

Medical Male Circumcision and HIV Testing Practices among Men Aged 15 to 59 Years Old: Evidence from Zambia Demographics and Health Survey

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Abstract

Medical male circumcision (MMC) and HIV testing have been recommended by the World Health Organization (WHO) as part of a comprehensive approach to HIV prevention. Zambia has integrated MMC with HIV testing interventions. This study examined the syndemic relationship between MMC and HIV testing, as well as sociodemographic characteristics influencing both MMC and HIV testing in Zambia. Data were derived from the 2018 Zambia Demographic and Health Survey (ZDHS), a nationally representative cross-sectional survey conducted among 12,123 men aged 15 to 59 years. Descriptive characteristics were summarized using frequencies and proportions. Two multivariate logistic regression models examined the relationship between independent and dependent variables (HIV testing and MMC alternatively). The results showed that 76.8% of men reported having ever tested for HIV, and 26% performed MMC. The logistic regression results showed that MMC was significantly associated with ever being tested for HIV and vice versa. Sociodemographic characteristics, including province, resident type, age, marital status, education, wealth status, and religion, were also significantly associated with MMC and having tested for HIV among men in Zambia. By and large, this study has identified that both MMC and HIV have an intricate relationship with health benefits to reduce the risk of HIV infections for men in Zambia. There is a need for continuous scaling up the perceived benefits of MMC and HIV testing uptake. In addition, more robust awareness is needed in specific provinces, rural areas, and other sociodemographic variables with lower incidences of MMC and HIV testing practices among men in Zambia.

Keywords: HIV testing, Men, Medical male circumcision, Sociodemographic characteristics, Zambia.

Introduction

Medical male circumcision (MMC) is the age-old practice of surgical removal of the foreskin from the penis [1, 2]. Historically, MMC portends deep cultural, religious, and public health implications with significant geographical disparities across the globe. In Judeo-Christian religious context, MMC is viewed as a sacred covenant with God and a rite

of passage, symbolizing maturity, and entrance into adulthood [3, 4]. Others allude to the religious, cultural health, and historical dimensions of the MMC and have ensured its practice is preserved [4]. Given the empirical evidence that suggests a lower rate of certain sexually transmitted infections (STIs) and human immunodeficiency virus (HIV) in individuals that are circumcised, there has been

Received: 26.11.2023

Accepted: 07.12.2023

Published on: 29.12.2023

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increased attention to MMC practices [5, 6]. Some studies suggest that MMC is highly beneficial compared to the potential risks considering that it could lower up to 70% of the HIV infection rate which is a new phenomenon [7]. Expectedly, many countries have made efforts to integrate MMC into HIV prevention programs with quantifiable implications on HIV prevalence rates. The emerging cultural shifts and health awareness campaigns present veritable research opportunities regarding MMC and HIV testing.

In Zambia, as in many other sub-Saharan African countries, HIV remains a significant public health concern considering the national HIV adult prevalence rate of 12.3% [8], exacerbated by structural stigma [9]. Understanding the prevalence of HIV testing among males is crucial for effective public health planning, resource allocation, and intervention. Since 2009, Zambia has adopted the WHO-recommended voluntary medical male circumcision (VMMC) as a preventive measure against HIV transmission among men. Zambia has made substantial strides in addressing its HIV epidemic, with concerted efforts to increase testing accessibility [10]. The 2018 Zambia Demographic and Health Survey (ZDHS) shows that the overall HIV testing rate among men aged 15-49 was 57% [11]. This indicates that there is still a considerable proportion of the male population not accessing HIV testing services. Recognizing the potential synergies between male circumcision and HIV prevention, Zambia has integrated these services [12, 13]. This integration not only provides a platform for comprehensive healthcare but also seeks to increase the accessibility and acceptance of both services among the male population. The integration of MMC and HIV testing services has contributed to an increased uptake of HIV testing among males in Zambia [12, 14]. By leveraging the cultural acceptance of male circumcision, health authorities have strategically positioned HIV testing as an integral component of the overall health package

offered during circumcision programs. This approach aims to overcome some of the barriers to HIV testing, as reported in studies highlighting stigma and fear as significant obstacles [15].

Several studies have also demonstrated the importance of some sociodemographic factors that influence MMC and HIV testing for men in different settings. Different regions and societies hold varying views regarding the necessity and preferred age for male circumcision. Research indicates that undergoing circumcision before the age of 20 significantly lowers the risk of HIV infections, with an average preventive impact of over 0.2. However, this preventive effectiveness notably decreases as individuals age, plummeting to 0.08 by the age of 30 [16]. Notably, male circumcision performed before puberty is associated with decreased HIV risk, while undergoing circumcision after the age of 20 doesn't provide significant protection against HIV infection [17]. Education plays a crucial role in lessening the impact of HIV/AIDS [18]. Previous studies indicated that men who had completed primary or secondary education were more likely to be uncircumcised compared to those with tertiary education [19, 20]. In addition, ongoing access to education could positively influence the effects of HIV infection and promote HIV testing practices that can improve physical well-being, and healthier lifestyle [21]. A recent study by Mwiinga [11] found a significant correlation between being employed and MMC. The study observed that employed men were more likely to be circumcised compared to their unemployed counterparts. Findings from the pooled Zambia Demographic and Health Survey (ZDHS) indicated that among circumcised men, a higher percentage (71.5%) were employed compared to 28.5% unemployed men [11]. Furthermore, in a study focusing on predictors of male circumcision among individuals aged 15-35 years in Harare, Zimbabwe, researchers identified employment status as one of the primary predictors of circumcision [22].

Moreso, extensive research has revealed a substantial correlation between being married and MMC, as well as HIV infections and testing [23, 24]. For example, younger age and marital status were significantly linked to the inclination to undergo MMC. Additionally, being married was associated with greater awareness regarding circumcision and HIV prevention among men [22, 25]. Religion continues to exert a significant influence on the acceptance and adoption of male circumcision [26]. In Zimbabwe, Chikutsa [27] found that men following the Christian faith were less inclined to adopt circumcision. Similarly, Kateule [28] noted in their study that due to Zambia's predominantly Christian population, fewer men opted for circumcision based on religious belief. Yet, a study conducted by Mwiinga et al [11] in Zambia, revealed that most circumcised men identified as Christians. The religious breakdown among circumcised males showed that the majority were affiliated with Christianity (89.8%), while only a small proportion (10.2%) belonged to 'other' religious groups [11]. Ultimately, wealth or socioeconomic standing holds considerable significance about MMC and various health-related results, such as HIV testing [29]. Previous research highlighted the connection between male circumcision, HIV risk, and socioeconomic factors, underscoring how wealth status can influence HIV prevention strategies, testing, and other related outcomes [30, 31]. These studies offer valuable insights into the intricate relationship between wealth status, MMC, and HIV testing patterns, underscoring the necessity for holistic approaches that account for socioeconomic factors in promoting MMC and HIV testing for the betterment of public health.

Despite its prevalence in many parts of the world, male circumcision is not without controversies. Barriers such as stigma and discrimination, misconceptions about HIV, ethical concerns about confidentiality, debates surrounding consent, and cultural clashes have prompted discussions on the ethics of

performing circumcisions, particularly in infancy [32]. These debates underscore the complexity of male circumcision as a cultural practice and a public health intervention. Thus, this study delves into the intricate relationship between MMC and HIV testing in Zambia, exploring how these two elements intersect and influence each other in the context of public health. Additionally, we sought to examine the relationship between sociodemographic characteristics with MMC and HIV testing practices among men in Zambia. Therefore, to fulfill these gaps in knowledge, this study sought to answer the following two research questions:

1. Is there a syndemic relationship between medical male circumcision (MMC) and HIV testing among men aged 15 to 59 years old in Zambia?
2. To what extent do sociodemographic characteristics influence medical male circumcision (MMC) and HIV testing practices among men aged 15 to 59 years old in Zambia?

Methods

Data Source

Data were obtained from the 2018 Zambia Demographic and Health Survey (ZDHS) and were implemented by the Zambia Statistics Agency (ZamStats) in collaboration with the Ministry of Health (MOH), Inner City Fund International (ICF), Global Fund (GF), the Department for International Development (DFID) in Zambia, and the United Nations Population Fund (UNFPA). The survey is a nationwide representative at the national, urban, rural, and provincial levels. All male participants between 15 to 59 years old who resided permanently in the selected households or visitors who stayed in the households temporarily the night before the survey were eligible to be interviewed. ZDHS data collection occurred between July 18, 2018, to January 24, 2019. The survey collected background characteristics, reproduction, conception, marriage, sexual activity, male circumcision,

employment, HIV, and other health issues. The study used the male questionnaire that collected information from all eligible male participants between 15 to 59 years old from the modules of HIV, condom use, a component of male circumcision, and demographics characteristics [33].

Sample Design

The 2018 ZDHS used a sampling frame from the Census of Population and Housing (CPH) of the Republic of Zambia, conducted in 2010 by ZamStats. The 2018 ZDHS followed a stratified two-stage sample design. The first stage involved selecting clusters that consisted of enumeration areas (EAs) selected with a probability proportional to their size within each sampling stratum. A total of 545 clusters were selected. The second stage involved systematic sampling of the listing of households in all of the selected clusters. The survey included ten provinces subdivided into constituencies, wards, census supervisory areas (CSAs), and enumeration areas (EAs) that consist of an average of 133 households was found in each cluster. A fixed number of 25 households were selected through an equal probability systematic selection process. In this study, only participants who responded to male circumcision questions were included, and this yielded a sample size of 12,123 of male participants between the age of 15 to 59 years old [33].

Measures

Medical male circumcision (MMC) was assessed by asking participants: “Some men are circumcised, that is, the foreskin is completely removed from their penis. What are some of the reasons you were circumcised?” (1) Were you circumcised for treatment for a disease? (2) Were you circumcised for hygiene? (3) Were you circumcised for prevention from disease? (4) Were you circumcised to increase sexual pleasure? These items were coded as a “yes” or “no”. These variables were summed for a total score. If the participants answered “no” to any of

the items, it was coded as 0 = uncircumcised, and “yes” 1 = circumcised. Substantial scientific evidence from sub-Saharan Africa indicates that medical male circumcision (MMC) reduces the risk of HIV acquisition among males [14].

Ever tested for HIV was assessed by asking the participants: “I don't want to know the results, but have you ever been tested for HIV?” “This variable was coded “yes” or “no”.

Sociodemographic Characteristics

Sociodemographic characteristics were chosen because of their dominance in literature and presence in the DHS dataset. WHO (2010) recognized a number of contributing factors to male circumcision and HIV testing, including age, religion, education, ethnicity, perceived social desirability, culture, socioeconomic status, and perceived social benefits, among other issues [9, 34]. Therefore, sociodemographic characteristics assessed were province, resident type, age, marital status, education, religion, and wealth index in the current study.

Province was assessed by asking the participants: “Before you moved here, which province did you live in?” This was categorized as Central, Copperbelt, Eastern, Luapula, Lusaka, Muchinga, Northern, Northwestern, Southern, and Western provinces.

Resident type was assessed by asking the participants: Before you moved here, did you live in Lusaka, another city, in a town, or in a village? This was binary coded as 1 = urban, and 2 = rural.

Age was assessed by asking participants: “How old were you on your last birthday?” In the original survey, this was coded as 1 = 15-19 years old, 2 = 20-24 years old, 3 = 25-29 years old, 4 = 30-34 years old, 5 = 35-39 years old, 6 = 40-44 years old, 7 = 45-49, 8 = 50-54 years old, 9 = 55-59 years old, 10 = 60-64 years old.” In the current study, age groups were recorded into three categories as 1 = 15-34 years old, 2 = 35-44 years old, and 3 = 45-64 years old.

Marital status was assessed by asking participants: “*What is your marital status?*” This was initially coded as 0=never in union, 2=Married, 3=Widowed, 4=Divorced, 5=No longer living together/separated. In this study, this was recorded as 0=never in union, 1=married, and 2=other.

Education level was assessed by asking the participants: “*What is the highest level of school you attended?*” This was initially categorized as 0=no education, 1=primary, 2= secondary, 3=higher than secondary. This was recorded as 0=no education, 1=primary, and 2= secondary or higher in the current study.

Employment was assessed by asking the participants: “*Are you currently working?*” This was coded dichotomously as 0=no or 1=yes in the current study.

Religion was assessed by asking the participants: “*What is your religion?*” In the original survey, this was coded as 1= Catholic, 2= Protestant, 3=Muslim, 96=Other. In this study, Muslims were included in the other categories due to lower response rates, and many Zambians tend to be Christians. Therefore, this variable was recoded as 1= catholic, 2= protestant, and 3=other.

Wealth status is a measure that has been used in many DHS and other country-level surveys to indicate inequalities in household characteristics, in the use of health and other services, and in health outcomes [33]. In the original survey, this was categorized as 1=poorest, 2=Poorer, 3=Middle, 4=Richer, 5=Richest. In this study, this was coded as 1=poor, 2=middle, and 3=rich. This variable was chosen because wealth is a household characteristic that often has a large effect on health. The wealth index allows for the identification of problems particular to the poor, such as unequal access to health care, as well as those particular to the wealthy, such as, in Africa, increased risk for infection with HIV[33].

Data Analysis

SPSS version 29.0 was used to perform all statistical analyses in this study. To address the issue of missing variables, listwise deletion was employed. Descriptive analysis was conducted to obtain the frequencies and proportions of the participants. Finally, two multivariate logistic regression models were used. In model 1, the relationship between independent variables (demographic characteristics and HIV testing) with MMC was examined as an outcome variable.

In Model 2, the relationship between independent variables (sociodemographic characteristics and MMC) and HIV testing was examined as an outcome. The significance level was determined at the p value of 0.05.

Ethical Considerations

Permission to use the 2018 dataset was obtained from the DHS Program website with ICF International assistance. The Central Statistical Office (CSO) granted permission to use the 2018 ZDHS dataset for the study. The researchers ensured unauthorized access, accidental loss, or destruction of the dataset by encrypting the dataset on a computer accessible using a password [33].

In addition, this study was exempted from the Institutional Review Board (IRB) by the first author's institution (Lewis University) since we used secondary data.

Results

Characteristics of the Participants

The descriptive characteristics of the participants are shown in Table 1. The results show that among the participants, 12.5% were living in Lusaka province, 62.9% were residents in rural areas, 64.6% were between 15 to 34 years old, 55.0% had at least secondary education or higher, 75.5% were working, and 42.7% were in the “rich” wealth index. In terms of religious affiliations, 79.7% of the participants were protestants.

In addition, 76.8% of the participants reported having tested for HIV, and 26.0% were circumcised for medical reasons in Zambia.

Table 1. Descriptive Characteristics of the Participants (n=12,123)

Variables	N	%
Province		
Central	1332	11.0
Copperbelt	1422	11.7
Eastern	1444	11.9
Luapula	1250	10.3
Lusaka	1518	12.5
Muchinga	1070	8.8
Northern	1089	9.0
Northwestern	916	7.6
Southern	1225	10.1
Western	857	7.1
Resident Type		
Urban	4496	37.1
Rural	7627	62.9
Age Group (years)		
15 - 34	7827	64.6
35 - 44	2376	19.6
45 - 59	1920	15.8
Education		
No education	504	4.2
Primary	4953	40.9
Secondary or higher	6666	55.0
Employment		
Not working	2965	24.5
Currently working	9158	75.5
Religion		
Catholic	2267	18.7
Protestant	9665	79.7
Other	191	1.6
Wealth Status		
Poor	4714	38.9
Neither poor nor rich	2235	18.4
Rich	5174	42.7
Ever tested for HIV		
No	2808	23.2
Yes	9315	76.8
MMC		
Not circumcised	8970	74.0
Circumcised	3153	26.0

Association between Socio-demographic Characteristics, HIV Testing and MMC

Logistic regression results showing association between demographic characteristics with MMC (model 1) and HIV testing (model 2) are shown in Table 2. Regarding province, the result shows that living in Copperbelt (AOR 1.52; 95% CI = 1.27 - 1.83), Luapula (AOR 2.29; 95% CI = 1.90 - 2.77), Northwestern (AOR 3.59; 95% CI = 2.96 - 4.36), and Western province (AOR 4.83; 95% CI = 3.95 - 5.91) was associated with higher odds of MMC, while living in Eastern (AOR 0.73; 95% CI = 0.59 - 0.89), Lusaka (AOR 0.81; 95% CI = 0.67 - 0.97) and Northern province (AOR 0.64; 95% CI = 0.51 - 0.81) were associated with lower odds of MMC compared to living in Central province (Model 1). However, living in Copperbelt (AOR 0.60; 95% CI = 0.50 - 0.73), Luapula (AOR 0.57; 95% CI = 0.47 - 0.70), and Northern province (AOR 0.69; 95% CI = 0.56 - 0.86) were associated with lower odds of HIV testing, but living in Northwestern province (AOR 1.41; 95% CI = 1.13 - 1.74), was associated with higher odds of having ever tested for HIV compared to living in Central province (model 2). On the other hand, living in rural areas was associated with a lower likelihood of MMC (AOR 0.52; 95% CI = 0.47 - 0.57) and ever tested for HIV (AOR 0.54; 95% CI = 0.48 - 0.60) relative to living in Urban areas (Model 1 and 2).

Furthermore, participants aged 35 to 44 years old (AOR 0.62; 95% CI = 0.54 - 0.72), and 45 to 59 years old (AOR 0.43; 95% CI = 0.36 - 0.51) were less likely to have performed MMC (Model 1). Similarly, participants aged 45 to 59 (AOR 0.67; 95% CI = 0.56 - 0.79) were less likely to have ever been tested for HIV compared to those

aged 15-34 years old (Model 2). Being married (AOR 0.60; 95% CI = 0.53 - 0.68) and never married (AOR 6.66; 95% CI = 0.45 - 0.73) were associated with lower odds of MMC (Model 1). By contrast, being married (AOR 6.66; 95% CI = 5.79 - 7.66) and never married (AOR 4.05; 95% CI = 3.12 - 5.25) were associated with the highest odds of having ever tested for HIV compared to other marital categories (divorced, separated, widowed) (Model 2). Having primary education (AOR 1.43; 95% CI = 1.07 - 1.91) and secondary education or higher (AOR 1.43; 95% CI = 1.07 - 1.91) was associated with higher odds of MMC (model 1). Similarly, having primary education (AOR 1.58; 95% CI = 1.27 - 1.97) and secondary education or higher (AOR 3.91; 95% CI = 3.10 - 4.94) was associated with higher odds of having ever tested for HIV (model 2). About religion, being protestant (AOR 2.11; 95% CI = 1.49 - 2.99) and Catholic was only associated with higher odds of having ever tested for HIV (model 2). However, religion was not significantly associated with MMC (Model 1). Regarding the wealth index, being neither rich nor poor (AOR 1.21; 95% CI = 1.07 - 1.38) and rich (AOR 1.53; 95% CI = 1.37 - 1.70) was associated with higher odds of MMC (model 1). Equally, being neither rich nor poor (AOR 1.26; 95% CI = 1.11 - 1.44) and rich (AOR 1.76; 95% CI = 1.57 - 1.97) was associated with higher odds of ever being tested for HIV. Finally, having ever tested for HIV (AOR 1.77; 95% CI = 1.58 - 1.98) was associated with MMC compared to having never ever tested for HIV (Model 1). On the other hand, being circumcised for medical reasons (AOR 1.78; 95% CI = 1.59 - 2.00) was associated with higher odds of having ever been tested for HIV compared to being uncircumcised (model 2).

Table 2. Sociodemographic Characteristics Associated with MMC and HIV Testing Practices Among Men in Zambia

Variables	Model 1	Model 2
	MMC	Ever tested for HIV
	AOR (95% C.I)	AOR (95% CI)
Province		
Central	Ref	Ref
Copperbelt	1.52 (1.27 - 1.83)***	0.60 (0.50 - 0.73)***
Eastern	0.73 (0.59 - 0.89)***	1.20 (0.98 - 1.47)
Luapula	2.29 (1.90 - 2.77)**	0.57 (0.47 - 0.70)***
Lusaka	0.81 (0.67 - 0.97)*	0.98 (0.80 - 1.21)
Muchinga	0.82 (0.66 - 1.03)	0.54 (0.44 - 0.66)***
Northern	0.64 (0.51 - 0.81)***	0.98 (0.79 - 1.21)
Northwestern	3.59 (2.96 - 4.36)***	0.69 (0.56 - 0.86)**
Southern	1.01 (0.83 - 1.23)	1.41 (1.13 - 1.74)***
Western	4.83 (3.95 - 5.91)***	1.12 (0.89 - 1.42)
Residence		
Urban	Ref	Ref
Rural	0.52 (0.47 - 0.57)***	0.54 (0.48 - 0.60)***
Age (years)		
15-34	Ref	Ref
35-44	0.62 (0.54 - 0.72)***	1.05 (0.89-1.25)
45-59	0.43 (0.36 - 0.51)***	0.67 (0.56 - 0.79)***
Marital status		
Other	Ref	Ref
Married	0.60 (0.53 - 0.68)***	6.66 (5.79 - 7.66)***
Never married	0.57 (0.45 - 0.73) ***	4.05 (3.12 - 5.25)***
Education		
No education	Ref	Ref
Primary	1.43 (1.07 - 1.91)	1.58 (1.27 - 1.97)
Secondary or higher	2.03 (1.51 -2.71)	3.91 (3.10 - 4.94)
Employment		
Not working	Ref	Ref
Currently working	0.98 (0.87 - 1.09)	1.66 (1.49 - 1.85)
Religion		
Other	Ref	Ref
Protestant	0.93 (0.64 - 1.35)	2.11 (1.49 - 2.99)***
Catholic	0.84 (0.57 - 1.23)	2.43 (1.69 - 3.49)***
Wealth Index		
Poor	Ref	Ref
Middle	1.21 (1.07 - 1.38)***	1.26 (1.11 - 1.44)***
Rich	1.53 (1.37 - 1.70)***	1.76 (1.57 - 1.97)***
Ever tested for HIV		
No	Ref	Ref

Yes	1.77 (1.58 - 1.98)***	X
MMC		
Not circumcised	Ref	Ref
Circumcised	X	1.78 (1.59 - 2.00)***

*=p<.05, **=p<.01, ***=p<.001, X=Variable analyzed because it was assessed as an outcome variable in a similar model; MMC = Medical male circumcision, AOR = Adjusted Odd Ratio, CI = Confidence Intervals; Model 1 = MMC is analyzed as an outcome variable, and Model 2= HIV testing is analyzed as an outcome.

Discussion

The primary purpose of this study was to investigate the syndemic relationship between MMC and HIV testing practices and examine their ultimate association with various sociodemographic characteristics among men aged 15 to 59 using a nationally representative sample in Zambia. The study unequivocally revealed that 76.8% of males had undergone HIV testing, whereas only 26% reported being circumcised in Zambia, which is slightly higher than what was previously found in the most recent study [8]. The higher rates of HIV testing suggests that men are more informed about the importance of undergoing HIV testing in Zambia [35]. However, the lower proportions of MMC remains a subject that many individuals may not fully comprehend the perceived benefits, especially for individuals from cultural backgrounds where such practices are not perceived to be the norm.

The geographical locations appear to play an important role in shaping attitudes towards MMC and HIV testing practices. For instance, it was evident in this study that men residing in the Northwestern province were associated with higher odds of having undergone MMC and HIV testing in Zambia. This observation is not surprising, considering that Northwestern has one of the highest rates of male circumcision than other provinces in Zambia [11, 36]. Traditional male circumcision amongst the people of the Northwestern province is part of initiation rituals conducted on boys who have attained puberty as a rite of passage from childhood to adulthood. However, it is unclear whether circumcision may be performed for health reasons or as simply as the normative

practice. Nevertheless, sensitization about MMC is needed, particularly in low-prevalence provinces, including Eastern, Luapula, and Northern provinces [36, 37]. On the other hand, HIV testing practices in the majority of the provinces remain lower, except for the Southern province. This may be primarily due to the stigma surrounding people living with HIV in Zambia. While the knowledge and treatment of HIV have improved significantly, stigma is still prevalent, and that prevents people from HIV testing. Thus, robust awareness should be undertaken, and the importance of HIV testing and treatment possibilities should be heralded to improve the quality of life and optimal health outcomes for men in Zambia.

Furthermore, this study revealed that residing in rural areas was associated with lower odds of having undergone HIV testing and MMC among men in Zambia. Frequently, people living in rural areas may have limited access to information and resources regarding the importance of HIV testing and MMC benefits. In addition, HIV-related stigma can significantly impact care utilization and increase health disparities, and people living in rural areas often experience high levels of HIV-related stigma [38]. Consequently, people in rural areas may require additional resources and knowledge, necessitating further awareness and sensitization on these crucial behavioral interventions with some tangible health benefits. In addition, strategies to address the wide range of barriers to HIV care in nonurban areas need to be multidisciplinary and consider the social determinants of health that contribute to HIV and MMC benefits for persons living in rural areas in Zambia.

Medical male circumcision (MMC) has been recommended by WHO as part of a comprehensive approach to HIV prevention [39]. Notably, in this study, it was revealed that men who had undergone HIV testing exhibited a higher likelihood of having undergone MMC compared to those who had never been tested for HIV in Zambia. Correspondingly, MMC was related to an increased probability of having ever undergone HIV testing for men in Zambia. These findings align with prior research indicating that voluntary medical male circumcision (VMMC) was associated with a noteworthy 60% reduction in the risk of female-to-male transmission of HIV (Peck et al., 2023, Perkins et al., 2023). Moreover, substantial evidence supports the protective role of MMC against various infectious diseases, including chancroid, urinary tract infections, invasive penile cancer, and HIV [40]. Nonetheless, conflicting findings exist, with some studies finding no significant difference in HIV prevalence between circumcised (12%) and uncircumcised men (10%). Among circumcised men, age and the number of lifetime partners emerged as primary factors correlating with HIV status [39]. Therefore, it is important to note that arguments have been posited asserting that male circumcision does not confer complete prevention against HIV infection; circumcised men can still contract and transmit the virus to their partners [26, 41]. There is a need to strengthen perceived susceptibility to HIV testing, especially among young men and the need for advocacy on the health benefits of male circumcision.

Religion plays an important role in the lives of many Zambians. In 1996, Zambia was officially declared as a Christian nation, marking a turning point where religion assumed a central position in various aspects of life, encompassing behavioral and health practices [42]. In the present study, we observed a significant association between religion and HIV testing, but not with MMC. Specifically, men identifying with Catholicism and Protestantism were

notably more inclined to have undergone HIV testing relative to those who belong to other religious groups. This is similar to previous studies that found a strong positive correlation between religious affiliation and HIV testing and prevention activities [3, 18, 26, 43]. The beliefs and values rooted in religious perspectives on sexuality could serve as potential mechanisms supporting HIV testing for men in Zambia. Plausibly, the association between low perception of risk of HIV infection and religion could be attributed to their teachings on nurturing religious experiences and strong synergies encouraged among members [44]. Socialization of congregants towards more frequent and overlapping interactions can discourage members' involvement in risky sexual behaviors and hence impact on their perception of risk of HIV infection, and the benefits of MMC.

Marriage can be a context for implementing behavioral interventions aimed at reducing HIV risk, such as HIV testing and MMC. This may include promoting partner communication, encouraging mutual testing, and emphasizing safe sexual practices [45]. This study revealed that being married as well as never married was associated with lower odds of performing MMC. This is consistent with the previous study that found that 66 % of unmarried and 36% of unmarried had an uptake of MMC [46]. However, being unmarried was associated with the highest odds of having ever tested for HIV among men in Zambia in this study, this supports prior studies that found that being married was correlated with higher knowledge of HIV prevention among men [22, 25, 44]. It is also possible that married men or those in long-term relationships may be more likely to have routine check-ups or visits to healthcare providers where they can discuss and receive information about sexual health, including HIV testing compared to those who are not married. It is important to note that the relationship between marriage, HIV testing, and MMC can vary across different cultures, regions, and individual circumstances.

Public health advocacy should include interventions for continuous HIV testing encouraging both married and unmarried men to go for MMC due to perceived health benefits. Public health campaigns, educational programs, and healthcare services aim to provide information to everyone, regardless of their relationship status, to promote overall health and well-being. Regular HIV testing is recommended for everyone, regardless of their marital status, especially if they engage in behaviors that may put them at risk of HIV transmission.

Previous study has shown knowledge about MMC and HIV testing behaviors appears to increase with age among men [22]. This contradicts our findings in the current study where we found that men aged 35 to 44 and 45 to 59 were less likely to have performed MMC and ever tested for HIV compared to those aged 15-34 years old. However, another study found no significant association between age and knowledge about MMC among young people and adults surveyed in rural Uganda [47]. These differences could be attributed to the differences in the context of the studies, exposure to knowledge of addressing the importance of MMC and HIV testing practices.

Regarding the wealth status, in this study, we found that being rich and being neither poor nor rich was associated with higher odds of reporting both MMC and having ever tested for HIV testing among men in Zambia. Similar to our findings, a prior study indicated that men in the richest quintile were more likely than those in the poorest quintile to be circumcised for health reasons [48, 49]. The study also reported that in 10 of the 12 countries researched, more men in the urban areas were circumcised as compared to those in rural areas, however results from Lesotho and Zimbabwe showed that more men in rural areas were circumcised [50, 51]. The findings suggest that depending on the local context, rates of MMC uptake may vary and can be impacted by social norms of the region under review, hence a one-size-fits-all approach to

improve uptake of MMC cannot be used. Implementers will need to depend on local data to design interventions suited for each region in Zambia.

Educational attainment predisposes individuals to appreciate health programs better [52]. Education significantly contributes to lessening the impact of HIV/AIDS by imparting knowledge crucial for self-protection and maintaining a healthy lifestyle. It helps develop a personally held, positive value system, self-protection, and encourages behaviors that can help to reduce HIV infection risks and enhances the ability to assist others in safeguarding themselves [18]. In the current study, men with at least primary, secondary, or higher education were more likely to have ever tested for HIV and performed MMC in Zambia. This aligns with the previous study that found that education was significantly related to knowledge about MMC and higher knowledge of HIV in Zimbabwe [22]. This suggests that as education increases among men, they may be more inclined to perceive the risk of HIV and the importance of the health benefits of having performed MMC. For instance, a study in Uganda found that informal education also significantly influenced the utilization of MMC services. Health education increased awareness of MMC, with 316 participants aware of its importance [53]. This suggests that regardless of one's level of education, health education interventions have a significant impact on the utilization of MMC and increased HIV testing uptake. The findings highlight the importance of considering health education when designing interventions to increase the uptake of MMC and HIV testing services for men in Zambia.

Limitations of the Study

This study has several limitations worth highlighting. ZDHS are cross-sectional studies that do not provide causal relationships, and only give a snapshot of the temporal sequence of events. A few key variables could not be included due to differences in classifications, as

data was collected and classified by the ZDHS team. This study excluded those who were circumcised for traditional reasons, which limits our understanding of this important component. Hence, future studies should primarily focus on examining factors influencing traditional male circumcision in Zambia and other Sub-Saharan countries where such practices are upheld. ZDHS only classifies urban residents as urban even though it includes peri-urban areas; thus, the definition could have been more precise in the dataset. The ZDHS often delays publishing results, which implies that information might not be a true reflection of the current situation in Zambia. HIV testing and MMC were self-reported, there was a potential possibility of underreporting due to stigma associated with these factors. It was also possible that participants might have underreported or might have some recall bias that could potentially influence the outcomes in the present study. Although there are some limitations, this study also offers a lot of strengths. In our models we included variables that were selected based on their relevance in the existing literature that have been examined widely in male circumcision and HIV related studies. Finally, this study used a nationally representative sample, which increases reliability and makes this study generalizable to other settings in Zambia and other sub-Saharan African countries.

Conclusions

This study has shown a direct relationship between MMC and HIV testing practices among men in Zambia. In addition, the majority of

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sociodemographic characteristics such as province of resident, and resident type (rural vs urban), age, marital status, religion, and wealth status were significantly associated with MMC and HIV testing practices among men in Zambia. There is a need to strengthen and promote the perceived health benefits of MMC and HIV testing interventions. Provinces, rural areas and other sociodemographic characteristics that appear to have lower incidences of participating in MMC and HIV testing should be prioritized for enlightenment and health education regarding the public health benefits of MMC and HIV testing. Public health campaigns, educational programs, and healthcare services should be targeted at providing information to everyone, regardless of their relationship status, to promote overall health and well-being. Finally, regular HIV testing should be recommended for everyone, regardless of their marital status, especially if they are behaviorally vulnerable to HIV infections.

Conflict of Interests

The author(s) declare that they have no competing interests.

Funding

No specific funding was provided for this study.

Acknowledgements

The authors would like to acknowledge Inner City Fund International (IFC) for granting us permission to use DHS dataset.

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