the two surgeons in the team rotated to the next available surgical

bay where stationary surgical assistants were on standby to complete less technical elements of the circumcision process. We optimize health-care personnel time by allocating at least surgical bays per mobile VMNC surgical team and two surgeons thus achieving more than one surgical bay per surgeon all the time. Allocation of multiple surgical bays per surgeon helps to minimize the idle time of health-care personnel. The health personnel, especially the surgeon does not have to wait for extended periods to perform surgical tasks between one patient and the next thus gaining maximum efficiency from available highly skilled manpower – the surgeon. Use of pre-bundled kits with single use disposable supplies: proved to be an effective supply of commodities which did not require sterilization in between use, enhance safety reducing potential occurrence of adverse events while additively enhanced efficiency and volume covered per day. All five elements were in interplay and could be utilized in combination to maximize VMMC efficiency, volume and output to scale.

Improving efficiency, maximizing volume and output could potentially compromise quality and safety [37]. On the contrary, our program observed fewer minor short term VMMC associated adverse events compared to VMMC implemented by the civilians in the rest of the country. Safety and quality measures to address potential short term adverse events such as managing post-operative bleeding, observing clients for allergic reaction/any other abnormality before they left the table or recovery area, providing clear instructions on post-operative care and pain, encouraging return for follow-up, providing emergency contact details, giving post-op counselling including reinforcement of previous messaging, and reminding clients of the six-week abstinence period were done at site.

A limitation to a scaled mobile VMMC approach like this is the dearth of functional community patient follow up structures and information systems that record and address potential medium to long term VMMC adverse events. We thus were unable to account for any such subsequent adverse events in the long run and guarantee functional 2 weeks/6 weeks post-operative follow up visits to linked health facilities. Adverse event monitoring and reporting are critical ingredients of program quality assurance. All adverse events during and after surgery should be recorded and managed. Such

alternate models of rapidly expanded, highly efficient and maximum output programs need to be considered in conjunction with concrete plans to maintain quality [38].

The likelihood of priority countries achieving set 2021 VMMC target to achieve epidemic control is partly influenced historical numbers of circumcisions conducted and coverage levels attained, some countries are unlikely to attain targeted coverage levels without significant strategic changes in both demand creation and service delivery [23]. The short term episodic mobile VMMC approach can safely aide rapid scale -up of circumcision coverage in communities served by the military. Mobile VMMC approaches that invoke command/leadership-led mobilization, stretch targeted setting, multiple stakeholder involvement and team strengthening/cohesion through regular debriefing enhance exponential VMMC coverage potential essential in the race towards the 2021 epidemic control vision.

4. CONCLUSION AND RECOMMENDATIONS

The technical support, granular approach, frequent review and revision of VMMC program implementation in the 28 military facilities demonstrated that achievement of set national VMMC is possible. Leveraging existing structures such as the *Command Driven* approach of the military and incorporating it with proven models in VMMC like the MOVE model enabled these military facilities to exceed the set VMMC targets.

Military health facilities in settings similar to Uganda could adopt this approach which has proved efficient. It is also recommended that other facilities identify existing structures or mechanisms that can be leveraged to improve the efficiency of their VMMC programs.

CONSENT AND ETHICAL APPROVAL

All ethical aspects pertaining to the procedure of VMMC were observed by the team. This work also received ethical approval from the AIDS Support Organisation (TASO) Institutional Review Board (IRB/REC) - TASOREC/048/2020-UG-REC-009 and was also cleared by the Uganda National Council of Science and Technology (UNCST).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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