Male circumcision: global trends and determinants of prevalence, safety and acceptability

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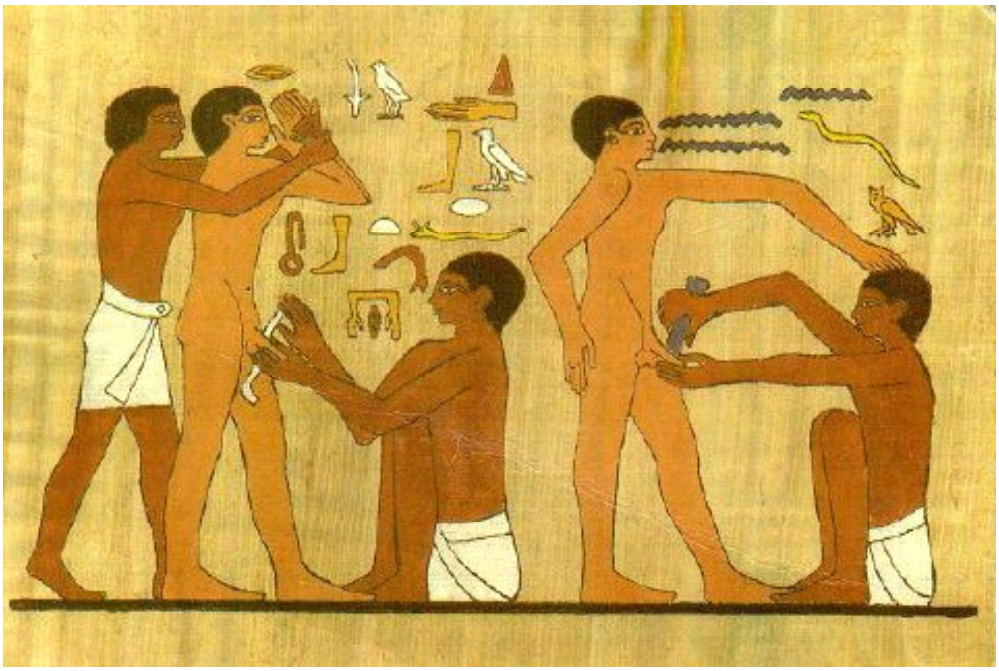

World Health Organization

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IWHO Library Cataloguing-in-Publication Data

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« UNAIDS / 07.29E / JC1320E ».

1. Circumcision, Male - trends. 2.Circumcision, Male - methods. 3.HIV infections - prevention and control. I.World Health Organization. II.UNAIDS.

ISBN 978 92 4 159616 9 (WHO) (NLM classification: WJ 790)
ISBN 978 92 9 173633 1 (UNAIDS)

Printed in

Contents

Acknowledgements

This report is the result of collaborative work between the London School of Hygiene and Tropical Medicine, the World Health Organization and the Joint United Nations Programme on HIV/AIDS (UNAIDS). The report was written by Helen Weiss, Jonny Polonsky, Robert Bailey, Catherine Hankins, Daniel Halperin and George Schmid. We also thank the following for their written comments: David Alnwick, Chiweni Chimbwete, Isabelle de Zoysa, Kim Dickson, Tim Farley, Brian Morris, Inon Schenker and Charles Shey Wiysonge. Layout by Cath Hamill. Our appreciation also goes to Lon Rahn, Tania Lemay, Mihika Acharya and Constance Kponvi for their assistance.

Abbreviations and acronyms

AIDS	acquired immunodeficiency syndrome
CI	confidence interval
FGM	female genital mutilation
HIV	human immunodeficiency virus
JHPIEGO	Johns Hopkins Program for International Education in Gynecology and Obstetrics
OR	odds ratio
RR	relative risk
STI	sexually transmitted infection
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Summary

Male circumcision is one of the oldest and most common surgical procedures worldwide, and is undertaken for many reasons: religious, cultural, social and medical. There is conclusive evidence from observational data and three randomized controlled trials that circumcised men have a significantly lower risk of becoming infected with the human immunodeficiency virus (HIV). Demand for safe, affordable male circumcision is expected to increase rapidly, and country-level decision-makers need information about the sociocultural and medical determinants of circumcision, as well as risks of the procedure, in the context of comprehensive HIV prevention programming.

Scope of the review

The aim of this report is to review the determinants, prevalence, safety and acceptability of male circumcision, focusing on sub-Saharan Africa. In the first section, we review the religious, cultural and social determinants of male circumcision and estimate the global and regional prevalences. In the second section, we summarize medical aspects of the procedure, including medical indications for circumcision, surgical methods used and the complications of circumcision carried out in clinical and non-clinical settings. The third section focuses on the public health implications of the fact that male circumcision reduces risk of HIV infection, including a summary of the acceptability of adult male circumcision in currently non-circumcising populations in sub-Saharan Africa with high incidence of HIV.

Results

Approximately 30% of males are estimated to be circumcised globally, of whom an estimated two thirds are Muslim. Other common determinants of male circumcision are ethnicity, perceived health and sexual benefits, and the desire to conform to social norms. Neonatal circumcision is common in Israel, the United States of America, Canada, Australia and New Zealand, and in much of the Middle East, Central Asia and West Africa, but is uncommon in East and southern Africa, where median age at circumcision varies from boyhood to the late teens or twenties. In several countries, prevalence of non-religious circumcision has undergone rapid increases and decreases, reflecting cultural mixing and changing perceptions of health and sexual benefits.

There is substantial evidence that male circumcision protects against several diseases, including urinary tract infections, syphilis, chancroid and invasive penile cancer, as well as HIV. However, as with any surgical procedure, there are risks involved. Neonatal circumcision is a simpler procedure than adolescent or adult circumcision and has a very low rate of adverse events, which are usually minor (0.2–0.4%). Adolescent or adult circumcision can be associated with bleeding, haematoma or sepsis, but these are treatable and there is little evidence of long-term sequelae when undertaken in a clinical setting with experienced providers. In contrast, circumcision undertaken by inexperienced providers with inadequate instruments, or with poor after-care, can result in serious complications.

Recent studies of acceptability among non-circumcising communities with high prevalence of HIV in southern Africa were fairly consistent in finding that a majority of men would be willing to be circumcised if it were done safely and at minimal cost. The primary concerns were around safety, pain and the cost of the procedure. Facilitators of acceptability of circumcision were perceived protection from sexually transmitted infections (STI), including HIV; improved genital hygiene; and improved sexual pleasure of both the male and his female partner. Public health concerns about increased uptake of male circumcision services focus on safety, acceptability and risk compensation. To date, there is modest evidence of risk compensation following adult male circumcision, and care must be taken to embed any male circumcision provision within existing HIV prevention packages that include intensive counselling on safer sex, particularly regarding reduction in number of concurrent sexual partners and correct and consistent use of male and female condoms.

Conclusions

There is increasing demand for male circumcision in southern Africa and future expansion of circumcision services must be embedded within comprehensive HIV prevention programming, including informed consent and risk-reduction counselling. Male circumcision can have serious sequelae if carried out in unhygienic settings or by inexperienced providers, and it is therefore essential that existing and future demand for circumcision is matched by provision of adequate equipment and training of personnel to conduct safe, voluntary and affordable male

circumcision. If correctly planned, increased provision of accessible, safe adult male circumcision services could also increase opportunities to educate men in areas of high HIV prevalence about a variety of sexual and reproductive health topics, including hygiene, sexuality, gender relations and the need for ongoing combination prevention strategies to further decrease risk of HIV acquisition and transmission.

SECTION 1. Determinants of male circumcision and global prevalence

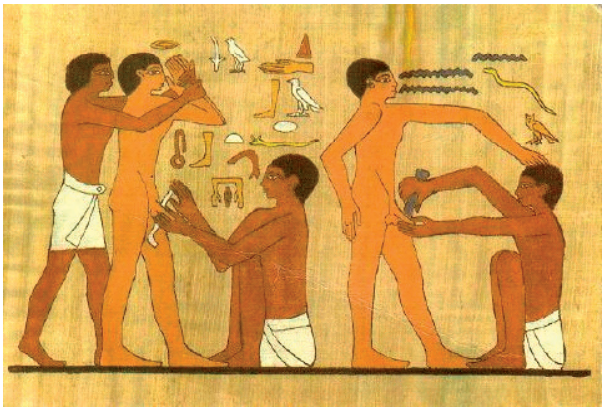
1.1 Introduction

Male circumcision is one of the oldest surgical procedures known, traditionally undertaken as a mark of cultural identity or religious importance. With advances in surgery in the 19th century, and increased mobility in the 20th century, the procedure was introduced into some previously non-circumcising cultures for both health-related and social reasons. In this section we review the main determinants of male circumcision and describe the global and regional prevalences of male circumcision today.

1.2 Determinants of male circumcision

Historically, male circumcision has been associated with religious practice and ethnic identity. Circumcision was practised among ancient Semitic peoples, including Egyptians and Jews (*1*), with the earliest records depicting the practice coming from Egyptian tomb work and wall paintings dating from around 2300 BC (Figure 1).

Figure 1. Ancient Egyptian relief from Ankhmahor, Saqqara, Egypt (2345–2182 BC), representing adult circumcision ceremony



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1.2.1 Religion

Judaism

In the Jewish religion, male infants are traditionally circumcised on their eighth day of life, providing there is no medical contraindication. The justification, in the Jewish holy book (the Torah), is that a covenant was made between Abraham and God, the outward sign of which was circumcision for all Jewish males: "This is my covenant, which ye shall keep, between me and you and thy seed after thee: every male among you shall be circumcised" (Genesis 17:10).

Male circumcision continues to be almost universally practised among Jewish people. For example, almost all newborn Jewish males in Israel *(2)*, an estimated 99% of Jewish men in the United Kingdom of Great Britain and Northern Ireland *(3)* and 98% of Jewish men in the United States of America are circumcised *(4)*.

Islam

Muslims are the largest religious group to practise male circumcision. As part of their Abrahamic faith, Muslims practise circumcision as a confirmation of their relationship with God; the practice is also known as *tahera*, meaning "purification". There is no specific mention of circumcision in the Qur'an (*5*), and it is only obligatory (*wajib*) among one of the six Islamic schools of law (the Shafi'ite school). The other schools regard the practice as traditional (*sunnah*) and strongly encourage it. It is also essential for a man to be circumcised to lawfully make the hajj (pilgrimage) to Mecca, one of the five pillars of Islamic belief (*6*).

With the global spread of Islam from the 7th century AD, male circumcision was widely adopted among previously non-circumcising peoples. In some regions, male circumcision was already a cultural tradition prior to the arrival of Islam (for example, among the Poro in West Africa, and in Timor in South-East Asia) (*7–9*). In other regions, Islam became a major determinant of circumcision. For example, in Rakai District, Uganda, 99% of Muslim men are circumcised, compared with just 4% of non-Muslim men (*10*). However, this is not always the case, and in nearby Mwanza region of the North-west of the United Republic of Tanzania, which has no traditionally circumcising ethnic group, circumcision is not universal among Muslim men (estimated prevalence is 74% among the Sukuma ethnic group), suggesting a continuing influence of the non-circumcising culture among Muslims in this setting (*11*).

There is no clearly prescribed age for circumcision in Islam, although the prophet Muhammad recommended it be carried out at an early age and reportedly circumcised his sons on the seventh day after birth (*6*). Many Muslims perform the rite on this day, although a Muslim may be circumcised at any age

between birth and puberty. In Pakistan, for example, the general practice is to circumcise boys born in hospital a few days before discharge, whereas those born outside hospital are circumcised between the ages of 3 and 7 years (*6*). Similarly, in Turkey, Muslim boys are circumcised between the eighth day after birth and puberty (*12*), and in Indonesia, typically between the ages of 5 and 18 years (*8*).

Other religions

With the major exceptions of Islam and Judaism, religion tends not to be a major determinant of male circumcision and many religions, including Hinduism and Buddhism, appear to have a neutral stance towards it.

The Coptic Christians in Egypt and the Ethiopian Orthodox Christians practise two of the oldest surviving forms of Christianity (*5*) and retain many of the features of early Christianity, including male circumcision (to take one instance, 97% of Orthodox men in Ethiopia are circumcised) (*13*). Circumcision is not prescribed in other forms of Christianity – for example, St Paul wrote: "In Christ Jesus neither circumcision nor uncircumcision count for anything" (Galatians 5:6), and a papal bull issued in 1442 by the Roman Catholic Church stated that male circumcision was unnecessary, "Therefore it strictly orders all who glory in the name of Christian, not to practise circumcision either before or after baptism, since whether or not they place their hope in it, it cannot possibly be observed without loss of eternal salvation" (*14*). Focus group discussions on male circumcision in sub-Saharan Africa found no clear consensus on compatibility of male circumcision with Christian beliefs (*15*). Some Christian churches in South Africa oppose the practice, viewing it as a pagan ritual (*16*), while others, including the Nomiya Church in Kenya, require circumcision for membership (*17*). Participants in focus group discussions in Malawi and Zambia mentioned similar beliefs that Christians should practise circumcision since Jesus was circumcised and the Bible teaches the practice (*18, 19*).

In some West African countries, circumcision prevalence tends to be lower among those of traditional religion than among Christians (66% vs. 93% in Burkina Faso, 68% vs. 95% in Ghana) (*13*). Although religion and ethnicity can be closely correlated, religion can be a strong determinant within an ethnic group. For example, among the Mole-Dagbani in Ghana 97% of Muslims are circumcised, 78% of Christians, 43% of those with traditional religion and 52% of those with no religion (*13*). In Cameroon, circumcision is almost universal among all religions except the Animists (79% prevalence), among whom there is one particular ethnic group, the Mboum, who tend not to circumcise (40%), compared with a circumcision prevalence of 89% among non-Mboum Animists.

1.2.2 Ethnicity

Circumcision has been practised for non-religious reasons for many thousands of years in sub-Saharan Africa, and in many ethnic groups around the world, including aboriginal Australasians (*20, 21*), the Aztecs and Mayans in the Americas (*5, 22, 23*), and inhabitants of the Philippines and eastern Indonesia (*8*) and of various Pacific islands, including Fiji (*24*) and the Polynesian islands (*7*).

Prevalence of circumcision within a country can vary dramatically by ethnicity. For example, although an estimated 84% of all Kenyan men are circumcised, the percentage is much lower among the Luo and Turkana ethnic groups (17% and 40%, respectively) (*13*), and focus group discussions among adult Luo men and women found no knowledge of any history of male circumcision among the Luo in Kenya. Instead, children traditionally had their six lower front teeth removed at initiation. Similarly, male circumcision is not practised among the Jopadhola, Acholi and other Luo-speaking River-Lake Nilotic groups in Uganda and southern Sudan, from where the Luo migrated (*25*).

In the majority of these cultures, circumcision is an integral part of a rite of passage to manhood, although originally it may have been a test of bravery and endurance (Figure 2) (*26*). Circumcision is also associated with factors such as masculinity, social cohesion with boys of the same age who become circumcised at the same time, self-identity and spirituality (*27*). The association with initiation to manhood is not universal, however, with some ethnic groups, such as the Yoruba and Igbo in Nigeria, circumcising in infancy (*21*). The ethnographer Arnold van Gennep, in his 1909 work *The rites of passage* (*28*), describes various initiation rites that are present in many circumcision rituals. These include a three-stage process: separation from normal society; a period during which the neophyte undergoes transformation; and, finally, reintegration into society in

Figure 2. Traditional circumcision in Uganda

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a new social role. A psychological explanation for this process is that ambiguity in social roles creates tension, and a symbolic reclassification is necessary as individuals approach the transition from being defined as a child to being defined as an adult. This is supported by the fact that many rituals attach specific meaning to circumcision that justify its purpose within this context. For example, certain ethnic groups, including the Dogon and Dowayo of West Africa and the Xhosa of South Africa, view the foreskin as the feminine element of the penis, the removal of which (along with passing certain tests) makes a man out of the child (*29, 30*).

Ethnicity is thus a major determinant of circumcision worldwide – for example, in ethnic groups of Bendel State in southern Nigeria, 43% of men stated that their motivation for circumcision was to maintain their tradition (*31*). In some settings where circumcision is the norm there is discrimination against non-circumcised men. In some cultures, such as the Yao in Malawi, the Lunda and Luvale in Zambia, or the Bagisu in Uganda (*18,19, 32*), it is unacceptable to remain uncircumcised, to the extent that forced circumcisions of older boys are not uncommon (*15*). Among the Xhosa in South Africa men who have not been circumcised can suffer extreme forms of punishment, including bullying and beatings (*29*). This discrimination may extend to entire ethnic groups, as in the case of the Luo in Kenya, who do not traditionally practise circumcision and report that they are often discriminated against by other Kenyans because of this (*25*).

1.2.3 Social determinants

Social desirability

Today, male circumcision is performed for a range of reasons, mainly social or health related, in addition to religion and ethnicity. The desire to conform is an important motivation for circumcision in places where the majority of boys are circumcised. A survey in Denver, United States of America, where circumcision occurs shortly after birth, found that parents, especially fathers, of newborn boys cited social reasons as the main determinant for choosing circumcision (for example, not wanting him to look different). The main correlate of circumcision status was circumcision status of the father, with 90% of circumcised fathers choosing to circumcise their son, compared with 23% of non-circumcised fathers (*33*).

In the Philippines, where circumcision is almost universal and typically occurs at age 10–14 years, a survey of boys found strong evidence of social determinants, with two thirds of boys choosing to be circumcised simply “to avoid being uncircumcised”, and 41% stating that it was “part of the tradition” (*34*). Social concerns were also the primary reason for circumcision in the Republic of Korea (*35*), with 61% of respondents in one study believing they would be ridiculed by their peer group unless they were circumcised (*36*).

Social desirability may also contribute to the relatively recent uptake of circumcision among the Akan ethnic group in Ghana, which traditionally did not elect circumcised men as chiefs. However, in the past century, male circumcision has become more common (*37, 38*) and the most recent Demographic and Health Survey shows that 99% of Akan men were circumcised and 83% of Akan men reported that circumcision was practised in their community (*13*). The reasons given for the uptake of male circumcision included social, hygiene, disease prevention, female preference and enhanced sexual enjoyment (*39*). A further example of recent changing practice comes from the Sukuma ethnic group in the North-west of the United Republic of Tanzania, which

is also traditionally non-circumcising. The word for circumcision in the Sukuma language is derogatory (*njilwa*); however, now that boys mix with other ethnic groups at school, the practice is more acceptable, with an estimated prevalence of 21% (*11*).

The desire to belong is also likely to be the main factor behind the high rate of adult male circumcisions among immigrants to Israel from non-circumcising countries (predominantly the former Soviet Union) (*40*).

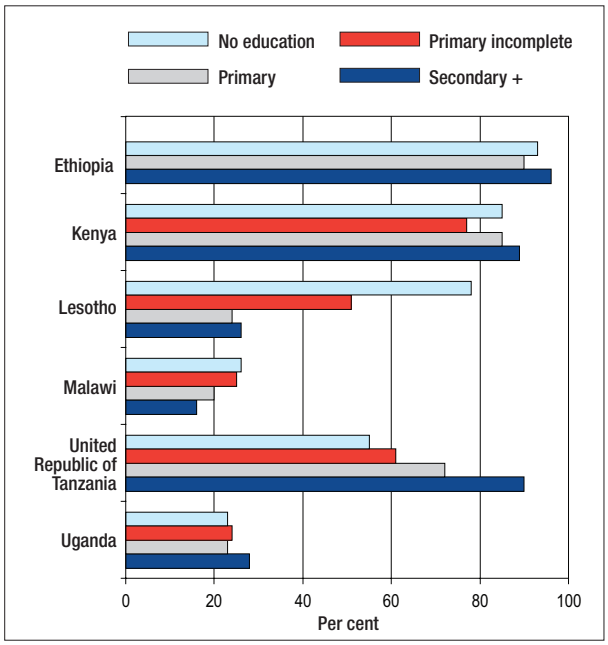
Socioeconomic status

Socioeconomic factors also influence circumcision prevalence, especially in countries with more recent uptake of the practice, such as English-speaking industrialized countries. When male circumcision was first practised in the United Kingdom in the late 19th and early 20th century, it was most prevalent among the upper classes (*41*). A study published in 1953 found that 74% of private-hospital patients in New York City were circumcised, compared to 57% of non-private patients (*42*). A similar association was seen in a recent nationwide survey in Australia, which found that the proportion of men circumcised was significantly associated with higher levels of education and income (*43*). In the United States of America, a review of 4.7 million newborn male circumcisions nationwide between 1988 and 2000 also found a significant association with private insurance and higher socioeconomic status (*44*), which is likely to reflect the low circumcision prevalence among recent immigrants, many of whom, in addition to coming from non-circumcising countries, such as China and Mexico, are more likely to be of lower socioeconomic status. Although circumcision is uncommon in Thailand, it tends to be associated with higher educational and socioeconomic status. In order to make male circumcision more accessible, it was recently added to the procedures covered under a flat rate payment scheme for a medical visit or procedure of any type (*45*).

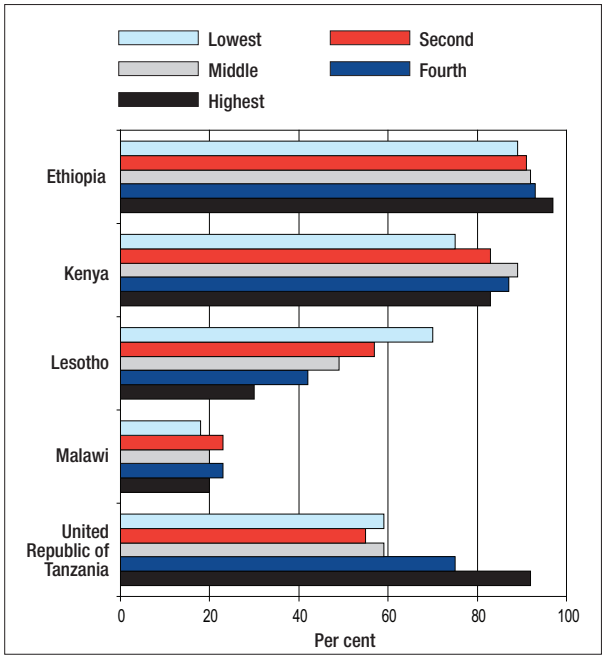
In contrast, the Demographic and Health Surveys in sub-Saharan African countries show no consistent association with socioeconomic status (Figure 3). For example, in the United Republic of Tanzania, higher rates of circumcision are seen among men with higher levels of education, of higher socioeconomic status and living in urban areas, whereas in Lesotho, circumcision is most common among men with no education, in the lowest wealth quintile and living in rural areas (*13*). Circumcision prevalence in Ethiopia is universally high (93%) but men are most likely to be circumcised if they are in a higher wealth quintile, have at least secondary education and live in an urban area.

Figure 3. Prevalence of male circumcision by education and wealth quintiles

Circumcision prevalence by education



Circumcision prevalence by wealth



Source: MEASURE DHS (*13*).

Perceived health and sexual benefits

One of the driving determinants in the spread of circumcision practices in the English-speaking industrialized world has been the perception that it results in improved penile hygiene and lower risk of infections. These were also the main determinants found in recent studies of factors determining acceptability of male circumcision in sub-Saharan African communities that do not traditionally circumcise (see section 3.3) (*15*). A male circumcision service was established at the University Teaching Hospital in Lusaka, Zambia, in August 2004, and of the 895 circumcisions that have been undertaken there, 91% of clients requested the procedure because they considered it protective against sexually transmitted infection (STI), including HIV (*46*).

In a study of newborns in the United States of America in 1983 (*33*), mothers cited hygiene as the most important determinant of choosing to circumcise their sons, and in Ghana, male circumcision is seen as cleansing the boy after birth (*27, 47*). Improved hygiene was also cited by 23% of 110 boys circumcised in the Philippines (*34*); and in the Republic of Korea, the principal reason given for circumcision among those who thought it was necessary, was "to improve penile hygiene" (78% and 71% respectively in two studies) (*36; 48*) and to prevent conditions such as penile cancer, sexually transmitted diseases and HIV (*48*). In Nyanza Province, Kenya, 96% of uncircumcised men and 97% of women, irrespective of their preference for male circumcision, stated their opinion that it was easier for circumcised men to maintain cleanliness (*17*). Men participating in focus group discussions in Botswana, Kenya, Malawi, the United Republic of Tanzania, Zambia and Zimbabwe also believed that it was easier to keep the circumcised penis clean (*11, 17–19, 25, 49–51*).

Perceived improvement of sexual attraction and performance can also motivate circumcision. In a survey of boys in the Philippines, 11% stated that a determinant of becoming circumcised was that women like to have sexual intercourse with a circumcised man (*34*), and 18% of men in the study in the Republic of Korea stated that circumcision could enhance sexual pleasure (*48*). In Nyanza Province, Kenya, 55% of uncircumcised men believed that women enjoyed sex more with circumcised men, and this belief was a strong predictor of preference to be circumcised even after controlling for education, employment and beliefs about whether circumcision was associated with disease. Similarly, the majority of women believed that women enjoyed sex more with circumcised men, even though it is likely that most women in Nyanza have never experienced sexual relations with a circumcised man (*17*). In the North-west of the United Republic of Tanzania, younger men associated circumcision with enhanced sexual pleasure for both men and women (*11*), and in Westonaria District, South Africa, about half of men said that women preferred circumcised partners (*52*). In southern Nigeria, the enhancement of sexual performance and reproductive ability was also an important reason given for male circumcision (*31*).

1.3 Global prevalence of male circumcision

We have estimated the global prevalence of circumcision among males aged 15 years or over by first assuming that all Muslim and Jewish males in this age group are circumcised. Then, using published data from the Demographic and Health Surveys and other sources (*13, 53, 54*), we estimated the number of non-Muslim and non-Jewish men circumcised in countries with substantial prevalence of non-religious circumcision (Angola, Australia, Canada, Democratic Republic of Congo, Ethiopia, Ghana, Indonesia, Kenya, Madagascar, Nigeria, Philippines, Republic of Korea, South Africa, Uganda, United Kingdom, United Republic of Tanzania and United States of America) (Table 1).

Using these assumptions, we estimate that approximately 30% of the world's males aged 15 years or older are circumcised (Table 2). Of these, around two thirds (69%) are Muslim (living mainly in Asia, the Middle East and North Africa), 0.8% are Jewish, and 13% are non-Muslim and non-Jewish men living in the United States of America.

This method is likely to underestimate the true prevalence of male circumcision, as we have excluded circumcision among non-Muslim and non-Jewish men in heavily populated countries such as Brazil, China, India and Japan where a small proportion of men are also circumcised, for medical, cultural or social reasons. If we assume that 5% of men aged 15 years or above who are not included in the countries or religions above are circumcised, then our estimate rises to 33%.

Table 1. Estimation of number of males aged 15 years or older circumcised for non-religious reasons, by country

Country	Male population aged 15 years or older				
		Not Muslim or Jewish			
	Number (millions)	Percent (*55*)	Number (millions)	Percent circumcised (*13, 53, 54*)	Number circumcised (millions)
Angola	3.44	99.0%	3.4	90%	3.1
Australia	8.05	98.5%	7.9	59%	4.7
Canada	11.79	96.9%	11.4	30%	3.4
Dem. Rep. of Congo	16.23	90.0%	14.6	90%	13.1
Ethiopia	20.92	55.0%	11.5	92%	10.6
Ghana	5.61	84.4%	4.7	85%	4.0
Indonesia	84.98	12.0%	10.2	25%	2.5
Kenya	9.99	93.0%	9.3	83%	7.7
Madagascar	4.24	90.0%	3.8	98%	3.7
Nigeria	35.23	50.0%	17.6	90%	15.9
Philippines	28.75	95.0%	27.3	90%	24.6
Republic of Korea	19.71	100.0%	19.7	60%	11.8
South Africa	14.87	98.5%	14.6	35%	5.1
Uganda	6.94	85.0%	5.9	14%	0.8
United Kingdom	24.22	97.3%	23.6	6%	1.4
United Republic of Tanzania	9.84	65.0%	6.4	58%	3.7
United States of America	115.56	98.0%	113.2	75%	84.9

Table 2. Proportion of males aged 15 years or older circumcised globally

	Prevalence of circumcision	Number circumcised (millions)	Proportion of those circumcised globally
Religious circumcision			
Muslim men	100%	455.0	68.8%
Jewish men	100%	5.3	0.8%
Non-religious circumcision			
United States of America	75%	84.9	12.8%
Other countries[a]	61%	116.3	17.6%
Global total	**30%**	**661.5**	**100%**

[a] Includes countries listed in Table 1. If 5% of men in other countries are assumed to be circumcised for non-religious reasons, the global prevalence of circumcision is 33%.

Further limitations are that the country-level estimates rely on self-reported circumcision status, which may be unreliable in some (*11, 56*) though not all (*43*) settings. A Kenyan study concluded that asking men "Are you circumcised?" is misleading, not only because of unreliability of self-report, but also because different styles of circumcision in this population result in varying amounts of residual foreskin (*56*). However, the impact of misclassification of self-reported circumcision status is not clear. A study in the North-west of the United Republic of Tanzania found that the self-reported prevalence of circumcision was higher than the actual rate upon genital examination (34% vs. 28%) (*57*), whereas in a study of adolescents in Texas, United States of America, the self-reported prevalence was lower than that found by clinical examination (36% vs. 49%) (*58*). Further, in this study, a substantial proportion of respondents (27%) stated that they did not know their circumcision status.

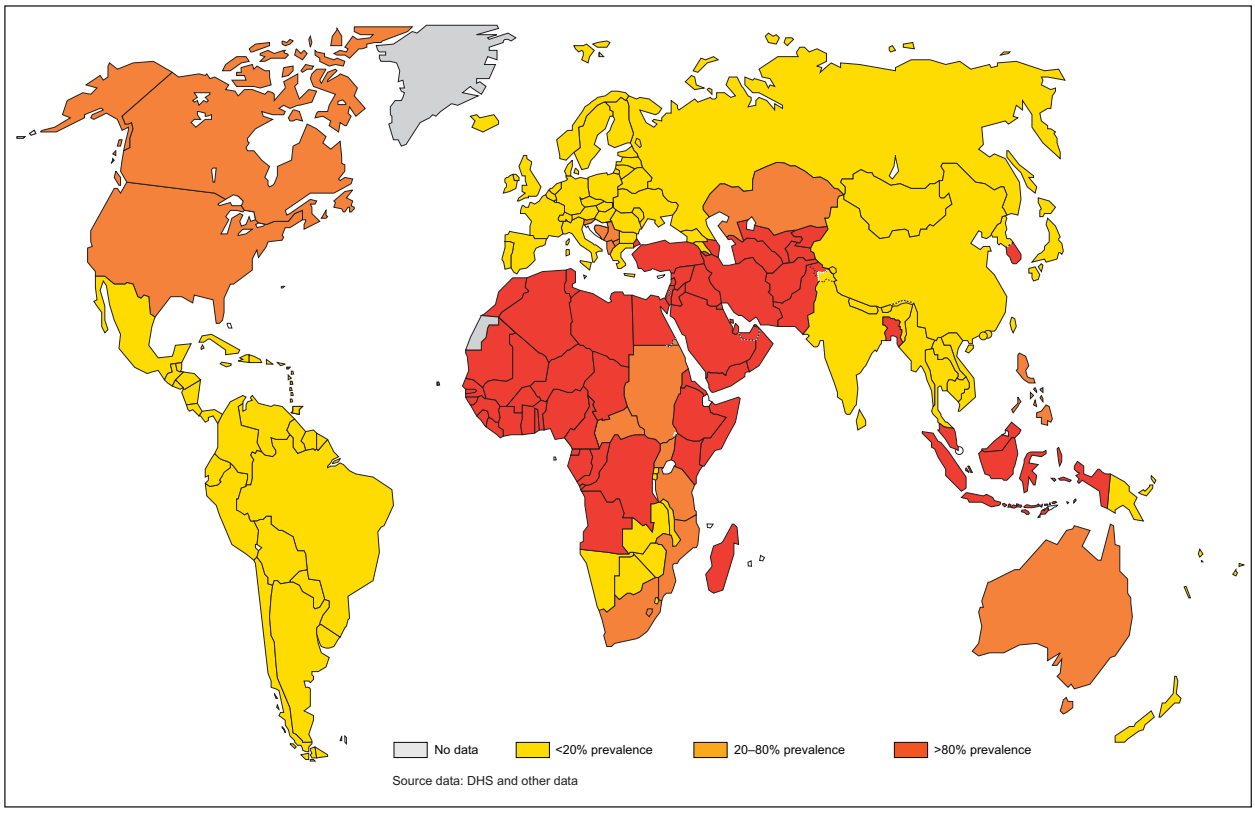
1.4 Regional prevalence of male circumcision

Figure 4 shows estimated country-level prevalence of male circumcision. However, these estimates do not reflect the substantial within-country variations in prevalence due to the social, cultural and religious determinants discussed in section 1.2. For example, the estimated prevalence in Uganda is 26%, but 97% of Muslims are circumcised compared with 14% of non-Muslims, and regional prevalence varies from 2% in North Central Region to 55% in Eastern Region (*13*).

1.4.1 Africa

Male circumcision is common in many African countries, and is almost universal in North Africa and most of West Africa. In contrast, it is less common in southern Africa, where self-reported prevalence is around 15% in several countries (Botswana, Namibia, Swaziland, Zambia and Zimbabwe) (*13, 53, 59, 60*) although higher in others (Malawi 21%,

Figure 4. Global map of male circumcision prevalence at country level, as of December 2006



Note: National prevalence of male circumcision was estimated using Demographic and Health Survey data where available. For other countries, estimates were made from other published sources. Countries with no published data on male circumcision prevalence are labelled "no data".

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

South Africa 35%, Lesotho 48%,[1] Mozambique 60%, and Angola and Madagascar > 80%) (*13, 53, 60*). Prevalence in Central and East Africa varies from approximately 15% in Burundi and Rwanda to 70% in the United Republic of Tanzania, 84% in Kenya and 93% in Ethiopia (*13*).

This variation is partly due to some groups (mainly Nilotic or Sudanic speakers) who are traditionally non-circumcising, and also to different ethnic traditions among Bantu-speaking populations (which include over 400 different ethnic groups in Africa, from Cameroon to South Africa), some of whom gradually stopped the practice, sometimes many centuries ago (*61*). The reasons for this cessation are unclear, but in more recent history it is known that in Botswana, southern Zimbabwe and parts of South Africa and Malawi circumcision was stopped by European missionaries and colonial administrators. In Zululand, King Shaka ordered that circumcision schools be abolished during the Zulu wars in the early 19th century, presumably because of the difficulty in holding the schools during the continual fighting (*61*). For similar reasons, many other groups in southern Africa are thought to have abandoned male circumcision at that time, including the Swazi, when King Mswati II banned the practice as it incapacitated men at times of war (*61*).

Another smaller region where circumcision was not traditionally practised is in a contiguous area in central and eastern Côte d'Ivoire, north-western and central Ghana, and south-western Burkina Faso (*61*). However, the procedure has become more widespread in this region over the past century (*37, 39*): prevalence has increased to 68% in north-western and central Ghana (still much lower than the national Ghanaian prevalence of 96%) but remains much less common (28%) among the Lobi in south-western Burkina Faso (national prevalence 90%) (*13*).

Age at circumcision varies by country. Neonatal circumcision is common in Ghana (*47*), but in other countries median age at circumcision varies from boyhood (median age 5–7 years in Burkina Faso) (*13*), age 7–10 years in Zambia (*62*), and age 8–16 years in Kenya (*63*) to the late teens or twenties, for example in parts of the United Republic of Tanzania and South Africa (*11, 64*). Age at circumcision can also vary considerably within a country. For example, in Burkina Faso, families of higher socioeconomic status and education level or living in urban areas are more likely to circumcise their sons at a young age (*13*).

1.4.2 Asia and the Middle East

Male circumcision is almost universal in the Middle East and Central Asia, and in Muslim Asian countries, such as Indonesia (*8*), Pakistan and Bangladesh (*53*). In addition, there is a large circumcised Muslim population (estimated at 120 million) in India (*55*).

There is generally little non-religious circumcision in Asia, with the exceptions of the Republic of Korea and the Philippines, where circumcision is routine. In the Republic of Korea, circumcision patterns changed dramatically during the 20th century, increasing from almost non-existence in 1945 to over 90% currently (Figure 5). This is thought to be largely the influence of the United States of America, which established a trusteeship in the Republic of Korea in 1945. The very rapid uptake of this practice is seen clearly in prevalence of male circumcision among 20-year-olds from 1950 to 2000 (Figure 5a), rising from almost zero in 1950 to 90% in 2000, with the sharpest increase in the 1980s. The overall prevalence among men is about 60% (*65*).

In the Republic of Korea, male circumcision tends to occur in adolescence or later rather than neonatally (*66*), and the median age of circumcision among 1500 young men interviewed in South Province was 10–15 years, with only 1% of boys circumcised in their first year (*35*). Another survey of 1124 men found that 80% were circumcised, and the median age of circumcision was 12–14 years (*67*).

The reason for the near-universal prevalence of male circumcision in the Philippines is less clear, but is long-standing and thought to be unrelated to religious influence (*34*). There are few data on age at circumcision but one study found that 42% of boys were circumcised aged under 10 years, 52% aged 10–14 years, and 5% aged 15–18 years (*34*).

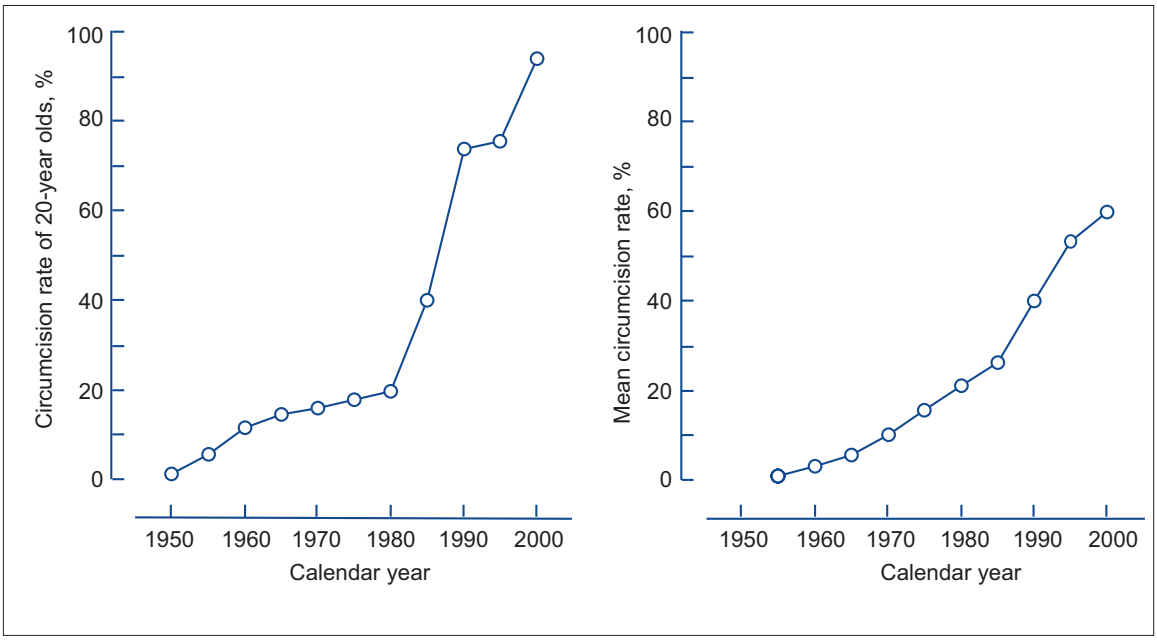
In Malaysia, male circumcision is also very common, probably due to the influence of its majority Muslim

[1] The self-reported prevalence of male circumcision in Lesotho is 48%, but this figure may refer to attendance at a circumcision school or ceremony. In many cases, only a small proportion of these men are actually circumcised. In addition, there is wide prevalence of incomplete circumcision, for example an incision only.

Figure 5. Republic of Korea: Circumcision trends 1950–2000

5a. Circumcision rate of then 20-year-olds among respondents as a function of calendar year

5b. Estimated circumcision rate over whole population as a function of calendar year



Source: Pang and Kim *(65)*. Permission granted by Blackwell Publishing.

population of 60% (*68*). In contrast, the practice is rare in neighbouring Thailand (*69, 70*), apart from among predominantly Muslim communities in southern Thailand.

1.4.3 North America, Europe, Australia and New Zealand

During the 19th century, male circumcision became increasingly popular in English-speaking industrialized countries following the advent of anaesthesia in surgery and the first epidemiological studies such as that of venereal patients in 1855, which found that 61% of non-Jewish patients (who were uncircumcised) had syphilis compared with 19% of Jewish patients (*71*). The Victorian establishment, including the medical profession, was concerned with issues surrounding the relationship between sexuality and disease, and there was a widespread belief that circumcision was beneficial, leading to statements such as "the prepuce is a frequent source of disease, often requiring its removal" (*72*).

By the end of the 19th century, male circumcision was advocated in these countries as a preventive measure against a range of conditions and behaviours, including masturbation, syphilis and nocturnal incontinence (*72*). As a result, neonatal and child circumcision rates in the United States of America increased to about 55% by 1938, and subsequently increased further to about 80% in the 1960s, possibly influenced by men returning from the Second World War, for whom circumcision was reportedly common to prevent penile infections while serving in North Africa and the Pacific (*73*). The American Academy of Pediatrics has issued several statements on neonatal circumcision since 1971, with the most recent (issued in 1999; reaffirmed in May 2005) stating that there are insufficient data to recommend routine neonatal circumcision (*74*). Despite this, there appears to be little decline in prevalence of neonatal circumcision in the United States of America. An estimated 61% of male newborns were recorded as being circumcised on hospital discharge sheets in 2000 (*44*), but the true figure will be higher than this because circumcision is not routinely documented on the hospital discharge sheet used to collate the data and, furthermore, post-neonatal circumcisions for religious or medical reasons are not captured. Community surveys have found higher neonatal male circumcision prevalence of 76–92% (*75*). There is also substantial regional variability, with lowest prevalence in the western United States of America, probably due to the high proportion of Hispanics, who have lower rates of male circumcision (*73*).

Most data from Canada are also hospital-based and therefore again exclude a substantial proportion of procedures. However, in contrast to the United States of America, there is clear evidence of a gradual decline in circumcision prevalence. Data from 1970–1971 found that neonatal circumcision rates varied from 42% in Nova Scotia to 67% in Alberta, and prevalence generally declined during the 1970s, with the lowest rate of 13% in Quebec, and 22% in Nova Scotia in 1978 (*76*). This decline may have been partly due to the American Academy of Pediatrics and Canadian Pediatric Society statements in the 1970s that there were no medical indications for routine neonatal circumcision (*77, 78*). A more recent study of 69 100 boys born in Ontario in 1993–1994 found a prevalence of 44% (*79*), and there is evidence of declining circumcision rates among male infants aged under 28 days in Ontario during the 1990s (inpatient circumcision prevalence of 39% in 1989–1992 and 30% in 1994–1995) (*80*).

The rate of neonatal circumcision in Australia declined in the 1970s and 80s, but is now slowly rising again (*81*). A recent nationwide survey of 10 173 men found that 59% of men were circumcised, decreasing from 66% of those aged 50–59 years to 32% of those aged 16–19 years (*43*). Other data confirm this, with reported neonatal circumcision rates of 50% in 1974, 24% in 1983 (*82*), and 17% in 2004 (*83*). There are few studies from New Zealand. A study of 435 men born in 1972-1973 in Dunedin found a prevalence of circumcision of 40% (*84*), substantially higher than that of 26% found among 1265 children born in the Christchurch urban region in 1977 (*85*), and just 7% in a 1991 survey in the Waikato region on North Island (*86*).

In the United Kingdom, circumcision prevalence is likely to have been 20–30% in the 1940s, with large variations due to socioeconomic status (*87*). Since then, prevalence has declined sharply, probably both for financial reasons, as the newly established National Health Service did not pay for the procedure, and also due to a 1949 *British Medical Journal* article that concluded that there was no medical justification for routine neonatal circumcision (*87*). A recent probability-based nationwide survey in 2000 found that 15.8% of men aged 16–44 years were circumcised, and this was lowest among those born more recently (for example, 11.7% among boys born in 1980–1984 compared with 19.6% among those born in 1955–1959) (*3*). This reflects the decreasing prevalence over time; currently, neonatal circumcision in the United Kingdom, as in the rest of Europe, is predominantly related to Muslim or Jewish religion, medical indications or immigration from circumcising countries.

1.4.4 Central and South America

There is little information on determinants of male circumcision in Central and South America, where the practice is uncommon. Circumcision was traditionally practised among the Aztec and Mayan civilizations but largely disappeared following the European conquests (*5, 22, 23*). Reports from the 17th to the 19th century suggest that male circumcision in the Caribbean was practised not only among Jews but also among local Africans working for them (*88*).

A study of male partners of women selected as controls in a case-control study of cervical cancer in Colombia, Costa Rica, Mexico and Panama found that 11% of men were circumcised on genital examination (although 25% of men reported being circumcised) (*89*). A more recent study, also among partners of controls in a cervical cancer study, found a prevalence of 7% in both Colombia and Brazil (*90*). A random sample of 300 men requesting pre-employment or routine annual worker health certification in low socioeconomic neighbourhoods of Lima, Peru, found that 6% were circumcised (*91*). A recent multicountry survey found no countries in Central or South America with circumcision prevalence greater than 20% (*53*).

1.5 Summary

Male circumcision is a common surgical procedure in many parts of the world, undertaken for religious, cultural and secular reasons. The most common determinant of circumcision globally is Muslim religion, and there are many regions of the world where non-religious circumcision is largely unknown. The age at which circumcision is undertaken is determined by sociocultural and religious traditions, and it may occur from the neonatal period to the early twenties. There have been rapid increases and decreases of prevalence in several settings among non-Muslims and non-Jews, which may result from increased mixing between different cultures, religions and socioeconomic groups, or from changes in perceptions of health or sexual benefits associated with the practice.

SECTION 2. Medical indications, clinical procedures and safety of male circumcision

2.1 Introduction

In this section, we review the physiology of the foreskin, current therapeutic and preventive medical indications for circumcision, the common methods of neonatal and adult circumcision, and the safety of these procedures when carried out both traditionally and medically.

2.2 The foreskin

The foreskin is a continuation of skin from the shaft of the penis that covers the glans penis and the urethral meatus (Figure 6a). The foreskin is attached to the glans by the frenulum, a highly vascularized tissue of the penis. The frenulum forms the interface between the outer and inner foreskin layers, and when the penis is not erect, it tightens to narrow the foreskin opening. Circumcision removes some, or all, of the foreskin from the penis. The word "circumcision" comes from the Latin *circumcidere* (meaning "to cut around").

There is debate about the role of the foreskin, with possible functions including keeping the glans moist (*92*), protecting the developing penis in utero (*73*), or enhancing sexual pleasure due to the presence of nerve receptors (*93*). The foreskin is part of our phylogenetic heritage; non-human primates, including our closest living relatives, chimpanzees, have prepuces that partially or completely cover the glans penis (*94*).

2.2.1 Mechanisms of penile infection

Epidemiological studies have shown circumcised men have a lower risk of several reproductive tract infections than uncircumcised men (see section 2.3.2). There are several likely biological mechanisms for this. The area under the foreskin is a warm, moist environment that may enable some pathogens to persist and replicate, especially when penile hygiene is poor (*93*). For example, it has been shown that uncircumcised infants are more likely to harbour a reservoir of uropathogenic organisms (for example *Escherichia coli*) in the urethral meatus and periurethral area (*95*) and that these uropathogenic bacteria adhere especially well to the inner mucosal surface of the foreskin as opposed to the keratinized external surface (*96*). These very adherent, more abundant uropathogenic organisms may then ascend to the bladder and kidneys, causing urinary tract infections and pyelonephritis (*97*).

In addition, the inner mucosal surface of the foreskin is thinly keratinized (*98*), unlike the penile shaft and the outer surface of the foreskin (*99*), and may be more susceptible to minor trauma and abrasions that facilitate entry of pathogens (*99*).

There are several mechanisms by which the foreskin may specifically increase risk of HIV acquisition. Firstly, there is an increased risk of genital ulcer diseases in uncircumcised men (*100*), which, in turn, increases risk of HIV, as the disrupted mucosal surface of the ulcer increases risk of HIV acquisition (*101*). Secondly, the foreskin may increase risk of HIV infection directly as tissue from the inner surface of the foreskin mucosa contains accessible HIV-1 target cells (CD4+ T cells, macrophages and Langerhans cells) (*102*). The density of these HIV-1 target cells in the inner foreskin is similar to that in the glans penis and outer foreskin, but those in the inner foreskin are closer to the epithelial surface than those situated elsewhere in the penis, due to the lack of keratin (*98*). Within the inner foreskin the Langerhans cells are more likely to be found near the epithelial surface than other cells, and are likely to be the first to be infected by HIV-1 (*103*). More direct evidence of the susceptibility of the foreskin to HIV-1 infection comes from Patterson et al. (*102*), who found that infectivity of the inner mucosal surface (assessed by quantity of HIV-1 DNA one day after ex vivo infection with explant culture) was greater than that of cervical tissue, which is a known primary site of HIV-1 acquisition in women.

In an uncircumcised man, the cells in the inner foreskin and frenulum are directly exposed to vaginal secretions during intercourse, and this superficial location of the HIV-1 target cells presumably increases risk of infection (Figure 6b). In contrast, in a circumcised man the penile shaft is covered with a thickly keratinized epithelium, providing some protection from infection (*98*).

2.2.2 Penile hygiene and circumcision status

The perception of improved penile hygiene is one of the main determinants of circumcision. The inner foreskin and glans require regular cleaning to ensure adequate penile hygiene as there is the potential for secretions to accumulate in the space between foreskin and glans, potentially leading to proliferation of pathogens (*93*). This substance, known as smegma, is a combination of exfoliated epithelial cells, transu-

Figure 6. Anatomy of the penis showing areas susceptible to HIV infection

Figure 6a. Flaccid uncircumcised penis

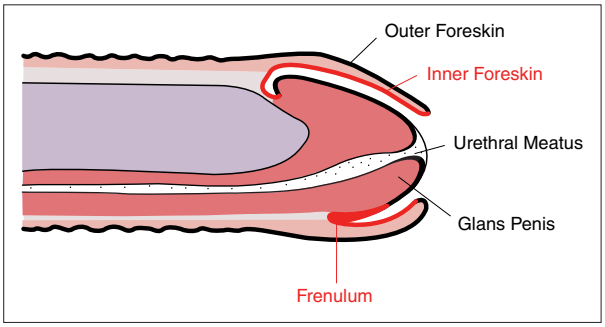
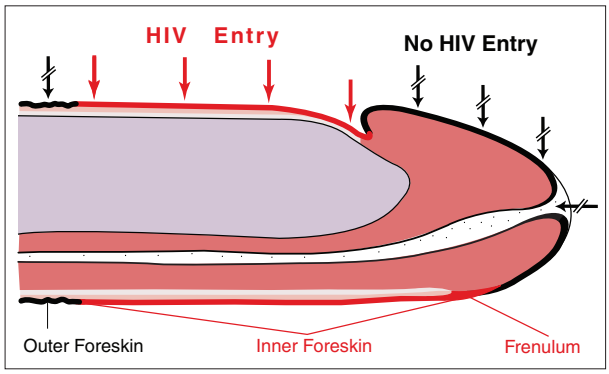


Figure 6b. Erect uncircumcised penis with the foreskin retracted showing likely sites of HIV-1 entry



Source: McCoombe and Short. (*98*). Permission granted by Lippincott Williams & Wilkins.

dated skin oils, moisture and bacteria. However, few studies have assessed the degree of penile hygiene among uncircumcised men. In a recent study, 49% of men attending an STI clinic in Durban, South Africa, had detectable wetness under the foreskin (thought to reflect poor genital hygiene) (*104*), similar to the proportion found in a study of men in India (*105*), but hygiene appeared to be better (9.5% wetness) among men attending an STI clinic in London (*106*).

Difficulty in maintaining good penile hygiene may contribute to the risk of infections among uncircumcised men. One cross-sectional study of men in Durban, South Africa, found a significantly higher prevalence of HIV among men with penile wetness 14 days after treatment for STI after adjusting for potential confounding factors (odds ratio (OR) = 2.38; 95% confidence interval (CI) = 1.4–4.0), and the circumcised men in the study had a similar prevalence of HIV as the uncircumcised men without penile wetness (43% vs. 46%) (*104*). Another cross-sectional study, of 150 male partners of women with lower genital tract symptoms from a family planning clinic and an STI clinic in Nairobi, Kenya, also found that increased post-coital washing was associated with lower HIV infection (*107*). Male circumcision was associated with lower risk of HIV in this study (OR = 0.12; CI = 0.02–0.91), independently of being associated with superior genital hygiene.

Interventions to improve penile hygiene may help reduce risk of STI/HIV, irrespective of circumcision status. Two studies of a topical microbicide (BZK 0.4%) wipe for penile cleaning among both circumcised and uncircumcised men in Malawi concluded that this wipe was safe and acceptable, and could decrease the frequency of penile colonization with microorganisms (*108*). However, it is also possible that frequent penile cleaning could cause inflammation and microabrasions, leading to increased risk of HIV acquisition.

2.3 Medical determinants of male circumcision

2.3.1 Therapeutic indications for male circumcision

The most frequent medical reason for male circumcision is phimosis – a stricture of the foreskin that narrows the opening and prevents it from being retracted to uncover the glans. In the United Kingdom from 1997 to 2003, 90% of medically indicated circumcisions were for phimosis (*109*). Phimosis may be currently overdiagnosed (*110*) and there was a 23% reduction in the number of circumcisions performed for phimosis during this period (from 11 501 in 1997 to 8866 in 2003), possibly due to greater awareness of overdiagnosis or to availability of alternative treatment by corticosteroids (*111, 112*).

Other, less common, medical indications for circumcision are otherwise untreatable paraphimosis (in which the foreskin is trapped behind the corona and forms a tight band of constricting tissue, causing swelling of the glans and foreskin), balanposthitis (an acute or chronic inflammation of the mucosal surface of the foreskin) and balanitis xerotica obliterans (a chronic sclerosis and atrophic process of the glans penis and foreskin – a risk factor for penile cancer and the only absolute indication for circumcision). In addition, preputial neoplasms, excessive skin and tears in the frenulum are also rare medical indications for adult circumcision (*113, 114*).

2.3.2 Preventative indications for male circumcision

Table 3 summarizes the systematic reviews and randomized controlled trials of the association of male circumcision with penile infections. These show that circumcised men are at significantly lower risk of urinary tract infections, HIV, syphilis and chancroid (*100, 115, 116*).

In addition, there is consistent evidence from studies in the United States of America that circumcised men are at significantly lower risk of invasive penile cancer (*117–120*). Most (*4, 121–128*), but not all (*129*), studies have found a reduced risk of gonorrhoea among circumcised men, and a significantly reduced risk of *Chlamydia trachomatis* infection has been found in female partners of circumcised men (OR = 0.18; CI = 0.05–0.58) compared with partners of uncircumcised men (*90*).

In addition to these viral and bacterial infections, a recent study found a significantly higher prevalence of yeast in samples from the prepuce and glans penis of uncircumcised (62.5%) compared to circumcised (37.5%) boys in Turkey (*136*), although an earlier study found no association of yeast in 66 circumcised and 69 uncircumcised men (*137*).

In the industrialized world, routine neonatal circumcision is not recommended by national paediatric societies, including those of Australia, Canada, Finland, New Zealand and the United States of America, for the prevention of these conditions (*74, 138–141*), because the risks are judged to outweigh the benefits.

There have been several cost–benefit analyses of impact of neonatal circumcision. Their conclusions depend on the assumed surgical complication rate of neonatal circumcision – for example, a decision-tree analysis found that circumcision would be preferred if the rate of surgical complications was below 0.6% (*142*). One study, using data from 350 000 neonatal circumcisions in Washington State, United States of America, observed a complication rate of 0.2%, and concluded that six urinary tract infections would be prevented for every complication (*143*). Conversely, two complications could be expected for each case

Table 3. Association of infections with male circumcision

Infection	Type of study/review	No. of studies[a]	Relative risk (RR) or odds ratio (OR) (95% CI)	Strength of evidence
Urinary tract infections *(115)*	Randomized controlled trial	1	OR = 0.13 (0.01–2.63)	+++
	Systematic review and meta-analysis	12	OR = 0.13 (0.08–0.20)	
Chancroid *(100)*	Systematic review	7	RRs from 0.12 to 1.11[b]	++
Syphilis *(100)*	Systematic review and meta-analysis	14	RR = 0.67 (0.54–0.83)	++
HIV *(130–134)*	Randomized controlled trial	3	RRs from 0.40 to 0.52	+++
	Systematic review and meta-analysis of observational data	15	RR = 0.52 (0.40–0.68)	
	Systematic review of observational data	19	RRs from 0.12 to 1.25[c]	
HSV-2 *(100)*	Systematic review and meta-analysis of observational data	7	RR = 0.88 (0.77–1.01)	+
HPV *(135)*	Systematic review and meta-analysis of observational data	8	OR = 0.57 (0.39–0.82)	+++

a. For meta-analyses of HIV infections in adults, only studies with adjusted RRs are included, as crude RRs are likely to be misleading due to potential confounding with behaviour and other factors. The meta-analyses of chancroid, syphilis and HSV-2 include best estimates of effect, which are the adjusted RR if it was available, otherwise the crude RR.

b. Protective effect in 6 out of 7 studies, of which 4 were significantly protective.

c. Protective effect in 18 out of 19 studies, of which 14 were significantly protective.

of penile cancer expected in later life. In contrast, in a recent meta-analysis, a complication rate of 2% was assumed (which is typical of the rate in adult circumcision, but much higher than that found in neonates), and concluded that circumcision would only have a favourable cost–benefit ratio for boys at high risk of urinary tract infection (*115*).

The complication rates cited in some medical society statements also tend to be higher than observed for neonatal circumcision (for example, 0.2–2% in the Canadian statement, 1–5% in the Australasian statement), and the Australasian and American statements have been criticized for being unduly negative towards circumcision and downplaying the benefits of circumcision in reducing infections, including urinary tract infections, penile and cervical cancer, and HIV (*144, 145*).

There is conclusive evidence that male circumcision protects men from acquiring HIV through heterosexual intercourse (Table 3) (*130, 133, 134*). The public health issues surrounding possible uptake of adult male circumcision to prevent HIV infections in settings with high incidence are discussed in section 3.

2.3.3 Sexual function

The impact of circumcision on sexual function has not been systematically reviewed, and remains unclear due to substantial biases in many studies. For example, reporting of post-surgical sexual performance may be related to whether circumcision was carried out for elective or therapeutic reasons. Although it has been argued that sexual function may diminish following circumcision due to the removal of the nerve endings in the foreskin and subsequent thickening of the epithelium of the glans (*93*), there is little evidence for this and studies are inconsistent (*4, 43, 146–148*). The randomized trials and increased provision of male circumcision services will thus provide important information on sexual function post-circumcision. So far, four out of 1131 HIV-1 negative men reported mild or moderate erectile dysfunction 21 months after the surgery in the Orange Farm Intervention Trial but it is unclear whether this was a pre-existing problem for any of them (*130*).

2.4 Male circumcision in clinical settings

A recent manual has been prepared by the World Health Organization (WHO), the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) that provides full details of methods of male circumcision in clinical settings (*149*). In this paper we summarize the main points only.

2.4.1 Methods of neonatal circumcision

Neonatal circumcision should only be undertaken if the baby is a normal full-term delivery with no significant medical problems after birth. There are four techniques for neonatal circumcision: the dorsal slit method, the Plastibell method, the Mogen clamp method and the Gomco clamp method.

The use of clamps reduces pain, minimizes or eliminates bleeding, promotes haemostasis and protects the glans. The Plastibell method is widely used around the world and has been shown to be acceptable and practical in developing country situations but incorrect technique can lead to complications and this method is recommended in the context of regular circumcision practice but not for occasional use. The Mogen clamp is used widely in North America and complications are less frequent than with other methods when used in neonates. Comparative studies have shown that it is quicker and causes less pain than the Gomco clamp (*150–152*). Unlike the Plastibell, the clamp is reusable and precautions are needed to ensure sterility. The Gomco clamp has different bell sizes and so can be used in infants and older children.

Circumcision is a simpler operation in infants and young children and healing is usually complete within a week. Bleeding is rare because the clamp crushes the foreskin edge. The use of local anaesthesia for the procedure and analgesics is recommended for neonates, and is necessary for older children (*74*). A pacifier soaked in a sucrose solution has been found to be effective in reducing fussiness in infants and oral doses of acetaminophen every 6 to 8 hours for 24 hours provide additional analgesia (*153*).

2.4.2 Methods of adult and adolescent circumcision

Figure 7. Male circumcision using forceps-guided method in Orange Farm, South Africa, trial

Permission granted by B. Auvert

Adult and adolescent circumcision is carried out using one of three methods: the forceps-guided method, the dorsal slit method or the sleeve method. Details are given in the WHO/UNAIDS/JHPIEGO manual (*149*). The procedure is more complex than in neonates or children, requiring local or general anaesthesia. Local anaesthesia is the preferred method because it is less risky and more economical. The nerve supply of the penis consists of the twin dorsal penile nerves and anaesthesia blocks the dorsal penile nerves and its branches.

The sleeve method produces the tidiest result but requires a higher level of surgical skill than the other method. The forceps-guided method (Figure 7) can be performed without an assistant and is suitable for resource-limited settings. The disadvantage is that it leaves between 0.5 and 1.0 cm of mucosal skin proximal to the corona. The dorsal slit method is widely used by general and urological surgeons throughout the world and, whilst requiring more skill than the forceps-guided method, can be done without an assistant. The South African (*130*) and Kenyan (*133*) trials employed the forceps-guided method, whilst the Ugandan (*134*) trial, used the sleeve method.

All methods of adult and adolescent circumcision require suturing and dressing. Minor bleeding should stop with a few minutes of pressure with a gauze. Once bleeding has ceased, the wound is dressed and the dressing left in place for 24–48 hours. A follow-up visit should occur within seven days of surgery to assess the progress of healing and to look for signs of infection.

2.4.3 Adverse events associated with male circumcision in clinical settings

Surgical complications of male circumcision can include excessive bleeding, haematoma formation, sepsis, unsatisfactory cosmetic effect, lacerations of the penile or scrotal skin and injury to the glans.

Neonatal circumcision is a simpler procedure than adult circumcision and very low rates of complications (0.2–0.4%) have been consistently reported in large series of neonatal circumcisions in the United States of America and Israel (*143, 154–157*). Most of these are relatively minor (bleeding and excess skin) but definition of “complication” varies – for example in one of these studies (*157*), the rate of “significant” complications (systemic infections, haemorrhage in a patient with factor VII deficiency, circumcisions of infants with hypospadias, denudation of the penile shaft) was 0.2%, but 2% of patients had some complication (mainly bleeding or infection). A higher rate was reported among 100 neonates circumcised in Canada in 1962 with the Plastibell or Gomco clamp, where moderate or severe complications (bleeding, ulcer and infection) were seen in seven infants (*158*). However, this paper provides an example of how reported rates can vary depending on definition – complication rates were reported as 55%, mainly due to the classification of any bleeding (including oozing) as “haemorrhage” (*158*).

There are relatively few data on complication rates following circumcision in developing countries. One study of 205 Jamaican neonates, using the Plastibell device, found minor complications in 2.4% of circumcisions (*159*); a study from Nigeria reported that, among 1563 boys circumcised at the hospital, five (0.3%) developed minor complications (*160*); and a report from Anjouan Island in the Comoros found seven cases of haemorrhage (0.6%) and 18 cases of infection (1.8%) among 1019 boys circumcised at ages 3–8 years (*161*). Only 5% of these circumcisions were performed by doctors and the remaining by teams of two to three surgical aides and nurses who were trained to perform circumcisions, which were carried out in the home under local anaesthe-

sia with full asepsis. In contrast, a recent study of 270 neonates in Nigeria found that two neonates sustained amputation of the glans penis, and one had a buried penis (a penis that lacks an appropriate sheath of skin and is located beneath the integument of the abdomen, thigh or scrotum) (*162*). The overall complication rate was 20.2%, with the most common complications being redundant foreskin (53.8% of all adverse events) and excessive loss of foreskin (24.6%). There were no reports of bleeding, swelling or infection. The method of circumcision in this study was not reported, but most circumcisions (80%) were carried out in hospitals, often by nurses, among whom complication rates were higher than among doctors or among traditional practitioners.

Turning to older children, a recent large study of 66 519 boys circumcised in the United Kingdom between 1997 and 2003 found a complication rate of 1.2% (*109*). Interestingly, complication rates were significantly lower among boys aged 5–9 years (0.7% with haemorrhage) compared with those aged 0–4 years (1.0% with haemorrhage). Of 200 boys circumcised in Australia (mean age 2 years 4 months), the overall complication rate was much higher at 15.5% (31/200). The main complication was bleeding (9 mild, 4 moderate, 1 unknown degree), and meatal ulcer (7 cases) (*163*). Again, rates were highest among the less experienced doctors. Among 600 boys circumcised in Turkey, the complication rate was 3.8%. Most of these (13/23) were bleeding, mostly simple oozing (*12*). In a series of 249 consecutive circumcisions in Kenya and Nigeria (*164*), of whom most (61%) were adolescents or young adults, there were 28 (11.2%) complications, predominantly wound infection (2.8%), but also severe haemorrhage (1.2%), retention of urine (1.2%) and swelling (1.2%).

The recent trials of elective male circumcision among men in Africa provide essential information on risks of surgery in adults. In the South African study, the overall risk of adverse events during surgery or in the first month post-surgery was 3.6% among the 1495 HIV-seronegative men and 8.2% among the 73 HIV-seropositive men (*130*). Pain was the most common adverse event, reported by 13/1568 men (0.8%), and problems with appearance were reported by 9 men (0.6%). Excessive bleeding, infection, swelling or other complications were reported for 38 men (2.4%). By 21 months after circumcision, 11 (1%) adverse events were reported (problem with urinating, dissatisfaction with appearance, mild or moderate erectile dysfunction). The rate of clinical adverse events was slightly lower among the HIV-seronegative men recruited into the Kenyan trial (1.8%), and all of these were resolved within hours or days (*165*). Again, the complication rate was substantially lower when performed by experienced surgeons (< 1% for those who had performed at least 200 circumcisions compared with 3.8% among those who had performed fewer than 100). The duration of the procedure also decreased as the trial progressed, from a median of 38 minutes for the first 100 procedures to a median of 21.5 minutes for the final 75 procedures (*165*). A complication rate of 3% (27/895) has been seen at the University Teaching Hospital in Lusaka, Zambia, where a dedicated public-sector male circumcision service has been available since August 2004. Circumcision is performed under local anaesthesia, predominantly by clinical officers using the dorsal slit method (*62*).

Box 1. Potential complications of male circumcision in clinical settings

- Pain
- Bleeding
- Haematoma
- Swelling
- Wound infection
- Anaesthesia-related events
- Delayed wound healing
- Excessive skin removed
- Insufficient skin removed
- Problems with urination
- Problems with appearance
- Erectile dysfunction
- Injury to glans

2.4.4 Summary

To summarize, neonatal male circumcision is a relatively simple, quick and safe procedure when performed in a clinical setting under aseptic conditions by trained professionals. Complication rates are between 1 in 500 and 2 in 100 and are usually minor.

In adults, the operation is more complex and under optimal conditions complication rates of about 2–4% are seen (Box 1). However, these optimal conditions are not always met. Reported rates of complications vary dramatically, due mainly to different definitions of adverse events, and also because complication rates are likely to depend on age at circumcision, experience of the surgeon, reason for circumcision (therapeutic versus elective), and the method used. The potential for complications is greater in adults, as the procedure is more complex, requiring suturing of skin edges.

2.5 Male circumcision in non-clinical settings

2.5.1 Methods of male circumcision in non-clinical settings

Male circumcision for religious or traditional reasons frequently takes place in a non-clinical setting, although in some cultures an increasing proportion now takes place in clinics (*26, 166*). The usual procedure, of which almost all ritual circumcisions are variants, involves pulling the foreskin forward and cutting through the prepuce above the level of the glans, sometimes using a shield to protect the glans.

Traditionally, Jewish males are circumcised neonatally by a specially trained mohel, or traditional circumciser, in a ceremony called a Bris Milah (Figure 8). The surgical training undertaken by a mohel may include anatomy, surgical technique, minimizing complications, treating complications and preoperative and postoperative care routines. The technique employed by some mohels is similar to the Mogen clamp, the foreskin being passed through a slit in a metal shield that protects the glans, while a scalpel is run across the face of the shield, removing the foreskin. The highly vascularized frenulum is not excised in this method, and so bleeding is minimized. The remaining inner foreskin is subsequently pulled back off the glans and excised, and the wound is bandaged without the use of stitches. As this is a neonatal procedure, this method is safer than many other non-clinical procedures.

Figure 8. Jewish Bris Milah

Source: Photo from http://www.305651bris.com/fenster_bris.htm. Photograph credit: Hagit Ilia. Permission granted by Jerusalem AIDS project, Israel.

Methods of non-clinical circumcision among Muslims vary and may be undertaken neonatally, which will generally be a safe procedure. However, it is often performed at older ages with increased risks. In Turkey, circumcision is traditionally undertaken by non-medically trained individuals, including barbers and traditional drummers (*12*). The usual technique involves pulling the foreskin in front of the glans, placing some kind of shield to protect the glans, and excising the skin. In northern Sudan, where boys must be circumcised before entering school at age 8 years, the traditional circumciser inserts a straw made from savannah grass into the foreskin opening, and pushes the glans down while pulling the foreskin as far forward as possible. A cord is then tied around the foreskin above the glans, and the foreskin excised with a knife immediately in front of the cord. The inner epithelium is then folded back over the glans and the wound is dressed, but not stitched.

Among the Xhosa of South Africa, circumcision is carried out using a razor blade or penknife (*26*), without anaesthesia (*167*). The wound is covered with eucalyptus leaves (*26*) or maize (*168*), and left in place for four weeks while the boys are in seclusion. Among the Australian Aboriginals and Polynesians, the foreskin is reportedly removed using seashells, and boys then squat or stand for several hours over the smoke from a fire covered with eucalyptus leaves to promote haemostasis (*26*). Eucalyptus oil is used due to its antiseptic, analgesic and even anticoagulant properties when used topically (*26, 169*).

The degree of foreskin removed also varies in traditional circumcision. A study among the Meru people in central Kenya revealed distinct differences between medical and traditional circumcision (*56*). In this culture, boys are typically circumcised between the ages of 13 and 17 years. Three types of circumcision were identified, including the clinic-based forceps-guided method (see section 2.4.2), but also freehand methods in which a smaller part of the foreskin is removed (1–2 cm, in contrast to the 4 cm removed in the forceps-guided method), and part of the outer layer of the foreskin is retained. The local "buttonhole" form, which is also used among the Maasai, Samburu and Dorobo (all in East Africa), results in the retention of part of the outer foreskin as an appendage below the glans. A study among the Babukusu in Kenya found that traditional circumcisions were highly variable, with some resulting in insufficient skin removal and flaps of foreskin partially covering the glans, and others with excessive skin removed, including non-foreskin tissue from the penile shaft (*166*). This can lead to problems, as the Babukusu are culturally expected to be completely circumcised, and having residual foreskin may lead to further surgery to complete the procedure.

Adult and adolescent Ethiopian Jews immigrating into Israel undergo "correctional" male circumcision to further remove (small or large) foreskin portions not cut by the traditional circumcisers in their home villages. This is required as the Jewish definition of circumcision is the complete removal of the foreskin (*170*).

2.5.2 Adverse events associated with male circumcision in non-clinical settings

Circumcisions undertaken in non-clinical settings can have significant risks of serious adverse events, including death. Among 50 patients admitted to hospital with post-circumcision complications in Nigeria and Kenya between 1981 and 1998, 80% had been circumcised by medically untrained traditional surgeons. One of these patients died from septicaemia, two lost their penis from gangrene, and five others had permanent disability from complete or partial amputation of the glans or shaft (*164*). Similar findings are reported from Turkey, where, of 200 boys admitted to hospital with circumcision complications over a 10-year period, 85% of the circumcisions were performed by traditional circumcisers, 10% by health technicians and 5% by doctors (*12*). One of these, a 2-year-old boy, died from haemorrhage. Although the proportion of circumcisions undertaken by traditional circumcisers in these two populations is not known, these data illustrate the risks associated with some traditional procedures. A further study of 48 boys presenting to hospital with post-circumcision complications in Nigeria found that the commonest complications were haemorrhage (52% of patients) and infection (21%) (*160*). One child had amputation of the penis with subsequent stricture of the external urethral meatus.

A sobering report of circumcision among the Babukusu ethnic group in western Kenya has recently been published (*166*). Among the Babukusu, circumcision is part of the initiation rite for youths aged 8–20 years, and circumcision may be carried out traditionally or medically by a doctor, clinician or health professional. Twenty-four circumcisions were directly observed (12 traditional and 12 medical). The results were alarming – 21 of the 24 men suffered adverse events, and none had fully healed by 30 days post-operation. Further, seven men (29%) were judged to have permanent adverse sequelae. Among the 1007 youths undergoing circumcision who were interviewed, complication rates were lower, and reported adverse events were twice as common among those circumcised traditionally (35%) compared with medically (18%). The most common complications were excessive bleeding, infections and excessive pain. More detailed examination of 298 of the boys at 45–96 days post-operation showed that traditional circumcision was also associated with slower healing, more swelling, laceration and keloid scarring. The rate of adverse events depended on the provider, with rates being higher in private clinics, where providers may have little or no health care education compared to public clinics. Although all providers stated they had been adequately trained for circumcision, about half were willing to have more training. Finally, as the mean healing time was long (47 days), some of the men had resumed sexual activity before wound healing, potentially increasing risk of HIV infection through the open wound (*166*).

Mass circumcisions are also common in some settings and can increase complication rates. Among the Xhosa in South Africa, an unsterilized unwashed blade may be used on a dozen or more initiates in a single session (*167, 168*). Initiates are also significantly dehydrated during their two-week period of seclusion in the belief that this reduces weeping of

the wound, and after-care may be in the hands of a traditional attendant with no basic medical training (*167*). The combination of dehydration and septicaemia can result in acute renal failure, gangrene, tetanus or even death (*167, 168*). An estimated 40–50 young men die annually following ritual circumcision in South Africa (*168*), predominantly from infection and haemorrhage (*167*). The Eastern Cape provincial Department of Health recorded 243 deaths and 214 genital amputations for circumcisions between 1995 and 2004. To address this, traditional surgeons are now required by law to be officially recognized and registered with the provincial Department of Health (*171*).

Aside from complications, traditional circumcision can also be more painful than clinical circumcision, as use of anaesthetics is rare (*12*), probably due to the origins of circumcision as a marker of bravery and endurance (*26*). The rite of skin-stripping, whereby much of the skin of the penile shaft is progressively flayed, is used to prove bravery, and therefore marriage suitability, among various ethnic groups, including the Dowayo of Cameroon and formerly among Arabian tribes (*172*).

2.6 Summary

Male circumcision is medically indicated for only a few conditions. There is substantial evidence that circumcised men have a lower risk of some reproductive tract infections, as well as penile cancer, but some of these conditions are rare while others are uncommon or treatable, and routine neonatal circumcision is not currently recommended on medical grounds.

The safety of male circumcision depends crucially on the setting, equipment and expertise of the provider. Neonatal circumcision is a simpler procedure than adult circumcision, and has very low rates of adverse events. Adolescent or adult circumcision in clinical settings can cause bleeding, haematoma or sepsis, but with no long-term sequelae when undertaken in a clinical setting by experienced, well-trained providers. In contrast, circumcisions undertaken in unhygienic conditions, by inexperienced providers with inadequate instruments, or with poor after-care, can result in serious complications and even death.

Reported demand for male circumcision is increasing in some countries with high rates of HIV (*173*). Consultations, training programmes, health personnel mobilization and provision of appropriate equipment and supplies are urgently needed to meet this demand, provide skilled and safe surgery and avoid unnecessary complications. WHO, UNAIDS and JHPIEGO have recently developed a manual to train practitioners in safe medical circumcision (*149*). This manual is targeted at trained health-care providers circumcising adult men, and is accompanied by guidance on training, instrumentation, and regulatory, licensing and ethical issues (including counselling on sexual behaviour) (*174*).

SECTION 3. Male circumcision and HIV: Public health issues concerning increased uptake of male circumcision in sub-Saharan Africa

3.1 Introduction

In this section, we focus on changing patterns of male circumcision in the face of the expanding HIV epidemic in southern Africa. Three randomized controlled trials, in Kenya, South Africa and Uganda, have found that circumcised men are at 48–60% reduced risk of becoming infected with HIV. Male circumcision is likely to be integrated into the current package of HIV prevention measures, and a rapidly increased demand for safe, affordable male circumcision services is anticipated. There are many challenges associated with expanding provision of male circumcision services. We have discussed safety issues in section 2, and in this section we focus on acceptability of male circumcision in traditionally non-circumcising communities, and some of the potential problems associated with increased uptake.

3.2 HIV prevention in southern Africa

An estimated 2.1 million adults were newly infected with HIV in 2007, of whom two thirds live in sub-Saharan Africa (*175*). The prevalence is highest in southern Africa, where over 15% of adults are living with HIV. Notably, each country in this region with high prevalence of HIV (Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe) has a relatively low circumcision prevalence (*53*), whereas over 80% of males are circumcised in the two southern African countries with low HIV prevalence (Angola 3.7%; Madagascar 0.5%). In Mozambique, the overall prevalence of self-reported male circumcision is 60% (*13*), but this varies by province. HIV prevalence is consistently lower in provinces where male circumcision is common (Cabo Delgado, Inhambane, Nampula, Niassa), and higher where few men are circumcised (Gaza, Manica, Maputo, Sofala, Tete, Zambezia).

HIV in sub-Saharan Africa is predominantly transmitted by unprotected heterosexual intercourse, and effective prevention strategies include behavioural change programmes to promote abstinence and delayed sexual debut in young people, fidelity within partnerships where both people know they are seronegative, reduction in the number of partners and correct and consistent condom use (*176*). Reduced incidence and prevalence in several African countries, including Zambia and Zimbabwe in southern Africa, show that these prevention messages can work, but the alarming number of new infections every day in the region means that there is a need not only to intensify and expand current prevention programmes, but also to identify new methods to add to the existing ones, while undertaking essential structural interventions in the social and economic spheres to reduce gender inequities in education, employment, property inheritance and other key areas.

Male circumcision is one of these new potential methods, along with vaginal microbicides, pre-exposure prophylaxis with antiretroviral medication, herpes suppressive therapy, cervical barrier methods and HIV vaccines (*177*). So far, it is the only new prevention method to have shown consistent efficacy through randomized controlled trials (*130*). An additional trial, in Rakai, Uganda, evaluating the impact of male circumcision on male-to-female transmission of HIV has reported preliminary results. These show a higher rate of transmission if sexual intercourse was resumed before certified wound healing, but no difference in transmission rates from circumcised and uncircumcised men when intercourse was resumed at later times (*178*).

There are reports that demand for safe, affordable male circumcision is already increasing in southern Africa (*173, 179*). Urgent consideration must be given to the need to provide increased access to safe, affordable male circumcision services on a large scale, embedded within a comprehensive package of proven HIV prevention measures. The current randomized controlled trials of circumcision also indicate that demand for male circumcision in non-circumcising communities is substantial when the procedure is offered at no cost in a safe setting. In Kisumu, Kenya, over 6686 of the 34 200 (19.5%) uncircumcised men in the city aged 18–24 years came to the study clinic for enrolment when they knew that willingness to be circumcised was a requirement for enrolment in the trial (*15*). Similarly, the Rakai trial in Uganda has recruited 5000 men, representing approximately 45% of all the HIV-uninfected eligible men in the study population (personal communication, R. Gray). Data from Lusaka, Zambia, show current demand for male circumcision exceeds capacity, with a shortage of skilled providers to meet demand (*179*), and the same situation exists in Swaziland. In light of the recent trial results, demand for male circumcision for HIV prevention is likely to increase rapidly.

3.3 Acceptability of male circumcision in East and southern Africa

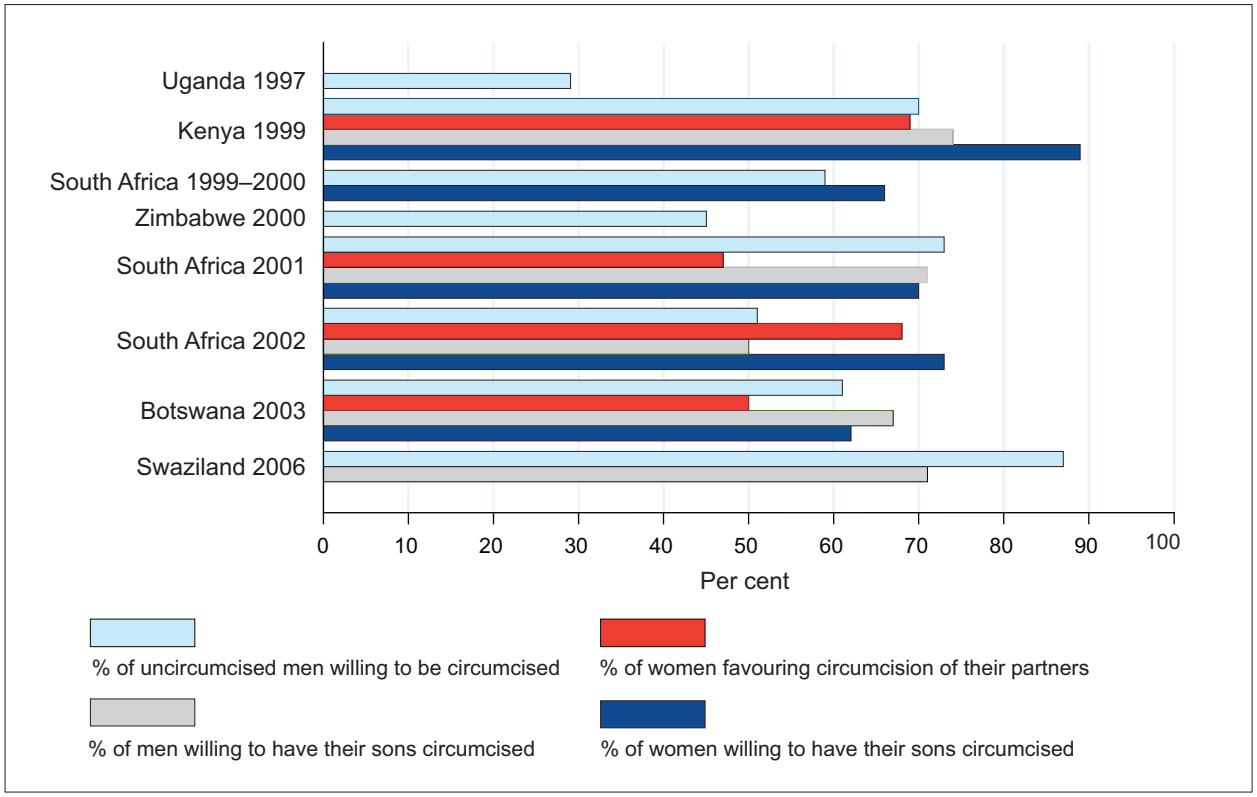
One concern around the potential for male circumcision as an HIV prevention measure is that it may not be acceptable in communities that do not traditionally circumcise. A recent comprehensive review (*15*) addresses this issue by summarizing eight quantitative and five qualitative studies assessing the acceptability of offering male circumcision services among traditionally non-circumcising groups in East and southern Africa (Table 4). The studies were carried out between 1991 and 2003 in Botswana, Kenya, Malawi, South Africa, Swaziland, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe. Women as well as men were included in 10 of the studies, enabling assessment of female perspectives on the acceptability of male circumcision.

The median proportion of uncircumcised men willing to become circumcised was 65% (range 29% in Uganda to 87% in Swaziland) (*15*). Similarly, 69% of women (range 47–79%) favoured circumcision for their partners and 71% (50–74%) of men and 81% (62–89%) of women were willing to have their sons circumcised (Figure 9). The response varied with how the questions were posed and the context of the study. For example, one of the highest acceptability levels was recorded in Botswana, rising from those shown in Figure 9 to 80-90% after an informational session in which participants were told about the health benefits and risks associated with the procedure (*51*).

3.3.1 Barriers to acceptability

The three most salient barriers to the acceptability of male circumcision were fear of pain, concerns for safety and the cost of the procedure. In areas where traditional circumcision is uncommon, the preference was overwhelmingly for a medical practitioner to be the provider, as this was perceived to be safer. All studies reported fear of infection, bleeding, excessive pain and possible mutilation at the hands of traditional circumcisers.

Figure 9. Acceptability of male circumcision from eight quantitative studies in six sub-Saharan African countries



Source: Adapted from Westercamp and Bailey (*15*). Permission granted by Springer Science & Business Media.

Table 4. Summary of studies assessing acceptability of male circumcision in non-circumcising communities in sub-Saharan Africa

Country/ study	Date of study	Participants interviewed	Ethnicity	Primary barriers	Primary facilitators
Botswana Kebaabetswe et al. *(51)*	March–June 2001	316 male and 289 female participants of 29 ethnicities, aged 18–74, in urban and rural settings	Ethnically heterogeneous (29 ethnicities)	Pain Safety concerns Not culturally acceptable Religion	Protection from STI/HIV Culture/tradition Improved hygiene
Kenya Bailey et al. *(25)*	April–May 1998	30 focus groups, urban and rural populations, farmers, business people, teachers, sex workers, barmaids and touts	Ethnically homogeneous (Luo)	Pain Cost Safety concerns Not culturally acceptable Difficulty of access to health facilities	Protection from STI/HIV Improved hygiene Enhanced sexual pleasure
Kenya Mattson et al. *(17)*	April–May 1999	107 men and 110 women of Luo ethnicity in urban and rural settings	Ethnically homogeneous (Luo)	Pain Cost	Protection from STI/HIV Improved hygiene Enhanced sexual pleasure
Kenya Agot et al. *(180)*	2002–2004	628 men enrolling in study offering circumcision to assess behaviour change post-surgery	Ethnically homogeneous (Luo)	(Not reported)	Protection from STI/HIV Improved hygiene Avoiding injuries during sex Social influence
Malawi Ngalande et al. *(19)*	July–August 2003	318 participants, 32 focus groups with men and women aged 16–80	Ethnically diverse (Chewa, Tonga, Yao, Ngoni, Lomwe, Nyanja)	Pain Surgical complications	Protection from STI/HIV Improved hygiene Social acceptability Enhanced sexual pleasure
South Africa Lagarde et al. *(52)*	August–September 2001	482 men aged 19–29 and 302 women aged 14–25	Ethnically heterogeneous (Sotho, Tswana, Xhosa and other ethnicities)	Cost Surgical complications "Old fashioned"	Enhanced sexual pleasure Increased sexual desirability
South Africa Scott, Weiss and Viljoen *(181)*	July 2002	100 adult men and 44 adult women in rural Zululand and 4 service providers	Ethnically homogeneous (Zulu)	Pain	Enhanced sexual pleasure
South Africa Rain-Taljaard et al. *(16)*	1999–2000	606 men aged 13–59 interviewed in August 2000 and 723 men aged 14–24 interviewed in August 1999	Ethnically diverse (Sotho, Xhosa, Zulu, Tswana, Shangaan, Venda)	Surgical complications "Old fashioned" Culture/tradition Religion	Protection from STI/HIV Improved hygiene Enhanced sexual performance Increased sexual desirability Greater respect Good fortune
Swaziland Tsela and Halperin *(182)*	2006	409 men aged 15–19 in urban and rural settings	Ethnically homogenous (Swazi)	(Not reported)	Protection from STI/HIV
Uganda Bailey et al. *(32)*	1997	365 men aged 18-67 from the Industrial Borough, Mbale	Ethnically diverse (17 tribal groups)	(Not reported)	(Not reported)
United Republic of Tanzania Nnko et al. *(11)*	1991–1997	998 Sukuma men from a cohort of factory workers in Mwanza town, 13 focus groups from mostly rural area, and population-based surveys	Ethnically homogenous (Sukuma)	(Not reported)	Protection from STI/HIV Improved hygiene Enhanced sexual performance
Zambia Lukobo and Bailey *(18)*	August–September 2003	160 men and 162 women in 34 focus groups in rural and urban settings	Ethnically diverse (Lunda, Luvale, Chewa, Tonga)	Pain Cost Surgical complications Not culturally acceptable	Protection from STI/HIV Improved hygiene Enhanced sexual performance Increased social acceptability Increased sexual desirability
Zimbabwe Halperin et al. *(50)*	2000	200 men attending beer halls in Harare	Not reported, likely to be mainly Shona	Risk of infection through traditional circumcision if single blade used	Protection from STI Improved hygiene

Fear of pain was the main reported barrier towards male circumcision acceptability in most studies. This fear was based largely on knowledge of traditional circumcisions in which pain is often viewed as an integral part of the rite of passage to manhood.

Concerns for safety were also very common, especially among mothers when asked about infant and early childhood circumcision. Overall, there was greater trust in medical practitioners and a strong preference for circumcision services to be made available in public health facilities by trained health professionals. For example, fears about the risk of excessive bleeding or infection were heightened if the procedure was performed by a traditional circumciser outside the clinical setting (*16, 19, 25, 50, 52*).

Cost was mentioned as a significant barrier to male circumcision acceptability in many studies. Some participants would prefer circumcision to be provided at health clinics and hospitals for free or at reduced cost (*19, 25*), whilst others recognized the need to pay for the service as free services were perceived as being of poor quality (*19*). During a pilot study of provision of male circumcision services in Siaya, Kenya, demand for circumcision rapidly increased when the cost was reduced from US$ 3.62 to US$ 1.45, and half of all circumcisions carried out during the 25-month study occurred during the two-month period in which lower fees were charged (*25*).

The determinants of male circumcision in traditionally circumcising populations, such as cultural identity, did not appear to be major barriers to circumcision in non-circumcising communities. Sanctions against circumcision in traditionally non-circumcising communities tend to be much less severe than the converse (i.e. not being circumcised in a circumcising community). In ethnically diverse areas, male circumcision status is likely to be less integral to cultural identity. For example, only 2% of the participants in the Botswana survey (which included 29 different ethnic groups) stated that circumcision would lead to disapproval by their community, although 22% cited “cultural reasons” as a factor in their decision not to circumcise their male child (*51*). Similarly, in South Africa, 38% of circumcised and 32% of uncircumcised study participants described circumcision as “forbidden” by their religion (*52*). In general, culture and religion tended to be more of a concern for older participants than for younger respondents, and several studies concluded that circumcision was increasingly an issue of personal choice rather than ethnic identity.

One factor that was discussed in focus group discussions but was not consistently found to be either a facilitator of or barrier to acceptability was sexual function. For example, in one study in South Africa 30% of uncircumcised men believed that circumcision would improve their sexual performance and 14% believed it would decrease sexual pleasure (*52*).

3.3.2 Facilitators of acceptability

The main factors associated with willingness to be circumcised were improved penile hygiene and a reduced risk of sexually transmitted infections (Table 4). Penile hygiene was widely recognized as being extremely important and was perceived as a major benefit of circumcision by both men and women. Participants also thought that it was easier for a circumcised man to maintain cleanliness and this was a major factor in women’s acceptability of male circumcision as, in many parts of Africa, cleaning of the penis following intercourse is viewed as the woman’s role, for example in Zambia, Malawi and Uganda (*18, 19, 32*).

Similarly, circumcision was widely perceived to protect against infections, and to allow for easier identification of sores and ulcers, permitting earlier treatment. For example, in Nyanza Province, Kenya, 79% of uncircumcised men and 81% of women believed that it was easier for uncircumcised men to acquire STIs compared with circumcised men (*17*), and in Swaziland, 81% of participants stated that circumcision reduced risk of STI, and 18% that it reduced risk of HIV (*182*). In a study in KwaZulu Natal, South Africa, the majority of men (65%) stated that uncircumcised men were more likely to acquire STIs, but this was not associated with willingness to become circumcised among men (*181*). Conversely, a minority of respondents in the acceptability study in Zambia reported that the circumcised penis was “always dry”, “susceptible to cracking”, and that this state provided a portal of entry for bacteria and viruses (*18*).

Beliefs about the impact of male circumcision on sexual performance and pleasure for the man or his partner were mentioned by men in most studies as a reason to become circumcised (Table 4) (*15*). In

addition, many younger men from traditionally non-circumcising communities cited being accepted as a sexual or marriage partner by women from other ethnic groups as an important reason to be circumcised (*11, 18, 19, 25*).

3.4 Behaviour change following circumcision

A major concern about the increased uptake of male circumcision in areas with high HIV incidence is that circumcision does not provide complete protection against infection. The public health message is that the procedure may reduce, but not eliminate, risk of infection, and safer sex practices must still be followed. However, this message may be difficult to communicate, and there is potential for risk compensation[2] (i.e. increases in risky behaviour sparked by decreases in perceived risk) (*183*).

Gray et al. used stochastic simulation models to estimate HIV transmission probabilities under various assumptions (*184*), including modelling the impact of male circumcision on HIV transmission (*185*). The model, using empirical data from the Rakai STI treatment trial, estimated that if newly circumcised men were to increase the number of sexual partners by an average of more than 25%, this would offset any beneficial effect of circumcision, even assuming a high efficacy of 60%.

To date, there are data on sexual behaviour following adult circumcision in two of the three randomized controlled trials. In the South African trial, men were asked about factors associated with numbers of sexual partners and contacts. Circumcised men reported higher risk behaviour for the five reported factors (being married or living as married; at least one sexual contact not protected by a condom; at least one non-spousal partner; at least one sexual partnership with only one sexual contact; at least five sexual contacts) during the period 4–12 months after randomization, and four out of five during the period 13–21 months after randomization. However, only the mean number of sexual contacts was significantly different between circumcised and uncircumcised men (5.9 vs. 5.0 in the period 4–12 months after randomization, $P < 0.001$; 7.5 vs. 6.4 in the period 13–21 months after randomization, $P = 0.002$) (*130*). The numbers of new partners reported was not significantly higher among circumcised and uncircumcised men, suggesting that, although sexual activity increased following circumcision, it was not with new partners. Notably, despite the increased reported sexual activity during follow-up, the risk of HIV acquisition in the circumcised men was the same whether behavioural variables were controlled for or not (unadjusted rate ratio = 0.40; adjusted rate ratio = 0.39). No risk compensation has been seen in either the Kisumu (Kenya) or Rakai (Uganda) trials (*133, 134*).

Behaviour change following circumcision within trials may differ from that in the "real world", where less intensive counselling may be given to men undergoing circumcision. The first study to examine sexual behaviour following circumcision outside a clinical trial setting was recently published (*180*). This cohort study offered circumcision to adult men at Siaya and Bondo District hospitals in western Kenya. The 324 men who chose to be circumcised were matched with eligible men who chose to remain uncircumcised, on the basis of age, marital status and residential location. The circumcised men reported more risky behaviour in the three months before study entry compared with men who chose to remain uncircumcised (for example, 34% vs. 26% reported risky sex acts in the preceding three months; $P = 0.03$), but during the 12-month follow-up period there were no significant differences in risky behaviour (number of unprotected sex acts, number of non-spousal partners, condom use), excluding the three months post-circumcision, when circumcised men were less sexually active due to the operation. The study provides reassurance that, within the context of adequate counselling on risk reduction, circumcised men did not increase their risky behaviour, but further studies are needed in other settings.

3.5 Cost-effectiveness of male circumcision for HIV prevention

The cost of clinic-based male circumcision in sub-Saharan Africa depends on the setting and resources available. For example, at the University Teaching Hospital in Lusaka, Zambia, the cost to the patient is $3,[3] whereas the cost in the private sector is $343 (*62*). Similarly, in Kisumu, Kenya, the cost is $3–15 in public facilities and $10–95 in pri-

[2] Risk compensation is also called "behavioural disinhibition" in some circles.

[3] All prices in this section are in US dollars.

vate clinics (*63*), and costs of $10–100 are typical in Senegal (*27*).

Two studies have estimated the cost-effectiveness of male circumcision for HIV prevention in Africa. The cost-effectiveness of expanding male circumcision services will depend on many factors, including the costs of the surgery and of averted HIV treatment. The first study to be published assumes full coverage of male circumcision in Gauteng Province, South Africa (location of the randomized controlled trial), which has an adult male HIV incidence of 3.8%. Based on the cost per circumcision in the trial of $47, the authors estimated that 1000 circumcisions would avert an estimated 308 (95% CI = 189–428) infections over 20 years. The cost was $182 (80% CI = $117–306) per HIV infection averted, and net savings would be $2.4 million (80% CI = $1.3–3.6 million). With a lower HIV incidence of 1%, the cost per HIV infection averted was $551 (80% CI = $344–1071) (*186*).

Higher estimates of the cost per HIV infection averted have been presented based on data from the randomized controlled trial in Rakai, Uganda. In this trial, which used physicians and fully equipped theatres, the cost per circumcision was $69, and, assuming HIV incidence of 1.25%, the estimated cost per HIV infection averted would be $3136 if the efficacy of male circumcision is 50%, or $1485 if circumcision also protects against acquisition in women (*185*). Given the "gold standard" settings of this trial, it can be assumed that actual programme costs would be lower.

Further work on cost-effectiveness using different assumptions is needed to compare usefully with other intervention methods in sub-Saharan Africa, such as treatment of sexually transmitted infections, voluntary counselling and testing and school-based educational interventions (*187, 188*). Suggested ranges of cost per HIV infection averted are $11–2188 for condom distribution, $18–950 for blood safety, $20–2198 for antiretroviral drugs to prevent mother-to-child transmission, $393–482 for voluntary counselling and testing, $58 for mass media-based education, $304–512 for treatment of STIs, and $6704–9448 for school-based HIV prevention programmes. Compared with these, data from the Orange Farm trial (South Africa) suggest that male circumcision is a highly cost-effective intervention, whereas those from Rakai (Uganda) suggest it would be less cost-effective than other HIV prevention methods.

3.6 Male circumcision and female genital mutilation

While both male circumcision and female genital mutilation[4] (FGM) are steeped in culture and tradition, the health consequences of each are drastically different (*189*). Male circumcision may seem similar as far as definition is concerned – "partial … removal of the external genitalia" – but in practice is substantially different. FGM, also referred to as "female circumcision", comprises surgical procedures involving partial or total removal of the external female genitalia. It is the manifestation of deep-rooted gender inequality that assigns women an inferior position in societies, and is unambiguously linked to a reduction in women's sexual desire and an irreversible loss of capability for a type of sexual functioning that many women value highly (*190*).

FGM frequently involves complete removal of the clitoris, as well as additional cutting and stitching of the labia resulting in a constricted vaginal opening. The procedures are linked to extensive and in some cases lifelong health problems (*191*). The immediate complications include severe pain, shock, haemorrhage, tetanus or sepsis, urine retention, ulceration of the genital region and injury to adjacent tissue. Haemorrhage and infection can be of such magnitude as to cause death (*191*). Moreover, the WHO collaborative prospective study in six African countries on female genital mutilation and obstetric outcomes, published in June 2006 (*192*), showed that deliveries to women who underwent FGM (all types considered) were significantly more likely to be complicated by Caesarean section, postpartum haemorrhage, episiotomy, extended maternal hospital stay, resuscitation of the infant and hospital inpatient perinatal death than deliveries to women who have not had FGM. FGM is estimated to lead to an extra one to two perinatal deaths per 100 deliveries.

There are no known health benefits associated with FGM and no research evidence to suggest that such procedures could reduce the risk of HIV transmission. For these reasons, bodies such as WHO, the

[4] For the purposes of this document, the term 'Female Genital Mutilation' is used. The word 'mutilation' reinforces that this practice is a violation of girls' and women's human rights, and thereby helps to promote national and international advocacy towards abandonment. However, some agencies employ the term 'female genital mutilation/cutting' to capture the significance of the term mutilation at the policy level while using the term 'cutting' which is more acceptable in practising communities.

United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), the International Council of Nurses, the American Academy of Pediatrics and the Royal College of Obstetricians and Gynaecologists consider FGM to be universally unacceptable, as it is an infringement on the physical and psychosexual integrity of women and girls and is a form of violence against them (*191*).

3.7 Human rights, ethical and legal implications

The protection and promotion of human rights is integral to all aspects of HIV prevention, treatment, care and support. Expansion and initiation of male circumcision services must ensure that the procedure is carried out safely, under conditions of informed consent and without discrimination. With the exception of South Africa, where the 2005 Children's Act prohibits male circumcision for males aged under 16 years except for medical or religious reasons, most countries do not currently have laws dealing specifically with male circumcision. One exception is Israel, where several regulations of the Ministry of Health are in place to regulate and supervise male circumcision (*170*).

Any future expansion of male circumcision services needs to be considered within a legal, regulatory and policy framework to ensure accessibility, acceptability and quality of service provision. Guidelines on these issues have been published separately (*193*).

3.8 Summary

There is already some evidence of increased demand for male circumcision in southern Africa, and this is likely to increase further now that results from the Kenyan and Ugandan trials have confirmed those of the South African trial. Major concerns about increased uptake of male circumcision services are safety, acceptability and risk compensation. Recent studies of acceptability among non-circumcising communities with high incidence of HIV in southern Africa were fairly consistent in finding that a majority of men would be willing to be circumcised if it were done safely and at minimal cost. In addition, the large numbers of men recruited into the trials in non-circumcising communities in South Africa, Uganda and Kenya, and the increased demand for male circumcision in Swaziland and Zambia, suggest that uptake of circumcision could be rapid if there was confidence in provision of safe and affordable surgery. To date, there is modest evidence of risk compensation following adult male circumcision, and care must be taken to embed any male circumcision provision within existing HIV prevention packages that include intensive counselling on safer sex, particularly regarding reduction in number of concurrent sexual partners and correct and consistent use of male and female condoms. Further data, both from the recently completed trials and from observational studies of men pre- and post- elective circumcision, are needed.

SECTION 4. Conclusions

Male circumcision has been carried out for many thousands of years, and is likely to be the most common surgical procedure globally, with an estimated 30% of men circumcised. Promotion of male circumcision for medical benefit has always been controversial, largely due to the lack of evidence for a strong protective effect of male circumcision against common diseases. However, there is now conclusive evidence that male circumcision significantly reduces risk of HIV infection in men.

Demand for male circumcision has already increased in East and southern Africa, the region of the world with highest HIV incidence among the general population. When the procedure is carried out under correct conditions, the risk of adverse events among adult men (mainly bleeding, infection and swelling) are about 2%, and these are readily treatable. However, in this review we have highlighted the dangers associated with male circumcision when undertaken in unhygienic, ill-equipped settings by inexperienced providers. There is an urgent need to establish national policies to maximize the safety of male circumcision provision.

The demand for circumcision is likely to increase further given the results of the trials. Ensuring an adequate supply of trained providers adequately equipped to meet this demand will be challenging, but will also provide an opportunity. Sexually active young men in areas of high HIV prevalence are usually a population that is hard to reach. Provision of circumcision services, with the necessary repeated visits, counselling and focus on sexuality and hygiene, will provide a much-needed opportunity to engage these men in comprehensive HIV prevention counselling as well as other sexual and reproductive health matters.

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ISBN 978 92 4 159616 9

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