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The Role of Nurses and Midwives in Expanding and Sustaining Voluntary Medical Male Circumcision Services for HIV Prevention: A Systematic and Policy Review

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Abstract

Male circumcision reduces men's risk of acquiring HIV through heterosexual sex, and voluntary medical male circumcision (VMMC) is central to HIV prevention strategies in 15 sub-Saharan

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Author Contributions

C. Toledo conceived of the study, performed article screening and data abstraction, interpreted data and policy implications, and provided intellectual input on the manuscript. S. M. Davis performed article screening and data abstraction, interpreted data and policy implications, and drafted and revised the manuscript. S. L. Leslie designed and performed the literature search and provided intellectual input and editing on the manuscript. H. Baker, J. M. Gross, and J. Samuelson designed and performed the policy search, performed article screening and data abstraction, interpreted data and policy implications, and provided intellectual input on the manuscript. C. M. Z. Chasokela interpreted data and policy implications, provided intellectual input on the manuscript.

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Disclosures

The authors report no real or perceived vested interests related to this article that could be construed as a conflict of interest.

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African countries. Nurses have emerged as primary VMMC providers; however, barriers remain to institutionalizing nurse-led VMMC. Patient safety concerns have hindered task sharing, and regulations governing nurse-performed VMMC are not always supportive or clear. We performed a systematic review on VMMC safety by provider cadre and a desk review of national policies governing the VMMC roles of nurses and midwives. Also, VMMC by nurses is safe and has become standard practice. Countries had multiple policy combinations among different documents, with only one disallowing VMMC by these cadres. Countries with alignment between policies often ensured that nursing workforces were equipped with clinical competencies through national certification. Regulatory clarity and formalized certification for nurse-performed VMMC can increase program sustainability and build nursing capacity to meet other critical basic surgical needs.

Keywords

desk review; HIV prevention; medical male circumcision; midwives; nurses; systematic review

Medical male circumcision reduces a man's risk of acquiring HIV through sex with a woman or women by approximately 55% (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007) and also provides partial protection against some other sexually transmitted infections, including human papillomavirus, trichomoniasis, and bacterial vaginosis (Farley et al., 2020). Since 2007, when the World Health Organization (WHO) and the United Nations Programme on HIV/AIDS (UNAIDS; World Health Organization/United Nations Programme on HIV/AIDS, 2007) first recommended voluntary medical male circumcision (VMMC) as an additional HIV prevention strategy in high-prevalence settings with low circumcision coverage, it has become a key HIV-prevention intervention in 15 countries in East and Southern Africa (Joint United Nations Programme on HIV/AIDS, 2011). Despite the current context of new, effective, HIV-prevention interventions and the secondary prevention effect of antiretroviral treatment, VMMC remains a cost-effective intervention recommended for adult men and adolescent males in East and Southern Africa (Farley et al., 2020), which needs to continue scaling up to reach its full potential impact. However, all VMMC-implementing countries have critical physician and particularly surgeon shortages (Meara et al., 2015; World Health Organization, 2017; Worldometer, 2019), and human resources quickly emerged as a limiting factor in VMMC scale-up in initial doctor-provided programs. Although nursing shortages are also critical in VMMC-implementing countries, the absolute nurse cadre size is far larger: more than 464,000 across the initial 14 VMMC priority countries (which does not include South Sudan), as compared with fewer than 86,000 doctors, according to latest-available WHO Global Health observatory data for each country (World Health Organization, 2019d). This context led WHO to promote task sharing under the Models to Optimize Volume and Efficiency (MOVE) approach in which multiple, interdisciplinary, midlevel providers support a surgeon who rotates more quickly between clients (World Health Organization, 2010). The majority of VMMC-implementing countries then adopted full task sharing with nurses, and sometimes, other nonphysician health care workers (HCWs) performing the entire VMMC procedure. The abbreviation HCWs and the term "providers" are used throughout this article to refer to clinical health care professionals, as distinguished from traditional practitioners without clinical training.

This emergence of nurses as the primary providers of VMMC has been a crucial innovation in the program's success to date and, more broadly, has demonstrated the potential of nonphysician HCWs to meet crucial minor surgical needs in resource-limited health care settings at an unprecedented scale. However, two key challenges remain. First, millions of VMMCs are needed in the future to achieve and maintain the current UNAIDS coverage targets of 90% among adult men through 2030 (UNAIDS, 2016). Yet, not every country implementing VMMC has adopted task sharing, amidst anecdotal concerns over surgical safety and nursing shortages. Second, national policies governing task sharing and nurses' scopes of practice (SOP) are not always clear or consistent across governmental agencies and regulatory bodies.

Although individual countries set national standards for nursing education and qualification, there are globally recognized standards addressing core requirements and responsibilities of a nurse, providing a degree of consistency across countries in the profile of this cadre when considering its role in VMMC across East and Southern Africa. The International Council of Nurses defines a nurse as "a person who has completed a program of basic, generalized nursing education and is authorized by the appropriate regulatory authority to practice nursing in his/her country," and a basic nursing education as "a formally recognised programme of study, providing a broad and sound foundation in the behavioural, life, and nursing sciences for the general practice of nursing" (International Council of Nurses, 2019a, para. 4). Also, WHO has provided a recommended set of global standards for the education of nurses and midwives (World Health Organization, 2009), which includes standards around outcomes (including graduate competencies and career tracking), graduate attributes (including use of evidence, cultural competence, and critical thinking), governance, accreditation, infrastructure, partnerships, curriculum design, core curriculum (including content in nursing theory, practice, interventions, and SOP), assessment, and faculty qualifications and development.

National and multilateral efforts are needed to address gaps in VMMC workforce sustainability planning, and these efforts can potentially draw support from current global momentum to recognize and expand nurse leadership in critical areas of health care. In 2016, the All-Party Parliamentary Group on global health published the "Triple Impact—how developing nurses will improve health, promote gender equality, and support economic growth" (World Health Organization, 2016, para. 4), aiming to "collect and disseminate evidence of the impact of nursing on access, quality, and costs, and ensure it is incorporated in policy and acted upon." WHO has designated 2020 as the International Year of the Nurse and the Midwife (International Council of Nurses, 2019b); this designation highlights the contributions of nurses and midwives and works to address nursing shortages. In addition, Nursing Now, launched in 2018, is a 3-year global campaign developed by the International Council of Nurses, WHO, and Burdett Trust for nursing. This initiative "aims to raise the status and profile of nursing worldwide" through working with policymakers and supporting nurses to "lead, learn, and build a global movement" (Nursing Now, 2019, para. 1). Conversely, the evidence base and policy development processes generated for the VMMC program may be able to assist these broader efforts to take advantage of nursing's potential to narrow critical gaps across multiple health domains.

The authors reviewed the evidence on VMMC safety when performed by diverse HCW cadres and documented the status of policies and SOP regarding nurses' and midwives' authorization to perform VMMC. We performed a systematic review of scientific literature on the safety of VMMC when performed by nurses and other nonphysician cadres and a desk review of national policy documents governing VMMC task sharing across all implementing countries. We discuss the gaps to create enabling environments for nurses to sustain VMMC service delivery and the opportunities created by the development of a large pool of nurses and midwives experienced in basic surgical skills and postoperative management.

Methods

Methods Part 1: Systematic Literature Review

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommendations were used to guide the review process (Liberati et al., 2009). A comprehensive literature search was undertaken to identify articles providing data on safety of male circumcision performed by nonphysicians in countries implementing VMMC. The term nonphysicians is used to be inclusive of nurses, midwives, and other medical cadres.

The search strategies were developed and conducted by an experienced medical librarian (S.L.) with input from all research team members. Specific search strategies can be found in the online supplementary material (Supplemental Digital Content 1, <http://links.lww.com/JNC/A9>). Six bibliographic databases were searched (the Cumulative Index to Nursing and Allied Health Literature, or CINAHL; Embase.com; Global Health; PubMed; Scopus; and Web of Science Core Collection). Gray literature sources were also searched (African-Wide Information, African Index Medicus, and Popline). The websites for the Conference on Retroviruses and Opportunistic Infections, the International AIDS Society, and the International Conference on AIDS/STIs in Africa were manually searched for relevant abstracts.

The searches combined controlled vocabulary supplemented with keywords related to the concepts of male circumcision (e.g., voluntary medical male circumcision, VMMC), adverse events (AEs; e.g., complication, injury), and cadre (e.g., nonphysician, nurse, midwife). Synonyms for "cadre" were drawn from WHO Recommendations (World Health Organization, 2012). Location was limited to the 15 African countries currently implementing large-scale VMMC programs: Botswana, Eswatini (formerly Swaziland), Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, South Sudan, Tanzania, Uganda, Zambia, and Zimbabwe. Search dates ranged between January 1, 2007, and May 2, 2019. Articles were excluded if they did not present primary data (e.g., literature reviews or modeling), did not address male adult or adolescent circumcision (e.g., were about female genital mutilation, sometimes described as "female circumcision" or infant male circumcision), did not stratify safety outcome data by cadre, or did not provide data on at least one entirely nonphysician cadre (whether comparative or only descriptive). Any outcome measure described as capturing safety by article authors was includable.

Citations were uploaded to Rayyan, a systematic review tool, for review (Ouzzani et al., 2016). In the title-abstract screening phase, the first 50 titles were independently assessed by two reviewers (S.M.D., S.L.). The results were briefly unblinded, and the two reviewers compared exclusion reasons and resumed double review. Articles that passed title/abstract screening moved on to independent double full-text review by four reviewers (H.B., S.M.D., J.S., J.G.). Those selected for inclusion moved on to data abstraction. In both phases, disagreements were resolved through discussion. Figure 1 shows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses-style article inclusion flow diagram. The major variables extracted included country, setting, client age ranges, study design, method, safety outcomes, and cadre. Results were not combined across studies but captured in an exhaustive table, with descriptive discussion of numbers of articles identified and showing significant and nonsignificant differences in safety outcomes by provider type. Article-level evidence quality on our outcomes was assessed using the Newcastle-Ottawa score (Wells et al., n.d., accessed 2020), a simple, validated, and widely-used quality grading scale for observational studies. Scoring systems are roughly similar for cohort and case-control designs; the cohort system scores multiple aspects of each of three domains for a maximum score of nine points: participant selection (four points), comparability of exposed and unexposed groups (here, clients of midlevel providers vs. doctors; two points), and outcome capture (three points). For noncomparison studies, we used a modified version of the cohort scale, which eliminated questions only relevant for intergroup comparison, leaving five maximum points. We set thresholds for adequate duration of follow-up at 14 days to allow for later AEs and for adequate capture because <5% missed follow-up.

Overall synthesis of findings was done via quantitative descriptive breakdowns of the included literature body by key article characteristics (particularly, study design, cadres included, and AE diagnostic criteria) and outcome findings.

Methods Part 2: Policy Review

Methods for data call for policy documents.—In 2019, WHO and CDC requested policy and regulatory documents by email from national nursing leaders, including chief nursing officers, registrars, academics, and presidents of national nurses and midwives associations from the 14 priority countries implementing VMMC—Botswana, Eswatini, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe (South Sudan was excluded from this analysis because the VMMC program has only recently been established)—and from global leaders in nursing workforce policy and regulation. Policy and regulatory documents related to nurses' and midwives' SOP, task sharing, and national nursing acts were searched using key words, including “circumcision,” “VMMC,” “minor procedure,” “minor surgery,” “procedure,” and “HIV,” and national VMMC policies were searched using the key words “nurse, midwife, task-sharing, certified, and trained” and analyzed for the 14 priority countries.

Methods for web-based search for policy documents.—Following the gathering of documents from VMMC-implementing countries, the websites of The Clearinghouse on Male Circumcision for HIV Prevention (<https://www.malecircumcision.org/>) and the National Council of State Boards of Nursing's (NCSBN) Global Regulatory Atlas (<https://>

www.regulatoryatlas.com/) were systematically searched for VMMC documents, which included information about the nonphysician role in VMMC care and for Nursing Scope of Practice documents.

The Clearinghouse on Male Circumcision for HIV Prevention was searched for the 14 VMMC priority countries along with “Guide,” “Job Aid,” “Policy or Guidance,” “Report,” “Strategy,” “Tool or Toolkit,” and “Training Materials,” and it resulted in 113 documents. Of these, five included information about the nonphysician role in VMMC.

The NCSBN’s Global Regulatory Atlas was searched for the 14 VMMC priority countries. Three documents were found from it, including the national nursing acts for Namibia, South Africa, and Rwanda. Also, a web search was performed in Google to locate the Republic of Rwanda Ministry of Health National Guidelines for Prevention and Management of HIV and STIs.

Policy document review.—Policy documents were reviewed regarding the extent to which nurses and midwives were authorized to perform VMMC, and coded using the following designations, based on the terms used in the documents: VMMC or other procedural authorization not mentioned, minor procedures authorized, minor surgeries authorized, procedures authorized, VMMC authorized, VMMC authorized, cadre not specified (e.g., in some VMMC policies), conditionally authorized, VMMC not mentioned (i.e., the authorization of any task is based on training, competency, SOP, job description, scheme of service), and VMMC not authorized. For the categories minor procedures authorized, minor surgeries authorized, and procedures authorized, VMMC is not explicitly mentioned but implicitly authorized. Policy documents were subsequently reviewed for documentation on required training or certification for VMMC providers, as a means to systematically ensure competency among VMMC providers, and coded using the following designations: no established VMMC training program, presence of approved or competency-based trainings, or established VMMC certification program.

Results

Part 1: Literature Review

In total, 225 deduplicated articles were identified; of which, 74 passed initial title/abstract screening, and 17 met all inclusion criteria after full-text review (Figure 1). These are summarized in Table 1. Abstracts meeting inclusion criteria and not presenting the same data as an includable full article were treated as articles. Nine articles compared two cadres on safety (of which, a physician or surgeon was a comparator in six), and the other eight assessed a single group composed of one or more nonphysician cadres on safety. The potentially ambiguous term “medical officer” referred to physicians in the countries included here, according to the relevant articles. Six countries implementing VMMC were Kenya, Malawi, Mozambique, Rwanda, Uganda, and Zambia. Seven of the included articles featured data sets enrolling only adults (18 years and older); the others also enrolled minors (nine) or did not specify (one). Those enrolling minors were frequently restricted to those 12 years or older.

Articles fell into one of several categories:

- retrospective assessments of routinely collected programmatic data (six articles),
- prospective studies primarily designed to evaluate safety with a new VMMC device, which also reported results by cadre suitable for inclusion (eight articles: six PrePex and two ShangRing),
- prospective study designed to evaluate safety by follow-up method (one article; Reed et al., 2015), and
- prospective studies specifically designed to evaluate safety of nonphysician cadres (two articles: one with only multiple nonphysician cadres, Ngo & Obhai, 2012; the other comparing nonphysicians with physicians, Frajzyngier et al., 2014).

Provider cadres included surgeons, physicians, medical officers, clinical officers, nurses, medical technicians, and nurse aides. All articles reported safety outcomes as AE rates, and these in turn were defined as rates of moderate or severe AEs diagnosed at any point in follow-up in most cases. Severity designations were as defined by the articles themselves; however, the categorization system most commonly used is that provided in the Population Services International Adverse Event Action Guide, which provides type-specific criteria, but in general, it designates severe AEs as those requiring extensive intervention with referral or specialist input, and moderate AEs as those that require intervention but do not qualify as severe (PSI, 2016). However, three studies reported total AE rates (Galukande et al., 2014; Mutabazi et al., 2013, 2014); two reported mild, moderate, and severe AE rates separately (Kigozi et al., 2014; Kohler, Namate, et al., 2016), and three studies reported AEs either stratified by period (Frajzyngier et al., 2014) or confined to only the intraoperative (Ngcobo et al., 2018) or the postoperative (Reed et al., 2015) period.

Reported AE rates were less than 3% in 11 studies and higher in six studies. Of those six, three had higher rates for both physician and the nonphysician cadres: two in which the high rate was attributed by authors to their aggressive nonroutine case-finding approach (Feldblum et al., 2014; Reed et al., 2015), and one in which the AE rate was not confined to moderate/severe cases (Ngcobo et al., 2018). Two reported only on nonphysician cadres in noncomparison studies from the same study team in the same country. Of those, one rate was found with surgical male circumcision prior to a documentation quality improvement intervention, attributed by authors to overdiagnosis (Kohler, Namate, et al., 2016); the other resulted from the inclusion of all pain as an AE (Kohler, Tippet Barr, et al., 2016). The final study (Herman-Roloff, Bailey, & Agot, 2012) had an apparent overall “passive surveillance” (routine follow-up) AE rate of 5.6% with higher AE rates among nonphysicians (discussed below) but did not report absolute rates for different provider cadres separately.

In total, among the 13 included studies that provided moderate/severe AE rates, six reported a point estimate of more than 2% among nonphysicians. Of these, one was interpreted by the authors as prequality intervention misclassification, which resolved after training; two had higher rates among physicians and attributed all to intensive nonroutine case-finding (Feldblum et al., 2014; Reed et al., 2015); one reported only on nonphysicians (Kohler,

Tippett Barr, et al., 2016), and one had a point estimate of 2.1 versus 1.9% among physicians (not significant, not provided; Frajzyngier et al., 2014). The last (Herman-Roloff et al., 2012) is discussed in detail below.

Among the six studies comparing nonphysician cadres to physicians or surgeons, none found large differences in AE rates between cadres, and only one found a statistically significant difference. Two showed lower AE rates for the nonphysician cadres, clinical officers (Buwembo et al., 2012), and nurses (Mutabazi et al., 2014), respectively, with statistical significance not found after adjustment and not tested, respectively. Three found lower rates for the physicians: two reporting physician AE rates of 0% (Galukande et al., 2014; Mwandu et al., 2012), one reporting rates of 7.1% versus 8.1% (Ngcobo et al., 2018), and none testing for significance. The last showed mixed results (Herman-Roloff et al., 2012). It compared “clinicians” (a mix of medical officers who were physicians and clinical officers who were not) with nurses, on data from the “passive” system (routine clinic follow-up) and an “active” system (using home visits to follow-up on lost clients). In the passive system, clinicians had statistically significant lower rates but also had 25% lower return for follow-up among clients. In the active system, and when restricting to providers who had performed 100 or more MCs, AE rate point estimates remained lower for clinicians but differences were not significant (odds ratios: 0.7 [95% confidence interval 0.5–1.0]; 0.41 [95% confidence interval 0.08–2.1]).

Among the eight noncomparison studies reporting AE rates on a single, exclusively nonphysician, provider pool, two reported on a pool of only nurses (Hove et al., 2019; Mutabazi et al., 2013), both with AE rates less than 1%. Others reported on a mixed pool, including one or more of the other nonphysician cadres listed above. Only one reported an AE rate greater than 2%, as described above (Kohler, Namate, et al., 2016); the provider pool was primarily clinical officers with less than 10% being nurses.

Perhaps, because many of the included studies were not designed primarily to compare safety across cadres, only three provided specific information on the backgrounds of the nonphysician-only cadres. One reported on years of training and experience (Mutabazi et al., 2013), and two reported on measures of surgical MC experience only (Frajzyngier et al., 2014; Galukande et al., 2014). Respectively, these studies reported on nurse providers with 6–9 years of health education, and a mean of 7 years of nursing experience; a mean of 4.3 years of experience in surgical MC; and at least 50 surgical MCs performed. The two comparison studies reported similar AE rates across cadres, and the nurse-only study reported an AE rate of less than 1%.

All studies were classified as cohort studies (either comparison or noncomparison) for Newcastle-Ottawa quality grading. Scores for comparison studies ranged from two to nine out of nine for comparison studies and from three to four of four for noncomparison studies. Points were lost across all domains; common issues included lack of blinding to surgical provider type in outcome assessment (not surprising as many were not primarily designed to compare outcomes by provider type) and inability to prevent substantial dropout over long follow-up periods. Additionally, abstracts, although held to the same standards as full articles, were less likely to provide all scored methodological elements.

Major limitations and potential biases in included studies are also listed in Table 1, and further explored in the Discussion section. A common theme was that prospective studies with multiple provider cadres did not specify how patients were assigned between them; none claimed to have randomized assignments. In one case (Ngcobo et al., 2018), nonphysician cadres were not eligible to circumcise higher-risk clients (boys younger than 13 years); conversely, another noted higher follow-up rates with nonphysician providers (Herman-Roloff et al., 2012), which could increase their apparent AE rate. Additionally, because the majority of studies were not designed primarily to compare safety rates across cadres, most did not provide statistical testing for these comparisons. All device studies are subject to anatomic eligibility criteria and some to minimum age criteria, which would be expected to select for low-risk clients (for all provider types). Three excluded articles, excluded based on not reporting on an exclusively nonphysician cadre, nonetheless have relevance, and are mentioned in the Discussion section.

Part 2: Policy Review

The policy analysis included 12 SOP, two memorandum/addenda to the SOP, six national nursing acts, 15 national VMMC policy documents from 13 countries (all except Lesotho), and two national task sharing policies (Table 2). In summary, 12 of 14 countries submitted a SOP (Zambia is revising its national SOP, and Mozambique is yet to approve an SOP, following the passage of the national nursing act in 2016). Among the 12 countries with national SOP documents included in the review, nurses and midwives were authorized in those documents to perform the following:

- minor surgeries in Kenya and Tanzania (Nursing Council of Kenya, 2012; Tanzania Nursing and Midwifery Council, 2014),
- procedures in Eswatini and Rwanda (Swaziland Nursing Council, 2010; Rwanda Minister of Health, 2012),
- VMMC in Lesotho, Malawi, Namibia, South Africa, Uganda, and Zimbabwe (Lesotho Nursing Council, 2013; Nurses and Midwives Council of Malawi, 2015a, 2015b; Nursing Council of Namibia, 2014; South Africa Nursing Council, 2014; Uganda Nurses and Midwives Council, 2014; Zimbabwe Ministry of Health and Child Care, 2014),
- conditionally authorized to perform tasks based on job descriptions, education and training, and competency in Botswana (i.e., VMMC not mentioned; Nursing and Midwifery Council of Botswana, 2019), and
- not authorized to perform VMMC in Ethiopia (i.e., VMMC was excluded; Ethiopian Food, Medicine and Health Care Administration and Control Authority, 2017).

South Africa and Zimbabwe also formally authorized nurses through a circular, or memo, from the National Nursing Council, as addenda to their SOP (Zimbabwe Ministry of Health and Child Care, 2014; South African Nursing Council, personal communication, 2014).

Among the six countries with national nurses acts reviewed, these acts authorized nurses and midwives to perform procedures in Zambia (Parliament of Zambia, 1997), and minor

procedures in Botswana (Nursing Council for Botswana, 1969). However, VMMC or other procedural authorization is not mentioned in the national nurses' act for Mozambique, Namibia, Rwanda, or South Africa (Fernanda Teixeira, do cargo de Director do Gabinete da Esposa do Presidente da Republica, 2016; President of the Republic of Rwanda [Paul Kagame], 2008; Republic of Namibia, 2004; South African Nursing Council, 2006).

Among the 13 countries with national VMMC policies reviewed, nurses and midwives were authorized in these policies to perform VMMC in Botswana, Eswatini, Ethiopia, Kenya, Mozambique, Namibia, Rwanda, Tanzania, Uganda, Zambia, and Zimbabwe (84%; Botswana Ministry of Health, 2009; Ethiopian Federal Ministry of Health, 2019; Government of Uganda, Ministry of Health, 2010; Ministry of Health, Government of the Kingdom of Swaziland, 2009; National AIDS & STI Control Programme & Ministry of Health, Nairobi, Kenya, 2018; Republic of Mozambique, Ministry of Health, National Directorate of Medical Care National Circumcision Program, 2017; Republic of Namibia Ministry of Health and Social Services, 2010; Republic of Rwanda Ministry of Health, 2016; Republic of Zambia Ministry of Health, 2009; The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children, National AIDS Control Programme, 2016; Zimbabwe Ministry of Health and Child Care, 2019); however, the cadre was not specified in South Africa and Malawi (16%; National AIDS Commission, 2012; Republic of South Africa Department of Health, 2016).

Finally, of the two countries with national task sharing policies reviewed, Botswana's policy conditionally authorized nurses and midwives to perform tasks based on job descriptions, schemes of services, training, and competency; however, VMMC was not specifically mentioned (Centre for Disease Control and Prevention Botswana, 2016). Tanzania's task sharing policy authorized nurses and midwives to perform VMMC (The United Republic of Tanzania Ministry of Health, Community Development, Gender, Elderly and Children, 2016).

In comparing countries' nursing and VMMC policies for alignment, countries fell into four main categories (Figure 2): (a) aligned explicit authorization to conduct VMMC in the nursing SOP, confirmed by explicit authorization in the national VMMC policy; (b) aligned explicit authorization to conduct VMMC in the nursing SOP and implicit authorization in the national VMMC policy; however, the provider types covered in it are not specified; (c) aligned implicit authorization to conduct VMMC, as noted by authorization to conduct procedures, minor procedures, or minor surgeries, in the SOP or national nursing act, and explicit authorization to conduct VMMC in national VMMC policies; and (d) conflicting or nonexistent authorization in national nursing policies yet formal authorization to conduct VMMC in national VMMC policies.

Namibia, Uganda, and Zimbabwe are classified in the first category, explicitly authorizing nurses and midwives to conduct VMMC in both the SOP and national VMMC policies. Malawi and South Africa are classified in the second category with explicit authorization in national nursing SOP; however, their national VMMC policies did not explicitly specify the cadre of the VMMC provider. Falling in the third category, Rwanda and Eswatini implicitly authorized nurses and midwives to conduct VMMC by authorizing procedures

and Kenya and Tanzania by authorizing minor surgeries, in their SOP; all four countries explicitly authorized nurses and midwives to conduct VMMC in national VMMC policies. Tanzania provided further explicit authorization through their national task sharing policy. Also, falling in the third category, Zambia and Botswana implicitly authorized VMMC by authorizing procedures and minor procedures, respectively, in their national nursing acts and explicitly authorizing VMMC in national VMMC policies. Botswana provided additional conditional authorization in their task sharing policy and SOP, depending on scheme of service, job description, training, and competencies. Falling in the fourth category, Ethiopia's policies provided conflicting guidance. In the national SOP, nurses and midwives were explicitly not authorized to perform VMMC; however, the national VMMC policy provided explicit authorization to conduct VMMC. National nursing policies for Mozambique either did not exist (i.e., SOP) or did not mention VMMC (i.e., national nursing act); however, the national VMMC policy authorized nurses to perform VMMC.

All 14 VMMC-implementing countries documented the presence of nationally approved or competency-based VMMC trainings, or the establishment of VMMC certification programs, to ensure that VMMC providers had the requisite competencies to delivery safe MC services (Table 2). Nine countries, including Namibia, Uganda, Zimbabwe, Eswatini, Rwanda, Zambia, Kenya, Ethiopia, and Mozambique, required nurses and midwives, among other MC providers, to be certified through a national VMMC training program or mechanism (Ethiopian Federal Ministry of Health, 2019; Government of Uganda, Ministry of Health, 2010; Ministry of Health and Child Care, personal communication, 2014; Ministry of Health, Government of the Kingdom of Swaziland, 2009; National AIDS & STI Control Programme & Ministry of Health, Nairobi, Kenya, 2018; Nursing Council of Namibia, 2014; Republic of Mozambique, Ministry of Health, National Directorate of Medical Care National Circumcision Program, 2017; Republic of Rwanda Ministry of Health, 2016; Republic of Zambia Ministry of Health, 2009). Five countries, including Lesotho, Malawi, South Africa, Tanzania, and Botswana, required nurses and midwives to undergo either a nationally approved or competency-based VMMC training to provide VMMC services (Botswana Ministry of Health, 2009; Lesotho Nursing Council, 2013; Nurses and Midwives Council of Malawi, 2015b; South African Nursing Council, personal communication, 2014; The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children, National AIDS Control Programme, 2016).

Discussion

Safety Literature Review

The preponderance of evidence on VMMC performed by nonphysician cadres is that it is safe, both by the standards of the often-cited 2% moderate/severe AE rate threshold and compared with physicians. Data came from 40% of VMMC-implementing countries representing almost 60% of all VMMCs reported to WHO in 2018, the most recent year with released data and so should be broadly generalizable (World Health Organization, 2019c). The noted exceptions to the overall safety equivalence between physician and nonphysician cadres support cautions around ensuring adequate mentorship for new providers as they develop experience. Speculatively, physicians may, on average, enter

VMMC with more general surgical experience, contributing to their early performance, which is balanced out in other cadres by their VMMC-specific experience once it accumulates. Nonphysicians were systematically assigned to lower-risk (nonadolescent) clients in some settings and may have been informally assigned in others, potentially biasing their reported AE rates downward. Another safety consideration is that AE rates capture events but not ultimate outcomes, which would be expected to improve with prompt care seeking, and nonphysicians have some evidence for higher follow-up rates. Speculatively, this may be attributed to backgrounds in patient communication among these cadres, which are often primarily responsible for patient education.

Articles' quality of evidence on our outcome of interest varied widely, particularly with respect to provider assignment method as discussed above, and lack of blinding to exposure by outcome assessors. These potential biases would be expected to drive findings in opposite directions, with any "shunting" of higher-risk patients to doctors tending to raise their relative AE rates and with potential assessor bias toward higher doctor safety tending to lower them. However, AE determination remains largely based on examination, and authors believe that the high consistency of the literature also strengthens the quality of the overall body of evidence.

The three studies excluded from this review due to the lack of a purely nonphysician cadre qualitatively reported similar results. Nonphysicians performed 88–97% of procedures in the arms reported, all device based, with moderate/severe AE rates of 0.6% (Feldblum et al., 2016) to 1.4% (Sokal et al., 2014), and a total AE rate of 4.2–4.9% (Ndagijimana et al., 2015).

A major gap in the included literature was on the lack of information provided in the article on specific training backgrounds of the nonphysician providers. Some VMMC-implementing countries have multiple subcategories of nurses (e.g., enrolled vs. registered nurses in Malawi), and countries can have varying training path-ways for other nonphysician cadres. Similarly, nurses' aides, although only performing circumcision in one included study (Ngo & Obhai, 2012), may not be equivalent to auxiliaries and/or may lack basic clinical training in some countries, to which findings would not be generalizable. In turn, these different subgroups can have substantially different workforce sizes, such that establishing safety outcomes specific to each has important human resource implications. Eight of the 14 initial VMMC priority countries reported nursing/midwifery subcadre sizes to the Global Regulatory Atlas (National Council of State Boards of Nursing, Inc., 2019). Numbers of midwives are consistently lower than those of nurses, by varying degrees. Among nurses, the numbers of highly trained practitioners vary tremendously: some countries have a predominance of these in the nursing workforce, whereas others have the opposite. In some countries, like Malawi, one subcadre far outnumbers the others and would be a clear priority for training and certification to provide VMMC services. In others, like Rwanda, the workforce is similar between registered nurses and enrolled or auxiliary nurses, such that prioritization might require a more careful assessment of the desired final size of the VMMC workforce. Existing data do not allow determination of whether or not experience, years of health training, general education level, or specific health curricula are each key determinants of provider safety. Analysis and dissemination of routinely collected

program data, or prospective data collection in program settings, could fill many or all of these gaps without the need for research interventions.

Policy Document Review

As countries work to align policy and practice to ensure access to sustainable VMMC services, prioritizing and expanding nursing and midwifery workforce authorization and competency will allow these cadres to fully support program scale-up. Explicit authorization to provide VMMC services in the nursing and midwifery SOP, supported by authorization in the national VMMC policy, provides a strong framework for clear and formal authorization, and a requisite mandate for competency-based training. All three countries—Namibia, Uganda, and Zimbabwe—with explicit VMMC authorization in their SOP and national VMMC policies also have certification programs for nurses and midwives. Namibia issues trained providers a Medical Male Circumcision Certificate of Proficiency and a Certificate to Perform Medical Male Circumcision with guidelines for certification renewal. In Uganda, nurses and midwives are certified through a training program authorized by the Ministry of Health and the Association of Surgeons of Uganda. Zimbabwe has a SOP specifically for nurse circumcisers and has integrated formal VMMC training into preservice and in-service education for nurses and midwives (Zimbabwe Ministry of Health and Child Care, 2019). It also certifies nurse circumcisers after assisting in 200 circumcisions and performing 20 under direct supervision, in line with the study findings from Kenya that found that AE rates were lower among providers with more experience (Feldblum et al., 2014; Herman-Roloff et al., 2012). South Africa requires nurses and midwives to demonstrate proof of competency-based VMMC training upon request by the South African Nursing Council, and Malawi requires nurses and midwives to complete an approved training program.

For countries with implicit authorization for nurses to perform VMMC, either through the national SOP or through national nurses act, and explicit authorization to perform VMMC through the national VMMC policy, the link between authorization and competency is less consistent. Four countries—Rwanda, Eswatini, Kenya, and Zambia—require nurses and midwives to be trained and certified to perform VMMC services, and Kenya and Zambia incorporated VMMC competencies into preservice nursing and midwifery curricula (National AIDS & STI Control Programme & Ministry of Health, Nairobi, Kenya, 2018; Republic of Zambia Ministry of Health, 2009, 2012). Eswatini requires MC providers to be certified through Eswatini’s Male Circumcision Task Force (Ministry of Health, Government of the Kingdom of Swaziland, 2009). Among the other countries, Tanzania requires nurses and midwives to be trained using the national VMMC or early infant male circumcision training modules, and Botswana’s national VMMC policy outlines a formal strategy for VMMC provider training and the need to establish a certification system for providers to ensure safe practice across public and private health facilities (Botswana Ministry of Health, 2009).

To ensure the development of a competent nursing and midwifery workforce to sustain the delivery of VMMC services, countries with implicit authorization can develop formal systems to train and certify existing providers, ensuring the requisite competencies to deliver safe VMMC services. Although multiple studies demonstrated that safe MC

services can be provided by nurses and midwives, study providers were well trained and operated within a controlled study setting. Health systems need mechanisms, such as certification, to ensure that providers have the appropriate competencies to deliver VMMC in programmatic settings. Integrating VMMC competencies into preservice education—like in Kenya, Zambia and Zimbabwe—is an investment in building core clinical competencies within the nursing and midwifery workforce and a sustainable foundation for future VMMC certification.

Countries, such as Ethiopia and Mozambique, lacking explicit or implicit authorization to perform VMMC in their nursing and midwifery SOP, or national nurses act, yet authorizing nurses and midwives to conduct VMMC in their national VMMC policy leave the nursing and midwifery workforce vulnerable and exposed, providing conflicting guidance on authorization (e.g., Ethiopia) or weak authorization that is not supported by national nursing and midwifery policies and regulations (e.g., Mozambique). Although both Ethiopia's and Mozambique's national VMMC policies specify that VMMC providers, including nurses, must be certified to provide services, the lack of authorization in national nursing and midwifery policies and regulations provides little protection in the case of an AE. When considering task sharing approaches to sustain service delivery, countries will be evaluating the demand for VMMC services in the context of their health workforce shortages and burdens of disease. In Ethiopia, the ratio of nurses and midwives to doctors is 8:1; however, the national HIV prevalence among adults is low (1.0%). In Mozambique, in contrast, the ratio of nurses and midwives to doctors is 6:1, with an HIV prevalence of 12.6% (UNAIDS, 2019; World Health Organization, 2019a, 2019b), necessitating a strong demand for VMMC services and more formal authorization for nurses and midwives to ensure requisite legal protection and clinical competencies to meet the demand for HIV prevention services.

The key limitations of the policy review include a reliance on personal knowledge of national colleagues for policy document collection in the absence of a standard repository for such documents. It is also possible that we may have missed documents or do not have the most up-to-date documents in this review. This review captured only national-level documents; several VMMC-implementing countries have highly decentralized health systems in which regional (e.g., county or province) level policies may supersede, or not align with, national policy. The minimum requirements for sublevels within the nurse and midwife cadres vary by country, and this review did not capture the specific minimum qualifications for nurses and midwives in each country to be eligible for authorization to perform VMMC. Finally, this review is limited by authorizations and certifications documented in national nursing and VMMC regulations and policies and may not be reflective of recent developments in practice that have yet to be formally updated in revised national policies.

Despite the near-universal use of task sharing for service delivery among VMMC-implementing countries, important gaps in institutionalizing it as routine practice remain. Our review has shown that policy and SOP regulations authorizing nurses and midwives to perform circumcision can be unclear or contradictory, leaving their engagement limited and their liability unclear in the case of adverse outcomes. This is complicated by the multiple subcategories in nursing and associated health education levels within nursing and any other

health cadres potentially authorized to do VMMC and the paucity of data on safety of procedures stratified by these groupings.

The Regulatory Functions Framework (Verani, 2017) may be useful in further analysis because it proposes a list of seven important regulatory functions for the nursing profession, each of which, in a given country, can lie along a spectrum of development stages from low (ad hoc) to high (mature): legislation, registration (systems and data use), licensure, SOP, continuing professional development, preservice accreditation, and misconduct and disciplinary powers. Systematic integration of VMMC across nursing and midwifery regulations would ensure that (a) VMMC is authorized in national legislation or SOP; (b) VMMC competencies are included in preservice nurse training curricula, assessed in national licensure examinations, and evaluated through national VMMC certification programs, as a form of continuing professional development or in-service training; (c) VMMC certified providers are listed on a national registry; and (d) AEs are evaluated to understand the root cause, identify areas for systematic improvement within the national VMMC program, and evaluate any needs for enhanced training or disciplinary action.

Alternative methods of male circumcision that use devices further complicate the situation. Device-based methods are usually simpler procedures, and thus, requirements to perform them may permit a broader set of health care provider types to use them safely. This has led to their use being regulated separately from that of conventional surgical male circumcision, with some cadres being permitted to perform device-based circumcisions only. Overall, if the currently available WHO-prequalified device, the ShangRing, scales up successfully, it could dramatically alleviate human resource shortages in the VMMC program through shorter procedure times and potentially higher acceptance of use for a wider range of cadres. However, ShangRing requires surgical backup by highly skilled providers to be available to manage difficult cases. This would have implications on the presence of such a provider on site or nearby. Given the personnel structure of the current program, the majority of highly experienced VMMC providers will still be nonphysicians. Countries will be faced with national-level decisions about how to regulate these devices, and the need for multidisciplinary backup accessible via rapid referral will not be removed by expansion of a nurse-led VMMC program.

Countries can address health workforce issues related to provider staffing and compensation as a key enabler to maintain VMMC HCW availability (assuming that sustainable VMMC programs will be integrated into routine health services, rather than having parallel service delivery mechanisms). Given other public sector nursing responsibilities, performing VMMC, which by definition is never medically urgent, may compete with urgently needed care in settings that are understaffed. Nursing leadership in VMMC-implementing countries have raised concerns about this scenario, resulting in “task dumping,” in which the SOP for nurses keeps expanding but staffing does not, based in part on experience with the history of similar expansions in nurse prescribing authority for antiretroviral therapy that made HIV treatment scale-up in resource-poor health settings possible.

The potential for skill sets expansion conferred by the VMMC program to benefit health systems more broadly has yet to be explored. Countries implementing VMMC face some

of the world's most severe shortages of surgical providers for common procedures. All VMMC-implementing countries together have an estimated 5,015 surgeons (World Health Organization, 2017), approximately 1.8 per 100,000 (Worldometer, 2019), far below the UN Lancet Commission on Global Surgery's proposed 2030 goal of 20 per 100,000 (Meara et al., 2015). Meanwhile, there is an estimated current unmet need in East and Southern Africa for more than 25 million procedures (Rose et al., 2015).

Efforts have been made in some countries to address this gap through creating categories of surgically trained midlevel providers for minor procedures like VMMC, but most have involved clinical officers or other non-nurse, nonphysician cadres. A 2007 nonphysician clinician SOP review in 47 sub-Saharan African countries found four where midlevel provider training programs for task sharing admitted nurses, but those covered medicine and nonsurgical obstetrics and did not include surgical procedures (Mullan & Frehywot, 2007). For many nurses (other than those trained in midwifery), VMMC provided their first-ever opportunity to develop competence in suturing, cutting live tissue, achieving hemostasis, and complication management, which are useful skills and foundations of surgical practice.

The few countries in sub-Saharan Africa, where nurse performance of specific surgeries is already established, provide some indication of the potential. Nurses perform trichiasis surgery in some eastern African countries (Gichangi et al., 2015). Mozambique is an interesting example where nurses can join the "surgical technician" cadre, which performs the majority of obstetric surgeries; however, it requires a 3-year training—longer than their original average of 2.6 years of nursing training (Pereira et al., 2007). Other surgeries already performed by other midlevel providers in various VMMC-implementing countries include episiotomy, incision and drainage (Msuya et al., 2017), elective and strangulated groin hernia repair, prostatectomy, exploratory laparotomy, and hydrocelectomy (Wilhelm et al., 2011). Examples like these could contribute to a national or regional process of developing a list of technically straightforward, frequently needed surgical procedures that VMMC-experienced nurses could be readily trained to perform. The *Disease Control Priorities, Third Edition* indicates essential surgical procedures that should be available at lower-level health care facilities, which could serve to inform a more holistic planning and the role of nursing (Debas et al., 2015).

Conclusion

VMMC performed by nurses is safe and has become standard practice in most VMMC settings, yet many countries have not yet aligned national nursing and midwifery regulations with national VMMC policies to provide clear authorization to perform VMMC services. Countries face a tremendous challenge in institutionalizing their VMMC programs to provide long-term, high-volume services to maintain high coverage with a robust referral process for AEs that require more specialized providers, particularly if the need outlasts the donor support that has driven national programs to date. Removing remaining barriers to full nurse participation can streamline this process. This work highlights the safety of nurse-performed VMMC and the potential of the nursing workforce to contribute to sustainable programs, as well as the need to harmonize national policies and formalize certification programs for nurses and midwives performing VMMC.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Considerations

- Nurses and midwives have played a critical role in the successful scale-up of VMMC as an HIV-prevention intervention in sub-Saharan Africa.
- Nurse-led VMMC is safe.
- Better alignment is needed between policy and regulatory environments for nurse-performed VMMC, including ensuring requisite clinical competencies needed for VMMC through the establishment of national certification programs.
- Nurses and midwives will be critical to the sustainability of the VMMC program, and the capacity of nurses and midwives to perform other surgical needs may be enhanced through VMMC.

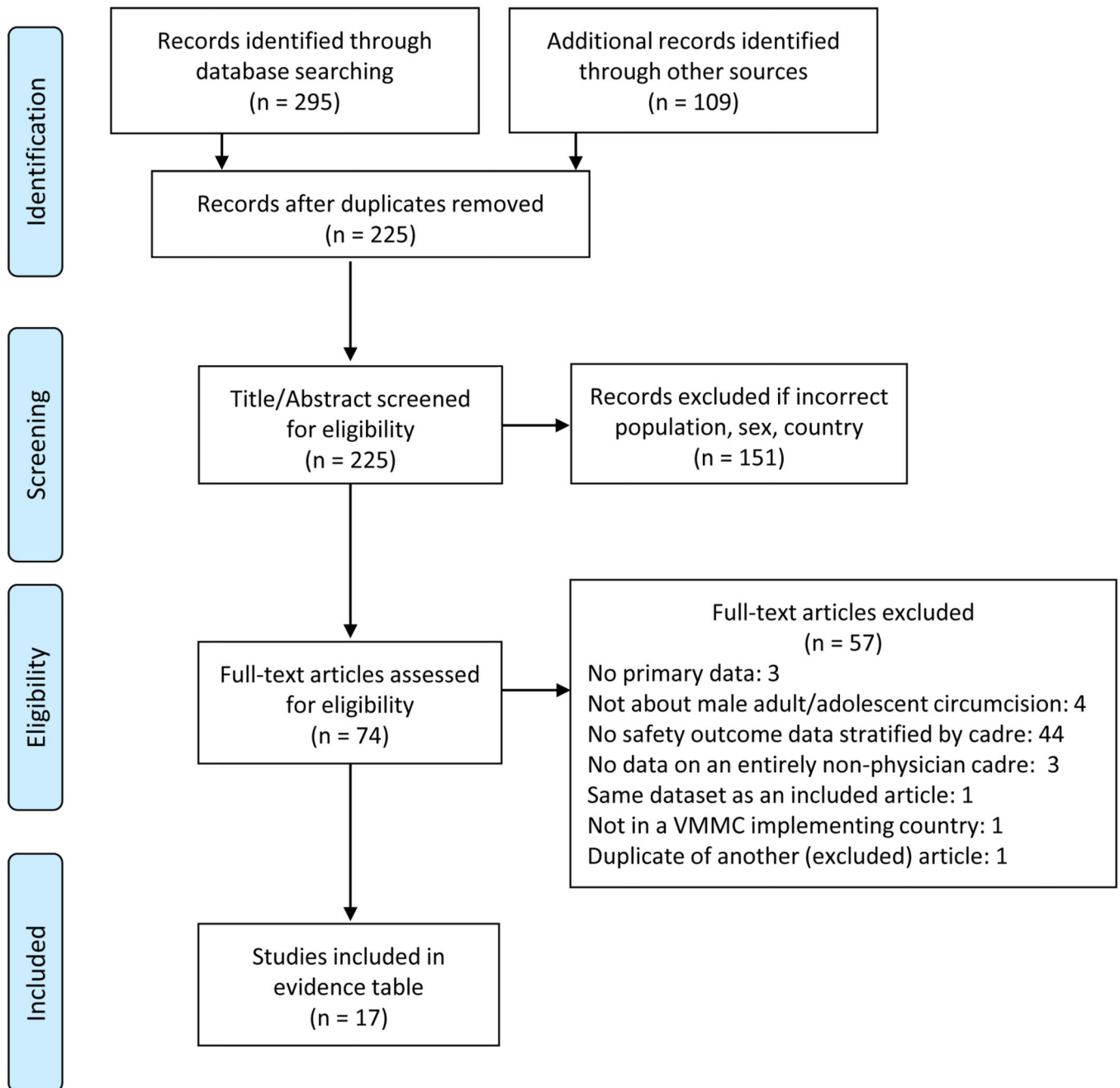


Figure 1. PRISMA (Liberati et al., 2009) flow diagram for article inclusion in review of literature on safety of voluntary medical male circumcision (VMMC) performed by non-physician cadres.

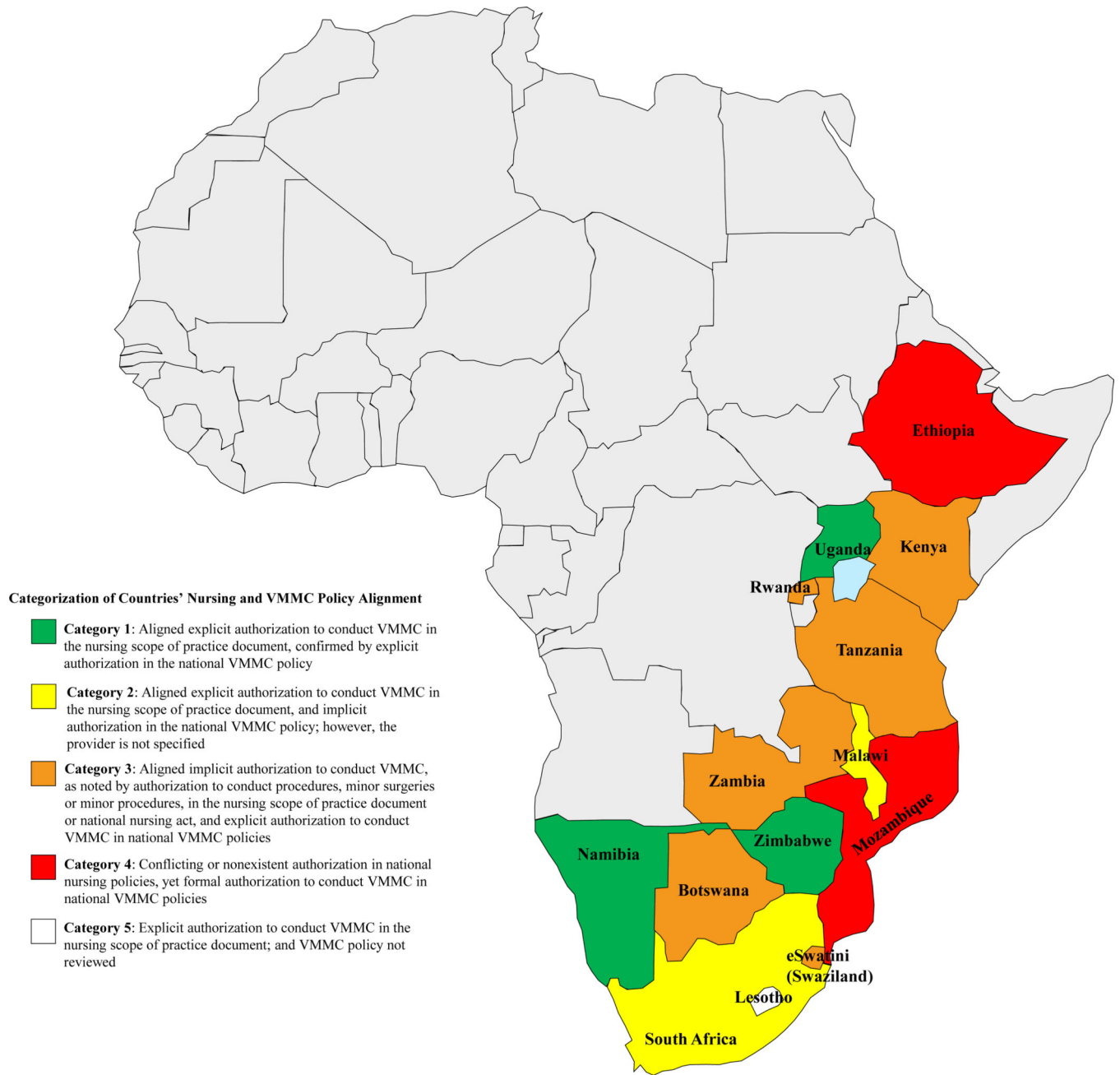


Figure 2. Categorization of Countries' nursing and voluntary medical male circumcision (VMMC) policy alignment.

Table 1. Summary of Included Articles and Findings on Safety of Medical Male Circumcision, by Performing Cadre

Author and Year	Country	Setting	Enrolled Client Age Range (Years)	Study Design	MC Method	Total Client Participants Across All Arms	Cadres Compared, Including Education Details	Safety Findings (Physician; Nonphysician)	Interpretation Notes, Potential Bias, Limitations	Newcastle-Ottawa Quality Type: Score (Subscores)
Comparison studies										
Buwembo et al., 2012	Uganda	Rural Rakai district	12–71	Programmatic	Surgical: dorsal slit, sleeve resection	5,152	Physicians and clinical officers	Moderate/severe AE rates 1.5% vs. 0.68% $p = .007$ unadjusted; $p = .525$ adjusted	Higher rate in physicians possibly driven by higher use of cauterization associated with AEs	Cohort 6/9 (selection 3/4, comparability 2/2, outcome 1/3)
Feldblum et al., 2014	Kenya	Nyanza province: mixed urban and rural, mixed clinics and dispensaries	18–49	Nonrandomized prospective	PrePex	427	Clinical officers and nurses	Moderate/severe AE rates to 7.3% (significance testing NP)	Authors attributed high AE rates intensive multimethod case finding. Pain scores lower in nurse clients. AE rates lower with more experience. Like all device studies, anatomic eligibility criteria likely limit to low-risk patients; this and self-selection may limit generalizability. Limitation to only adults, who have lower AE rates than adolescents, has the same expected effect	Cohort 6/9 (selection 4/4, comparability 0/2, outcome 2/3)
Frajzyngier et al., 2014	Kenya	Nyanza; six hospitals, four health centers, one dispensary	13–54	Prospective; provider assignment method not specified	Surgical, technique not specified	2,244	Clinical officers and nurses	Moderate/severe AE rates: at 7 days 1.9% vs. 2.1% (OR = 0.96, 95% CI, 0.4–2.4); at 60 days 0.09% vs. 0.29% (CI not provided)		Cohort 9/9 (selection 4/4, comparability 2/2, outcome 1/3)

Author and Year	Country	Setting	Enrolled Client Age Range (Years)	Study Design	MC Method	Total Client Participants Across All Arms	Cadres Compared, Including Education Details	Safety Findings (Physician/ Nonphysician)	Interpretation Notes, Potential Bias, Limitations	Newcastle-Ottawa Quality Type: Score (Subscores)
Gabukande et al., 2014	Uganda	Kampala International Hospital	not specified	Prospective multiarm by cadre; arm assignment method not specified	PrePex	625	Surgeons, medical officers, clinical officers, nurses; all experienced at surgical MC. Medical officers were physicians	Total AE rates 0% vs. 0% vs. 1.56% vs. 2.56% ($p > .25$ for clinical officer vs. nurse; others not provided)	All providers had surgical MC experience, so not clear if results generalize to newer providers	Cohort 5/9 (selection 4/4, comparability 0/2, outcome 1/3)
Herman-Roloff et al., 2012	Kenya	Nyanza province, 16 clinic study facilities	12–78	Programmatic	Surgical: forceps-guided	1,672	Medical or clinical officers and nurses; all experienced at surgical MC. Medical officers were physicians.	Complex AE reporting. Overall mod/severe AE rate among those returning for follow-up = 5.6%, aOR = 0.6 (95% CI, 0.36–0.98) in passive system; 0.75 (0.48–1.2) in active system; 0.41 (0.08–2.1) restricted to providers with 100+ MCs experience	Providers circumcised by physicians 25% less likely to return, perhaps depressing physician AE rates	Cohort 6/9 (selection 4/4, comparability 2/2, outcome 0/3)
Mutabazi et al., 2014	Rwanda	Kanombe Military Hospital (also serves civilians), Kigali	18–40	Prospective single arm in two phases (physicians then nurses)	PrePex	147	Physicians and nurses	Total AE rate 1.5% vs. 0%		Cohort 5/9 (selection 3/4, comparability 0/2, outcome 2/3)
Mwandi et al., 2012	Kenya	260 sites, urban and rural	0–84	Programmatic	Surgical, technique not specified	312,789 over 2008–2011 but AE data are 2011 only; 102,372 (32.7%) with follow-up to day 7	Medical officers, clinical officers, and nurses. Medical officers are physicians	Moderate/severe AE rate 0% vs. 1.4% vs. 1.4%		Cohort 2/9 (selection 2/4, comparability 0/2, outcome 0/3)
Ngobo et al., 2018	South Africa	Tshwane district multiple VMMC sites—clinics and hospitals	Not specified	Programmatic	Not specified	4,738	Doctors and clinical associates	Intraoperative total AE rate 7.1% vs. 8.1%	Clinical associates do not circumcise children <13 years so had average	Cohort 4/9 (selection 3/4, comparability 0/2, outcome 1/3)

Author and Year	Country	Setting	Enrolled Client Age Range (Years)	Study Design	MC Method	Total Client Participants Across All Arms	Cadres Compared, Including Education Details	Safety Findings (Physician; Nonphysician)	Interpretation Notes, Potential Bias, Limitations	Newcastle-Ottawa Quality Type: Score (Subscores)
Reed et al., 2015	Kenya	50 high-volume MC sites in Nyanza	13+	Prospective single-arm, subset not returning to clinic thus followed up by home visits	Surgical not specified	754	Clinical officers, nurse	Postoperative moderate/severe AE rate 5.6%, vs. 8.77% (OR, 0.8, 95% CI = 0.4–1.6)	Home follow-up accounts for high AE rates	Cohort 9/9 (selection 4/4, comparability 2/2, outcome 3/3)
Non-comparison (single provider group) studies										
Feldblum et al., 2016	Mozambique, Zambia	Mixed; urban tertiary care sites and clinics	18–49	Nonrandomized prospective	PrePex	1,003	Nurses (Mozambique); nurses and clinical officers (Zambia)	Moderate AE rate 0.6%; severe AE rate 1.5%		Noncomparison cohort 4/5 (selection 2/2, comparability 0/0, outcome 2/3)
Hove et al., 2019	Zimbabwe	VaRemba circumcision camp—rural, mountainous	10–50+	Programmatic	Surgical: dorsal slit for 10- to 14-year-olds, forceps guided for 15+	657	Nurses	Moderate/severe AE rate 0.5%	Nurses treated boys 10–14 prophylactically with antibiotics, which is not standard of care	Noncomparison cohort 4/5 (selection 2/2, comparability 0/0, outcome 2/3)
Kigozi et al., 2013	Uganda	Rural Rakai (southwest Uganda)	18–40+	Nonrandomized prospective twocarm by method; participants selfassigned	PrePex	429	Clinical officers and nurses	Total AE rate 2.6%; severe 1.4%, moderate 0%; mild 1.1%	Potential selfselection bias based on client interest in PrePex; unclear how this might affect AE rates	Noncomparison cohort 5/5 (selection 2/2, comparability 0/0, outcome 3/3)
Kigozi et al., 2013	Uganda	Rural Rakai, outpatient facilities	18+	Nonrandomized prospective twocarm by method; participants selfassigned	ShangRing, surgical: dorsal slit	621	Clinical officers and nurses	Moderate/severe AE rate 1.8% SR, 0.8% DS		Noncomparison cohort 5/5 (selection 2/2, comparability 0/0, outcome 3/3)

client age 19 years vs. 17.7 for doctors. This would be expected to lower their AE rate

Author and Year	Country	Setting	Enrolled Client Age Range (Years)	Study Design	MC Method	Total Client Participants Across All Arms	Cadres Compared, Including Education Details	Safety Findings (Physician/ Nonphysician)	Interpretation Notes, Potential Bias, Limitations	Newcastle-Ottawa Quality Type: Score (Subscores)
Kohler, Tippett Barr, et al., 2016	Malawi	One urban static site, one rural static, one tent	18–49	Prospective	PrePex	791	Combined midlevel: nurses, clinical officers, nurse midwives, medical assistants	Moderate AE rate 7%; severe 0.9%	High AE rate driven by pain	Noncomparison cohort 4/5 (selection 0/1, comparability 0/0, outcome 3/3)
Kohler, Namate, et al., 2016	Malawi	Bwaila VMMC clinic, Lilongwe	not specified	Programmatic, collected before and after a quality improvement intervention	Surgical: forceps-guided	3,000 pre; 2,450 post	<10% nurses and >90% clinical officers	Mild AE rate 0.2% pre, 2.6% post; moderate 7.3% pre, 1.1% post; severe 1.1% pre, 0.8% post	Postintervention rates may be more reliable, as QI intervention addressed misclassification	Noncomparison cohort 4/5 (selection 2/2, comparability 0/0, outcome 2/3)
Mutabazi et al., 2013	Rwanda	Kanombe Military Hospital (also serves civilians), Kigali	21–54	Prospective	PrePex	518	Nurses: levels A1 (9 years health education) and A2 (6 years), with average 7 years nursing experience	Total AE rate 0.96% (0.31–2.24%)		Noncomparison cohort 4/5 (selection 2/2, comparability 0/0, outcome 2/3)
Ngo & Obhai, 2012	Kenya	Rural Nyanza and Western provinces, mobile outreach sites in eight traditionally noncircumcising districts	2–60	Prospective	Surgical: forceps-guided	240	Mixed: medical technicians, registered nurses, nurse aides	Moderate/severe AE rate 1.3%	High loss to follow-up at 15%; some expected symptoms counted as AEs. Median client age 20 years, but inclusion of clients <10 years (likely higher risk) prevents risk comparison to typical programs	Noncomparison cohort 4/5 (selection 2/2, comparability 0/0, outcome 2/3)

Note: AE = adverse event; CI = confidence interval; DS = dorsal slit; MC = male circumcision; NP = not provided; OR = odds ratio; PrePex = a nonsurgical circumcision device;

QI = quality improvement; SR = ShangRing; VMMC = voluntary medical male circumcision.

Table 2.

Summary of National HIV and Health Workforce and Policy Documents

Country	National HIV and Health Workforce			Authorization of Nurses and Midwives to Perform VMMC Services by Policy Document			Establishment of National VMMC Training or Certification Program	
	HIV prevalence (UNAIDS, 2019) (15–49 years old)	MDs per 100,000 population (World Health Organization, 2019a)	Nurses/ midwives per 100,000 population (World Health Organization, 2019b)	Scope of practice	National VMMC policy, strategy, or operational plans	National Nurses Act		Task-sharing policies
Botswana	20.3	36.9	330.0	Conditionally authorized (VMMC not mentioned) (Nursing and Midwifery Council of Botswana, 2019)	VMMC authorized (Botswana Ministry of Health, 2009)	Minor procedures authorized (Nursing Council for Botswana, 1969)	Conditionally authorized (VMMC not mentioned) (Centre for Disease Control and Prevention Botswana, 2016)	Presence of approved or competency-based trainings (Botswana Ministry of Health, 2009)
Eswatini	27.3	8.0	200.0	Procedures authorized (Swaziland Nursing Council, 2010)	VMMC authorized (Ministry of Health, Government of the Kingdom of Swaziland, 2009)			Established VMMC Certification Program (Ministry of Health, Government of the Kingdom of Swaziland, 2009)
Ethiopia	1.0	10.0	84.0	VMMC not authorized (Ethiopian Food, Medicine and Health Care Administration and Control Authority, 2017)	VMMC authorized (Ethiopian Federal Ministry of Health, 2019)			Established VMMC Certification Program (Ethiopian Federal Ministry of Health, 2019)
Kenya	4.7	19.9	154.2	Minor surgeries authorized (Nursing Council of Kenya, 2012)	VMMC authorized (National AIDS&STI Control Programme & Ministry of Health, Nairobi, Kenya, 2018)			Established VMMC Certification Program (National AIDS&STI Control Programme & Ministry of Health, Nairobi, Kenya, 2018)
Lesotho	23.6	6.8	65.1	VMMC authorized (Lesotho Nursing Council, 2013)				Presence of approved or competency-based trainings (Lesotho Nursing Council, 2013)
Malawi	9.2	1.6	25.3	VMMC authorized professional nurse (Nurses and Midwives	VMMC authorized—provider not specified			Presence of approved or competency-based trainings

National HIV and Health Workforce			Authorization of Nurses and Midwives to Perform VMMC Services by Policy Document			Establishment of National VMMC Training or Certification Program		
Country	HIV prevalence (UNAIDS, 2019) (15–49 years old)	MDS per 100,000 population (World Health Organization, 2019a)	Nurses/ midwives per 100,000 population (World Health Organization, 2019b)	Scope of practice	National VMMC policy, strategy, or operational plans	National Nurses Act	Task-sharing policies	Documented presence of National VMMC Certification or approved Training Program
				Council of Malawi, 2015a; Nurses and Midwives Council of Malawi, 2015b)	(National AIDS Commission, 2012)			(Nurses and Midwives Council of Malawi, 2015b)
Mozambique	12.6	7.4	44.4		VMMC authorized (Republic of Mozambique, Ministry of Health, National Directorate of Medical Care National Curcumeison Program, 2017); VMMC authorized—provider not specified (Ministry of Health, Mozambique, 2018)	VMMC or other procedural authorization not mentioned (Fernanda Teixeira, do cargo de Director do Gabinete da Esposa do Presidente da Republica, 2016)		Established VMMC Certification Program (Republic of Mozambique, Ministry of Health, National Directorate of Medical Care National Curcumeison Program, 2017)
Namibia	11.8	37.2	276.5	VMMC authorized registered nurse (Nursing Council of Namibia, 2014)	VMMC authorized (Republic of Namibia Ministry of Health and Social Services, 2010)	VMMC or other procedural authorization not mentioned (Republic of Namibia, 2004)		Established VMMC Certification Program (Nursing Council of Namibia, 2014)
Rwanda	2.5	13.5	83.1	Procedures authorized associate nurse (Rwanda Minister of Health, 2012)	VMMC authorized (Republic of Rwanda Ministry of Health, 2016)	VMMC or other procedural authorization not mentioned (President of the Republic of Rwanda (Paul Kagame), 2008)		Established VMMC Certification Program (Republic of Rwanda Ministry of Health, 2016)
South Africa	20.4	91.0	351.7	VMMC authorized professional nurses (South African Nursing Council, personal communication, 2014)	VMMC authorization—provider not specified (Republic of South Africa Department of Health, 2016)	VMMC or other procedural authorization not mentioned (South African Nursing Council, 2006)		Presence of approved or competency-based trainings (South African Nursing Council, personal communication, 2014)

National HIV and Health Workforce			Authorization of Nurses and Midwives to Perform VMMC Services by Policy Document			Establishment of National VMMC Training or Certification Program		
Country	HIV prevalence (UNAIDS, 2019) (15–49 years old)	MDs per 100,000 population (World Health Organization, 2019a)	Nurses/ midwives per 100,000 population (World Health Organization, 2019b)	Scope of practice	National VMMC policy, strategy, or operational plans	National Nurses Act	Task-sharing policies	Documented presence of National VMMC Certification or approved Training Program
Tanzania	4.6	4.0	41.3	Minor surgeries authorized nurses (Tanzania Nursing and Midwifery Council, 2014)	VMMC authorized (The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children, National AIDS Control Programme, 2016)	VMMC authorized nurses enrolled and registered nurses (The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children, 2016)	VMMC authorized and enrolled nurses (The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children, 2016)	Presence of approved or competency-based trainings (The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children, National AIDS Control Programme, 2016)
Uganda	5.7	9.1	63.0	VMMC authorized registered-level Diploma and Bachelor Nurses (Uganda Nurses and Midwives Council, 2014)	VMMC authorized (Government of Uganda, Ministry of Health, 2010)			Established VMMC Certification Program (Government of Uganda, Ministry of Health, 2010)
Zambia	11.3	9.1	89.3		VMMC authorized (Republic of Zambia Ministry of Health, 2009; Republic of Zambia Ministry of Health, 2012)	Procedures authorized nurses and midwives (Parliament of Zambia, 1997)		Established VMMC Certification Program (Republic of Zambia Ministry of Health, 2009)
Zimbabwe	12.7	7.6	115.5	VMMC authorized (Ministry of Health and Child Care, personal communication, 2014; Zimbabwe Ministry of Health and Child Care, 2014)	VMMC authorized (Zimbabwe Ministry of Health and Child Care, 2019)			Established VMMC Certification Program (Ministry of Health and Child Care, personal communication, 2014)

Note: MD = medical doctor; VMMC = voluntary medical male circumcision.