

Review

Evidence-based circumcision policy for Australia

Brian J. Morris^{1,*}, Athos Katelaris², Norman J. Blumenthal³, Mohamed Hajoona⁴,
Adrian C. Sheen⁵, Leslie Schrieber⁶, Eugenie R. Lumbers⁷, Alex D. Wodak⁸,
Phillip Katelaris⁹

¹School of Medical Sciences, University of Sydney, Sydney, NSW 2006, Australia

²Department of Urology, St George Hospital, Sydney, NSW 2217, Australia

³Department of Obstetrics and Gynaecology, SAN Clinic, Wahroonga, NSW 2076, Australia

⁴Victoria Circumcision Clinic, The Regent Medical Group, Preston, VIC 3072, Australia

⁵Mulgoa Medical Centre, Mulgoa, NSW 2745, Australia

⁶Department of Medicine, Royal North Shore Hospital, St Leonards, NSW 2065, Australia

⁷School of Biomedical Sciences and Pharmacy, University of Newcastle, Pregnancy and Reproduction Program, Hunter Medical Research Institute, New Lambton Heights; Priority Research Centre for Reproductive Sciences, University of Newcastle, Callaghan, NSW 2308, Australia

⁸St Vincent's Hospital, Australian Tobacco Harm Reduction Association and Australia21, Darlinghurst, NSW 2010, Australia

⁹Katelaris Urology, North Shore Private Hospital, St Leonards, NSW 2065, Australia

*Correspondence: brian.morris@sydney.edu.au (Brian J. Morris)

Submitted: 22 November 2021 Revised: 24 January 2022 Accepted: 9 February 2022 Published: 30 May 2022

Abstract

The aim was (1) to perform an up-to-date systematic review of the male circumcision (MC) literature and (2) to determine the number of adverse medical conditions prevented by early MC in Australia. Searches of PubMed using “circumcision” with 39 keywords and bibliography searches yielded 278 publications meeting our inclusion criteria. Early MC provides immediate and lifetime benefits, including protection against: urinary tract infections, phimosis, inflammatory skin conditions, inferior penile hygiene, candidiasis, various STIs, and penile and prostate cancer. In female partners MC reduces risk of STIs and cervical cancer. A risk-benefit analysis found benefits exceeded procedural risks, which are predominantly minor, by approximately 200 to 1. It was estimated that more than 1 in 2 uncircumcised males will experience an adverse foreskin-related medical condition over their lifetime. An increase in early MC in Australia to mid-1950s prevalence of 85% from the current level of 18.75% would avoid 77,000 cases of infections and other adverse medical conditions over the lifetime for each annual birth cohort. Survey data, physiological measurements, and the anatomical location of penile sensory receptors responsible for sexual sensation indicate that MC has no detrimental effect on sexual function, sensitivity or pleasure. US studies found that early infant MC is cost saving. Evidence-based reviews by the AAP and CDC support early MC as a desirable public health measure. Although MC can be performed at any age, early MC maximizes benefits and minimises procedural risks. Parents should routinely be provided with accurate, up-to-date evidence-based information in an unbiased manner early in a pregnancy so that they have time to weigh benefits and risks of early MC and make an informed decision should they have a son. Parental choice should be respected. A well-trained competent practitioner is essential and local anaesthesia should be routinely used. Third party coverage of costs is advocated.

Keywords: circumcision male; policy; urinary tract infection; sexually transmitted infections; inflammatory conditions; penile cancer; prostate cancer; sexual function; complications; risk benefit; cost benefit

1. Introduction

Circumcision of males (MC) involves removal of the foreskin. It has been practiced for thousands of years by diverse cultural groups globally [1]. In Victorian times medical circumcision became popular to prevent syphilis, phimosis, penile cancer and inferior hygiene [1]. In the 21st century it was approved for protection against HIV in epidemic settings [2–5]. MC is currently the world's most widely performed surgical procedure, prevalence globally being 37–39% [6]. In Australia, a 2010 telephone survey found that 33% of Australian men under 30 years of age were circumcised [7]. Recent data show a reduction in early MC prevalence from a peak of 85% in the 1950s to 18.75% in 2019 [8]. In the US, Centers for Disease Control and Prevention

(CDC) estimates show an increasing trend in MC prevalence to 92% in white, 76% in black and 44% of Hispanic males aged 14–59 years [9].

Evidence-based reviews of MC were published by the American Academy of Pediatrics (AAP) in 2012 [10,11], the CDC in 2018 [12,13], and the Circumcision Academy of Australia in 2012 [14]. (See **Supplementary Material 1** for summaries of available circumcision policy statements.) The aim of the present study was to conduct a systematic review of the literature and use this to develop an up-to-date MC policy tailored to the setting of Australia. Data for Australia were used when possible, otherwise information was from mostly from the comparable setting of the US, which is the richest data source.



2. Literature searches

Articles were retrieved from PubMed using the keyword "circumcision" together with one of 39 other relevant keywords (**Supplementary Material 2**), leading to 253 that were included. Additional publications (10 articles and 15 Internet publications) were identified in bibliographies of these. In total 278 publications meeting the inclusion criteria were obtained. Particular priority was given to randomized controlled trials, systematic reviews and meta-analyses. Studies were rated Level 1+, 1++, 1-, 2++, 2+, 2- and 3 by the Scottish Intercollegiate Guidelines Network (SIGN) system [15] (**Supplementary Material 3**).

3. Phimosis

In newborn males the inner surface of the foreskin adheres lightly to the underlying glans making foreskin retraction difficult, a condition termed phimosis [16]. During childhood the foreskin gradually separates from the glans. By age five most boys are able to retract their foreskin partially, with some adhesions usually remaining. By puberty full retraction is generally possible [17]. Forceable retraction can be painful, and could injure the foreskin, leading to scarring and persistence of the phimosis [16]. Gentle manipulation during bathing is helpful.

A recent systematic review of phimosis prevalence at all ages found that the condition remained in 3.4% (range 0.5–13%) of uncircumcised males aged ≥ 18 years [18] (SIGN rating: Level 2++). Phimosis can result in pain, especially during erections, sexual dysfunction, increased risk of penile inflammatory conditions such as balanitis and penile cancer. Lichen sclerosus (next section) is usually accompanied by secondary phimosis. Steroid creams can be used [16], but are not always successful (see below), and circumcision is the definitive option [16] (Level 2+). Paraphimosis is an even more serious condition and involves failure of the foreskin to return after retraction. Constriction of the the glans leads to oedema, and in some cases ischaemia with a risk of progression to gangrene. Paraphimosis is a urological emergency which may require immediate surgery, particularly if not detected in a timely fashion. Adolescent and young adult males may not know that they have phimosis and could suffer in silence.

4. Penile inflammation

The most common forms are balanitis and balanoposthitis that affect the glans penis and foreskin of uncircumcised boys [19]. In a meta-analysis, reported prevalence was 68% lower in uncircumcised males [20] (Level 1+). Circumcision was a common treatment for penile inflammation (as well as phimosis), but in recent years steroid creams have become more common [19,21] (Level 1+). A recent meta-analysis of the devastating penile inflammatory condition lichen sclerosus (old term: balanitis xerotica obliterans) in boys aged 1 month to 15 years, found

that steroid treatment for an average of 4 months (range 6 weeks to 5 years) avoided circumcision in just 35% of cases [21] (Level 1+). A commitment to regular application is required, which may limit compliance to prescribed treatment protocols, and there is a risk of side effects from long-term usage. In contrast, circumcision is ~100% effective and protection is lifelong [22].

5. Candidiasis

In a large Australian survey, this fungal infection of the penis (commonly known in Australia as thrush), was reported by 7.7% of uncircumcised vs. 4.9% of circumcised men [7] (Level 2+). In boys of mean age 6.4 years (range 8 months to 18 years), prevalence was 18% in those who were circumcised vs. 44% in the uncircumcised [23]. Of interest, cases of phimosis, balanitis and candidiasis can occur in isolation or simultaneously.

6. Urinary tract infections

Urinary tract infection (UTI) is more common among uncircumcised boys, especially those with underlying renal tract anomalies [16,24–26]. UTIs are common in infancy and often present with the infant febrile, distressed and in pain. In infancy, the prevalence of febrile UTIs is highest (8.7%) in those aged < 3 months, 3.3% in those aged 3–6 months and 1.7% in the 6–12 month old age group [16,27]. Pediatric UTI can lead to significant short and long term morbidity [28]. The younger the infant, the higher the likelihood of progression to sepsis, and greater risk of fatality [29]. A survey in Sydney, Australia, found that by age 7 years, 2.1% of boys have had at least one UTI and another 4.8% have probably had one [30]. The fact that the infant kidney is still growing means greater susceptibility to renal injury and scarring [31,32], so exposing half to serious, life-threatening conditions later in life [33].

The acute febrile illness results in 25% of boys with UTI being hospitalised and receiving a period of parenteral antibiotics [34,35]. Older children are more likely to be able to be managed with oral antibiotics on an outpatient basis. Oral administration in infants is difficult and absorption is low, requiring hospitalisation to enable intravenous antibiotic administration [36,37]. Emergence of resistance to most or all antibiotics, including methicillin, will make treatment of UTI more challenging [38,39]. Maternal antibiotic use during pregnancy also increases the risk of resistant pathogens during neonatal UTI [40].

Pyelonephritis develops in ~80% of febrile infants and young boys diagnosed with UTI [41,42]. In the US ~20,000 annual cases of acute pyelonephritis in infancy were prevented by MC [43]. Pyelonephritis leads to renal scarring in 36–52% of cases [41,44]. Nuclear imaging studies have confirmed that renal scarring occurs following pyelonephritis even in the absence of vesicoureteric reflux (VUR) [45]. In boys without VUR, ~36% have recurrent UTI [46]. The reason is that the aetiology of renal scarring

from pyelonephritis is parenchymal infection and inflammation rather than VUR [44,45]. Permanent kidney damage is seen in 10–15% of boys with high grade VUR [47].

There are strong biological reasons why MC can prevent UTI [16] (Level 2+). Concentration of uropathogenic organisms near the urethral meatus is much higher in uncircumcised male infants than circumcised male infants in the highest risk period of 6 months post-birth [48]. The bacteria adhere to the foreskin's mucosal surface and readily colonize it [49]. Since uropathogens are substantially lower by 3 weeks after circumcision of boys, it was suggested that by removing the foreskin MC eliminates the haven for organisms responsible for ascending UTI by changing it into an external skin surface [50–52]. For boys with hydronephrosis, MC is strongly recommended [53,54].

A systematic review and meta-analysis that included data for 296,837 circumcised and 111,065 uncircumcised males (from 1 randomized controlled trial, 6 cohort studies, 11 case-control studies, 2 cross-sectional studies, 1 retrospective cross-sectional study and 1 retrospective analysis) found that for uncircumcised vs. circumcised boys, relative risk (RR) of UTI was 9.91-fold higher for age 0–1 year, 6.56-fold higher for age 1–16 years, and 3.41-fold higher for males aged over 16 years of age [55] (Level 1++). It calculated that, over the lifetime, 32.1% of uncircumcised males vs. 8.8% circumcised males develop UTI (RR = 3.65). Value for number needed to treat (NNT) was 4.29. Data from bag specimens or clean-catch urine samples were similar to those for studies in which most samples were from suprapubic aspiration or bladder catheterization. Risk reduction from being circumcised was, in older meta-analyses, 10–12 fold in infants [27,56] (Level 2++), and 8-fold in a study combining infants and older males [57] (Level 2–). The latter reported a cumulative incidence of UTI of 1.1% in uncircumcised infant boys [57]. In boys aged under 5 years of age in Western Sydney, UTI was diagnosed in 6% of those uncircumcised and 1% (n = 2) of the circumcised [58]. Prevalence by age 2 years was 2.2% in a Swedish study [59] and was 3.6% to age 16 in a UK study [60]. Recurrence of UTI was seen in 35% of boys diagnosed with UTI in the first year of life [57]. Most (up to 12%) of recurrence occurs after the age of 12 months. Boys with more than 2 recurrent UTIs often have urinary tract abnormalities. For those with high grade VUR, NNT by circumcision is low [57] (Level 2+). In uncircumcised boys with recurrent UTI MC should be advised for treatment. A past chair of the AAP Task Force on infant MC strongly recommended early MC to avoid risk of renal damage in immature kidneys and of VUR from pyelonephritis [29]. He compared postponing MC to postponing vaccinations. The level of protection that newborn MC affords against UTIs is comparable to that of many vaccines given to children to prevent other infections and diseases [61], an example being vaccination against influenza [62,63].

7. Sexually transmitted infections

7.1 *Human immunodeficiency virus (HIV)*

Randomized controlled trials (RCTs) in Africa found MC was protective against HIV transmission from infected women [64–66] (Level 1++). Overall efficacy was ~60% [67]. A Cochrane committee meta-analysis found high consistency of the trial results [68] (Level 1++). The World Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) then recommended adoption of voluntary medical MC (VMMC) for reduction in HIV prevalence in epidemic settings in Africa [2,3] (Level 1+). Roll-out has resulted in over 20 million procedures in high-priority African countries [4], and has reduced HIV infections by up to 50% [5]. Levels of protection found in recent meta-analyses were 70% [69] and 72% [70] (Level 1++). Meta-analyses found risk compensation after VMMC, such as not using condoms, was negligible [71] (Level 1++).

The CDC [72,73] has endorsed MC as a means of protection against HIV during heterosexual intercourse, as confirmed in US studies [74,75] (Level 2+). In the US most men are circumcised in infancy. In the Netherlands and France, where MC prevalence is low, but sexual behaviour indices are comparable, heterosexually-acquired HIV diagnoses were 6 times higher in men and 10 times higher in women than in Israel, where infant MC prevalence is very high [76]. A systematic review of contrary arguments by MC opponents found their statements misrepresent good studies, selectively cite references containing fallacious information, draw erroneous conclusions, and are contradicted by evidence from high-quality studies [77,78] (Level 2++). The late David Cooper, when director of the Kirby Institute at UNSW, argued in favour of infant MC for HIV prevention in Australia [79]. Similarly, the Canadian Urological Association states that circumcision “is one of several partially effective risk-reduction alternatives for heterosexual men that should be used in combination with other measures” [16].

The biology of the foreskin makes it vulnerable to HIV infection [80–85]. Inflammatory conditions and ulcerative STIs increase risk [86–90], as do coital injuries, which uncircumcised men are prone to [91–93], and risk is higher when foreskin size is large [94]. Some protection against low levels of HIV is afforded by langerin, which is produced by the inner foreskin mucosal epithelium [95]. Langerin becomes overwhelmed, however, at high HIV loads [95,96].

7.2 *Human papillomavirus (HPV)*

HPV prevalence in developed countries is ~75% [16]. High-risk (oncogenic) HPV genotypes mostly infect the foreskin and underlying glans [97]. Meta-analyses found MC to be associated with 32–65% reduction in genital HPV prevalence [98–100] (Level 1+). Reduction averaged 40% in data from the African RCTs [101–106] (Level 1+). In one

of these studies, flat penile lesions (an indicator of high-risk HPV) were 98% less common in circumcised men [101] (Level 1+). A study involving 1913 couples in 5 European, Asian and South American settings found penile HPV prevalence of 5.5% in circumcised and 19.6% in uncircumcised men [107] (Level 2++). After adjustment for potential confounding factors, HPV infection risk in circumcised men was 63% lower than in uncircumcised men. A large survey in the UK found 86% lower prevalence of high-risk HPV genotypes in circumcised men [108]. Low-risk HPV genotypes responsible for genital warts infect the anogenital region more broadly and therefore MC is less effective in prevention of these genotypes [97]. In a RCT, duration of infection of the glans/coronal sulcus by high-risk HPV was shorter for circumcised men [109] (Level 1+), but circumcision status did not affect duration of infection in the penile shaft, scrotum or all genital sites combined. Thus, clearance is greatest in the glans, the area of the penis exposed by circumcision. In confirmation, a US study found 2.7-fold greater likelihood of clearance of any HPV infection, a 3.2-fold increased clearance of oncogenic HPV infection, but no difference in clearance of non-oncogenic HPV infection in circumcised vs. uncircumcised men [110] (Level 2++). Men with phimosis have higher prevalence of HPV infection of their foreskin [111].

7.3 Other STIs

Genital herpes simplex virus-2 (HSV-2) prevalence was 45%, 30%, and 28% lower in circumcised men in the RCTs in Uganda, South Africa and Kenya, respectively [86, 112–115]. Protection was ~50% against *Trichomonas vaginalis* [116], ~40% against *Mycoplasma genitalium* [117], 33–50% against *Treponema pallidum* (syphilis) [118–120], ~50% against chancroid [118], and ~50% against genital ulcer disease [86,121,122], as found in RCTs (Level 1++) and observational studies (Level 2++ and 2+). Data from a RCT noted that MC reduces total prevalence and load of anaerobic bacteria as well as microbiota biodiversity [123]. RCT data [124] (Level 1+) and a meta-analysis [125] (Level 1+) found that MC does not protect men against sexually transmitted urethritis (gonorrhoea, chlamydia and nonspecific urethritis). For more on the role of MC in protection against STIs in men see reviews [126–129].

7.4 STIs in women

Recent systematic reviews of RCTs and numerous observational studies found that MC was associated with reduced risk of infection by HSV-2, chlamydia, syphilis, high- and low-risk HPV genotypes, genital warts, *Mycoplasma genitalium*, candidiasis, dysuria, and possibly bacterial vaginosis, HIV, non-specific genital ulcers, trichomoniasis and vaginal discharge [130,131] (see also an editorial [132]). HIV prevalence in South African women who only had circumcised male partners was significantly lower by 78% [133]. Meta-analyses of all studies, how-

ever, found non-significantly lower HIV risk reduction of 20% [134] and 32% [69]. In one trial, disobeying medical advice to abstain from sexual intercourse for 6 weeks after MC was responsible for slightly higher HIV infection in female partners [135].

7.5 STIs in men who have sex with men (MSM)

A recent study from Melbourne, noted a reduction of barrier contraception use and an increase in casual sex, HIV, syphilis and gonorrhoea over the past decade in MSM [136]. For MSM who adopt the insertive role during anal intercourse, a Cochrane meta-analysis found MC was associated with 73% lower HIV infection risk [137]. As expected, for men who adopt the receptive role there was no significant protection. Another meta-analysis found MC was associated with a significant 23% reduction in overall risk of HIV infection [138]. The findings led to a call for action [139]. Each of these studies noted the highly significant 89% risk reduction amongst circumcised insertive MSM in Sydney [140].

For HPV, MC afforded 57% protection against the most common genotype, HPV16, in MSM who practiced predominantly insertive anal intercourse, but there was no protection in the receptive partner [141]. HIV-infected MSM who were circumcised had 29% lower HPV in a 2019 meta-analysis [138] (Level 1+). HSV-2 infection was found to be 16% lower in circumcised MSM overall in this meta-analysis. In Sydney, a 65% lower prevalence of incident syphilis, was found amongst circumcised MSM and was 90% lower in the one-third who engaged predominantly in insertive anal intercourse [142] (Level 2+). The finding for incident but not prevalent syphilis in that study was because MSM who initiated sexual activity during the late 1980s and 1990s when syphilis prevalence was low would have been at very low risk of acquiring syphilis irrespective of their MC status, whereas only since 2001 has syphilis seen a re-emergence amongst Australian MSM [142].

It has been emphasized that bisexual men pose a particular risk for STI transmission to women [136,140].

7.6 Condoms

Condoms provide 80% [143] to 71–77% [144] protection against HIV infection, but only if used consistently and correctly [143,145]. Condoms may break or slip off. A Cochrane systematic review and meta-analysis of RCTs of condom use (2 in the US, one in England and 4 in Africa) found, “little clinical evidence of effectiveness” and no, “favourable results” for HIV prevention [146]. Condoms were, however, 42% effective in prevention of syphilis [146].

It should be noted, moreover, that condoms must be used at each sexual encounter, whereas MC is a one-off procedure that is always in place. MC and condom use each provide a reasonable degree of protection against STIs. When both are in place protection is higher [77]. Vacci-

nation too can be compared with behavioural and barrier protections against infectious agents, but the only STI for which a vaccine offering reasonable, but not complete, protection is directed at common anogenital HPV genotypes. HPV vaccination is available early in high school, with parent approval required.

8. Genital cancers

8.1 Penile cancer

Cancer of the penis has a lifetime risk in uncircumcised men of ~1 in 1000 [147], making it uncommon, but not rare. It is rare in circumcised men, prevalence being 0.00008–0.02 in 1,000 [148,149]. Consistent with a role for MC in prevention, annual incidence was highest in England and Wales (1.44 per 100,000), lower in Australia (0.80 per 100,000) and lowest in the US (0.66 per 100,000) [150], commensurate with MC prevalence in each country. A study in California found risk was 22-fold higher in uncircumcised men [151]. The disease is debilitating. It results in substantial functional impairment and devastating psychological effects [152,153]. Recurrence is 28% following penile preserving therapies and 5-year mortality is 90%, whereas recurrence is 5.3% after ablation of all or part of the penis [152].

Factors associated with increased risk of penile cancer were shown in meta-analyses to include phimosis (12.1-fold), balanitis (3.8-fold) and smegma (3.0-fold) [154] (Level 1+). Another meta-analysis found an average of 47% of penile cancers contain high-risk HPV genotypes [98] (Level 1+). Genital warts, smoking, STI history, extramarital relationships, multiple sexual partners, inferior genital hygiene, previous genital conditions, protracted penile rash, and penile tear are also risk factors. If the quadrivalent HPV vaccine was fully implemented in the target population of boys early in high school, population prevalence of the most common oncogenic HPV genotypes (16 and 18) could be reduced by ~70%. Consequently, HPV vaccination could reduce penile cancer prevalence by $47 \times 0.7 = 33\%$ [155]. Vaccines are ineffective for non-HPV related causes [156]. The overall level of effectiveness of vaccination is similar to effectiveness of MC found in a meta-analysis [100] and RCTs [101–106].

8.2 Prostate cancer

Lifetime risk of prostate cancer is $\geq 10\%$. One in 6 men in Australia are at risk of developing the condition by the age of 85 years [157], making it the most common male cancer. In 2020 there were 17,000 new cases and 3200 deaths, representing 12% of cancer deaths in Australian males [157]. Globally, there is an inverse correlation between prostate cancer incidence and MC prevalence [158] (Level 2++). After correction for potential confounding factors, countries with high MC prevalence have lower prostate cancer-related mortality, which is a harder endpoint than prevalence [159]. Meta-analyses found prostate

cancer risk is ~10% lower in circumcised men [160–162] (Level 1+). Risk reduction was 12% lower ($p = 0.01$) in the post-PSA testing era, 16% lower in population-based studies ($p = 0.05$), 17% lower in studies that collected data by personal interview ($p = 0.03$), 41% lower in studies of black race ($p = 0.02$) [160] (36% in US [163] and 60% in Canadian [164] studies), and 16% lower for more aggressive prostate cancer ($p = 0.02$) [161]. Thus, risk reduction associated with MC is on a par with other factors associated with reduced risk of prostate cancer [165,166].

8.3 Cervical cancer in women

Oncogenic HPV genotypes are responsible for 99% of cervical cancers. Since women may have a history of circumcised and uncircumcised sexual partners, a large multinational study focused on women who had had only one sexual partner. Monogamous women whose male partner had a high sexual-behaviour risk index (≥ 6 sexual partners and first intercourse prior to 17 years of age; $n = 1420$) were 82% less likely to have had a cervical cancer diagnosis if their male partner was circumcised [107] (Level 2++). Monogamous women whose male partner had an intermediate risk index and was circumcised were 50% less likely to be diagnosed with cervical cancer than if their male partner was uncircumcised. Cervical cancer incidence was 35 per 100,000 women per year in 51 countries in which MC prevalence was low ($< 20\%$) but was 20 per 100,000 in 52 countries with high ($> 80\%$) MC prevalence ($p < 0.001$) [167]. The study examined many factors and being uncircumcised was the strongest risk factor for cervical cancer. In Israel, low cervical cancer prevalence compared with the 11.7% global prevalence [168] was attributed in part to MC [169]. In Kuwait, where males are circumcised prior to puberty, HPV prevalence is 2.3%, one of the lowest in the world [170]. In a Danish study, the 5-fold lower HPV prevalence in circumcised men was implicated in lower cervical cancer prevalence in their female partners [171]. Women in Myanmar with circumcised husbands had significantly lower cervical cancer prevalence [172]. In Seoul, South Korea, 53% lower risk of invasive cervical cancer was seen in women with circumcised male sexual partners [173]. Amongst 3261 women in Spain, HPV infection risk was 40% lower in those with ≥ 2 lifetime sexual partners who were circumcised [174]. There were similar HPV findings in Ghana [175] and in a Nigerian study, which also found a 14-fold difference in cytological abnormalities (5% vs. 63%) in women with a circumcised vs. uncircumcised male partner [176].

A meta-analysis of 2 studies in Australia, 5 in the US, 2 in Mexico, and one each in South Korea, Denmark, England, Kenya and the multinational study in Brazil, Colombia, Spain, Thailand and The Philippines [107] found cervical cancer to be less common in women whose male partner was circumcised (OR = 0.75 overall, and 0.18 for those whose husband had a high sexual behaviour risk index)

[177] (Level 1+). (See also systematic reviews [130,131]).

Vaccination against up to 9 anogenital HPV genotypes early in high school should help reduce cervical cancer. But vaccines are not directed at all of the >14 mucosotropic HPV genotypes. Overall vaccine uptake in the 10–20 year old age group in high income countries is only 33.6% [178]. In Australia, however, full vaccination by age 15 was 78.6% in girls and 72.9% in boys [179]. Ideally, if vaccine coverage in school children were universal and if the nonavalent HPV vaccine were effective, total HPV infections could be reduced by 93%. A systematic review of HPV vaccination experience revealed effectiveness was suboptimal (see Fig. 3C of that publication) [180]. In Australia, HPV 6, 11, 16 and 18 targeted by the quadrivalent vaccine were reduced by 86% (not 100%) [180]. While prevalence of high-risk HPV 16 and 18 has declined, replacement by HPV genotypes not included in vaccines used has been seen [181].

While HPV vaccination against a subset of HPV genotypes in early adolescence should help mitigate cervical cancer risk, uptake is not widespread in all settings and durability of effectiveness is not assured. Adoption of multiple effective preventive measures is usual for public health recommendations. Thus, early MC plus vaccination should have a greater impact than vaccination or MC alone. More accurate screening by the advent of PCR-based detection of HPV [182,183] should further reduce cervical cancer prevalence.

9. Trends

A 2021 study of Medical Benefits Scheme (MBS) claims found that early MC in Australia declined from a peak of ~85% in the 1950s to 18.75% in 2019 [8]. The authors concluded that “Medical and surgical authorities may have played an important role in the gradual reduction of procedures over the last decade”. In particular, negative policies instituted in the 1970s following the appointment of paediatricians from the UK to Chairs of pediatrics contributed to these [184]. In the UK, MC is a “mark” of the upper classes. An overall decline in early MC of boys in the UK occurred after 1949 following the withdrawal of coverage by the National Health Service (NHS).

A study examining the US Pediatric Health Information System database of MC prevalence at different ages in US hospitals found an increase in the rate of neonatal MC ensued in response to the AAP’s 2012 affirmative policy in which a literature review led the AAP to conclude that the benefits of MC during the neonatal period outweigh the risks and recommended various means to increase rates, partly because “circumcision during the birth hospitalization in the neonatal period is more resource-effective than postponing until later in infancy” [185]. In the US, up until 2012 there had been a downturn in neonatal MC prevalence. This was attributed to weak paediatric policy statements prior to 2012, increased immigration from countries, particularly Hispanic, in which MC is uncommon, a dimi-

niton in access and affordability owing to non-coverage in some states by Medicaid, and lobbying by MC opponents [186].

10. Sexual function and pleasure

RCT findings [187,188] (Level 1+), a large UK survey [189] (Level 2++), 4 systematic reviews [190–193] (Level 2++) and 2 Meta-analyses [191,192] (Level 1+) showed that MC has no adverse effect on sexual function, penile sensitivity, nor sexual sensation, arousal, or pleasure. The most recent meta-analysis found 64% of circumcised vs. uncircumcised men experienced less pain during intercourse, 28% had lower ejaculation latency time, and 58% had less erectile dysfunction [192]. An Australian study found sexual experience in homosexual men circumcised early was unaffected [194] (Level 2++). However, homosexual men circumcised later in life for medical reasons were more likely to report sexual problems. A systematic review critically comparing high quality evidence with evidence of sexual harms from infant MC strongly favoured the former over the latter [78] (Level 2++). A study involving only men who believed their sex life had been diminished by their early MC [195] (Level 2–) was critically evaluated and shown to be flawed owing to recruitment bias, none of the self-selected participants claimed problems having been confirmed by a medical practitioner, “loaded” and subjective questions and exaggerated responses, “cherry-picked” information that contradicted high-quality evidence, and confirmation bias [196].

Quantitative sensory testing found no difference in penile sensitivity between circumcised and uncircumcised men [197]. Using thermal imaging, another study found basal temperature of the penis of circumcised men was higher, and in response to an erotic video, temperature during erection more rapidly reached the same plateau as uncircumcised men, and a greater proportion of circumcised men reported being sexually aroused whereas a greater proportion of uncircumcised men reported being unaffected [198] (Level 2+). Such methods, moreover, revealed the foreskin is not involved in sexual sensitivity, sensation or pleasure [198,199] (Level 2++). The neuroreceptors responsible are genital corpuscles located in the glans and underside of the distal shaft, thus further ruling out the foreskin as a location of pleasure response [200] (Level 2++). Tugging the foreskin could, via the frenulum, stimulate genital corpuscles in the shaft. Less pain and better erectile function in circumcised men were found in a large Australian survey [201].

Women’s experiences of circumcised vs. uncircumcised male sexual partners were found in systematic reviews to favour the circumcised penis [202,203] (Level 2++). The reasons were esthetics, ease of vaginal penetration, less dyspareunia, better hygiene, and reduced risk of infection [202,203].

11. Benefit to risk ratio

Considering data relevant to an Australian context, a risk-benefit analysis found that based on data for level of protection and prevalence of conditions for which early MC provides protection and the frequency of procedural complications benefits were calculated to exceed risk by approximately 200 to 1 (Table 1, Ref. [7,15,18,20,55,70,98,112–118,121,122,151,162,190,191,200,204–211]). Furthermore, over their lifetime an estimated 80% of uncircumcised males would likely suffer an adverse medical condition attributable to their foreskin.

12. Procedures used for neonatal circumcision

The Plastibell, Gomco and Mogen devices are commonly used for neonatal MC, the Plastibell being particularly common in Australia. For a detailed description of the technique involved in each of these see: [212]. Circumcision should be indicated for most male neonates. The practitioner needs to be aware, however, that there are several contraindications (Table 2).

13. Adverse procedural events

Risk of an adverse event from MC is $\leq 0.5\%$ during infancy [11,16,207,208,213]. Most adverse events are minor, and can be immediately and easily treated, with complete resolution, but some very rare complications can be severe [16]. In older boys and men complications are 10–20 times higher [207,208] (Level 2++). Traditional/ritual MC presents a higher risk than medical MC by a competent practitioner [214]. Provider training is essential to reduce risk of complications [215]. A New Zealand birth cohort study found neonatally circumcised males followed from infancy had fewer penile problems than the uncircumcised [216], and no differences in breastfeeding outcomes, health in infancy nor cognitive ability in later childhood [217] (Level 2++). US findings were similar [218,219].

Risk of post-MC meatal stenosis was low (0.66%) in a recent Meta-analysis [220] (Level 1++). Its diagnosis by visual inspection is subjective, leading to over-estimation of prevalence. Most cases were asymptomatic with no obstructive uropathy. An appearance of meatal stenosis at age 3–8 years in boys circumcised neonatally may be an illusion arising from a ventral “meatal web” [221] (Level 2+). Monitoring for meatal stenosis onset by repeated visual inspection found that most cases developed on average 2–4 weeks after neonatal MC and 95% were asymptomatic [222] (Level 2+). This challenges the idea that meatal stenosis is a long-term complication of MC. Diagnosis should only be made on the basis of urine flow rate, evidence of urinary tract blockage, or testing of kidney function.

Meatal examination in the circumcised male is trivial. In uncircumcised infants only 54% had a visible meatus [17], as did 47% of uncircumcised boys aged <3 years

[223]. The reason is because non-retractile foreskins are common [224], so impeding visual inspection. Data from a Danish study of meatal stenosis [225] (Level 2+), when examined in detail by others, revealed overall prevalence of 0.12% in uncircumcised males and 0.099% in circumcised males [226]. Prevalence of meatal stenosis increases with age, a major cause being from penile inflammation secondary to lichen sclerosis, a condition much more common in uncircumcised than in circumcised males [19], as was apparent in the Danish study [226].

14. Anaesthesia

Circumcision must be performed using adequate anaesthesia and analgesia [16]. For a comprehensive review see [16]. Local anaesthesia is recommended for neonatal MC. After the infant becomes mobile general anaesthesia may be required.

Boys circumcised neonatally without anaesthetic exhibited greater pain and crying response during routine immunisation at age 4–6 months compared with uncircumcised boys and boys who had received topical anaesthesia during their circumcision [227,228] (Level 2+). A systematic review found there was little effect on breastfeeding or cognitive ability, and that low quality studies reporting associations with sudden infant death syndrome, autism, alexithymia, impaired sexual experience and socio-affective processing contained flaws in study design, statistical analysis, sample size and other factors rendering them unreliable [78] (Level 2++).

The AAP and Canadian Paediatric Society issued joint guidelines in 2000 for prevention and management of pain and stress in the neonate [229] (Level 2++). Anaesthetic techniques were reviewed in the AAP’s 2012 policy statement [11]. Topical administration of eutectic mixture of local anaesthetics (EMLA 5%, an emulsion containing 2.5% lidocaine and 2.5% prilocaine), when applied 60 to 80 minutes before the procedure, was superior to placebo in attenuating MC pain measured by heart rate, oxygen saturation, facial responses, as well as period and characteristics of crying [230,231] (Level 2+). LMX4 lidocaine 4% is a more recent local anaesthetic cream. Methods more effective than topical creams include dorsal penile nerve block (DPNB) and subcutaneous ring block [232,233] (Level 1+). Each require training in application and avoidance of complications [234–236]. In its 2012 policy review, the AAP [11] referred to a landmark ultrasound guided technique developed by Sydney paediatric anaesthetists for correct needle placement during DPNB in children under general anaesthesia [235,237]. This resulted in lower pain scores in the first postoperative hour and a longer interval should rescue analgesia be required. When the infant is younger than 6 months, general anaesthesia for MC should be avoided [238]. General anaesthesia has inherent risks, albeit low. Local anaesthesia is much cheaper, especially as it does not require the services of an anaesthetist [239]. Another

Table 1. Risk-benefit analysis for newborn male circumcision in Australia.

(A) Medical conditions, risk reduction and number of cases prevented					
Condition	Decrease in risk ^a	Approximate % affected ^b	Study type [Ref]	Quality score ^c	Approximate number of cases
Urinary tract infections (lifetime)	72%	27	Meta-analysis [55]	1+	30,300
Phimosis persistence at age ≥ 18 years	97%	3	Systematic review [18]	2+	3400
Balanitis	68%	10	Meta-analysis [20]	1+	11,000
Candidiasis (thrush)	60%	10	Original study [7]	2+	11,000
High-risk HPV infection	60%	10	Meta-analysis [98]	1++	11,000
HIV (acquired heterosexually)	72%	0.1	Meta-analysis [70]	1++	100
Genital ulcer disease	50%	1	Original study [121,122,204]	2+	1100
Syphilis	47%	1	Meta-analysis [118]	1+	1100
Trichomonas vaginalis	50%	1	RCT [116]	1+	1100
Mycoplasma genitalium	40%	0.5	RCT [117]	1+	500
Herpes simplex virus type 2	30%	4	RCTs [112–115]	1++	4500
Chancroid	50%	1	Meta [118]	1+	1000
Penile cancer (lifetime)	95%	0.1	Original study [151,205,206]	2+	100
Prostate cancer: population-based	10%	2.1	Meta-analysis [162]	1+	1100
Totals		80	–	–	77,300
Total percentage of uncircumcised males affected = approximately 80%					
(B) Risks posed by infant MC and percent affected					
Condition	–	Approximate % affected	Study type [Ref]	Quality score	–
Excessive minor bleeding	–	0.1–0.2	Original study [207,208]	2++	–
Infection, local	–	0.06	Original study [207,208]	2++	–
Infection, systemic	–	0.03	Original study [208]	2++	–
Need for repeat surgery	–	0.08	Original study [208]	2++	–
Meatal stenosis	–	0.007	Original study [208–211]	2++	–
Partial loss of penis	–	0.0002	Original study [208]	2++	–
Death	–	<0.000001	Original study [206]	2++	–
Reduced penile function, sensitivity, sexual pleasure	–	0	Systematic review [190,191,200]	2++	–
Reduced penile function	–	0	Meta-analysis [191]	1+	–

Risk:benefit

Thus, over the lifetime, the risk to an uncircumcised male of developing a foreskin-related condition requiring medical attention may be up to 80%. In comparison the procedural risk during infant MC of experiencing an easily treatable condition is approximately 1 in 250. The risk of a moderate or serious complication is approximately 1 in 3000. Thus benefit to risk = 1:200.

^aBased on data for circumcised vs. uncircumcised males.

^bThe percentage of males who will be affected as a result of the single risk factor of retention of the foreskin. Data for STIs were estimated after taking into account the external factor of heterosexual exposure, which is dependent on population prevalence of each STI in Australia and risk reduction conferred by MC.

^cQuality rating was based on an international grading system [15] (**Supplementary Material 3**). Rating was 1++ or 1+ for well-conducted meta-analysis and RCTs, was 2++ for well-conducted systematic reviews, and was 2++ or 2+ for the original studies cited.

Table 2. Contraindications to infant circumcision.*

Anatomical
(1) Congenital abnormality of penile curvature (cordee).
(2) Concealed or buried penis, including from large suprapubic fat pad.
(3) Congenital megaprepuce. This is a specific form of buried penis characterized by extensive redundancy and ballooning of the inner foreskin as a result of foreskin stenosis and phimosis, resulting in voiding difficulties.
(4) Micropenis.
(5) Epispadias. This is a rare congenital abnormality in which the urethra opens on the upper surface of the penis rather than the distal end. The space between the opening and the tip of the penis has the appearance of a gutter.
(6) Hypospadias. This condition involves the urethra opening on the ventral shaft rather than the tip, causing downward curvature of the penis and spraying of urine during urination.
(7) Penile torsion. This presents as a rotation of the penis or a corkscrew-like appearance of the penis and affects approximately 1 in 80 male neonates. It is mostly seen in uncircumcised boys.
(8) Penoscrotal webbing in when the skin of the scrotum is attached to the underside of the shaft. Apart from abnormal cosmetic appearance it does not cause functional problems.
(9) Posthitis: substantial inflammation of the penis or foreskin presenting as a red, tender, sensitive rash and oedema.
Medical
(1) Unstable or premature infant admitted to the neonatal ICU.
(2) Neonatal age less than 12 hours.
(3) Bleeding diathesis, an unusual susceptibility to haemorrhage, mostly due to hypocoagulability.
(4) Current illness.
(5) Jaundice.
(6) Vitamin K not yet administered or parental refusal.

*See **Supplementary Material 4** for glossary of terms used.

technique is caudal epidural block, which can be used during MC of older children [240] (Level 1+).

The 2012 AAP policy statement mentioned the possible risk of methaemoglobinemia with lidocaine-prilocaine [11], but noted that when methaemoglobin has been measured after lidocaine-prilocaine application, the level, although elevated, was not clinically significant [231]. The AAP nevertheless noted isolated case reports of clinically significant methaemoglobinemia, but those involved prolonged application time or its use in premature infants [11].

15. Cost benefit

The reasons for the decline in early MC in the US has included cessation of Medicaid coverage for the procedure in 18 States. Any such decline was deemed, in the long-term, to result in substantially higher costs because of: (1) the need for more expensive MC to treat medical conditions that could have been prevented had MC been performed shortly after birth [75,241–244], (2) the fact that later MC is associated with a 10–20 fold higher risk of complications [208], and (3) treatment required for the wide array of adverse medical conditions that would have likely been prevented or reduced in frequency had the boy been circumcised early [75,155,241–246]. It was estimated by researchers at Johns Hopkins University that if MC declined from the high US levels to a level of 10%, direct costs for treatment of UTIs and STIs would rise to US\$4.4 billion for 10 annual birth cohorts [241] (Level 2++). The increase in expenditure was said to be on average US\$313 per foregone

MC. Indirect costs for just HIV may be more than 4 times the direct medical costs [247]. The CDC reported that in the US MC was cost-saving for HIV prevention in black and Hispanic males in whom HIV prevalence is highest [75]. If one took into account the other conditions prevented by MC, direct and indirect costs would be even higher. For prostate cancer, without MC there would be 24–40% more cases in the US and US\$0.8–1.1 billion extra in costs for treatment and terminal care per year [165].

Several US states do not provide Medicaid coverage for elective MC, so making MC unaffordable for poor families. As a result, the decrease in infant MC in the poor has resulted in over 100 additional HIV cases and US\$30M in medical treatment costs annually [242]. The MC cost in the birth cohort was US\$4,856,000, which was found to be 6% of the cost just for treatment of HIV. In Louisiana [243] and Florida [244], cost savings initially generated by not allowing Medicaid to cover elective infant MC were mitigated by increases in rate and expense of medically indicated MC required later to treat various conditions. Since the Louisiana study only considered costs of later MC of boys aged 0–5 years, lifetime costs would likely be far greater, impacting healthcare systems. Medicaid defunding in Florida was shown to result in a 6-fold increase in publicly-funded MC and to cost US\$112M [244]. Florida responded by restoring Medicaid coverage for elective MC [248]. In Australia and New Zealand, the lack of government coverage for non-therapeutic MC in public health systems would similarly be having cost impacts for treatment of medical conditions

protected against by neonatal MC. An increase in early MC in Australia to 85% from the current level of 18.75% [8] would avoid 77,000 cases of infections and other adverse medical conditions over the lifetime for each annual birth cohort (Table 1).

16. Legality of circumcision of boys

Circumcision of males is a legal procedure in virtually all countries worldwide, including Australia, New Zealand, the UK, the USA and Canada. In Australia and New Zealand legality is based on well-established rights of parents to make decisions about medical care for their children. Generally, both parents should agree. Australia has ratified Article 24(3) of the United Nations Convention on the Rights of the Child [249]. Consistent with Australian legislation, Article 24(3) requires that the best interests of the child shall be the primary consideration.

Despite attempts to legislate against circumcision of male minors in Scandinavian countries, circumcision of boys remains legal. A controversial case in Cologne in 2012 concerning a bleeding complication in a Muslim boy circumcised by a Muslim doctor was misconstrued by news media and others as Germany having banned MC, whereas that regional court had ruled the illegality of MC of boys to be among the “undecided questions of law,” concluding that the defendant was not guilty of a criminal, act and was acquitted, with costs ordered to be paid from public funds [250]. An appeal failed. The German Parliament then enacted legislation upholding the legal right of parents to choose MC for their sons, providing that it was performed by a trained professional in a safe environment [251].

An attempt to have infant MC banned in San Francisco was challenged in court and a bill was subsequently passed unanimously by both houses of the California legislature to prevent any future municipal initiatives to ban MC and other medical procedures [252]. Arguments supporting the legality of infant MC were presented by a member of the AAP’s 2012 Task Force on MC [253]. Arguments challenging the legality of MC of minors in the US were considered by legal, bioethics and medical academics to depend on speculative claims, obfuscation of scientific data, failure to appreciate benefits or the higher risks and barriers to later MC, to be inconsistent with evidence that parent-approved MC is legal, ethical (see next section), is in the best interests of the health of the male child, and consistent with the Hippocratic Oath which contains the statement “I will prevent disease whenever I can, for prevention is preferable to cure” [254–256]. The oft quoted “First do no harm” (Latin: “primum non nocere”) is a mistranslation of the Greek text “ὄφραλέειν ἢ μὴ βλάπτειν”, the English translation of which is “for better or for worse” or “for good or ill”.

Decisions by legislative and judicial bodies in Australia upholding the legality of MC appear in a review by a lawyer and medical experts [257]. That review found

a Tasmanian report recommending prohibition [258] to be illogical, dangerous, unworkable, and that doctors should have guaranteed protection in performing medical procedures based on sound evidence of effectiveness and safety [257]. The report has never been presented to the Tasmanian Parliament.

17. Ethics

Parents’ reasons for choosing circumcision for a son include better health, hygiene, appearance, culture and religion [259]. Scholarly assessments support circumcision of male minors as being ethical [253,257,260–266]. When considering the wide-ranging protection that MC affords against an array of adverse medical conditions and infections in infancy and childhood, and STIs in adolescent boys who become sexually active, there are cogent arguments as to why it would be unethical to leave boys uncircumcised [257,263]. Ethicists and others have interpreted Article 24(3) of the United Nations International Convention of the Rights of the Child as mandating MC, since not doing so would be prejudicial to male health [263]. Nevertheless, in line with views published by AAP Task Force member and professor of bioethics Douglas Diekema [267], the AAP’s 2012 infant MC policy states, “parents should weigh health benefits and risks in light of their own religious, cultural, and personal preferences, as the medical benefits alone may not outweigh these other considerations for individual families” [11]. Medical practitioners with a conscientious objection to performing the procedure should refer parents to another doctor.

Accurate information on benefits and risks should be provided to all parents in an unbiased manner, ideally early in a pregnancy should they be having a son. Parents should be informed that the option of delaying MC beyond early infancy, or leaving it to the boy to decide, will mean missing out on benefits early in life and pose substantial obstacles that may ultimately mean it will not happen, so diminishing the health and other benefits and increasing the risk of adverse medical conditions over his lifespan (Table 3). While some males may resent their parents’ decision to have them circumcised as a baby, others who were not circumcised in infancy may resent their parents’ decision not to have them circumcised, especially if suffering from infections and other medical conditions that may have been avoided by being circumcised.

Oponents of boyhood circumcision have used ethical arguments in support of their cause. A consortium of mostly Northern Europeans alleged that the AAP’s 2012 infant MC policy was culturally biased, arguing that the only relevant benefit was protection against UTI, extent of complications was unknown, and that there “are no compelling reasons for surgery before boys are old enough to decide for themselves” [268]. In response, the AAP Task Force on infant MC found the opinions expressed were “not comprehensive, systematic, or unbiased,” instead contain-

Table 3. Issues to consider for time of male circumcision: neonatal vs. later.

<i>Neonatal circumcision</i>	<i>Circumcision of older boys and men</i>
<ul style="list-style-type: none"> • Simple • Quick (takes several minutes) • Cost is lower • Low risk (adverse events 0.4%) • Bleeding (uncommon) is minimal and easily stopped • Sutures not needed • Convenient for patient (sleeps mostly) 	<ul style="list-style-type: none"> • More complex • Half an hour or more to perform • Much more expensive (often unaffordable) • Moderate risk (adverse events 4–8%) • Bleeding more common, requiring cautery or other interventions • Sutures or tissue glue needed • Inconvenient (time off school or work) • General anaesthesia for age >2 months to 9 years.
<ul style="list-style-type: none"> • Local anaesthesia for age <2 months 	<ul style="list-style-type: none"> Local anaesthesia for men, although general anaesthesia often preferred by surgeon
<ul style="list-style-type: none"> • Healing is fast (<2 weeks) • Cosmetic outcome usually good • No long-term memory of the procedure • Does not disrupt feeding or other day-to-day activities 	<ul style="list-style-type: none"> • Healing takes 6 weeks or more • If stitches used then stitch marks may be seen • Fear of undergoing an operation • Abstinence from sexual intercourse during the 6-week healing period

Table 4. Recommendations by the Circumcision Academy of Australia.

(1) Circumcision must be performed by a well-trained competent practitioner under sterile conditions using appropriate anaesthesia for pain management according to the age of the patient.
(2) Parents should routinely be informed accurately early in a pregnancy in an unbiased manner about (i) the range of health benefits conferred by neonatal circumcision, (ii) the low risk of complications and that if any occur most are minor and easily treated with complete resolution, severe complications being rare, (iii) when performed in older boys complications are more common and the procedure is more expensive, (iv) circumcision is a well tolerated, minor procedure, and (v) pain will be managed.
(3) The benefits of circumcision compared with the low risk in newborn boys are sufficient to justify nation-wide access to the procedure.
(4) Third-party payment of costs by the federal government under Medicare and private health insurance is warranted.
(5) After being fully informed, it is up to the parents to decide whether their boy should receive circumcision. In so doing, they will need to weigh up the medical information in the context of their own beliefs, be they cultural or religious practices or ethical views. The parents' decision should be respected.

ing false and one-sided information, suggested that the “obvious” cultural bias referred to stemmed from “the normality of non-therapeutic MC in the US,” arguing that because “approximately half of US males are circumcised, and half are not,” any bias “is more likely likely to be neutral... so predisposing the AAP Task Force to a more dispassionate analysis of the scientific literature than a culture with a bias that is either strongly opposed to circumcision or strongly in favor of it” [269]. Arguments that the AAP’s policy was unethical and unlawful [35] were shown by academics with expertise in medicine, ethics and law to lack merit, because arguments against MC involve “poor understanding of epidemiology, erroneous interpretation of the evidence, selective citation of the literature, statistical manipulation of data, and circular reasoning” [254,270]. Similarly, such experts repudiated [255,271] criticisms of the CDC’s 2014 draft recommendations [272,273] by pointing out that the strong medical evidence would make it unethical to withhold information about the risks and benefits of MC from parents of boys. They quoted the following from Article 24(1) of the United Nations International Convention on the Rights of the Child: “States Parties recognize the right

of the child to the enjoyment of the highest attainable standard of health” and “shall strive to ensure that no child is deprived of his or her right of access to health care services.” A recent systematic review [78] has provided a detailed evaluation of the contrasting arguments and counter-arguments published by MC opponents and proponents.

18. Conclusions

This review finds that circumcision of boys early in infancy is a low risk procedure providing a lifetime of benefits by protecting against infection and disease. Medical practitioners, nurses and other health professions in Australia have an ethical duty to present clear and unbiased information to parents of boys and to men regarding the range of benefits from MC, the net level of lifetime protection against disease, the low prevalence of procedural risks, that MC is generally performed using local anaesthesia in neonates, and, if need be, to direct parents to competent operators when they choose to proceed. The Circumcision Academy of Australia’s policy recommendations appear in Table 4.

Abbreviations

AAP, American Academy of Pediatrics; CDC, Centers for Disease Control and Prevention; HPV, human papillomavirus; LMX4, a topical anesthetic cream containing 4% lidocaine; MC, male circumcision; MSM, men who have sex with men; RCT, randomized controlled trial; RR, relative risk; SIGN, Scottish Intercollegiate Guidelines Network; STIs, sexually transmitted infections; UNAIDS, Joint United Nations Programme on HIV/AIDS; UTI, urinary tract infection; VMMC, voluntary medical MC; VUR, vesicoureteric reflux.

Author contributions

BJM conceived, designed the study, performed literature searches, and prepared the initial draft of the manuscript; AK, NJB, MH, ACS, LS, ERL, ADW and PK provided input to successive drafts.

Ethics approval and consent to participate

Not applicable.

Acknowledgment

Thanks to all the peer reviewers for their opinions and suggestions.

Funding

This research received no external funding.

Conflict of interest

BJM is a Member of the Editorial Board of Journal of Men's Health. MH is medical director of Quick Medical Pty Ltd, a company that markets medical devices, including circumcision devices, in Australia. All authors are Members of the Circumcision Academy of Australia, a not-for-profit, government registered, medical society that provides accurate, evidence-based information on male circumcision to parents, practitioners and others, as well as contact details of doctors who perform the procedure in Australia and New Zealand; PK is President, BJM is Secretary, NB is Treasurer and MH is Surgical Training Co-ordinator of this organization.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.31083/j.jomh1806132>.

References

- [1] Cox G, Morris BJ. Why circumcision: from prehistory to the twenty-first century. *Surgical Guide to Circumcision*. 2012; 59: 243–259.
- [2] World Health Organization and Joint United Nations Programme on HIV/AIDS. Male circumcision: Global trends and determinants of prevalence, safety and acceptability.

2007. Available at: http://whqlibdoc.who.int/publications/2007/9789241596169_eng.pdf (Accessed: 25 October 2021).
- [3] World Health Organization and UNAIDS. New data on male circumcision and HIV prevention: policy and programme implications. 2007. Available at: http://who.int/hiv/mediacentre/MCRecommendations_en.pdf (Accessed: 25 October 2021).
- [4] World Health Organization. Remarkable progress in the scale up of voluntary medical male circumcision as an HIV prevention intervention in 15 ESA countries: UNAIDS and WHO, 2019. Available at: <https://www.who.int/publications/i/item/voluntary-medical-male-circumcision-progress-brief-2019> (Accessed: 28 October 2021).
- [5] Borgdorff MW, Kwaro D, Obor D, Otieno G, Kamire V, Odongo F, *et al.* HIV incidence in western Kenya during scale-up of antiretroviral therapy and voluntary medical male circumcision: A population-based cohort analysis. *The Lancet HIV*. 2018; 5: e241–e249.
- [6] Morris BJ, Wamai RG, Henebeng EB, Tobian AA, Klausner JD, Banerjee J, *et al.* Estimation of country-specific and global prevalence of male circumcision. *Population Health Metrics*. 2016; 14: 4.
- [7] Ferris JA, Richters J, Pitts MK, Shelley JM, Simpson JM, Ryall R, *et al.* Circumcision in Australia: further evidence on its effects on sexual health and wellbeing. *Australian and New Zealand Journal of Public Health*. 2010; 34: 160–164.
- [8] Qin KR, Paynter JA, Wang LC, Mollah T, Qu LG. Early childhood circumcision in Australia: trends over 20 years and interrupted time series analysis. *ANZ Journal of Surgery*. 2021; 91: 1491–1496.
- [9] Introcaso CE, Xu F, Kilmarx PH, Zaidi A, Markowitz LE. Prevalence of circumcision among men and boys aged 14 to 59 years in the United States, National Health and Nutrition Examination Surveys 2005–2010. *Sexually Transmitted Diseases*. 2013; 40: 521–525.
- [10] Blank S, Brady M, Buerk E, Carlo W, Diekema D, Freedman A, *et al.* Circumcision policy statement. *Pediatrics*. 2012; 130: 585–586.
- [11] Blank S, Brady M, Buerk E, Carlo W, Diekema D, Freedman A, *et al.* Male circumcision. *Pediatrics*. 2012; 130: e756–e785.
- [12] Centers for Disease Control and Prevention. Information for providers counseling male patients and parents regarding male circumcision and the prevention of HIV infection, STIs, and other health outcomes. 2018. Available at: <https://stacks.cdc.gov/view/cdc/58456> (Accessed: 25 October 2021).
- [13] Centers for Disease Control and Prevention. Background, Methods, and Synthesis of Scientific Information Used to Inform “Information for Providers to Share with Male Patients and Parents Regarding Male Circumcision and the Prevention of HIV Infection, Sexually Transmitted Infections, and other Health Outcomes”. 2018. Available at: <https://stacks.cdc.gov/view/cdc/58457> (Accessed: 25 October 2021).
- [14] Morris BJ, Wodak AD, Mindel A, Schrieber L, Duggan KA, Dillely A, *et al.* Infant male circumcision: an evidence-based policy statement. *Open Journal of Preventive Medicine*. 2012; 02: 79–92.
- [15] Harbour R, Miller J. A new system for grading recommendations in evidence based guidelines. *British Medical Journal*. 2001; 323: 334–336.
- [16] Dave S, Afshar K, Braga LH, Anderson P. Canadian Urological Association guideline on the care of the normal foreskin and neonatal circumcision in Canadian infants (full version). *Canadian Urological Association Journal*. 2018; 12: E76–E99.
- [17] Gairdner D. The fate of the foreskin, a study of circumcision. *British Medical Journal*. 1949; 2: 1433–1437.
- [18] Morris BJ, Matthews JG, Krieger JN. Prevalence of phimosis in males of all ages: systematic review. *Urology*. 2020; 135: 124–132.

- [19] Morris BJ, Krieger JN. Penile inflammatory skin disorders and the preventive role of circumcision. *International Journal of Preventive Medicine*. 2017; 8: 32.
- [20] Morris BJ, Waskett JH, Banerjee J, Wamai RG, Tobian AAR, Gray RH, *et al.* A 'snip' in time: what is the best age to circumcise? *BMC Pediatrics*. 2012; 12: 20.
- [21] Folaranmi SE, Corbett HJ, Losty PD. Does application of topical steroids for lichen sclerosus (balanitis xerotica obliterans) affect the rate of circumcision? A systematic review. *Journal of Pediatric Surgery*. 2018; 53: 2225–2227.
- [22] Kirtschig G, Becker K, Günthert A, Jasaitiene D, Cooper S, Chi C-, *et al.* Evidence-based (S3) guideline on (anogenital) lichen sclerosus. *Journal of the European Academy of Dermatology and Venereology*. 2015; 29: e1–e43.
- [23] Iskit S, Ilkit M, Turç-Biçer A, Demirhindi H, Türker M. Effect of circumcision on genital colonization of *Malassezia* spp. in a pediatric population. *Medical Mycology*. 2006; 44: 113–117.
- [24] Mukherjee S, Joshi A, Carroll D, Chandran H, Parashar K, McCarthy L. What is the effect of circumcision on risk of urinary tract infection in boys with posterior urethral valves? *Journal of Pediatric Surgery*. 2009; 44: 417–421.
- [25] Shaikh N, Morone NE, Lopez J, Chianese J, Sangvai S, D'Amico F, *et al.* Does this child have a urinary tract infection? *Journal of the American Medical Association*. 2007; 298: 2895–2904.
- [26] Bader M, McCarthy L. What is the efficacy of circumcision in boys with complex urinary tract abnormalities? *Pediatric Nephrology*. 2013; 28: 2267–2272.
- [27] Shaikh N, Morone NE, Bost JE, Farrell MH. Prevalence of urinary tract infection in childhood: A meta-analysis. *The Pediatric Infectious Disease Journal*. 2008; 27: 302–308.
- [28] Chon CH, Lai FC, Shortliffe LM. Pediatric urinary tract infections. *Pediatric Clinics of North America*. 2001; 48: 1441–1459.
- [29] Schoen EJ. Circumcision for preventing urinary tract infections in boys: North American view. *Archives of Disease in Childhood*. 2005; 90: 772–773.
- [30] Sureshkumar P, Jones M, Cumming RG, Craig JC. Risk factors for urinary tract infection in children: A population-based study of 2856 children. *Journal of Paediatrics and Child Health*. 2009; 45: 87–97.
- [31] Rushton HG, Majd M. Pyelonephritis in male infants: how important is the foreskin? *The Journal of Urology*. 1992; 148: 733–738.
- [32] Stull TL, LiPuma JJ. Epidemiology and natural history of urinary tract infections in children. *Medical Clinics of North America*. 1991; 75: 287–297.
- [33] Wiswell TE. The prepuce, urinary tract infections, and the consequences. *Pediatrics*. 2000; 105: 860–862.
- [34] Svoboda JS. Circumcision of male infants as a human rights violation. *Journal of Medical Ethics*. 2013; 39: 469–474.
- [35] Svoboda JS, Adler PW, Van Howe RS. Circumcision is unethical and unlawful. *The Journal of Law, Medicine & Ethics*. 2016; 44: 263–282.
- [36] Morris BJ, Tobian AAR. Legal threat to infant male circumcision. *JAMA Pediatrics*. 2013; 167: 890.
- [37] Long SS. Can lumbar puncture be deferred in febrile neonates with suspected UTI? *The Journal of Pediatrics*. 2017; 184: 3.
- [38] Looke DFM, Gottlieb T, Jones CA, Paterson DL. Gram-negative resistance: can we combat the coming of a new "Red Plague"? *Medical Journal of Australia*. 2013; 198: 243–244.
- [39] Wang J, He L, Sha J, Zhu H, Huang L, Zhu X, *et al.* Etiology and antimicrobial resistance patterns in pediatric urinary tract infection. *Pediatrics International*. 2018; 60: 418–422.
- [40] Arshad M, Seed PC. Urinary tract infections in the infant. *Clinics in Perinatology*. 2015; 42: 17–28, vii.
- [41] Rushton HG. Urinary tract infections in children. *Epidemiology, evaluation, and management. Pediatric Clinics of North America*. 1997; 44: 1133–1169.
- [42] Zorc JJ, Kiddoo DA, Shaw KN. Diagnosis and management of pediatric urinary tract infections. *Clinical Microbiology Reviews*. 2005; 18: 417–422.
- [43] Roberts JA. Neonatal circumcision: an end to the controversy? *Southern Medical Journal*. 1996; 89: 167–171.
- [44] Benador D, Benador N, Slosman D, Mermillod B, Girardin E. Are younger children at highest risk of renal sequelae after pyelonephritis? *Lancet*. 1997; 349: 17–19.
- [45] Rushton HG. The evaluation of acute pyelonephritis and renal scarring with technetium 99m-dimercaptosuccinic acid renal scintigraphy: evolving concepts and future directions. *Pediatric Nephrology*. 1997; 11: 108–120.
- [46] Shim YH, Lee JW, Lee SJ. The risk factors of recurrent urinary tract infection in infants with normal urinary systems. *Pediatric Nephrology*. 2009; 24: 309–312.
- [47] Alsaywid BS, Saleh H, Deshpande A, Howman-Giles R, Smith GHH. High grade primary vesicoureteral reflux in boys: long-term results of a prospective cohort study. *The Journal of Urology*. 2010; 184: 1598–1603.
- [48] Wiswell TE, Miller GM, Gelston HM, Jr, Jones SK. Effects of circumcision status on periurethral bacterial flora during the first year of life. *Journal of Paediatrics*. 1988; 113: 442–446.
- [49] Fussell EN, Kaack MB, Cherry R, Roberts JA. Adherence of bacteria to human foreskins. *The Journal of Urology*. 1988; 140: 997–1001.
- [50] Wijesinha SS, Atkins BL, Dudley NE, Tam PK. Does circumcision alter the periurethral bacterial flora? *Pediatric Surgery International*. 1998; 13: 146–148.
- [51] Gücük A, Burgu B, Gökçe İ, Mermerkaya M, Soygür T. Do antibiotic prophylaxis and/or circumcision change periurethral uropathogen colonization and urinary tract infection rates in boys with VUR? *Journal of Pediatric Urology*. 2013; 9: 1131–1136.
- [52] Ladenhauf HN, Ardelean MA, Schimke C, Yankovic F, Schimpl G. Reduced bacterial colonisation of the glans penis after male circumcision in children—a prospective study. *Journal of Pediatric Urology*. 2013; 9: 1137–1144.
- [53] Kose E, Yavascan O, Turan O, Kangin M, Bal A, Alparslan C, *et al.* The effect of circumcision on the frequency of urinary tract infection, growth and nutrition status in infants with antenatal hydronephrosis. *Renal Failure*. 2013; 35: 1365–1369.
- [54] Ellison JS, Dy GW, Fu BC, Holt SK, Gore JL, Merguerian PA. Neonatal circumcision and urinary tract infections in infants with hydronephrosis. *Pediatrics*. 2018; 142: e20173703.
- [55] Morris BJ, Wiswell TE. Circumcision and lifetime risk of urinary tract infection: A systematic review and meta-analysis. *The Journal of Urology*. 2013; 189: 2118–2124.
- [56] Wiswell TE, Hachey WE. Urinary tract infections and the circumcision state: An update. *Clinical Pediatrics*. 1993; 32: 130–134.
- [57] Singh-Grewal D, Macdessi J, Craig J. Circumcision for the prevention of urinary tract infection in boys: A systematic review of randomised trials and observational studies. *Archives of Disease in Childhood*. 2005; 90: 853–858.
- [58] Craig JC, Knight JF, Sureshkumar P, Mantz E, Roy LP. Effect of circumcision on incidence of urinary tract infection in preschool boys. *The Journal of Pediatrics*. 1996; 128: 23–27.
- [59] Jakobsson B, Esbjörner E, Hansson S. Minimum incidence and diagnostic rate of first urinary tract infection. *Pediatrics*. 1999; 104: 222–226.
- [60] Coulthard MG, Lambert HJ, Keir MJ. Occurrence of renal scars in children after their first referral for urinary tract infection. *British Medical Journal*. 1997; 315: 918–919.
- [61] Schoen EJ, Colby CJ, Ray GT. Newborn circumcision decreases

incidence and costs of urinary tract infections during the first year of life. *Pediatrics*. 2000; 105: 789–793.

- [62] Fiore AE, Shay DK, Haber P, Iskander JK, Uyeki TM, Mootrey G, *et al*. Prevention and control of influenza. Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2007. *Morbidity and Mortality Weekly Report. Recommendations and Reports*. 2007; 56: 1–54.
- [63] Kelly H, Carville K, Grant K, Jacoby P, Tran T, Barr I. Estimation of influenza vaccine effectiveness from routine surveillance data. *PLoS One*. 2009; 4: e5079.
- [64] Auvert B, Taljaard D, Lagarde E, Sobngwi-Tambekou J, Sitta R, Puren A. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 Trial. *PLoS Medicine*. 2005; 2: e298.
- [65] Bailey RC, Moses S, Parker CB, Agot K, Maclean I, Krieger JN, *et al*. Male circumcision for HIV prevention in young men in Kisumu, Kenya: A randomised controlled trial. *The Lancet*. 2007; 369: 643–656.
- [66] Gray RH, Kigozi G, Serwadda D, Makumbi F, Watya S, Nalugoda F, *et al*. Male circumcision for HIV prevention in men in Rakai, Uganda: A randomised trial. *Lancet*. 2007; 369: 657–666.
- [67] Weiss HA, Halperin D, Bailey RC, Hayes RJ, Schmid G, Hankins CA. Male circumcision for HIV prevention: from evidence to action? *AIDS*. 2008; 22: 567–574.
- [68] Siegfried N, Muller N, Deeks JJ, Volmink J. Male circumcision for prevention of heterosexual acquisition of HIV in men. *The Cochrane Database of Systematic Reviews*. 2009: CD003362.
- [69] Lei JH, Liu LR, Wei Q, Yan SB, Yang L, Song TR, *et al*. Circumcision status and risk of HIV acquisition during heterosexual intercourse for both males and females: A meta-analysis. *PLoS ONE*. 2015; 10: e0125436.
- [70] Sharma SC, Raison N, Khan S, Shabbir M, Dasgupta P, Ahmed K. Male circumcision for the prevention of human immunodeficiency virus (HIV) acquisition: A meta-analysis. *BJU International*. 2018; 121: 515–526.
- [71] Kabwama SN, Ssewanyana D, Berg-Beckhoff G. The association between male circumcision and condom use behavior - A meta-analysis. *Materia Socio-Medica*. 2018; 30: 62–66.
- [72] Centers for Disease Control and Prevention. Male circumcision. 2018. Available at: <https://www.cdc.gov/hiv/risk/male-circumcision.html> (Accessed: 25 October 2021).
- [73] Smith DK, Taylor A, Kilmarx PH, Sullivan P, Warner L, Kamb M, *et al*. Male circumcision in the United States for the prevention of HIV infection and other adverse health outcomes: report from a CDC consultation. *Public Health Reports*. 2010; 125: 72–82.
- [74] Warner L, Ghanem KG, Newman DR, Macaluso M, Sullivan PS, Erbeling EJ. Male circumcision and risk of HIV infection among heterosexual African American men attending Baltimore sexually transmitted disease clinics. *The Journal of Infectious Diseases*. 2009; 199: 59–65.
- [75] Sansom SL, Prabhu VS, Hutchinson AB, An Q, Hall HI, Shrestha RK, *et al*. Cost-effectiveness of newborn circumcision in reducing lifetime HIV risk among U.S. males. *PLoS One*. 2010; 5: article e8723.
- [76] Chemtob D, Op de Coul E, van Sighem A, Mor Z, Cazein F, Semaille C. Impact of male circumcision among heterosexual HIV cases: comparisons between three low HIV prevalence countries. *Israel Journal of Health Policy Research*. 2015; 4: 36.
- [77] Morris BJ, Bailey RC, Klausner JD, Leibowitz A, Wamai RG, Waskett JH, *et al*. Review: A critical evaluation of arguments opposing male circumcision for HIV prevention in developed countries. *AIDS Care*. 2012; 24: 1565–1575.
- [78] Morris BJ, Moreton S, Krieger JN. Critical evaluation of arguments opposing male circumcision: A systematic review. *Journal of Evidence-Based Medicine*. 2019; 12: 263–290.
- [79] Cooper DA, Wodak AD, Morris BJ. The case for boosting infant male circumcision in the face of rising heterosexual transmission of HIV. *The Medical Journal of Australia*. 2010; 193: 318–319.
- [80] Szabo R, Short RV. How does male circumcision protect against HIV infection? *British Medical Journal*. 2000; 320: 1592–1594.
- [81] McCoombe SG, Short RV. Potential HIV-1 target cells in the human penis. *AIDS*. 2006; 20: 1491–1495.
- [82] Hirbod T, Bailey RC, Agot K, Moses S, Ndinya-Achola J, Murgu R, *et al*. Abundant expression of HIV target cells and C-type lectin receptors in the foreskin tissue of young Kenyan men. *The American Journal of Pathology*. 2010; 176: 2798–2805.
- [83] Ganor Y, Zhou Z, Tudor D, Schmitt A, Vacher-Lavenu M, Gibault L, *et al*. Within 1 h, HIV-1 uses viral synapses to enter efficiently the inner, but not outer, foreskin mucosa and engages Langerhans-T cell conjugates. *Mucosal Immunology*. 2010; 3: 506–522.
- [84] Ganor Y, Bomsel M. HIV-1 transmission in the male genital tract. *American Journal of Reproductive Immunology*. 2011; 65: 284–291.
- [85] Morris BJ, Wamai RG. Biological basis for the protective effect conferred by male circumcision against HIV infection. *International Journal of STD & AIDS*. 2012; 23: 153–159.
- [86] Gray RH, Serwadda D, Tobian AAR, Chen MZ, Makumbi F, Suntuoke T, *et al*. Effects of genital ulcer disease and herpes simplex virus type 2 on the efficacy of male circumcision for HIV prevention: analyses from the Rakai trials. *PLoS Medicine*. 2009; 6: e1000187.
- [87] Freeman EE, Weiss HA, Glynn JR, Cross PL, Whitworth JA, Hayes RJ. Herpes simplex virus 2 infection increases HIV acquisition in men and women: systematic review and meta-analysis of longitudinal studies. *AIDS*. 2006; 20: 73–83.
- [88] Boily M, Desai K, Masse B, Gumel A. Incremental role of male circumcision on a generalised HIV epidemic through its protective effect against other sexually transmitted infections: from efficacy to effectiveness to population-level impact. *Sexually Transmitted Infections*. 2008; 84: ii28–ii34.
- [89] Tobian AA, Quinn TC. Herpes simplex virus type 2 and syphilis infections with HIV: An evolving synergy in transmission and prevention. *Current Opinion in HIV and AIDS*. 2009; 4: 294–299.
- [90] Bailey R, Mehta S. Circumcision's place in the vicious cycle involving herpes simplex virus type 2 and HIV. *The Journal of Infectious Diseases*. 2009; 199: 923–925.
- [91] Brito MO, Khosla S, Pananookooln S, Fleming PJ, Lerebours L, Donastorg Y, *et al*. Sexual pleasure and function, coital trauma, and sex behaviors after voluntary medical male circumcision among men in the Dominican Republic. *The Journal of Sexual Medicine*. 2017; 14: 526–534.
- [92] Mehta SD, Krieger JN, Agot K, Moses S, Ndinya-Achola JO, Parker C, *et al*. Circumcision and reduced risk of self-reported penile coital injuries: results from a randomized controlled trial in Kisumu, Kenya. *The Journal of Urology*. 2010; 184: 203–209.
- [93] Westercamp N, Mehta SD, Jaoko W, Okeyo TA, Bailey RC. Penile coital injuries in men decline after circumcision: Results from a prospective study of recently circumcised and uncircumcised men in western Kenya. *PLoS One*. 2017; 12: e0185917.
- [94] Kigozi G, Wawer M, Ssettuba A, Kagaayi J, Nalugoda F, Watya S, *et al*. Foreskin surface area and HIV acquisition in Rakai, Uganda (size matters). *AIDS*. 2009; 23: 2209–2213.
- [95] de Witte L, Nabatov A, Pion M, Fluitsma D, de Jong MAWP, de Grijl T, *et al*. Langerin is a natural barrier to HIV-1 transmission by langerhans cells. *Nature Medicine*. 2007; 13: 367–371.
- [96] Schwartz O. Langerhans cells lap up HIV-1. *Nature Medicine*. 2007; 13: 245–246.
- [97] Tobian AAR, Kong X, Gravitt PE, Eaton KP, Kigozi G, Ser-

- wadda D, *et al.* Male circumcision and anatomic sites of penile high-risk human papillomavirus in Rakai, Uganda. *International Journal of Cancer*. 2011; 129: 2970–2975.
- [98] Albero G, Castellsagué X, Giuliano AR, Bosch FX. Male circumcision and genital human papillomavirus: A systematic review and meta-analysis. *Sexually Transmitted Diseases*. 2012; 39: 104–113.
- [99] Larke N, Thomas SL, Dos Santos Silva I, Weiss HA. Male circumcision and human papillomavirus infection in men: A systematic review and meta-analysis. *The Journal of Infectious Diseases*. 2011; 204: 1375–1390.
- [100] Zhu Y, Jia Z, Dai B, Ye D, Kong Y, Chang K, *et al.* Relationship between circumcision and human papillomavirus infection: A systematic review and meta-analysis. *Asian Journal of Andrology*. 2017; 19: 125–131.
- [101] Backes DM, Bleeker MCG, Meijer CJLM, Hudgens MG, Agot K, Bailey RC, *et al.* Male circumcision is associated with a lower prevalence of human papillomavirus-associated penile lesions among Kenyan men. *International Journal of Cancer*. 2012; 130: 1888–1897.
- [102] Gray RH, Serwadda D, Kong X, Makumbi F, Kigozi G, Gravitt PE, *et al.* Male circumcision decreases acquisition and increases clearance of high-risk human papillomavirus in HIV-negative men: A randomized trial in Rakai, Uganda. *The Journal of Infectious Diseases*. 2010; 201: 1455–1462.
- [103] Senkomago V, Backes DM, Hudgens MG, Poole C, Agot K, Moses S, *et al.* Acquisition and persistence of human papillomavirus 16 (HPV-16) and HPV-18 among men with high-HPV viral load infections in a circumcision trial in Kisumu, Kenya. *The Journal of Infectious Diseases*. 2015; 211: 811–820.
- [104] Tobian AAR, Serwadda D, Quinn TC, Kigozi G, Gravitt PE, Laeyendecker O, *et al.* Male circumcision for the prevention of HSV-2 and HPV infections and syphilis. *New England Journal of Medicine*. 2009; 360: 1298–1309.
- [105] Wilson LE, Gravitt P, Tobian AAR, Kigozi G, Serwadda D, Nalugoda F, *et al.* Male circumcision reduces penile high-risk human papillomavirus viral load in a randomised clinical trial in Rakai, Uganda. *Sexually Transmitted Infections*. 2013; 89: 262–266.
- [106] Auvert B, Sobngwi-Tambekou J, Cutler E, Nieuwoudt M, Lissouba P, Puren A, *et al.* Effect of male circumcision on the prevalence of high-risk human papillomavirus in young men: results of a randomized controlled trial conducted in Orange Farm, South Africa. *The Journal of Infectious Diseases*. 2009; 199: 14–19.
- [107] Castellsagué X, Bosch FX, Muñoz N, Meijer CJLM, Shah KV, de Sanjosé S, *et al.* Male circumcision, penile human papillomavirus infection, and cervical cancer in female partners. *New England Journal of Medicine*. 2002; 346: 1105–1112.
- [108] Homfray V, Tanton C, Miller RF, Beddows S, Field N, Sonnenberg P, *et al.* Male circumcision and STI acquisition in Britain: evidence from a national probability sample survey. *PLoS One*. 2015; 10: e0130396.
- [109] Hernandez BY, Shvetsov YB, Goodman MT, Wilkens LR, Thompson P, Zhu X, *et al.* Reduced clearance of penile human papillomavirus infection in uncircumcised men. *The Journal of Infectious Diseases*. 2010; 201: 1340–1343.
- [110] Lu B, Wu Y, Nielson CM, Flores R, Abrahamsen M, Papenfuss M, *et al.* Factors associated with acquisition and clearance of human papillomavirus infection in a cohort of us men: A prospective study. *The Journal of Infectious Diseases*. 2009; 199: 362–371.
- [111] Afonso LA, Cordeiro TI, Carestiano FN, Ornellas AA, Alves G, Cavalcanti SMB. High risk human papillomavirus infection of the foreskin in asymptomatic men and patients with phimosis. *The Journal of Urology*. 2016; 195: 1784–1789.
- [112] Tobian AAR, Ssempijja V, Kigozi G, Oliver AE, Serwadda D, Makumbi F, *et al.* Incident HIV and herpes simplex virus type 2 infection among men in Rakai, Uganda. *AIDS*. 2009; 23: 1589–1594.
- [113] Tobian AA, Charvat B, Ssempijja V, Kigozi G, Serwadda D, Makumbi F, *et al.* Factors associated with the prevalence and incidence of herpes simplex virus type 2 infection among men in Rakai, Uganda. *The Journal of Infectious Diseases*. 2009; 199: 945–949.
- [114] Sobngwi-Tambekou J, Taljaard D, Lissouba P, Zarca K, Puren A, Lagarde E, *et al.* Effect of HSV-2 serostatus on acquisition of HIV by young men: results of a longitudinal study in orange farm, South Africa. *The Journal of Infectious Diseases*. 2009; 199: 958–964.
- [115] Mehta SD, Moses S, Agot K, Maclean I, Odoyo-June E, Li H, *et al.* Medical male circumcision and HSV-2 acquisition: Post-trial surveillance in Kisumu, Kenya. *Journal of Infectious Diseases*. 2013; 208: 1869–1876.
- [116] Sobngwi-Tambekou J, Taljaard D, Nieuwoudt M, Lissouba P, Puren A, Auvert B. Male circumcision and *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and *Trichomonas vaginalis*: observations in the aftermath of a randomised controlled trial for HIV prevention. *Sexually Transmitted Infections*. 2009; 85: 116–120.
- [117] Mehta SD, Gaydos C, Maclean I, Odoyo-June E, Moses S, Agunda L, *et al.* The effect of medical male circumcision on urogenital *Mycoplasma genitalium* among men in Kisumu, Kenya. *Sexually Transmitted Diseases*. 2012; 39: 276–280.
- [118] Weiss HA, Thomas SL, Munabi SK, Hayes RJ. Male circumcision and risk of syphilis, chancroid, and genital herpes: a systematic review and Meta-analysis. *Sexually Transmitted Infections*. 2006; 82: 101–9; discussion 110.
- [119] Pintye J, Baeten JM, Manhart LE, Celum C, Ronald A, Mugo N, *et al.* Association between male circumcision and incidence of syphilis in men and women: a prospective study in HIV-1 serodiscordant heterosexual African couples. *The Lancet. Global Health*. 2014; 2: e664–e671.
- [120] Otieno-Nyunya B, Bennett E, Bunnell R, Dadabhai S, Gichangi A A, Mugo N, *et al.* Epidemiology of syphilis in Kenya: results from a nationally representative serological survey. *Sexually Transmitted Infections*. 2011; 87: 521–525.
- [121] Nasio JM, Nagelkerke NJ, Mwatha A, Moses S, Ndinya-Achola JO, Plummer FA. Genital ulcer disease among STD clinic attenders in Nairobi: association with HIV-1 and circumcision status. *International Journal of STD & AIDS*. 1996; 7: 410–414.
- [122] Mehta SD, Moses S, Parker CB, Agot K, Maclean I, Bailey RC. Circumcision status and incident herpes simplex virus type 2 infection, genital ulcer disease, and HIV infection. *AIDS*. 2012; 26: 1141–1149.
- [123] Liu CM, Hungate BA, Tobian AAR, Serwadda D, Ravel J, Lester R, *et al.* Male circumcision significantly reduces prevalence and load of genital anaerobic bacteria. *MBio*. 2013; 4: e00076.
- [124] Mehta S, Moses S, Agot K, Parker C, Ndinya-Achola J, Maclean I, *et al.* Adult male circumcision does not reduce the risk of incident neisseria gonorrhoeae, Chlamydia trachomatis, or Trichomonas vaginalis infection: results from a randomized, controlled trial in Kenya. *The Journal of Infectious Diseases*. 2009; 200: 370–378.
- [125] Waskett JH, Morris BJ, Weiss HA. Errors in meta-analysis by Van Howe. *International Journal of STD & AIDS*. 2009; 20: 216–220.
- [126] Tobian AAR, Gray RH. The Medical benefits of male circumcision. *Journal of the American Medical Association*. 2011; 306: 1479.

- [127] Tobian AAR, Kacker S, Quinn TC. Male circumcision: a globally relevant but under-utilized method for the prevention of HIV and other sexually transmitted infections. *Annual Review of Medicine*. 2014; 65: 293–306.
- [128] Morris BJ, Hankins CA, Tobian AAR, Krieger JN, Klausner JD. Does male circumcision protect against sexually transmitted infections? Arguments and meta-analyses to the contrary fail to withstand scrutiny. *ISRN Urology*. 2014; 2014: 1–23.
- [129] Morris BJ, Wamai RG, Krieger JN, Banerjee J, Klausner JD. Male circumcision to prevent syphilis in 1855 and HIV in 1986 is supported by the accumulated scientific evidence to 2015: Response to Darby. *Global Public Health*. 2017; 12: 1315–1333.
- [130] Grund JM, Bryant TS, Jackson I, Curran K, Bock N, Toledo C, *et al.* Association between male circumcision and women's biomedical health outcomes: A systematic review. *The Lancet. Global Health*. 2017; 5: e1113–e1122.
- [131] Morris BJ, Hankins CA, Banerjee J, Lumbers ER, Mindel A, Klausner JD, *et al.* Does male circumcision reduce women's risk of sexually transmitted infections, cervical cancer, and associated conditions? *Frontiers in Public Health*. 2019; 7: 4.
- [132] Morris BJ, Hankins CA. Effect of male circumcision on risk of sexually transmitted infections and cervical cancer in women. *The Lancet. Global Health*. 2017; 5: e1054–e1055.
- [133] Fatti G, Shaikh N, Jackson D, Goga A, Nachega JB, Eley B, *et al.* Low HIV incidence in pregnant and postpartum women receiving a community-based combination HIV prevention intervention in a high HIV incidence setting in South Africa. *PLoS One*. 2017; 12: e0181691.
- [134] Weiss HA, Hankins CA, Dickson K. Male circumcision and risk of HIV infection in women: a systematic review and meta-analysis. *the Lancet. Infectious Diseases*. 2009; 9: 669–677.
- [135] Wawer MJ, Makumbi F, Kigozi G, Serwadda D, Watya S, Nalugoda F, *et al.* Circumcision in HIV-infected men and its effect on HIV transmission to female partners in Rakai, Uganda: A randomised controlled trial. *The Lancet*. 2009; 374: 229–237.
- [136] Martín-Sánchez M, Case R, Fairley C, Hocking JS, Bradshaw C, Ong J, *et al.* Trends and differences in sexual practices and sexually transmitted infections in men who have sex with men only (MSMO) and men who have sex with men and women (MSMW): A repeated cross-sectional study in Melbourne, Australia. *BMJ Open*. 2020; 10: e037608.
- [137] Wiyongse CS, Kongnyuy EJ, Shey M, Muula AS, Navti OB, Akl EA, *et al.* Male circumcision for prevention of homosexual acquisition of HIV in men. *The Cochrane Database of Systematic Reviews*. 2011; CD007496.
- [138] Yuan T, Fitzpatrick T, Ko N, Cai Y, Chen Y, Zhao J, *et al.* Circumcision to prevent HIV and other sexually transmitted infections in men who have sex with men: A systematic review and meta-analysis of global data. *The Lancet Global Health*. 2019; 7: e436–e447.
- [139] Pintye J, Baeten JM. Benefits of male circumcision for MSM: evidence for action. *The Lancet Global Health*. 2019; 7: e388–e389.
- [140] Templeton DJ, Jin F, Mao L, Prestage GP, Donovan B, Imrie J, *et al.* Circumcision and risk of HIV infection in Australian homosexual men. *AIDS*. 2009; 23: 2347–2351.
- [141] Poynten IM, Jin F, Templeton DJ, Prestage GP, Donovan B, Pawlita M, *et al.* Prevalence, incidence, and risk factors for human papillomavirus 16 seropositivity in Australian homosexual men. *Sexually Transmitted Diseases*. 2012; 39: 726–732.
- [142] Templeton DJ, Jin F, Prestage GP, Donovan B, Imrie JC, Kippax SC, *et al.* Circumcision and risk of sexually transmissible infections in a community-based cohort of HIV-negative homosexual men in Sydney, Australia. *The Journal of Infectious Diseases*. 2009; 200: 1813–1819.
- [143] Weller S, Davis K. Condom effectiveness in reducing heterosexual HIV transmission. *The Cochrane Database of Systematic Reviews*. 2002; CD003255.
- [144] Giannou FK, Tsiara CG, Nikolopoulos GK, Talias M, Benetou V, Kantzanou M, *et al.* Condom effectiveness in reducing heterosexual HIV transmission: A systematic review and meta-analysis of studies on HIV serodiscordant couples. *Expert Review of Pharmacoeconomics & Outcomes Research*. 2016; 16: 489–499.
- [145] Hearst N, Chen S. Condom promotion for AIDS prevention in the developing world: is it working? *Studies in Family Planning*. 2004; 35: 39–47.
- [146] Lopez LM, Otterness C, Chen M, Steiner M, Gallo MF. Behavioral interventions for improving condom use for dual protection. *The Cochrane Database of Systematic Reviews*. 2013; CD010662.
- [147] Kochen M. Circumcision and the risk of cancer of the penis. *American Journal of Diseases of Children*. 1980; 134: 484.
- [148] Wiswell TE. Neonatal circumcision: A current appraisal. *Focus & Opinion. Pediatrics*. 1995; 1: 93–99.
- [149] Wiswell TE. Circumcision circumspection. *The New England Journal of Medicine*. 1997; 336: 1244–1245.
- [150] Sewell J, Ranasinghe W, De Silva D, Ayres B, Ranasinghe T, Hounsoume L, *et al.* Trends in penile cancer: A comparative study between Australia, England and Wales, and the us. *SpringerPlus*. 2015; 4: 420.
- [151] Schoen EJ, Oehrli M, Colby CD, Machin G. The highly protective effect of newborn circumcision against invasive penile cancer. *Pediatrics*. 2000; 105: E36.
- [152] Ahmed ME, Khalil MI, Kamel MH, Karnes RJ, Spiess PE. Progress on management of penile cancer in 2020. *Current Treatment Options in Oncology*. 2020; 22: 4.
- [153] Harju E, Pakarainen T, Vasarainen H, Törnävä M, Helminen M, Pertilä I, *et al.* Health-related quality of life, self-esteem and sexual functioning among patients operated for penile cancer – A cross-sectional study. *The Journal of Sexual Medicine*. 2021; 18: 1524–1531.
- [154] Morris BJ, Gray RH, Castellsague X, Bosch FX, Halperin DT, Waskett JH, *et al.* The strong protective effect of circumcision against cancer of the penis. *Advances in Urology*. 2011; 2011: 812368.
- [155] Morris BJ, Mindel A, Tobian AA, Hankins CA, Gray RH, Bailey RC, *et al.* Should male circumcision be advocated for genital cancer prevention? *Asian Pacific Journal of Cancer Prevention*. 2012; 13: 4839–4842.
- [156] Harder T, Wichmann O, Klug SJ, van der Sande MAB, Wiese-Posselt M. Efficacy, effectiveness and safety of vaccination against human papillomavirus in males: A systematic review. *BMC Medicine*. 2018; 16: 110.
- [157] Australian Government. Australian Institute of Health and Welfare. Prostate cancer in Australia statistics. 2022. Available at: <https://www.canceraustralia.gov.au/affected-cancer/cancer-types/prostate-cancer/prostate-cancer-australia-statistics> (Accessed: 26 October 2021).
- [158] Morris BJ, Waskett JH. Circumcision reduces prostate cancer risk. *Asian Journal of Andrology*. 2012; 14: 661–662.
- [159] Wachtel MS, Yang S, Morris BJ. Countries with high circumcision prevalence have lower prostate cancer mortality. *Asian Journal of Andrology*. 2016; 18: 39–42.
- [160] Pabalan N, Singian E, Jarjanazi H, Paganini-Hill A. Association of male circumcision with risk of prostate cancer: a meta-analysis. *Prostate Cancer and Prostatic Diseases*. 2015; 18: 352–357.
- [161] Li YD, Teng Y, Dai Y, Ding H. The association of circumcision and prostate cancer: A meta-analysis. *Asian Pacific Journal of Cancer Prevention*. 2016; 17: 3823–3827.
- [162] Morris BJ, Matthews JG, Pabalan N, Moreton S, Krieger JN.

- Male circumcision and prostate cancer: A meta-analysis revisited. *Canadian Journal of Urology*. 2021; 28: 10768–10776.
- [163] Wright JL, Lin DW, Stanford JL. Circumcision and the risk of prostate cancer. *Cancer*. 2012; 118: 4437–4443.
- [164] Spence AR, Rousseau MC, Karakiewicz PI, Parent ME. Circumcision and prostate cancer: A population-based case-control study in Montreal, Canada. *BJU International*. 2014; 114: E90–E98.
- [165] Morris BJ, Waskett J, Bailis SA. Case number and the financial impact of circumcision in reducing prostate cancer. *BJU International*. 2007; 100: 5–6.
- [166] American Cancer Society. Prostate cancer risk factors. 2022. Available at: <https://www.cancer.org/cancer/prostate-cancer/causes-risks-prevention/risk-factors.html> (Accessed: 26 October 2021).
- [167] Drain PK, Halperin DT, Hughes JP, Klausner JD, Bailey RC. Male circumcision, religion, and infectious diseases: an ecologic analysis of 118 developing countries. *BMC Infectious Diseases*. 2006; 6: 172.
- [168] Bruni L, Diaz M, Castellsagué X, Ferrer E, Bosch FX, de Sanjosé S. Cervical human papillomavirus prevalence in 5 continents: meta-analysis of 1 million women with normal cytological findings. *The Journal of Infectious Diseases*. 2010; 202: 1789–1799.
- [169] Shavit O, Roura E, Barchana M, Diaz M, Bornstein J. Burden of human papillomavirus infection and related diseases in Israel. *Vaccine*. 2013; 31: I32–I41.
- [170] Al-Awadhi R, Chehadah W, Kapila K. Prevalence of human papillomavirus among women with normal cervical cytology in Kuwait. *Journal of Medical Virology*. 2011; 83: 453–460.
- [171] Svare EI, Kjaer SK, Worm AM, Osterlind A, Meijer CJLM, van den Brule AJC. Risk factors for genital HPV DNA in men resemble those found in women: A study of male attendees at a Danish STD clinic. *Sexually Transmitted Infections*. 2002; 78: 215–218.
- [172] Aung MT, Soe MY, Mya WW. Study on risk factors for cervical carcinoma at Central Womens Hospital, Yangon, Myanmar. 10th International Scientific Congress of the Royal College of Obstetricians and Gynaecologists, RCOG 2012 Kuching, Sarawak Malaysia. *British Journal of Obstetrics and Gynaecology*. 2012; 119: 124.
- [173] Kim J, Kim BK, Lee CH, Seo SS, Park S, Roh J. Human papillomavirus genotypes and cofactors causing cervical intraepithelial neoplasia and cervical cancer in Korean women. *International Journal of Gynecological Cancer*. 2012; 22: 1570–1576.
- [174] Roura E, Iftner T, Vidart JA, Kjaer SK, Bosch FX, Muñoz N, *et al.* Predictors of human papillomavirus infection in women undergoing routine cervical cancer screening in Spain: the cleopatre study. *BMC Infectious Diseases*. 2012; 12: 145.
- [175] Obiri-Yeboah D, Akakpo PK, Mutocheluh M, Adjei-Danso E, Allornuvor G, Amoako-Sakyi D, *et al.* Epidemiology of cervical human papillomavirus (HPV) infection and squamous intraepithelial lesions (SIL) among a cohort of HIV-infected and uninfected Ghanaian women. *BMC Cancer*. 2017; 17: 688.
- [176] Kolawole O, Olatunji K, Durowade K, Adeniyi A, Omokanye L. Prevalence, risk factors of human papillomavirus infection and papanicolaou smear pattern among women attending a tertiary health facility in south-west Nigeria. *TAF Preventive Medicine Bulletin*. 2015; 14: 453.
- [177] Bosch FX, Albero G, Castellsagué X. Male circumcision, human papillomavirus and cervical cancer: from evidence to intervention. *The Journal of Family Planning and Reproductive Health Care*. 2009; 35: 5–7.
- [178] Bruni L, Diaz M, Barrionuevo-Rosas L, Herrero R, Bray F, Bosch FX, *et al.* Global estimates of human papillomavirus vaccination coverage by region and income level: A pooled analysis. *The Lancet. Global Health*. 2016; 4: e453–e463.
- [179] Hall MT, Simms KT, Lew J, Smith MA, Brotherton JM, Saville M, *et al.* The projected timeframe until cervical cancer elimination in Australia: A modelling study. *The Lancet Public Health*. 2019; 4: e19–e27.
- [180] Garland SM, Kjaer SK, Muñoz N, Block SL, Brown DR, DiNubile MJ, *et al.* Impact and effectiveness of the quadrivalent Human papillomavirus vaccine: A systematic review of 10 years of real-world experience. *Clinical Infectious Diseases*. 2016; 63: 519–527.
- [181] Freire-Salinas J, Benito R, Azueta A, Gil J, Mendoza C, Nicolás M, *et al.* Genotype distribution change after human papillomavirus vaccination in two autonomous communities in Spain. *Frontiers in Cellular and Infection Microbiology*. 2021; 11: 633162.
- [182] Morris BJ, Flanagan JL, McKinnon KJ, Nightingale BN. Papillomavirus screening of cervical lavages by polymerase chain reaction. *Lancet*. 1988; 2: 1368.
- [183] Morris BJ. The advent of human papillomavirus detection for cervical screening. *Current Opinion in Obstetrics & Gynecology*. 2019; 31: 333–339.
- [184] Morris BJ, Wodak AD. Causes and consequences of the decline in circumcision in Australia. *ANZ Journal of Surgery*. 2021; 91: 2546–2547.
- [185] Many BT, Rizeq YK, Vacek J, Cheon EC, Johnson E, Hu Y, *et al.* A contemporary snapshot of circumcision in us children's hospitals. *Journal of Pediatric Surgery*. 2020; 55: 1134–1138.
- [186] Morris BJ, Bailis SA, Wiswell TE. Circumcision rates in the United States: rising or falling? What effect might the new affirmative pediatric policy statement have? *Mayo Clinic Proceedings*. 2014; 89: 677–686.
- [187] Kigozi G, Watya S, Polis CB, Buwembo D, Kiggundu V, Wawer MJ, *et al.* The effect of male circumcision on sexual satisfaction and function, results from a randomized trial of male circumcision for human immunodeficiency virus prevention, Rakai, Uganda. *BJU International*. 2008; 101: 65–70.
- [188] Krieger JN, Mehta SD, Bailey RC, Agot K, Ndinya-Achola JO, Parker C, *et al.* Adult male circumcision: effects on sexual function and sexual satisfaction in Kisumu, Kenya. *The Journal of Sexual Medicine*. 2008; 5: 2610–2622.
- [189] Homfray V, Tanton C, Mitchell KR, Miller RF, Field N, Macdowall W, *et al.* Examining the association between male circumcision and sexual function: evidence from a British probability survey. *AIDS*. 2015; 29: 1411–1416.
- [190] Morris BJ, Krieger JN. Does male circumcision affect sexual function, sensitivity, or satisfaction?—A systematic review. *The Journal of Sexual Medicine*. 2013; 10: 2644–2657.
- [191] Tian Y, Liu W, Wang J, Wazir R, Yue X, Wang K. Effects of circumcision on male sexual functions: A systematic review and meta-analysis. *Asian Journal of Andrology*. 2013; 15: 662–666.
- [192] Yang Y, Wang X, Bai Y, Han P. Circumcision does not have effect on premature ejaculation: A systematic review and meta-analysis. *Andrologia*. 2018; 50.
- [193] Shabanzadeh DM, Düring S, Frimont-Moller C. Male circumcision does not result in inferior perceived male sexual function—A systematic review. *Danish Medical Journal*. 2016; 63: A5245.
- [194] Mao L, Templeton DJ, Crawford J, Inrie J, Prestage GP, Grulich AE, *et al.* Does circumcision make a difference to the sexual experience of gay men? Findings from the Health in Men (HIM) cohort. *The Journal of Sexual Medicine*. 2008; 5: 2557–2561.
- [195] Hammond T, Carmack A. Long-term adverse outcomes from neonatal circumcision reported in a survey of 1,008 men: An overview of health and human rights implications. *The International Journal of Human Rights*. 2017; 21: 189–218.
- [196] Bailis SA, Moreton S, Morris BJ. Critical evaluation of a sur-

- vey claiming “long-term adverse outcomes from neonatal circumcision”. *Advances in Sexual Medicine*. 2019; 09: 67–109.
- [197] Bleustein CB, Fogarty JD, Eckholdt H, Arezzo JC, Melman A. Effect of neonatal circumcision on penile neurologic sensation. *Urology*. 2005; 65: 773–777.
- [198] Payne K, Thaler L, Kukkonen T, Carrier S, Binik Y. Sensation and sexual arousal in circumcised and uncircumcised men. *The Journal of Sexual Medicine*. 2007; 4: 667–674.
- [199] Bossio JA, Pukall CF, Steele SS. Examining penile sensitivity in neonatally circumcised and intact men using quantitative sensory testing. *The Journal of Urology*. 2016; 195: 1848–1853.
- [200] Cox G, Krieger JN, Morris BJ. Histological correlates of penile sexual sensation: does circumcision make a difference? *Sexual Medicine*. 2015; 3: 76–85.
- [201] Richters J, Smith AMA, de Visser RO, Grulich AE, Rissel CE. Circumcision in Australia: prevalence and effects on sexual health. *International Journal of STD & AIDS*. 2006; 17: 547–554.
- [202] Morris BJ, Hankins CA, Lumbers ER, Mindel A, Klausner JD, Krieger JN, *et al.* Sex and male circumcision: women’s preferences across different cultures and countries: A systematic review. *Sexual Medicine*. 2019; 7: 145–161.
- [203] Grund JM, Bryant TS, Toledo C, Jackson I, Curran K, Zhou S, *et al.* Association of male circumcision with women’s knowledge of its biomedical effects and with their sexual satisfaction and function: a systematic review. *AIDS and Behavior*. 2019; 23: 1104–1114.
- [204] Aslam M, Kropp RY, Jayaraman G, Dinner K, Wong T, Steben M. Genital herpes in Canada: deciphering the hidden epidemic. *The Canadian Journal of Infectious Diseases & Medical Microbiology*. 2012; 23: e6–e9.
- [205] Christakis DA, Harvey E, Zerr DM, Feudtner C, Wright JA, Connell FA. A trade-off analysis of routine newborn circumcision. *Pediatrics*. 2000; 105: 246–249.
- [206] Wingo PA, Tong T, Bolden S. Cancer statistics, 1995. *CA: A Cancer Journal for Clinicians*. 1995; 45: 8–30.
- [207] Wiswell TE, Geschke DW. Risks from circumcision during the first month of life compared with those for uncircumcised boys. *Pediatrics*. 1989; 83: 1011–1015.
- [208] El Bcheraoui C, Zhang X, Cooper CS, Rose CE, Kilmarx PH, Chen RT. Rates of adverse events associated with male circumcision in US medical settings, 2001 to 2010. *JAMA Pediatrics*. 2014; 168: 625.
- [209] Cathcart P, Nuttall M, van der Meulen J, Emberton M, Kenny SE. Trends in paediatric circumcision and its complications in England between 1997 and 2003. *British Journal of Surgery*. 2006; 93: 885–890.
- [210] Simforoosh N, Tabibi A, Khalili SAR, Soltani MH, Afjehi A, Aalami F, *et al.* Neonatal circumcision reduces the incidence of asymptomatic urinary tract infection: A large prospective study with long-term follow up using Plastibell. *Journal of Pediatric Urology*. 2012; 8: 320–323.
- [211] Yegane RA, Kheirollahi AR, Salehi NA, Bashashati M, Khoshdel JA, Ahmadi M. Late complications of circumcision in Iran. *Pediatric Surgery International*. 2006; 22: 442–445.
- [212] Zeitler M, Rayala B. Neonatal circumcision. *Primary Care: Clinics in Office Practice*. 2021; 48: 597–611.
- [213] Srinivasan M, Hamvas C, Copley D. Rates of complications after newborn circumcision in a well-baby nursery, special care nursery, and neonatal intensive care unit. *Clinical Pediatrics*. 2015; 54: 1185–1191.
- [214] Weiss HA, Larke N, Halperin D, Schenker I. Complications of circumcision in male neonates, infants and children: A systematic review. *BMC Urology*. 2010; 10: 2.
- [215] Gyan T, Strobel NA, McAuley K, Shannon C, Newton S, Tawiah-Agyemang C, *et al.* Health service provider education and/or training in infant male circumcision to improve short- and long-term morbidity outcomes: A systematic review. *Journal of Paediatrics and Child Health*. 2019; 55: 895–906.
- [216] Fergusson DM, Boden JM, Horwood LJ. Circumcision status and risk of sexually transmitted infection in young adult males: an analysis of a longitudinal birth cohort. *Pediatrics*. 2006; 118: 1971–1977.
- [217] Fergusson DM, Boden JM, Horwood LJ. Neonatal circumcision: effects on breastfeeding and outcomes associated with breastfeeding. *Journal of Paediatrics and Child Health*. 2008; 44: 44–49.
- [218] Mondzelewski L, Gahagan S, Johnson C, Madanat H, Rhee K. Timing of circumcision and breastfeeding initiation among newborn boys. *Hospital Pediatrics*. 2016; 6: 653–658.
- [219] Marshall RE, Porter FL, Rogers AG, Moore J, Anderson B, Boxerman SB. Circumcision: II. Effects upon mother-infant interaction. *Early Human Development*. 1982; 7: 367–374.
- [220] Morris BJ, Krieger JN. Does circumcision increase meatal stenosis risk?—A systematic review and meta-analysis. *Urology*. 2017; 110: 16–26.
- [221] Özen MA, Gündoğdu G, Taşdemir M, Eroğlu E. Complication of newborn circumcision: meatal stenosis or meatal web? *Journal of Pediatric Urology*. 2017; 13: 617.e1–617.e4.
- [222] Salimi A, Besharati M, Rashidi Nia S, Shahmoradi S, Eftekhari SS. Application of topical hydrocortisone ointment decreases post-circumcision meatal stenosis in neonates: A cross-sectional study. *International Journal of Pediatrics*. 2017; 5: 5061–5067.
- [223] Dubrovsky AS, Foster BJ, Jednak R, Mok E, McGillivray D. Visibility of the urethral meatus and risk of urinary tract infections in uncircumcised boys. *Canadian Medical Association Journal*. 2012; 184: E796–E803.
- [224] McGregor TB, Pike JG, Leonard MP. Pathologic and physiologic phimosis: approach to the phimotic foreskin. *Canadian Family Physician Medecin De Famille Canadien*. 2007; 53: 445–448.
- [225] Frisch M, Simonsen J. Ritual circumcision and risk of autism spectrum disorder in 0- to 9-year-old boys: national cohort study in Denmark. *Journal of the Royal Society of Medicine*. 2015; 108: 266–279.
- [226] Morris BJ, Krieger JN. Re: Cultural background, non-therapeutic circumcision and the risk of meatal stenosis and other urethral stricture disease: two nationwide register-based cohort studies in Denmark 1977–2013. *The Surgeon*. 2018; 16: 126–129.
- [227] Taddio A, Katz J, Ilersich AL, Koren G. Effect of neonatal circumcision on pain response during subsequent routine vaccination. *Lancet*. 1997; 349: 599–603.
- [228] Taddio A, Pollock N, Gilbert-MacLeod C, Ohlsson K, Koren G. Combined analgesia and local anesthesia to minimize pain during circumcision. *Archives of Pediatrics & Adolescent Medicine*. 2000; 154: 620–623.
- [229] American Academy of Pediatrics and Canadian Paediatric Society. Prevention and management of pain and stress in the neonate. (published corrections: *Pediatrics*. 2006;118(5):2231–2241 and *Pediatrics*. 2007;119(2):425). *Pediatrics*. 2000; 105: 454–461.
- [230] Benini F. Topical anesthesia during circumcision in newborn infants. *Journal of the American Medical Association*. 1993; 270: 850–853.
- [231] Taddio A, Stevens B, Craig K, Rastogi P, Ben-David S, Shennan A, *et al.* Efficacy and safety of lidocaine-prilocaine cream for pain during circumcision. *The New England Journal of Medicine*. 1997; 336: 1197–1201.
- [232] Lander J, Brady-Fryer B, Metcalfe JB, Nazarali S, Muttitt S. Comparison of ring block, dorsal penile nerve block, and topical anesthesia for neonatal circumcision: A randomized controlled

- trial. *Journal of the American Medical Association*. 1997; 278: 2157–2162.
- [233] Wang J, Zhao S, Luo L, Liu Y, Zhu Z, Li E, *et al.* Dorsal penile nerve block versus eutectic mixture of local anesthetics cream for pain relief in infants during circumcision: A meta-analysis. *PLoS One*. 2018; 13: e0203439.
- [234] Brady-Fryer B, Wiebe N, Lander JA. Pain relief for neonatal circumcision. *The Cochrane Database of Systematic Reviews*. 2004: CD004217.
- [235] Sandeman DJ, Dilley AV. Ultrasound guided dorsal penile nerve block in children. *Anaesthesia and Intensive Care*. 2007; 35: 266–269.
- [236] Cyna AM, Middleton P. Caudal epidural block versus other methods of postoperative pain relief for circumcision in boys. *The Cochrane Database of Systematic Reviews*. 2008: CD003005.
- [237] Sandeman DJ, Reiner D, Dilley AV, Bennett MH, Kelly KJ. A retrospective audit of three different regional anaesthetic techniques for circumcision in children. *Anaesthesia and Intensive Care*. 2010; 38: 519–524.
- [238] Nguyen TT, Kraft E, Nasrawi Z, Joshi M, Merianos D. Avoidance of general anesthesia for circumcision in infants under 6 months of age using a modified plastibell technique. *Pediatric Surgery International*. 2019; 35: 619–623.
- [239] Jayanthi VR, Burns JE, Koff SA. Postneonatal circumcision with local anesthesia: A cost-effective alternative. *Journal of Urology*. 1999; 161: 1301–1303.
- [240] Weksler N, Atias I, Klein M, Rosenztsveig V, Ovadia L, Gurman GM. Is penile block better than caudal epidural block for postcircumcision analgesia? *Journal of Anesthesia*. 2005; 19: 36–39.
- [241] Kacker S, Frick KD, Gaydos CA, Tobian AAR. Costs and effectiveness of neonatal male circumcision. *Archives of Pediatrics & Adolescent Medicine*. 2012; 166: 910–918.
- [242] Andrews AL, Lazenby GB, Unal ER, Simpson KN. The cost of Medicaid savings: the potential detrimental public health impact of neonatal circumcision defunding. *Infectious Diseases in Obstetrics and Gynecology*. 2012; 2012: 540295.
- [243] Ortenberg J, Roth CC. Projected financial impact of noncoverage of elective circumcision by Louisiana Medicaid in boys 0 to 5 years old. *Journal of Urology*. 2013; 190: 1540–1544.
- [244] Gutwein LG, Alvarez JF, Gutwein JL, Kays DW, Islam S. Allocation of healthcare dollars: analysis of nonneonatal circumcisions in Florida. *The American Surgeon*. 2013; 79: 865–869.
- [245] Leibowitz AA, Desmond K, Belin T. Determinants and policy implications of male circumcision in the United States. *American Journal of Public Health*. 2009; 99: 138–145.
- [246] Morris BJ, Bailis SA, Waskett JH, Wiswell TE, Halperin DT. Medicaid coverage of newborn circumcision: A health parity right of the poor. *American Journal of Public Health*. 2009; 99: 969–971.
- [247] Hutchinson AB, Farnham PG, Dean HD, Ekwueme DU, del Rio C, Kamimoto L, *et al.* The economic burden of HIV in the United States in the era of highly active antiretroviral therapy: evidence of continuing racial and ethnic differences. *Journal of Acquired Immune Deficiency Syndromes*. 2006; 43: 451–457.
- [248] Attorneys for the Rights of the Child. June update: Florida and Norway. 2014. Available at: <http://www.arclaw.org/news/june-update-florida-and-norway> (Accessed: 5 August 2021).
- [249] United Nations Human Rights Office of the High Commissioner for Human Rights, Convention on the Rights of the Child. 44/25 20 November 1989. Available at: <https://www.ohchr.org/en/professionalinterest/pages/crc.aspx> (Accessed: 6 November 2021).
- [250] Cologne Regional Court. Decision of May 7, 2012, Docket No. Az. 151 Ns 169/11, Landgericht Köln Cologne. Available at: <http://adam1cor.files.wordpress.com/2012/06/151-ns-169-11-beschneidung.pdf> [English translation, Durham University, UK: <http://www.dur.ac.uk/resources/ilm/CircumcisionJudgmentLGCologne7May20121.pdf>] (Accessed: 26 July 2016). (In German)
- [251] Stafford N. German ethics council backs religious circumcision if specific conditions met. *British Medical Journal*. 2012; 345: e5789.
- [252] California Assembly Bill 768. Male circumcision. 2011. Available at: <http://legiscan.com/CA/text/AB768/id/348729> (Accessed: 11 June 2021).
- [253] Brady MT. Newborn male circumcision with parental consent, as stated in the AAP circumcision policy statement, is both legal and ethical. *The Journal of Law, Medicine & Ethics*. 2016; 44: 256–262.
- [254] Morris BJ, Krieger JN, Klausner JD, Rivin BE. The ethical course is to recommend infant male circumcision — arguments disparaging American academy of pediatrics affirmative policy do not withstand scrutiny. *Journal of Law, Medicine & Ethics*. 2017; 45: 647–663.
- [255] Rivin BE, Diekema DS, Mastroianni AC, Krieger JN, Klausner JD, Morris BJ. Critical evaluation of Adler’s challenge to the cdc’s male circumcision recommendations. *The International Journal of Children’s Rights*. 2016; 24: 265–303.
- [256] Centers for Disease Control and Prevention. Summary of Public Comments and CDC Responses to Public Comments for Information for Providers Counseling Male patients and Parents Regarding Male Circumcision and the Prevention of HIV Infection, Sexually Transmitted Infections, and Other Health Outcomes. 2018. Available at: <https://www.cdc.gov/hiv/pdf/risk/MC-HISA-Public-Comments-and-Responses.pdf> (Accessed: 25 October 2021).
- [257] Bates MJ, Ziegler JB, Kennedy SE, Mindel A, Wodak AD, Zoloth LS, *et al.* Recommendation by a law body to ban infant male circumcision has serious worldwide implications for pediatric practice and human rights. *BMC Pediatrics*. 2013; 13: 136.
- [258] Tasmanian Law Reform Institute. Non-therapeutic male circumcision. Final report no 17, 2012 (pp. 109). Available at: http://www.utas.edu.au/_data/assets/pdf_file/0006/302829/Non-Therapeutic-Circ_Final-Report-August-2012.pdf (Accessed: 26 October 2021).
- [259] Xu B, Goldman H. Newborn circumcision in Victoria, Australia: reasons and parental attitudes. *ANZ Journal of Surgery*. 2008; 78: 1019–1022.
- [260] Benatar M, Benatar D. Between prophylaxis and child abuse: the ethics of neonatal male circumcision. *The American Journal of Bioethics*. 2003; 3: 35–48.
- [261] Benatar D, Benatar M. How not to argue about circumcision. *American Journal of Bioethics*. 2003; 3: W1–W9.
- [262] Benatar D. Evaluations of circumcision should be circumscribed by the evidence. *Journal of Medical Ethics*. 2013; 39: 431–432.
- [263] Jacobs AJ. The ethics of circumcision of male infants. *The Israel Medical Association Journal*. 2013; 15: 60–65.
- [264] Jacobs AJ, Arora KS. Ritual male infant circumcision and human rights. *The American Journal of Bioethics*. 2015; 15: 30–39.
- [265] Bester JC. Ritual male infant circumcision: the consequences and the principles say yes. *The American Journal of Bioethics*. 2015; 15: 56–58.
- [266] Mazor J. The child’s interests and the case for the permissibility of male infant circumcision. *Journal of Medical Ethics*. 2013; 39: 421–428.
- [267] Diekema DS. Boldt v. Boldt: A pediatric ethics perspective. *The Journal of Clinical Ethics*. 2009; 20: 251–257.
- [268] Frisch M, Aigrain Y, Barauskas V, Bjarnason R, Boddy S, Cza-

- uderna P, *et al.* Cultural bias in the AAP's 2012 Technical Report and Policy Statement on male circumcision. *Pediatrics*. 2013; 131: 796–800.
- [269] Blank S, Brady M, Buerk E, Carlo W, Diekema D, Freedman A, *et al.* Cultural bias and circumcision: The AAP Task Force on circumcision responds. *Pediatrics*. 2013; 131: 801–804.
- [270] Morris BJ, Tobian AAR, Hankins CA, Klausner JD, Banerjee J, Bailis SA, *et al.* Veracity and rhetoric in paediatric medicine: A critique of Svoboda and Van Howe's response to the AAP policy on infant male circumcision. *Journal of Medical Ethics*. 2014; 40: 463–470.
- [271] Morris BJ, Krieger JN, Klausner JD. CDC's male circumcision recommendations represent a key public health measure. *Global Health, Science and Practice*. 2017; 5: 15–27.
- [272] Frisch M, Earp BD. Circumcision of male infants and children as a public health measure in developed countries: A critical assessment of recent evidence. *Global Public Health*. 2018; 13: 626–641.
- [273] Adler PW. The draft CDC circumcision recommendations: medical, ethical, legal, and procedural concerns. *The International Journal of Children's Rights*. 2016; 24: 239–264.