THE ROLE OF NURSES IN VOLUNTARY MEDICAL MALE CIRCUMCISION FOR HIV PREVENTION: AN INTEGRATIVE REVIEW

by

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ABSTRACT

In 2007, the World Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) announced their recommendation to include voluntary medical male (VMMC) circumcision in the comprehensive human immunodeficiency virus (HIV) prevention package. Evidence supports that male circumcision, the surgical removal of the foreskin, reduces a heterosexual male's chance of acquiring HIV by approximately 60% (WHO, 2007). The purpose of this project was to address the clinical question: What is the role of nurses in the VMMC initiative for HIV prevention? This integrative review of 19 studies provides evidence to support the need and current involvement of nurses in the VMMC for HIV prevention effort. Evidence supports that task-shifting VMMC services from physicians to nurses would be a safe and effective means of addressing the shortage of skilled healthcare workers. Nurses with sufficient experience can safely and effectively provide VMMC without compromising patient outcomes or satisfaction (Ngo & Obhai, 2012). The literature supported task-shifting VMMC services to nurses; however, there was little evidence available regarding the current contribution of nurses to the VMMC for HIV prevention effort.

When the human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) epidemic emerged in the early 1980s, people around the world became afraid. Afraid of what the virus was, afraid of what it could do, and ultimately afraid of the unknown. Although generalized fear among the public has decreased in the past three and a half decades as we've learned more about the virus, its treatment and prevention, HIV is still considered a major public health issue. An estimated 36.7 million people worldwide were living with HIV at the end of 2016 with 1.8 million new infections acquired during 2016 (World Health Organization[WHO], 2017a). The region most burdened with HIV is Sub-Saharan Africa, with 25.6 million people living with HIV and accounting for approximately two thirds of the total new global infections (WHO, 2017). South-East Asia has the second highest HIV burden with 3.5 million people living with HIV (WHO, 2017a). In light of these statistics, World Health Organization (WHO) and partners such as the Joint United Nations Programme on HIV/AIDS (UNAIDS) are continuously working to combat the HIV epidemic through the release and implementation of evidence-based guidelines outlining protocols for the diagnosis, prevention, and treatment of HIV.

In 2007, the WHO and UNAIDS announced their recommendation to include voluntary medical male circumcision (VMMC) in the HIV comprehensive prevention package that consists of encouraging female and male condom use, HIV testing and counseling services, antiretroviral drug use for prevention. Evidence supports male circumcision, the surgical removal of the penis foreskin, reduces a heterosexual male's chance of acquiring HIV by approximately 60% (WHO, 2007). Uncircumcised heterosexual men are more susceptible to HIV because the foreskin is rich in non-keratinized Langerhans' cells with target receptors that are likely to be the primary port of entry for the virus (Szabo, 2000). Due to the fact that circumcision only provides partial

protection from HIV, the WHO and UNAIDS recommend that VMMC is used in conjunction with other HIV prevention methods such as the promotion of correct and consistent use of condoms, promotion of safer sex practices and HIV testing and counseling services (WHO, 2007).

In order to maximize the public health benefit, the WHO recommends that VMMC for HIV prevention programs be implemented in countries with generalized heterosexual HIV epidemics, low rates of male circumcision and high rates of HIV, where VMMC is likely to have the greatest impact (WHO, 2007). In the past decade since WHO/UNAIDS released the recommendation, nearly 15 million VMMC have been performed in 14 countries in Eastern and Southern Africa, averting an estimated half million new HIV infections through the year 2030 (WHO, 2017b). Countries that have incorporated VMMC in their HIV prevention protocols include Botswana, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, United Republic of Tanzania, Uganda, Zambia, and Zimbabwe (WHO, 2017b). In order to accommodate the impressive scale up of VMMC since 2007, a large number of non-physician clinicians, such as nurses, have been successfully trained on infection prevention and how to perform this minor surgical procedure (WHO, 2017). This project explores how nurses have impacted and contributed to the VMMC for HIV prevention effort in the last 10 years since the recommendation was made.

Statement of Clinical Question

This project addresses the clinical question: What is the role of nurses in VMMC intervention for HIV prevention?

Design

This integrative literature review approved by the Texas Christian University (TCU) Harris College of Nursing & Health Sciences Nursing Review Board sought to provide a current summation of available literature regarding the role of nurses in the VMMC for HIV prevention effort.

Operational Definitions

Due to the fact that the majority of the countries needing to scale up VMMC for HIV prevention efforts have relatively weak healthcare systems, the WHO recommends task-shifting or task-sharing in order to compensate for a shortage of skilled healthcare workers. In task-shifting, non-physician providers perform all steps of the male circumcision, whereas in task-sharing non-physician providers only perform specific steps (WHO, 2010). Adult VMMC is usually accomplished either surgically using local anesthesia or through a device assisted method. The WHO has two pre-approved non-surgical male circumcision devices: the PrePex device and the Shang Ring (WHO, 2010). The PrePex device is a sterile, disposable device consisting of a placement ring, elastic ring, inner ring and a verification thread (PrePex, 2016). The device does not require any incisions or sutures. After the device is placed, the male returns one week later to have the device and the necrotic foreskin removed. The Shang Ring consists of an inner ring and an outer ring, which is split in half and hinged together at one end. When the device is applied, the foreskin is crushed in between the inner and outer ring allowing for a bloodless removal without sutures. The male then returns a week later for the device to be removed (Barone, Li, Awari, Lee & Goldstein, 2014). The WHO has approved both devices as safe and effective means of performing VMMC.

For the purpose of this integrative review, healthcare professionals and their scope of practice are defined using the *WHO Classifying Health Workers; Mapping Occupations to the International Standard Classification* document. Physicians require the completion of a university-level medical degree plus clinical training. Physicians' scope of practice includes the diagnosis, treatment and prevention of illness, disease or injury. Nursing professionals are able to provide treatment, support, and care for patients in need due to the effects of illness, disease, injury or physical impairment. Nurses require formal training at a "higher educational institution in nursing" in order to be considered competent upon entry into practice (WHO, p. 3). This paper focuses on entry-level nurses, unless otherwise specified to be a specialty or advanced practice nurse. Clinical officers or paramedical practitioners require tertiary-level training in medical services. Clinical officers can provide medical services in a more limited scope than physicians.

Methodology

The author searched the following databases: Medline Complete, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Scopus, and Embase, using the search terms: "nurse", "HIV" "human immunodeficiency virus", "AIDS", "acquired immunodeficiency syndrome", "circumcision" and "removal of foreskin." The student consulted the TCU health sciences librarian to ensure search terms used were as exhaustive as possible. The initial electronic search yielded 132 articles after duplicates were removed.

In order to be included in this study, articles must have been published after January 1, 2007, and pertain to the population of interest (nurses involved with VMMC). Articles were included regardless of the country of origin. Articles were excluded if they did not pertain to adolescent or adult male circumcision. Grey literature, conference abstracts, and articles not available in full text were also excluded. A total of 19 articles met the above criteria and were

included in this integrative review to see how nurses have impacted the VMMC for HIV prevention movement. Following the selection of articles, the student used the *Johns Hopkins Nursing Evidence-Based Practice: Research Evidence Appraisal Tool* (2005) to appraise and determine the level of evidence of the articles.

Results

The 19 articles included in this study consisted of a range of non-experimental studies, quasi-experimental studies, and randomized controlled trials. The level of evidence ranged from Level I to Level III depending on the nature and design of the study. The quality of evidence ranged from Good to High (Appendix A). Although studies were included regardless of country of origin, the majority of the research took place in Eastern and Southern Africa.

Safety of Task-Shifting to Nurses

Task-shifting to nurses is necessary in order to achieve massive rollout of VMMC in communities with limited physician healthcare providers. An assessment of the VMMC implementation in Kenya during the first year found that only 12.4% of facilities had adequate numbers of clinical officers to perform circumcisions; however, 85.2% had an adequate number of nurses (Herman-Roloff et al., 2011). This assessment demonstrates the capacity for task-shifting VMMC services from physicians to nurses.

Surgical circumcision. A prospective cohort study conducted at mobile outreach sites located in rural Kenya aimed to assess postoperative adverse events and patient satisfaction with circumcision performed by registered nurses, medical technicians, and nurse aides (Ngo & Obhai, 2012). A total of 240 participants received VMMC using the guided forceps technique, with registered nurses performing 94.2% (226/240) of the procedures. The prevalence of moderate/severe complications was 1.3% (3/240). Additionally, the majority (99%) of patients

reported they were satisfied with the procedure, final cosmetic outcome, patient education, and counseling they received (Ngo & Obhai, 2012).

Similarly, Frajzyngier, Odingo, Barone, Perchal and Pavin (2014) conducted a larger prospective cohort study in Kenya consisting of 2,224 men receiving surgical male circumcision performed by 15 nurses and 11 clinical officers. Nurses performed 1,426 (64%) of the surgeries and clinical officers performed 818 (36%). Nurses, on average, preformed the procedure in slightly less time than the clinical officers (22.4 minutes versus 24.5 minutes, respectively). Frajzyngier et al. (2014) also found no significant difference in adverse events in circumcisions conducted by a nurse (2.1%) or clinical officer (1.9%). Once again, over 99% of participants stated they were satisfied with the procedure and the results (Frajzyngier et al., 2014). Both of these studies provide evidence that registered nurses and non-physician providers can safely provide VMMC with high client satisfaction.

Conversely, a prospective study conducted by Herman-Roloff, Bailey, and Agot (2012) on the incidence of adverse events following VMMC by non-physician providers found circumcisions performed by nurses were 40.0% more likely to result in an adverse event than those performed by clinical officers. However, when analysis was limited to procedures performed by providers with 100+ circumcision experience, the relationship between provider type and risk of developing an adverse effect was no longer significant (Herman-Roloff et al.,2012). Frajzyngier et al. (2014) also found circumcisions performed by providers with six or more years of experience were less likely to result in serious adverse events. Health care providers with more experience perform faster circumcisions, which require lower doses of anesthesia and are therefore associated with fewer adverse events (Herman-Roloff et al., 2012). Both studies provide evidence supporting VMMC as safe and effective when performed by

nurses and other non-physician providers with significant experience. Therefore, evidence supports task-shifting VMMC responsibilities to nurses.

Device assisted circumcisions. Generally, the evidence indicates that circumcision devices such as the PrePex device or the Shang Ring device are safe and could assist in task-shifting from physicians to nurses when performing VMMC. A prospective cohort study conducted in Kenya found the PrePex device to be a safe, effective, and quick alternative to surgical VMMC (Feldblum et al., 2014). Researchers found the mean placement time for the PrePex device was 3.1 minutes, which is shorter than the reported surgical procedure time. Feldblum et al. (2014) did not directly compare circumcision techniques but stated the healing time was longer than the reported healing time for surgical circumcision in Kenya. Only 44% of men who received circumcision via the PrePex device were completely healed by day 42 compared to 94.1% of men who received surgical VMMC (Feldblum et al., 2014). Despite the longer healing time, Feldblum et al. (2014) concluded that the PrePex device was an effective method for VMMC and supported task-shifting to non-physician providers such as nurses.

Tshimanga et al. (2016) conducted a randomized control trial in Zimbabwe to assess the performance of the PrePex device compared to forceps guided circumcisions and found similar results. In Kenya, Feldblum et al. (2014) conducted a prospective cohort study assessing the safety and effectiveness of circumcisions using the PrePex device and found similar results. Mean placement time was 3.1 minutes, even shorter than that reported by Tshimanga et al. (2016). However, Feldblum et al. (2014) found that only 44% of men who received circumcision via the PrePex device were completely healed by day 42. Feldblum et al. (2014) did not directly compare circumcision techniques but stated the required healing time was longer than the reported healing time for surgical circumcision in Kenya. Despite this, Feldblum et al. (2014)

concluded that the PrePex device was an effective method for VMMC and supported task-shifting from physicians to non-physician providers such as nurses.Findings from a randomized controlled trial in Zimbabwe to assess the performance of the PrePex device compared to forceps guided circumcision supported the PrePex device as safe, easy to apply, and a quick alternative to surgical VMMC (Tshimanga et al., 2016). Furthermore, Tshimanga et al. (2016) found that The mean procedure time for the PrePex device was one-third that of the mean surgical procedure time (4.8 minutes versus 14.6 minutes, respectively). However, Tshimanga et al. (2016) found the healing time was significantly shorter for the PrePex device; a finding that differed from the Feldblum et al. (2014) study. By day 42, 87.3% of participants who received circumcision with the PrePex device were healed, compared to 76.3% of participants who received surgical circumcision (Tshimanga et al., 2016). These findings support the PrePex device as a safe and effective alternative to surgical VMMC.

Mutabazi, Bitega, Ngeruka, Hategekimana et al. (2014) conducted a non-randomized quasi-experimental study that further supports task-shifting from physicians to nurses using the PrePex device. This study consisted of two phases. Physicians performed VMMC using the PrePex device on 100 study participants in Phase 1 of the study, and nurses performed the procedure on 47 participants in Phase 2. One adverse event (transient edema) was reported in Phase 1, and no adverse events were reported during Phase 2. There were no cases of infection or bleeding reported (Mutabazi, Bitega, Ngeruka, Hategekimana et al., 2014). Total procedure time (device placement and removal combined) became shorter for both physicians and nurses as they gained experience and felt more comfortable with the device. However, there was no significant difference in the procedure times in Phase 1 compared to Phase 2. Overall, this study provided

evidence to support that VMMC task-shifting from physicians to nurses using the PrePex device could be accomplished without compromising the results.

Evidence supports that training nurses and non-physician providers to use the PrePex device is easy and feasible. In a prospective cohort study conducted by Galukande, Duffy, Bitega, and Wooding (2014), ten healthcare workers (physicians, nurses, and clinical officers) were successfully trained to perform VMMC using the PrePex device during a three-day, on-the-job training course. Although the adverse event rate of nurses performing the procedure was nearly double that of clinical officers, the nurse adverse event incidence of 2.6% (1 in 39 patients) was still within the generally acceptable adverse event rate (2-5%). This suggests that nurses were safe operators of the PrePex device and therefore successfully trained.

In a different non-randomized field study, ten nurses were trained to use the PrePex device using a similar three-day training program (Mutabazi et al., 2013). The nurses did not have any previous experience using the PrePex device prior to training. Following training, nurses conducted 518 circumcisions in a period of three months. The adverse event incidence in this study was 0.96%, and there were no severe adverse events reported (Mutabazi et al., 2013). The mean total procedure time, recorded on the last 125 patients after the nurse gained experience, was 4 minutes and 39 seconds including preparation time. The low adverse event rate and short procedure time in both of these studies demonstrates that the three-day training courses are effective in training nurse how to safely and correctly use the PrePex device to perform circumcision. These studies, once again, validate the feasibility of task-shifting from physicians to nurses in order to assist the VMMC for HIV prevention effort.

The integrative literature search only yielded a single article pertaining to the use of the Shang Ring device by nurses to perform VMMC. A literature review of clinical trials supports

that non-physician providers can easily be trained to use the Shang Ring, which could assist in task-shifting (Barone et al., 2014). The review looked at five different clinical studies regarding the safety of the Shang Ring, all conducted in Africa. Data from these studies found adverse event rates to be similar with conventional circumcision techniques; however, healing time was prolonged. The data regarding the Shang Ring was very similar to the PrePex device. Overall, the studies support the use of the Shang Ring to facilitate task-shifting to nurses and other non-physician providers.

Cost Effectiveness of Task-Shifting to Nurses

Evidence indicates that task-shifting from physicians to nurses could significantly decrease the cost of VMMC. Tchuenche et al. (2016) conducted a cost analysis study to derive the unit cost of VMMC delivery in South Africa. In order to assess the potential cost savings from task-shifting, researchers replaced the salaries of doctors with the salaries of nurses. The cost analysis produced evidence showing direct labor unit costs could be reduced from $56.60 per circumcision to $47.18 per circumcision if nurses replaced doctors. That represents a saving of 17% in direct labor costs, or 7% of the unit cost per circumcision (Tchuenche et al., 2016). When this estimate was applied to the amount of circumcisions performed in South Africa in 2015, task-shifting from physicians to nurses would have saved $15 million in VMMC costs. The data did not include the cost of training nurses to perform circumcisions, which could take away from the savings slightly. However, evidence indicates that nurses would require less retraining than doctors because systemic monitoring shows nurses are less likely to leave the VMMC program due to provider burn-out (Tchuenche et al., 2016). Overall, authors conclude that task-shifting from physicians to nurses performing VMMC would lead to significant cost savings.

Additionally, Mutabazi, Bitega, Ngeruka, Nyemazi, et al. (2014) conducted a single-center, non-blinded randomized controlled trial to assess costs associated with surgical male circumcision performed by a physician-nurse team versus nonsurgical male circumcision performed by a team of two nurses using the PrePex device. Evidence supports that nonsurgical male circumcision performed by trained nurses using the PrePex device is significantly more cost effective than surgical circumcision performed by physicians, US $22.73 per procedure versus US $40.85, respectively (Mutabazi, Bitega, Ngeruka, Nyemazi, et al. 2014). The evidence supports that significant cost savings can be achieved by training more nurses on how to perform male circumcision using the PrePex device.

Attitudes and Perceptions of the Procedure

In order to fully understand the role nurses are currently playing and could potentially play in the VMMC effort, it is important to address the knowledge, attitudes, and perceptions of both providers and potential patients. Evidence shows that nurses and providers could benefit from additional training and education on VMMC for HIV prevention. Also, a patient perspective of nurse involvement showed a potential barrier to task-shifting from physicians to nurses.

Provider perceptions. Milford et al. (2016) conducted in-depth interviews among 25 healthcare providers (consisting of nurse managers, nurses, and counselors) in South Africa in order to assess provider knowledge prior to the roll-out of VMMC. Researchers found the majority of the providers knew that VMMC could reduce HIV transmission; however, their understanding was limited, and only one provider had received any formal education (Milford et al., 2016). Only six of the providers had any prior involvement in medical circumcision procedures at the time of the interviews. Milford et al. (2016) determined that providers required

more education on the effectiveness and value of VMMC as an HIV prevention method in order to properly educate their patients. Nurses, specifically, must be equipped with adequate knowledge since they are often the healthcare providers who counsel men prior to and after VMMC. It is important for nurses to understand the VMMC procedure, the risks associated with it, and the extent to which it protects against HIV in order to properly educate patients (Mildford et al., 2016).

In addition, a cross-sectional study conducted among final year nursing and pharmacy students at University of KwaZulu-Natal found that less than 45% of the respondents were aware that VMMC decreases a heterosexual male's chance of acquiring HIV (Naidoo et al., 2012). More nursing students than pharmacy students knew that HIV lives longer on the foreskin of the penis (47.8% compared to 37.9%). By assessing nursing and pharmacy students, this study looks at future healthcare providers and their attitudes and knowledge before they enter clinical practice. Naidoo et al. (2012) suggested the schools of nursing and pharmacy should evaluate their curriculum in order to include more education on VMMC as a preventive measure for HIV. Overall, the evidence shows that nurses in practice and those in training need more education regarding VMMC.

Evidence also supports that nurses desire to be trained to conduct VMMC. Sheldon et al. (2012) conducted national probability surveys of clinicians in Zimbabwe and South Africa to determine clinician factors relating to the VMMC effort. Researchers found that 57% of clinicians were providing counseling to male patients on circumcision; however, only 17% were offering services. Provision of services was greater among physicians than nurses, 56% versus 14%, respectively (Sheldon et al., 2012). However, nurses showed a greater desire for training than physicians with 62% of nurses versus 49% of physicians wanting additional training

(Sheldon et al., 2012). In an exploratory survey conducted in Haiti among nurses (49.0%), doctors (31.0%), and other healthcare professionals (20.0%), researchers found that 76% of providers would be willing to offer VMMC services if they received proper training (Dévieux et al., 2015). Additionally, 81% of participants expressed a need and willingness to receive training on VMMC. This evidence shows that nurses express a desire to receive training and be part of the VMMC effort.

A cross-sectional survey also assessed provider attitudes and perceptions of the PrePex device (Milovanovic, Taruberekera, Hatzold, Martison & Lebina, 2016). Researchers found that the majority of healthcare providers, including nurses, found the PrePex device to be simple, efficient and easy to apply. Training for the PrePex device, consisting of one day of theory followed by hands on experience, was effective and sufficient to make healthcare providers proficient and comfortable using the PrePex device for VMMC (Milovanvic et al., 2016). Overall the providers' perception of the PrePex device was positive and could be beneficial to task-shifting from physicians to nurses.

Patient perceptions. Umar, Mandalazi, Jere and Muula (2013) conducted a qualitative study using six different focus groups in Malawi to establish the experience of men who receive VMMC. In order to be eligible to participate, men had to be circumcised within two to six months of the start of the study. Umar et al. (2013) found that the majority of participants were opposed to having female health providers, either as clinician or nurse, performing the circumcision procedure or even being in the operating room during the procedure. Participants were concerned about both clinician and patient embarrassment if sexual arousal occurred. Participants reported that it would be natural to become aroused if a man in perfect health undresses in front of a female provider and the female provider proceeds to touch their private

parts. Participants also stated concern that female providers would become aroused if they noticed the patient has an erection, which would have negative effects on the operation (Umar et al., 2013). In addition, participants also feared that women providers would not keep the procedure confidential, placing the patient at risk of community disclosure and associated stigma.

In general, focus group participants felt that VMMC should exclude female providers, given that the procedure is not a medical emergency. Alternatively, a few of the men who did not oppose female participation in VMMC said that a female provider may be more empathetic and gentle and could potentially be better than a male provider (Umar et al., 2013). This evidence presents a potential barrier to the involvement of nurses in VMMC, as the majority of nurses are female. However, it is important to know and understand this information in order to improve massive rollouts of VMMC to become more client friendly and effective.

Other Nurse Involvement in VMMC

A study conducted by Ashengo et al. (2014) assessed the effectiveness of telephone triage by nurses of adverse events following VMMC. During the rollout of VMMC in Swaziland, the Ministry of Health implemented a toll-free telephone hotline ran by trained nurses, which men could call to inquire about VMMC or regarding post-operative side effects. From April 13, 2011, to December 29, 2011, triage nurses registered a total of 17,059 calls (Ashengo et al., 2014). The most common reason men called the hotline was for VMMC education and counseling (12,492 calls, 73.2%). Triage nurses received 500 calls regarding adverse events, of which 240 calls were referred to the appropriate provider based on the seriousness of the adverse event. The most common adverse events were “bleeding (28.6%), infection (27.6%), swelling (24.8%), pain (8.6%) and wound disruption (6.9%)” (Ashengo et al., 2014, p. 5). Researchers

found that a telephone triage system was effective and may be an appropriate step to identify severe adverse events following VMMC. This study shows another way in which nurses can be and are involved in the VMMC for HIV prevention effort.

Discussion

This integrative review of 19 studies provides evidence to support the need for and current involvement of nurses in the VMMC for HIV prevention effort. Due to the shortage of skilled healthcare workers, the WHO recommends task-shifting VMMC services from physicians to non-physician providers such as nurses (WHO, 2010). Evidence supports that nurses with sufficient experience can safely and effectively provide VMMC with high client satisfaction. Additionally, non-surgical circumcision devices such as the PrePex device and the Shang Ring can greatly assist in the task-shifting from physicians to nurses. Task-shifting was also found to be cost-effective and could potentially save millions of dollars per year in VMMC costs (Tchuenche et al., 2016).

A contraindication that was not expressed in the reviewed literature is the patient risk for acquiring tetanus when using circumcision devices (WHO, 2016). As of July 2016, the WHO recommends that the client must be adequately protected against tetanus in order to receive circumcision via a device that leaves the foreskin exposed and is removed several days later (WHO, 2016).This recommendation may slow task-shifting and the use of non-surgical devices like the PrePex and Shang Ring; however, the use of tetanus vaccine prior to VMMC was not yet reflected in the literature.

Generally, nurses and other providers could benefit from additional training and education on VMMC for HIV prevention. Milford et al. (2016) found that the majority of the providers knew that VMMC could reduce HIV transmission; however, they had limited

understanding of the relationship between VMMC and the prevention of HIV transmission. Therefore, more training and educational programs regarding VMMC should be implemented in countries with VMMC for HIV prevention programs. Appropriate training is especially important for nurses, as they are often the primary health provider to educate and counsel patients on circumcision services. It is important for healthcare providers to have adequate knowledge in order to properly educate their patients.

In addition, nurses expressed a greater desire to be trained in VMMC than physicians, with 62% of nurses wanting additional training versus 49% of physicians (Sheldon et al., 2012). Additional healthcare worker training and education programs are likely to be well received by nurses. Likewise, the PrePex device is reviewed favorably by healthcare providers and is found to be simple, easy and quick (Milovanvic et al., 2016).

A potential barrier to task-shifting VMMC services from physicians to nurses was discussed in the study conducted by Umar et al. (2013). Men in Malawi opposed having female providers, either as a physician or a nurse, performing their circumcisions. The men expressed concerns regarding sexual arousal for both the patient and the provider that they believed would negatively impact the procedure (Umar et al., 2013). In addition, men believed that female providers would be more likely to breach patient confidentiality. This presents a potential barrier to task-shifting as the majority of nurses are female. It is important to understand and address barriers like this to dispel any myths or bias related to sexual arousal and confidentiality in order to improve rollouts of VMMC.

Although articles were included regardless of country of origin, the majority of research took place in countries in Eastern and Southern Africa. This may be due to the fact that since the WHO/UNAIDS released the recommendation in 2007, 15 countries in this region have

implemented VMMC for HIV prevention programs. Therefore, most research is taking place in these areas to assess the programs. Limitations to this study include potential researcher bias due to the fact that only one person performed the selection of articles with consultation of the supervising professor.

The current available literature provides support for task-shifting from physicians to nurses in VMMC. However, there is little available data on what nurses are doing in the field to contribute to the VMMC for HIV prevention effort. For example, none of the articles included in this literature review provided statistics on how many circumcisions are performed by nurses in each country per year or the cost savings resulting from task-shifting. Recommendations for further research would be gather and synthesize data on what nurses are currently doing in the field to contribute to VMMC. Another recommendation for further research would be to assess any legal or social barriers that prevent task shifting VMMC services to nurses.

Conclusion

In conclusion, the literature included in this integrative review provides overwhelming support for the task-shifting of VMMC services from physicians to nurses. Task-shifting would not only help with the shortage of skilled healthcare professionals providing adult VMMC for HIV prevention services but could also potentially save millions of dollars. Evidence shows nurses can provide safe male circumcisions with high client satisfaction. Nurses also express a desire to be trained and to perform VMMC services. Despite potential patient perception barriers, task-shifting VMMC services to nurses would be extremely beneficial and should be implemented.

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Appendix A

Table 1. Safety of Task-Shifting to Nurses

Citation	Method	Sample	Purpose	Results	Appraisal
Barone et al. (2014)	Non-Systematic Literature Review	5 studies	"To assess the feasibility and safety of using the Shang Ring device for VMMC in Africa"	Shang Ring circumcision is easy to teach and learn and can assist in the task-shifting from physicians to nurses.	Level III Good Quality
Feldblum et al. (2014)	Prospective Observational Study	427 men ages 18-49	"To assess the safety, effectiveness and acceptability of the PrePex device for VMMC in Kenya"	The PrePex device was effective and well-accepted. Adverse event rates were higher than reported in previous PrePex studies. Healing time was also longer.	Level III High Quality
Frajzyngier, Odingo, Barone, Perchal and Pavin (2014)	Prospective Cohort Study	2,223 men/boys age 13-54 2192 (98%) returned for 7 day follow up 1,845 (82%) returned for 60 day follow up	"To evaluate the safety of male circumcision performed by non-physician clinicians in Kenya"	Nurses and clinical officers provided safe VMMC with acceptable adverse event rates.	Level III High Quality
Galukande, Duffy, Bitega, and Wooding	Prospective Observational Study	10 health care workers trained	"To assess the practicability and feasibility	Overall the adverse event rates were ≤	Level III Good

(2014)		561 device placements 529 device removals	of rapid short duration training for safe PrePex device use."	2%. The rapid training for safe PrePex device use is feasible.	Quality
Herman-Roloff, Bailey, and Agot (2012)	Prospective Cohort Study	4010 VMMC clients Median age 20.0 years	"To determine factors associated with the incidence of adverse events associated with VMMC."	Trained nurses with experience can perform VMMC as safely as physicians.	Level III High Quality
Herman-Roloff et al. (2011)	Health Facility Needs Assessment	81 facilities 2,675 VMMC clients	"To evaluate the implementation of VMMC services in Nyanza Province of Kenya."	The VMMC program requires support from partner organizations in order to address challenges like human resource shortages.	Level III High Quality
Mutabazi et al. (2013)	Non-randomized field study.	519 subjects	"To assess the safety and efficacy of the PrePex device when circumcision is performed by nurses."	All subjects achieved complete circumcision. Demonstrated that nurses can safely and effectively use the PrePex device.	Level II High Quality
Mutabazi, Bitega, Ngeruka, Hategekimana et al. (2014)	Non-randomized Control Trial	152 VMMC volunteers 105 performed by physicians 47 performed	"To determine the safety and effectiveness of task-shifting from physicians to nurses using the PrePex	Both physicians and nurse can safely perform VMMC using the PrePex device.	Level II High Quality

		by nurses	device."		
Ngo & Obhai (2012)	Prospective Cohort Study	249 study participants	"To assess postoperative complications and patient satisfaction when circumcision is performed by non-physician providers."	VMMC can be delivered safely and effectively by non-physician providers with high client satisfaction.	Level III High Quality
Tshimanga et al. (2016)	Randomized, Open-lable control trial	160 Males received circumcision via PrePex device. 80 males received forceps guided.	"To assess performance of the PrePex device compared to forceps guided surgical circumcision"	PrePex device is safe, quick, easy to apply and effective.	Level I High Quality

Table 2. Cost Effectiveness of Task-Shifting to Nurses

Citation	Method	Sample	Purpose	Results	Appraisal
Mutabazi, Bitega, Ngeruka, Nyemazi, et al. (2014)	Non-blinded Randomized Control Trial	217 volunteers 144 received VMMC via PrePex device performed by nurses 73 received VMMC via dorsal-slit surgical performed by physician/nurse teams.	"To compare cost data from the study of procedure times for non-surgical VMMC performed by nurses and surgical VMMC performed by physician-nurse teams."	The total cost for the PrePex device method was $22.73 compared to $40.85 for conventional surgical. Cost savings of using the PrePex device is substantial.	Level II High Quality
Tchuenche et al. (2016)	Cost Analysis	Cost data collected using	"To derive the unit cost	Task shifting from doctors	Level III

	Study	providers perspective from 33 facilities	of delivering VMMC in South Africa and to identify the level of spending incurred for demand creation."	to nurses could save 17% and could have saves ad much at $15 million in 2015.	High Quality

Table 3. Attitudes and Perceptions of the Procedure

Citation	Method	Sample	Purpose	Results	Appraisal
Dévieux et al. (2015)	Survey Study	Convenience sample of 153 health care providers	"To assess knowledge, attitudes, practices, and beliefs about VMMC among health care providers in Haiti."	Participants demonstrated adequate knowledge and positive attitudes toward VMMC.	Level III High Quality
Milford et al. (2016)	Interviews	25 health care providers (nurse managers, nurses, and counselors)	"To explore health care providers' knowledge, attitudes, and practices about VMMC."	Many providers did not have scientific understanding of how VMMC could reduce risk of HIV in heterosexual males and needed more training.	Level III High Quality
Milovanovic, Taruberekera, Hatzold, Martison & Lebina (2016)	Cross-sectional Survey	77 health care workers (physicians, clinical offiers, nurses, counselors and	"To assess the perceptions attitudes, and experiences healthcare workers using the	The PrePex device was considered to be easy, simple, quick and convenient.	Level III High Quality

		managers)	PrePex device for VMMC."		
Naidoo et al. (2012)	Descriptive Cross-sectional Study	89 students Response rate = 83.18%	"To assess final year pharmacy and nursing students' knowledge, attitudes, and perception regarding VMMC."	Students hard moderate knowledge of VMMC for HIV prevention. The majority supported the promotion of circumcision.	Level III High Quality
Sheldon et al. (2012)	Probability Surveys	1444 completed respondent surveys 830 in Zimbabwe 614 in South Africa Response rate= 73%	"To determine clinician factors relating to the VMMC effort."	The inclusion of nurses in future training in circumcision should be considered to alleviate provider constraints.	Level III Good Quality
Umar, Mandalazi, Jere and Muula (2013)	Focus Group Discussions	6 focus groups 47 men total Mean age = 23 years	"To explore the acceptability, among male clients, of female clinicians taking part in the VMMC procedure."	The majority of participants objected to the presence of females in the circumcision procedure.	Level III High Quality

Table 4. Other Nurse Involvement

Citation	Method	Sample	Purpose	Results	Appraisal
Ashengo et al. (2014)	Retrospective Analysis	17,059 Calls Triaged by nurses from April – December 2011	"To determine reasons clients called the VMMC hotline to	The use of a telephone based system may be an appropriate	Level III High Quality

			ascertain accuracy of the campaign.”	first step to identify adverse events related to VMMC.	