

The Contrasting Evidence Concerning the Effect of Male Circumcision on Sexual Function, Sensation, and Pleasure: A Systematic Review



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ABSTRACT

Introduction: Active debate concerns whether male circumcision (MC) affects sexual function, penile sensation, or sexual pleasure.

Aim: To perform a systematic review examining the effect of MC on these parameters.

Methods: PRISMA-compliant searches of PubMed, EMBASE, the Cochrane Library, and Google Scholar were performed, with “circumcision” used together with appropriate search terms. Articles meeting the inclusion criteria were rated for quality by the Scottish Intercollegiate Guidelines Network system.

Main Outcome Measure: Evidence rated by quality.

Results: Searches identified 46 publications containing original data, as well as 4 systematic reviews (2 with meta-analyses), plus 29 critiques of various studies and 15 author replies, which together comprised a total of 94 publications. There was overall consistency in conclusions arising from high- and moderate-quality survey data in randomized clinical trials, systematic reviews and meta-analyses, physiological studies, large longitudinal studies, and cohort studies in diverse populations. Those studies found MC has no or minimal adverse effect on sexual function, sensation, or pleasure, with some finding improvements. A consensus from physiological and histological studies was that the glans and underside of the shaft, not the foreskin, are involved in neurological pathways mediating erogenous sensation. In contrast to the higher quality evidence, data supporting adverse effects of MC on function, sensation, or pleasure were found to be of low quality, as explained in critiques of those studies.

Conclusion: The consensus of the highest quality literature is that MC has minimal or no adverse effect, and in some studies, it has benefits on sexual functions, sensation, satisfaction, and pleasure for males circumcised neonatally or in adulthood. **Morris BJ, Krieger JN. The Contrasting Evidence Concerning the Effect of Male Circumcision on Sexual Function, Sensation, and Pleasure: A Systematic Review. Sex Med 2020;8:577–598.**

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Key Words: Male Circumcision; Sexual Function; Sexual Pleasure; Sexual Sensation

INTRODUCTION

Questions concerning the impact of male circumcision (MC), especially when performed in infancy, on men’s sexual functioning and pleasure are important. The issue is also highly contentious. Because 38–39% of the global male population

undergo MC during their lifetime,¹ it is vital to understand the impact of MC on physiological as well as psychological function and well-being based on high-quality scientific data. Much has happened in recent years to address these issues. Our aim is to provide a systematic review of knowledge concerning the effect of MC on sexual function, sensitivity, and pleasure.

METHODS

Sequential searches were conducted on April 8, 2020, in PubMed, EMBASE, the Cochrane Library, and Google Scholar, following PRISMA guidelines (Figure 1).² Search terms are shown in Table 1. PubMed was searched first, then EMBASE, the Cochrane library, and Google Scholar. Publications already identified were not included again if found in subsequent searches. Inclusion criteria were articles containing original data,

Received May 24, 2020. Accepted August 31, 2020.

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<https://doi.org/10.1016/j.esxm.2020.08.011>

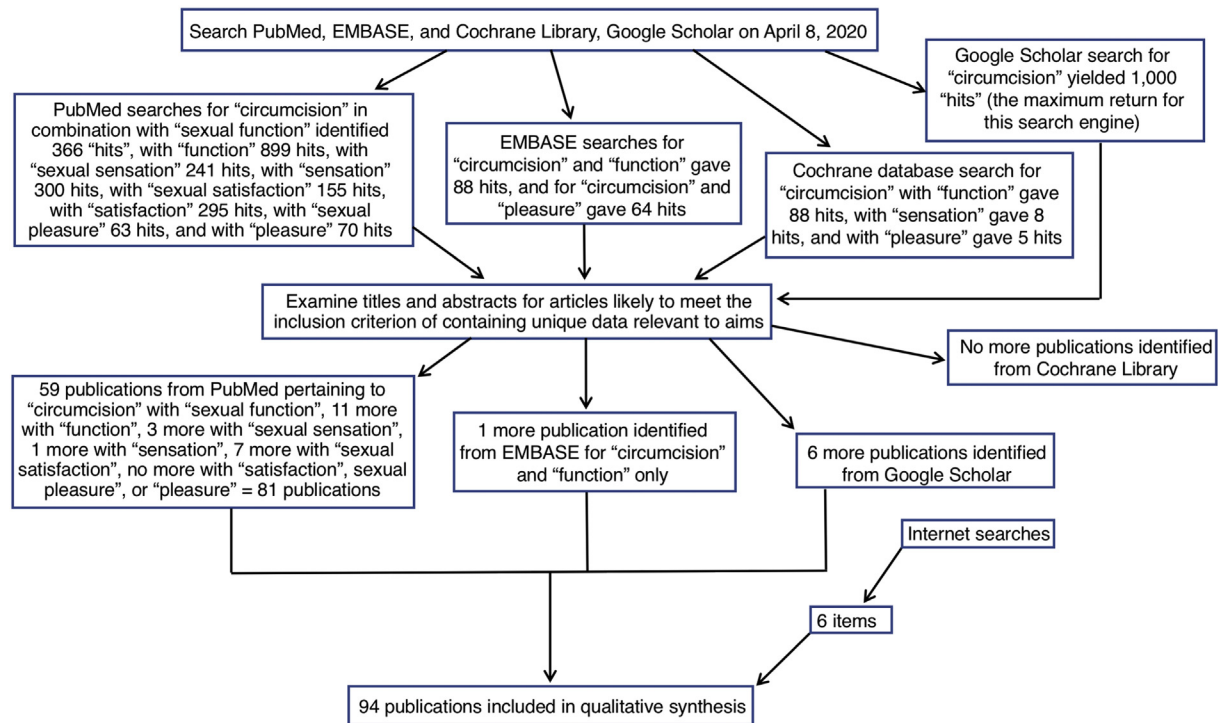


Figure 1. PRISMA flow chart showing the reference retrieval strategy and results.

systematic reviews, meta-analyses, critiques of published studies, and author replies. Publications on female circumcision, more accurately termed female genital cutting and often female genital mutilation, were excluded, as were conference abstracts. Titles of articles and their abstracts were examined, and the full texts of

those articles with the potential to meet the inclusion criteria were examined. The search strategy, following PRISMA guidelines,² is shown in Figure 1.

Articles were assessed for quality, and those rated as having a level of evidence of “2–” and higher by the Scottish

Table 1. Database search terms and results from sequential searches of each

Publication database searched and search term	Number retrieved	
	As “hits”*	Number included
PubMed		
“circumcision sexual function”	366	59
“circumcision function”	899	11
“circumcision sexual sensation”	241	3
“circumcision sensation”	300	1
“circumcision sexual satisfaction”	155	7
“circumcision satisfaction”	295	0
“circumcision sexual pleasure”	63	0
“circumcision pleasure”	70	0
EMBASE		
“circumcision” and “function”	88	1 [†]
“circumcision” and “pleasure”	64	0
Cochrane library		
“circumcision function”	27	0
“circumcision sensation”	8	0
“circumcision pleasure”	5	0
Google Scholar	1000 [‡]	6

*The term “hits” is used rather than “publications,” as many of the same publications were retrieved in sequential searches.

[†]This publication was a corrected version¹⁰³ of a Letter retrieved on PubMed¹²⁵ in which the authors’ names had been rearranged.

[‡]The maximum return for this search engine.

Table 2. The Scottish Intercollegiate Guidelines Network (SIGN) grading criteria³

Levels of evidence	
1++	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias.
1+	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias.
1–	Meta-analyses, systematic reviews or RCTs, or RCTs with a high risk of bias.
2++	High quality systematic reviews of case-control or cohort studies or high-quality case-control or cohort studies with a very low risk of confounding, bias, or chance and a high probability that the relationship is causal.
2+	Well conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal.
2–	Case-control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal.
3	Non-analytic studies, eg, case reports, case series.
4	Expert opinion.
Grades of recommendations	
A	At least one meta-analysis, systematic review, or RCT rated as 1++ and directly applicable to the target population or a systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+ directly applicable to the target population and demonstrating overall consistency of results.
B	A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results or extrapolated evidence from studies rated as 1++ or 1+
C	A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results or extrapolated evidence from studies rated as 2++
D	Evidence level 3 or 4 or extrapolated evidence from studies rated as 2+

Intercollegiate Guidelines Network (SIGN) grading criteria³ (Table 2) were included. Bibliographies were examined to retrieve further key references. High-quality studies that include randomized controlled trials (RCTs), systematic reviews and meta-analyses (level of evidence 1++ or 1+, grade of recommendation A³), high-quality cohort studies and physiological studies (level 2++, grade B³), and moderate-quality studies (level 2+, grade C³) were presented first, followed by lower quality studies (level 2–, grade D). Critiques, published as Letters to the Editor or articles, and replies by authors were also included.

RESULTS

References Retrieved

Table 1 shows search results. One publication,⁴ found on Google Scholar, was not included because the complete data were published subsequently. In all, we identified 81 articles from PubMed, 1 from EMBASE, none from the Cochrane library, 6 from Google Scholar, and 6 from Internet searches. In all, 94 publications were included. These included 46 publications containing original data, 4 systematic reviews (2 with meta-analyses), and 19 letters to the editor, 13 author replies to those, 5 critique articles, 1 response article, 5 Internet critiques, and 1 response.

Studies retrieved and the quality rating of each are shown as Tables. Table 3 lists the highest quality (grade A and B) studies retrieved. Table 4 lists studies finding no adverse effect of MC on sexual function, sensation, or pleasure, as well as published critiques of these and responses by study authors. Table 5 lists

studies that found an adverse effect, as well as critiques and responses by study authors.

SEXUAL FUNCTION IN HIGH- AND MODERATE-QUALITY STUDIES

Secondary Data from RCTs

(Level 1++; Grade A)

2 RCTs compared HIV infection rates in socioeconomically and age-matched sexually active men, randomized to intervention (MC) and control (MC delayed for 2 years),^{5,6} and also gathered data on aspects of sexual function.^{7,8} Questions used were from the International Index of Erectile Function (IIEF)⁷ or were similar to questions used by the US National Health and Social Life Survey (NHSL), British National Survey of Sexual Attitudes and Lifestyle (NATSAL), and Global Study of Sexual Attitudes and Behaviors.⁸

The study of RCT participants in rural Uganda by Kigozi et al involved sexually experienced males aged 15–49 years.⁷ Of these, 2,210 participants were randomized to a group that received immediate circumcision, and 2,246 were randomized to a control group to remain uncircumcised until after 24 months of follow-up.⁷ Participants completed a survey involving the IIEF tool. Sexual function, based on the ability to achieve and maintain an erection (99.7% vs 99.9%, respectively), difficulty with vaginal penetration (99.4% vs 99.9%), difficulty with ejaculation (99.7% vs 99.9%), and pain during or after intercourse (99.9% vs 99.6%), did not differ significantly between each group at the end of the 24-month evaluation.

Table 3. List of all level A and B studies by type of study and quality rating³

Type of study and references	Level of evidence	Grade
Sexual function		
Secondary data from RCTs Kigozi et al 20,08 ⁷ Krieger et al 20,08 ⁸	1++	A
Systematic reviews Morris & Krieger 2013 ¹⁵ Tian et al 2013 ¹⁸ Shabanzadeh et al ²⁰ Yang et al 2018 ¹⁹	1+	A
Meta-analyses Tian et al 2013 ¹⁸ Yang et al 2018 ¹⁹	1+	A
Longitudinal cohort studies Nordstrom et al 2017 ²⁷ Galukande et al 2017 ²⁸	2++	B
Retrospective cohort studies Laumann et al 1997 ³⁰ Mao et al 2008 ²¹ Ferris et al 2010 ³¹ Hoschke et al 2014 ³³ Homfray et al 2015 ³⁵ Chinkoyo & Pather 2015 ³⁶ Jönsson et al 2015 ³⁷ Collins et al 2002 ³⁸ Fink et al 2002 ⁴¹ Senkul et al 2004 ⁴²	2++	B
Physiological measurements Waldinger et al 2005 ⁵¹ Waldinger et al 2009 ⁵³ Alp et al 2014 ⁵⁵ Xia et al 2016 ⁵⁸	2++	B
Penile sensitivity		
Physiological measurements Bleustein et al 2005 ⁵⁹ Payne et al 2007 ⁶⁰ Bossio et al 2016 ⁶⁴	2++	B
Secondary data from RCT Krieger et al 2008 ⁸	1++	A
Systematic Reviews Cox et al 2015 ¹² Morris & Krieger 2013 ¹⁵ Shabdnazeh et al ²⁰	1+	A
Sexual satisfaction and pleasure		
Randomized controlled trials Kigozi et al ⁷ Krieger et al ¹⁸	1++	A
Systematic Reviews Morris & Krieger 2013 ¹⁵	1++	A
Longitudinal cohort studies Zulu et al 2015 ⁷⁶ Nordstrom et al 2017 ²⁷ Brito et al ²⁴	2++	B

Letters commenting on the Uganda findings⁷ were mostly positive. Bowa, however, suggested that if the dorsal slit method had been used rather than the sleeve technique, then sexual function may have improved rather than having remained the same.⁹ In response, Gray and Kigozi mentioned that the other 2 RCTs (in Kenya and South Africa) had used the forceps-guided MC technique.¹⁰ Sexual function was studied in the Kenyan trial and reported no difference (see next paragraph). A letter by Daar suggested that because the sleeve technique used made a cut 0.5–1 cm from the frenulum, erogenous tissue may have remained to explain the results.¹¹ However, a systematic review (detailed in the next section) of histological correlates of sexual pleasure attributed erogenous sensation to the glans and underside of the shaft, not the foreskin, with the erogenous sensations claimed to arise from the frenulum actually stemming from stimulation of nearby genital corpuscles in the glans and shaft rather than the frenulum itself.¹² A mostly positive letter by Drenth pointed to the inability of participants in a circumcision RCT to be blinded to the intervention.¹³ Drenth also considered that there were statistical anomalies in the data. In a response, Gray, showed that Drenth's latter criticism stemmed from an inadequate understanding of statistics.¹⁴

Krieger et al conducted personal interviews involving trained counsellors of RCT participants in Kenya the interviews, including 1,391 circumcised men and 1,393 control men aged 18–24 years.⁸ Participants were evaluated in detail at 1, 3, 6, 12, 18, and 24 months. Sexual function parameters and results at 24 months included inability to ejaculate (1.3% vs 1.2%, respectively), premature ejaculation (PE; 3.9% vs 4.6%), pain during intercourse (0.7% vs 1.2%), lack of pleasure during intercourse (1.8% vs 1.0%), difficulty achieving/maintaining erection (2.3% vs 1.4%), or any of these dysfunctions combined (6.2% vs 5.8%). No statistically significant differences were found in frequency of any of the parameters between the circumcised and uncircumcised men. None of the circumcised men had long-term penile deformities or complications from the surgery, and 99% of the men were satisfied with their circumcisions. In each group, men reporting at least one sexual dysfunction at baseline averaged 24.7%, and this decreased over the 24-month trial period to 6.0% at 24 months, possibly from increases in experience and confidence in these 18- to 24-year-old males with time, as well as the general psychological counselling and support provided to trial participants. None of the men received treatment for sexual dysfunction.

Systematic Reviews

(Level 1+, Grade A)

A systematic review in 2013 by Morris and Krieger on sexual function, sensitivity, and satisfaction contained 36 studies that met the inclusion criteria.¹⁵ A total of 40,473 men were involved in those studies, comprising 20,931 circumcised and 19,542 uncircumcised men. There were 22 studies with data on PE, 19 on erectile dysfunction, 10 on ejaculatory latency, 8 on

Table 4. Studies finding no overall adverse effect of male circumcision on sexual function, sensation, and satisfaction, together with published critiques and author responses

Quality	Reference	Published critiques	Author responses
1++, A	Kigozi et al 2008 ⁷	Bowa 2008 ⁹ Daar 2008 ¹¹ Gray 2008 ¹⁴	Gray & Kigozi 2008 ¹⁰
1++, A	Drenth 2008 ¹³	—	—
1++, A	Krieger et al 2008 ⁸	—	—
1+, A	Cox et al 2015 ¹²	—	—
1+, A	Morris & Krieger 2013 ¹⁵	Boyle 2015 ¹⁶	Morris & Krieger ¹⁷
1+, A	Tian et al 2013 ¹⁸	—	—
1+, A	Yang et al 2018 ¹⁹	—	—
1+, A	Shabanzadeh et al 2016 ²⁰	Frisch & Earp ²²	Shabanzadeh et al ²³
2++, B	Brito et al 2017 ²⁴	—	—
2++, B	Nordstrom et al 2017 ²⁷	—	—
2++, B	Galukande et al 2017 ²⁸	—	—
2++, B	Laumann et al 1997 ³⁰	—	—
2++, B	Ferris et al 2010 ³¹	—	—
2++, B	Son et al 2010 ³²	—	—
2++, B	Hoschke et al 2014 ³³	—	—
2++, B	Homfray et al 2015 ³⁵	—	—
2++, B	Chinkoyo & Pather 2015 ³⁶	—	—
2++, B	Jönsson et al 2015 ³⁷	—	—
2++, B	Collins et al 2002 ³⁸	Casella 2002 ³⁹	Collins reply ⁴⁰
2++, B	Fink et al 2002 ⁴¹	—	—
2++, B	Senkul et al 2004 ⁴²	Denniston & Hill 2004 ⁴³ Boyle 2004 ⁴⁴	Senkul et al 2004 ⁴⁵ Senkul et al 2004 ⁴⁵
2++, B	Masood et al 2005 ⁴⁶	—	—
2++, B	Cortés-González 2009 ⁴⁷	—	—
2++, B	Dias et al 2013 ⁴⁸	—	—
2++, B	Yang et al 2014 ⁴⁹	—	—
2++, B	Gao et al 2015 ⁵⁰	—	—
2++, B	Waldinger et al 2005 ⁵¹	—	—
2++, B	Waldinger et al 2009 ⁵³	—	—
2++, B	Senol et al 2008 ⁵⁴	—	—
2++, B	Alp et al 2014 ⁵⁵	—	—
2++, B	Xia et al 2016 ⁵⁸	—	—
2++, B	Bleustein et al 2005 ⁵⁹	—	—
2++, B	Payne et al 2007 ⁶⁰	Taylor 2007 ⁶²	Payne 2007 ⁶³
2++, B	Bossio et al 2016 ⁶⁴	Frisch 2016 ⁶⁵	Bossio et al 2016 ⁶⁸
	Rotta 2016 ⁶⁶	Bossio et al 2016 ⁶⁸	
	Van Howe et al ⁶⁷	Bossio et al 2016 ⁶⁸	
	Earp 2016 ⁶⁹		
2++, B	Malkoc et al 2012 ⁷⁵	—	—
2++, B	Zulu et al 2015 ⁷⁶	—	—
2++, B	Aydur et al 2007 ⁷⁷	—	—
2++, B	Armagan et al 2014 ⁷⁸	—	—
2++, B	Cucegoglu 2012 ⁷⁹	—	—
2++, B	Aydogmus 2016 ⁸⁰	—	—

dyspareunia, 6 on orgasm difficulties, 2 on ease of reaching orgasm, 1 on sexual arousal, and 1 on difficulty with penile insertion. The findings led Morris and Krieger to conclude that based on quality, the highest quality studies indicate that there is no adverse effect on sexual function from medical MC.¹⁵ In

2015, Boyle, a psychologist, criticized the systematic review, but rather than pointing out errors in that article, he suggested that the low rates of sexual dysfunction in the RCTs were an anomaly and cited opinion pieces and low-quality data suggesting that MC has adverse effects on sexual pleasure.¹⁶ His critique was

Table 5. Studies finding adverse effects of male circumcision on sexual function, sensation, and satisfaction, together with published critiques and author responses

Quality	Topic and reference	Published critiques	Responses
2-, C	Sorrells et al 2007 ⁸¹	Waskett & Morris 2007 ⁸²	—
		Morris & Krieger 2013 ¹⁵	—
		Cox et al 2015 ¹²	—
		Bossio et al 2016 ⁶⁴	—
2-, C	Podnar 2011 ⁸³	Morris & Krieger 2013 ¹⁵	—
		Boyle 2012 ⁸⁷	Podnar 2012 ⁸⁸
2-, C	Boyle & Bensley 2001 ⁸⁹	Morris & Krieger 2013 ¹⁵	—
2-, C	Kim & Pang 2007 ⁹⁰	Willcourt 2007 ⁹¹	—
2-, C	Frisch et al 2011 ⁹²	Morris et al 2012 ⁹³	Frisch ⁹⁴
		—	—
		King interview 2013 ⁹⁶	Frisch interview 2013 ⁹⁶
		Meyrowitsch ⁹⁵	—
2-, C	Bronselaeer et al 2013 ⁹⁸	Morris et al 2013 ⁹⁹	Bronselaeer ⁷¹
		Wang et al 2013 ¹⁰³	—
		Hegarty 2013 ¹⁰¹	—
2-, C	Hammond & Carmack ¹⁰⁵	Bailis et al ¹⁰⁶	—

rebutted by Morris and Krieger, who showed that Boyle’s conclusions were based on personal opinions, that he misrepresented data in the studies included, misunderstood the quality ranking (SIGN) system that was used, and had failed to reveal his center involved in assisting unhappily circumcised men to stretch their shaft skin to create pseudoforeskin.¹⁷

Systematic reviews in 2013, 2016, and 2018 by researchers in China^{18,19} and Denmark,²⁰ countries in which MC is uncommon, also found that MC has no adverse effect on sexual functions. The sexual functions evaluated included erectile function, PE, ejaculatory latency, orgasm difficulties, and pain during

penetration.^{15,18–20} In support, the 2 studies from China performed meta-analyses of each sexual dysfunction.^{18,19}

The 2016, a systematic review by Danish researchers identified 38 relevant studies.²⁰ Study findings were presented descriptively, and differences that were statistically significant were indicated. Of 21 studies evaluating sexual outcomes before vs after circumcision, erectile dysfunction, reported in 18, was significantly decreased in 3, significantly increased in 3, and not significantly different in 11. 5 studies of dyspareunia found a significant decrease in circumcised males in 4 studies and no significant difference in 1. PE was significantly decreased in 3 of

Table 6. Sexual satisfaction and pleasure reported by men at the final timepoint of 24 months after circumcision in a large RCT⁸

Characteristic	Much more	Somewhat more	About the same	Somewhat less	Much less	Don’t know	
Penile sensitivity	64*	7.8	19.3	5.3	1.6	2.1	
Ease of reaching orgasm	54.4	8.6	22.4	8.8	2.1	3.5	
Frequency of sex	29.0	9.8	34.7	12.6	12.0	1.8	
Feeling of being protected against sexual disease	67.9	15.6	10.3	1.1	1.1	4.0	
	Not aware of having been circ’d	Very pleased	Somewhat pleased	Neutral or expressed no opinion	Somewhat displeased	Very displeased	No opinion
Sexual partners’ reaction to MC	7.6	59.6	3.0	28.6	0.6	0	0.6
	Have not used a condom since MC		Easier to use	Not as easy to use	Same as before		
Easiness of condom use	23.7		59.3	1.9	15.2		

*Values shown are percentages.

6 studies and not significantly different in 3. Difficulty in ejaculation was not significantly different in 9 studies of sexual intercourse, whereas one study of masturbation found a significant increase. Problems in reaching orgasm were significantly lower in 2 and significantly higher in 1 study. Of 11 studies, sexual drive in circumcised males was significantly higher in 2 and not significantly different in 9. There were also 21 studies of males undergoing MC, comprising 19 studies of circumcised vs uncircumcised males (3 for a nonmedical indication, 2 for a medical indication, and 14 in which indication was not reported). Overall, there was no significant difference in any parameter studied. The review authors found 3 studies, all in Turkey, indicating that younger age of MC was associated with significantly less risk of sexual dysfunction. They noted a Sydney study by Mao et al of men who have sex with men (MSM) that found MC for a medical reason was significantly associated with aversion to penetrative intercourse.²¹ The authors of that study (detailed in the following section) attributed the finding to ongoing psychosexual sequelae stemming from the penile pain that existed before MC.

Frisch in Denmark and Earp in the United States criticized the Danish review for not including data on homosexual practices.²² They also suggested that studies involving men circumcised as adults and men circumcised for therapeutic reasons should have been excluded because such men had a motive to get circumcised. Shabanzadeh et al responded by pointing out that their systematic review complied with the PRISMA statement, they discussed heterogeneity and limitations in existing studies, that their conclusion was based on results from the highest quality evidence available, and it reflected the lack of research in specific domains of sexual function, such as sexual orientation.²³ They agreed that many studies fail to distinguish MC for clinical indications and MC for cultural or prophylactic reasons. They also agreed that other factors besides a clinical perspective may contribute to an outcome of sexual satisfaction being perceived by men after their circumcision.

Meta-analyses

(Level 1+, Grade A)

Tian et al, in 2013, performed meta-analyses of data from 10 studies.¹⁸ 6 studies had data on erectile dysfunction (6,826 circumcised and 6,052 uncircumcised men in total), 3 on ejaculatory latency time (ELT; 309 vs 332 men), 5 on PE (7,695 vs 6,326 men), 4 on sexual desire low or lacking (6,826 vs 6,052 men), 4 on orgasm difficulties (6,683 vs 5,727 men), and 6 on dyspareunia (8,288 vs 6,894). For each dysfunction, no statistical difference was found between circumcised and uncircumcised men.

The 2018 systematic review by Yang et al identified 12 studies containing data for 10,019 circumcised and 11,570 uncircumcised men.¹⁹ Their meta-analysis of data on orgasm difficulty in 5 studies comprising in total 6,745 circumcised and 5,789

uncircumcised men found no statistically significant difference. In contrast, compared with uncircumcised men, meta-analyses found circumcised men had on average 64% less pain during intercourse ($P = .007$; 6 studies comprising a total of 6,736 circumcised and 4,201 uncircumcised men), 28% lower ELT ($P < .00001$; 2 studies, 626 and 652 men), and 58% lower erectile dysfunction ($P < .006$; 6 studies, 6,764 and 5,947 men).¹⁹ Other studies have found that coital injuries were less common in circumcised men.^{24–26}

Longitudinal Cohort Studies

(Level 2++, Grade B)

A 2017 longitudinal cohort study by Nordstrom et al of voluntary medical MC (VMMC) participants in Kisumu, Kenya, aged 18–24 (mean 20) years included 1,509 recently circumcised men and 1,524 uncircumcised men matched for age and were followed from baseline to 24 months.²⁷ Data collection spanned 2008–2012. There was no significant effect of MC on sexual function, except for dyspareunia, which was significantly lower in circumcised men than in uncircumcised men at the end of follow-up ($P < .001$).²⁷ A similar 2-year follow-up study of PrePex circumcision in Uganda by Galukande et al in 2017, in which data for 304 men aged 28 years were obtained, found 77% reported improved sex life after MC, 10% no change, and 1% a deterioration.²⁸ Smoother penetration was reported by 42%, prolonged ejaculation by 32%, heightened glans sensitivity by 18%, lowered glans sensitivity by 6%, complete absence of dyspareunia compared with a pre-MC prevalence of 31%, and that 97% were satisfied with penile scar appearance.²⁸

Pintye et al found in 2020 that at 3 months after VMMC of 378 men in Botswana, 96% reported an improvement in at least one sexual function (sexual desire, ease of vaginal penetration, ease of ejaculation, ability to achieve and maintain an erection, hygiene or cleanliness, and ability to use condoms), while 19% reported an improvement in all 6 parameters.²⁹ In the limited follow-up period of 3 months, 24% reported worsening of at least one aspect, with lower sexual desire reported by 11%, and one of the others by <10%.

Retrospective Cohort Studies

(Level 2++, Grade B)

The NHLS of a representative sample of 1,410 US men who were aged 18–59 years carried out by Laumann et al in 1997 documented a significantly greater prevalence of sexual dysfunctions in uncircumcised than in circumcised men.³⁰ These were uncommon in younger men but became more frequent later in life. The study found that circumcised white men in particular, but also black and Hispanic men, engaged in a more elaborate set of sexual practices.³⁰ Engaging in masturbation was 40% more frequent in circumcised men than uncircumcised men, this being 76% greater for circumcised white men. Passive heterosexual oral sex was more common in circumcised white

men and black men, being nonsignificantly less common among circumcised Hispanic men. Differences across ethnic groups suggested the involvement of social factors.

A study in Sydney by Mao et al examined 1,426 HIV-negative MSM, of whom 939 (66%) were circumcised.²¹ Prevalence of engagement in insertive or receptive anal intercourse, difficulties in use of condoms, and sexual difficulties, including loss of libido, did not differ between circumcised and uncircumcised men, after the data were adjusted for age and ethnicity. When age and ethnicity adjusted data for 854 men circumcised during infancy were compared with those of 81 men circumcised after infancy (mostly because of phimosis or parents' decision), engaging in any receptive anal intercourse was significantly more common (88% vs 75%, $P < .05$), as were difficulties with erection (52% vs 47%, $P < .05$), and practicing any insertive anal sex was less common (79% vs 87%, $P < .05$), as was experiencing PE (15% vs 23%, $P < .05$), than men circumcised in infancy.

A 2010 random digit dialling telephone survey of 4,290 men in Australia by Ferris et al found only 2 differences in sexual function and activity between circumcised and uncircumcised men.³¹ Circumcised men were less worried about attractiveness of their body (odds ratio [OR] 0.77, $P = .04$) and were more likely to masturbate (OR: 1.20, $P = .02$). A 2010 Internet survey of PE by Son et al involving 3,980 Korean men using the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV-TR found that MC status did not significantly influence PE risk.³²

The 2014 Cottbus 10,000-men survey of German men by Hoschke et al used a 35-item questionnaire integrating the IIEF-6 and further questions to assess quality of sex life, comorbidities, as well as previous surgical treatment.³³ Among a sample of 2,499 men surveyed, there were 167 who reported being circumcised (6.7%). A multivariable logistic regression analysis of the results was performed. The study, which was stated to be "*the largest survey worldwide on male [erectile dysfunction] using the IIEF as a validated instrument,*" found no significant association between MC status and erectile dysfunction or sexual satisfaction. A table summarizing the main findings was published in a letter the same year.³⁴

In 2015, Homfray et al reported results of a stratified probability survey conducted in the UK during 2010–2012 of 6,293 sexually active men who were aged 16–74 years.³⁵ This study was one of the largest surveys of its kind in the world. It used NATSAL-SF, a 17-item validated measure of overall sexual function suitable for use in community surveys. The survey involved psychophysiological aspects, including sexual interest, enjoyment, anxiety, pain, arousal, timing of orgasm, erectile function, and the effect of relationship context and self-appraisal on the individual's sex life. The only difference found was borderline higher erectile difficulties in circumcised men (OR:

1.27; 95% confidence interval: 0.99–1.63). As circumcised men (20.7% of the total) were not questioned about age of circumcision, psychological problems stemming from circumcision for medical reasons, as in the Mao study mentioned previously,²¹ could have contributed in part to this finding. This is especially likely in the context of the UK where infant MC is uncommon, thereby increasing the likelihood of the need for later MC owing to a foreskin-related medical condition. Age at circumcision was not stated, although a small study in Zambia found IIEF-5 scores to be similar between men circumcised in childhood and men circumcised in adulthood.³⁶ Homfray et al concluded that their study found no overall difference in sexual function between circumcised and uncircumcised men.³⁵

Based on the premise that interpersonal touch appears to be a powerful means for communicating emotions and in evoking feelings of eroticism and sexual arousal, a 2015 study by Jönsson et al investigated C tactile afferent stimulation in relation to erotic touch perception in the inner thigh (in subjects whose self-rated erotic touch perception was high) and forearm of healthy Swedish volunteers.³⁷ Participants included 10 men and 10 women, aged 19–33 (mean 23.5) years, who completed the Multidimensional Mood State Questionnaire and the Social Touch Questionnaire, each of which had been translated into Swedish.³⁷ A second study used the Social Touch Questionnaire to survey frequency of intimate body contact (including each of sexually motivated touch as well as hugging and cuddling) with family and friends, together with how much the type of activity was appreciated. Desired and actual frequencies of sexual activity were also surveyed. Level of arousal in response to touch was documented for various parts of the body by the Erogenous Zone Questionnaire. The authors found significantly higher ratings for touch velocity and pleasantness for C tactile optimum velocities than for suboptimum velocities. They concluded that eroticism appears to be perceived much more readily for those touch stimuli that induced high activity of C tactile fibers and low intensity for Ab fibers. The results were used to infer genital sequelae, in particular, for the glans penis and glans clitoris, which each contains a high concentration of unmyelinated nerve fibers.

Small Surveys

(Level 2+, grade C)

A 2002 survey by Collins et al of 15 US men aged ≥ 18 (mean 37 ± 12) years both before and at ≥ 12 weeks after MC found no significant difference in any of the Brief Male Sexual Function Inventory (BMSFI) scores after MC.³⁸ Casella criticized the small sample size and thus low power of the study,³⁹ with which Collins et al agreed in a reply.⁴⁰ Another 2002 US survey, by Fink et al, involved 54 men of mean age 46 years circumcised after the age of 18 (mean 42) years for medical indications.⁴¹ The study used the IIEF, the Before School Functioning

Questionnaire, and NHSLs questions. The key findings were that men undergoing MC reported improved satisfaction ($P = .04$), worse erectile function ($P = .01$), decreased penile sensitivity ($P = .08$), more fellatio ($P = .08$), and no change in sexual activity.

A 2004 study in Turkey by Senkul et al of 42 men aged 19–28 (mean 22.3) years found no difference in mean BMSFI scores before and after MC, whereas post-MC ELT was longer ($P = .02$).⁴² Denniston and Hill,⁴³ as well as Boyle,⁴⁴ criticized the study by invoking cultural factors, failure to include older men, used weak data that included findings from their own studies, and invoked as support speculative claims. Senkul provided a robust data-based response contradicting their claims.⁴⁵ He pointed out that their cohort included healthy men, that MC caused no harm, the 1-minute increase in ELT they observed was likely a benefit, suggested that psychological factors contribute to sexual pleasure, and pointed out that there is no test for the latter.

A 2005 UK survey of 88 men aged 18–60 years by Masood et al used the IIEF-5 tool.⁴⁶ They found no difference in mean IIEF-5 score before vs after MC, with 74% reporting no difference in libido, 69% having lower dysuria, and 44% regarding penile appearance to have improved, and 44% thought that penile sensation was the same, 38% that it was improved, and 18% thought it was worse.

A 2009 Mexican study by Cortés-González et al of 22 sexually active men circumcised for a medical reason found 82% reported improved sexual function and satisfaction, 4.5% a diminution, and 13.5% no change.⁴⁷ Erectile function (IEF-5 score; $P = .0007$) and “*perception of sexual events*” ($P = .04$) were higher, as was appearance for 95.5% of subjects. PE was reported in 7 men before MC, and in 3 afterwards.

A 2014 survey in Portugal by Dias et al of 62 men ≥ 3 months after MC for a medical reason used questions based on the IIEF, Before School Functioning Questionnaire, and BMSFI.⁴⁸ The authors reported an increase in ED in 16%, delayed orgasm in 37.1%, and reduction in dysuria in 43.5%.⁴⁸ Significant predictors for ED were type 2 diabetes (OR: 9.8, $P = .048$) and lack of sexual desire (OR: 8.8, $P = .028$). Significant predictors for *de novo* delayed orgasm were < 3 sex partners (OR: 7.0, $P = .007$) as well as low sexual desire (OR: 7.5, $P = .029$).

A 2014 study in Taiwan by Yang et al evaluated 442 men before and 90 days after circumcision.⁴⁹ The authors found no reduction in ability to maintain an erection, in penetration, ejaculation, or satisfaction. In contrast, there was an increase in confidence ($P < .001$). BMSFI score was also significantly higher after circumcision, as was sexual drive (each $P < .001$). A 2015 study in China by Gao et al involved 12-month follow-up of 575 men circumcised to treat PE, as well as 623 uncircumcised men.⁵⁰ The study found circumcised men experienced higher ELT scores and improved scores for ejaculation control, satisfaction with sexual intercourse, and severity of PE than before they had been

circumcised. Their post-MC scores also compared favorably with scores for the men who were uncircumcised (all $P < .001$).

Physiological Measurements

(Level 2++, Grade B)

In 2005, Waldinger et al studied sexual intercourse in 500 heterosexual couples, using a stopwatch and paper diary to measure the time from start of vaginal intromission to intravaginal ejaculation (intravaginal ELT).⁵¹ An ELT of < 1 minute is an indicator of PE.⁵² In the circumcised men, intravaginal ELT was 6.7 minutes (range 0.7–44.1 minutes), which was not significantly different from the time of 6.0 minutes (range 0.5–37.4) found in the uncircumcised men.⁵¹ The authors obtained similar results for couples in the Netherlands, Spain, the UK, and the US. But in Turkey (circumcised men only), ELT was significantly less (3.7 minutes).⁵¹ In men aged 18–30 years, the average time to ejaculation was 6.5 min, compared with 4.3 min in men over 51 years of age ($P < .0001$). The data were not affected by condom use. In 2009, Waldinger et al repeated the study with a blinded timer to reduce bias and used different cohorts from the same countries as used in their previous study.⁵³ As in the latter study, they found intravaginal IELT was positively skewed in the general male population, the median being 6.0 minutes (range 0.1–52.7). In circumcised men (excluding Turkey), the mean intravaginal ELT was 10.3 ± 9.3 SD minutes (range 0.6–52.7), compared with 8.8 ± 6.9 SD minutes (range 0.3–38.6) in uncircumcised men ($P = .13$). Values for median intravaginal ELT were 7.2 and 6.0 minutes, respectively, in countries other than Turkey. In Turkey, the mean intravaginal ELT was 6.6 ± 6.6 , and median was 4.4 minutes.

A 2008 study in Turkey by Senol et al evaluated pudendal evoked potential in 43 men aged 18–27 years before and ≥ 12 weeks after MC.⁵⁴ At each time, the men were surveyed using the BMSFI. The mean pudendal evoked potential latency was 42.0 ± 0.25 before MC and 44.7 ± 0.33 milliseconds after MC ($P < .001$).⁵⁴ ELT was, moreover, longer after MC (4.4 ± 1.1 SD vs 3.1 ± 0.9 minutes before MC, $P < .001$). A study in Turkey in 2014 by Alp et al of 30 healthy men aged 21.2 ± 0.4 years found that MC did not adversely affect ejaculatory functions.⁵⁵ Mean ELT increased from 104 ± 66 seconds before MC to 124 ± 54 seconds 3 months after MC ($P < .001$).⁵⁵ Median ELTs were 88 (range 26–307) and 108 (67–300) seconds, respectively. Mean PE diagnostic tool (PEDT) scores were 4.3 ± 2.9 and 2.6 ± 1.8 before and after MC ($P < .0001$), respectively, with median being 3 (1–12) before and 2 (0–7) after MC. PE, measuring ELT by a stopwatch, was not affected by post-MC cuff length or penile length in 2 other studies of Turkish men.^{56,57}

In 2016, Xia et al measured somatosensory evoked potentials (SEP) of 81 men who were circumcised to treat redundant prepuce or PE.⁵⁸ The latency of the glans penis SEP was prolonged after

MC (38.1 ± 4.0 ms [amplitude 3.0 ± 1.9 μ V] vs 42.8 ± 3.3 ms [amplitude 2.8 ± 1.6 μ V]; $P < .001$), whereas there was no significant change in dorsal nerve SEP (40.5 ± 3.4 ms [amplitude 2.8 ± 1.6 μ V] vs 40.5 ± 4.1 ms [amplitude 2.4 ± 1.2 μ V]). After MC, mean intravaginal ELT increased from 1.07 to 2.16 minutes ($P < .001$). The Chinese Index of PE with 5 questions score was significantly increased after MC ($P < .001$).

PENILE SENSITIVITY IN HIGH- AND MODERATE-QUALITY STUDIES

Physiological Measurements

(Level 2++, Grade B)

In 2005, Bleustein et al used quantitative sensory testing to evaluate the spectrum of midline glans small to large axon nerve fiber function of 63 neonatally circumcised men and 62 uncircumcised men in New York.⁵⁹ Measurement assessed vibration, pressure, and spatial perception, together with thermal thresholds for warmth and cold. Uncircumcised men were tested with and without their foreskin retracted. 2 measures achieved significance initially: Circumcised men exhibited lower threshold (better functioning) to vibration ($P < .001$), whereas uncircumcised men had a lower threshold (better functioning) to pressure ($P < .001$). However, after controlling for age, erectile function, diabetes, and hypertension, statistical significance was lost. No significant difference was found for any measurement in uncircumcised men with their foreskin retracted or in its normal position. Bleustein et al concluded that MC does not affect results of quantitative sensory testing of the glans penis.⁵⁹

A study in Montreal in 2007 by Payne et al assessed sexual arousal by quantitative genital and nongenital sensory testing using thermal imaging of the penis in 18 healthy circumcised and 19 healthy uncircumcised men.⁶⁰ Measurements were made at baseline and in response to erotic and control stimulus films. Thresholds for touch and pain were assessed on the penile shaft, the glans penis, and the volar surface of the forearm. During the control stimulus (a travelogue), penile temperature of the flaccid penis was 1°C lower in uncircumcised than in circumcised men ($P < .01$). In response to the erotic stimulus of a sexually arousing film, the temperature of the penis in both the circumcised and uncircumcised men increased to a similar plateau after 8 minutes. Based on an IIEF questionnaire, subjective arousal scores were found to correlate with penile temperatures in each group. A higher proportion of circumcised men reported that their level of sexual arousal had increased in response to the erotic stimulus, whereas a greater proportion of uncircumcised men reported having been unaffected ($P < .05$). In both circumcised and uncircumcised men, sensitivity of the penile shaft and glans to touch was lower while watching the erotic film than baseline or while watching the control film (each,

$P < .01$). The authors interpreted the findings as evidence that reduced penile sensation during arousal is necessary to facilitate penile penetration. Furthermore, they suggested that “*these results do not support the hypothesized penile sensory differences associated with circumcision.*” In a letter, Taylor disagreed, reiterating his 1996 assertion⁶¹ of the existence at the tip of the foreskin of a “*ridged band*”, claiming that this contentious structure was crucial to erogenous sensation.⁶² In a brief response, Payne dismissed Taylor’s claims, although conceding the speculative claim that “*the prepuce allows for penile ‘stroking’ with much less friction*”.⁶³

A 2016 study in Ontario by Bossio et al assessed touch and pain thresholds using quantitative sensory testing, as well as using a thermal analyzer to determine thresholds for warmth detection and heat pain.⁶⁴ Participants included 30 circumcised and 32 uncircumcised mostly Canadian born, religiously unaffiliated, educated, demographically matched men aged 18–37 years (mean 24.2 ± 5.1 SD). Evaluations were made at the forearm as a control site and at 3–4 sites on the penis: glans penis, midline shaft, proximal (slightly lateral) to midline shaft, and the foreskin if present. Sexual functioning (IIEF) scores were found not to differ significantly between circumcised and uncircumcised men, nor did tactile thresholds, the forearm being significantly more sensitive than the glans penis ($P < .01$) and proximal ($P < .01$), but not midline ($P = .08$), shaft. The midline shaft was more sensitive than the proximal shaft ($P < .01$). The foreskin was more touch-sensitive than the 3 other penile testing sites but was less sensitive to touch than the forearm. The authors stated that this finding was as expected because of the abundance of fine-touch receptors, namely Meissner’s corpuscles, in the foreskin. Pain thresholds were similar between circumcised and uncircumcised men, sensitivity being greatest for the glans penis, followed by the midline, shaft, then proximal shaft and forearm. Pain threshold of the foreskin was not significantly different from that of any of the other sites. Sensitivity to warmth for the glans penis, midline shaft, proximal shaft, and forearm did not differ significantly between circumcised and uncircumcised men. The glans, only, exhibited lower sensitivity to warmth than the foreskin ($P = .02$). Heat pain of each penile site did not differ significantly by MC status. In both groups, the forearm was least sensitive to punctate and heat pain, with the glans and midline shaft being more sensitive than the proximal shaft. No significant difference was found for the foreskin. The authors concluded that, “*this study challenges past research suggesting that the foreskin is the most sensitive part of the adult penis.*”

In response to the Bossio study, Frisch,⁶⁵ Rotta,⁶⁶ and Van Howe et al⁶⁷ published letters disagreeing with the findings. Their arguments were rebutted by Bossio et al, who explained that their data had been misconstrued.⁶⁸ In responding to Frisch⁶⁵ and Van Howe et al,⁶⁷ who claimed

the foreskin has greater tactile sensitivity than other parts of the penis, Bossio et al pointed out that fine touch pressure activates nerve fibers less relevant for sexual pleasure. In disagreeing with Rotta,⁶⁶ who was concerned that only flaccid penises and a dorsal unretracted foreskin site were studied rather than the internal foreskin surface exposed during erection, Bossio et al stated that their study was not “an exploration of the biomechanics of the foreskin during intercourse”, which they pointed out would be “incredibly difficult to measure”. As requested in the letter by Van Howe et al,⁶⁷ Bossio et al presented, in their reply, data for touch, pain, warmth and heat thresholds for forearm, glans, midline shaft, proximal to midline shaft, and foreskin (when present) for their circumcised and uncircumcised subjects. Those data showed that the tactile sensitivity of the foreskin was similar to that of the forearm but was significantly less than glans and shaft sites, consistent with data from Payne et al suggesting that decreased penile sensitivity was necessary for vaginal penetration.⁶⁰ In a general comment, Bossio et al pointed to the critics’ overreliance on weak studies supporting a particular agenda. They further stated that their study should “serve as a ‘call to arms’ for researchers interested in examining the sexual correlates of circumcision” by conducting scientifically rigorous studies. In a different journal, Earp criticized the Bossio study for providing objective assessments while ignoring subjective sexual experience and satisfaction, as well as psychological and contextual mediators.⁶⁹ Just as Van Howe et al,⁶⁷ Earp noted that the oldest subject was aged 37 years, whereas sexual dysfunction increases in older ages. He also objected to Bossio et al having excluding men with sexual dysfunction. Much of Earp’s commentary merely repeated what Frisch,⁶⁵ Rotta,⁶⁶ and Van Howe et al⁶⁷ had stated and misrepresented the findings by Bossio et al.

Physiological Measurements

(Level 2+, Grade C)

In a “classic” study, Masters and Johnson performed clinical and neurological testing of sites on the flaccid penis, specifically the ventral surface, dorsal surface, and glans.⁷⁰ They reported that perception of fine touch was similar when comparing results for circumcised and uncircumcised men.

Secondary Data from a RCT

(Level 1++, Grade A)

In the Kenyan RCT, participants were surveyed at month 24 of follow-up. Of men in the intervention group, 64.0% reported that their penis was “much more sensitive,” and ease of reaching orgasm was rated as “much more” by 54.5% of men who had been circumcised.⁸ Increased penile sensitivity was found not to be related to PE status.

Systematic Reviews

(Level 1+, Grade A)

A systematic review by Cox et al of histological correlates of penile sensitivity¹² supported the findings from physiological data outlined previously. They concluded that the glans and underside of the proximal shaft, not the foreskin, were the critical sites determining erogenous sensation.⁷¹ In stating that “genital corpuscles are the only mediators of sexual response”, they pointed to data showing that, “the glans has a unique corpuscular receptor, consisting of axon terminals that resemble the tangled skein of free nerve endings and that [these] are probably derived from Krause’s end bulbs”,⁷² and that erogenous sensation is attributed to corpuscular end bulbs, which are concentrated in the corona and near to (not in) the frenulum.⁷³ Manipulation of the frenulum would stimulate the highly erogenous underside of the glans. Sexual stimulation of the foreskin will stimulate the frenulum, and thence the highly erogenous underside of the glans, so explaining claims by some that the frenulum is erogenous. Genital corpuscles have connections to a unique innervation system, and this is distinct from the innervation system of the foreskin.⁷⁴ Cox et al noted that a circumcised penis has a glans that is always exposed, whereas for an uncircumcised penis, glans exposure may only occur during erection when the foreskin generally retracts.¹² In contrast to glans and shaft neuroreceptors, foreskin neuroreceptors resemble those found in skin elsewhere on the body, these being receptors able to sense touch, heat, cold, and pain. In the foreskin, the density of Meissner’s corpuscles (which are fine-touch receptors) decreases at puberty, which is when male sexual activity is increasing.⁴ This finding was used to further argue against their involvement in sexual sensation.¹² Free nerve endings respond to touch too but do not correlate with sexual response.¹² Sensitivity of the penis to vibration, a stimulus able to elicit sexual arousal and thence ejaculation, does not differ by MC status.¹² Malkoc et al observed that total free nerve endings on the foreskin obtained by circumcision of 20 men aged 21 ± 0.4 years did not correlate with ELT and PEDT scores.⁷⁵

The 2013 systematic review by Morris and Krieger listed studies as having examined “sensitivity” if they had studied the flaccid penis but listed them as having studied “sensation” if they reported data concerning the erect penis.¹⁵ Accordingly, they listed 3 studies on sensitivity, and 6 on sensation. The 3 sensitivity studies were of physiological testing, with 1 reporting no difference, 1 reporting better vibration sensitivity of the circumcised penis, and 1 higher fine-touch sensitivity of the foreskin than other sites of the penis. Of the sensation data, 2 studies reported higher sensation in circumcised men, 1 lower, and 3 no difference. The 2016 systematic review by Danish researchers found 2 cohort studies reporting higher penile sensitivity after MC and 2 reporting no difference.²⁰

To summarize, high-quality studies have found no diminution in sensitivity of the penis comparing circumcised and uncircumcised men for any stimulus type or penile site examined by well-designed quantitative testing procedures. The data were supported by evaluation of histological correlates. Fine touch appears not relevant to erogenous sensation.

SEXUAL SATISFACTION AND PLEASURE IN HIGH- AND MODERATE-QUALITY STUDIES

Secondary Data from RCTs

(Level 1++, Grade A)

At the 2-year follow-up in 2 RCTs, sexual pleasure was surveyed. In the Rakai, Uganda trial, no statistically significant differences in satisfaction were found between the circumcised and uncircumcised men at the trial end-point (98.4% vs 99.9%, respectively), nor was there any significant difference in medium to high level of sexual desire (99.1% vs 99.3%).⁷

In the Kisumu RCT in Kenya, Krieger et al evaluated parameters of sexual satisfaction and pleasure by questioning whether the participants had ever avoided engaging sexual activity because of having been circumcised, and asking them (i) whether, in comparison to before they had been circumcised, penile sensitivity, ease of reaching orgasm, frequency of sexual intercourse, and how protected they felt against STIs, were “*more vs same*,” “*less*,” or “*don’t know*”; (ii) regarding their sexual partners’ reaction to MC (among those men whose sex partners were aware of the men’s MC status) were they “*pleased vs neutral*,” “*displeased*,” or “*don’t know*”; and (iii) regarding ease of using a condom was it “*not as easy*” or “*same*.”⁸ Table 6 shows the spectrum of the circumcised men’s responses to the survey asking about their sexual satisfaction and pleasure at the follow-up visit 24 months after MC. Sexual satisfaction became progressively higher over the course of the RCT in all men ($P < .001$).

Systematic Reviews

(Level 1+, Grade A)

The 2013 systematic review by Morris and Krieger identified 4 studies reporting significantly greater sexual satisfaction in circumcised men, 2 reporting less satisfaction, and 13 that found no difference.¹⁵ Morris and Krieger concluded that, overall, sexual satisfaction did not differ between circumcised and uncircumcised men. In the Danish systematic review of men before and after circumcision, satisfaction during sexual intercourse was reported to be significantly higher in 8 studies and not significantly different in 10 studies.²⁰

Longitudinal Cohort Studies

(Level 2++, Grade B)

A 12-month follow-up prospective cohort study of VMMC participants in Zambia by Zulu et al in 2015 found that 42% of recently circumcised men reported increased sexual pleasure, while 22% reported a decrease.⁷⁶ Overall satisfaction, sexual desire, orgasm functioning, and perception of better penile appearance and cleanliness were all significantly greater after MC. Men who ignored advice and engaged in sexual intercourse before completing the recommended 6-week period for healing

reported more adverse events ($P < .001$), lower orgasm functioning ($P < .001$), lower overall satisfaction ($P = .001$), and lower sexual desire ($P = .05$) than men who adhered to advice to wait 6 weeks before resuming sexual activity.

The 2017 large longitudinal study in Kenya by Nordstrom et al found higher sexual satisfaction in the circumcised group after 2 years of follow-up ($P < .001$).²⁷ On average, compared with before MC, satisfaction with sexual intercourse was reported by 97% of circumcised men, and finding that sexual activity became more enjoyable or not different after MC was reported by 92% (each, $P < .001$). Results were stated to be similar to the earlier findings of Krieger et al in Kenya for RCT participants.⁸

A 2-year post-VMMC follow-up study in the Dominican Republic in 2017 by Brito et al found that after VMMC 67% of men reported an increase in sexual enjoyment, while 12% said it was the same; for sexual intercourse, 86% reported being very satisfied and 8% reported being somewhat satisfied; more potent erections were reported by 58%, with 40% reporting no change; higher penile sensitivity was reported by 34%, while 21% said that it was somewhat more sensitive; in relation to their sexual partners, 75% felt much more capable of being able to confer pleasure, while 14% thought that they were somewhat more capable, 11% said there was no difference, and 1% thought they were somewhat less capable.²⁴ Coital trauma was significantly reduced ($P < .001$), and condom use was unchanged, with 47% reporting consistent condom use with nonregular partners after VMMC.

Small Surveys

(Level 2+, grade C)

The UK survey mentioned previously by Masood et al using the IIEF-5 found 65% of circumcised men reported overall satisfaction.⁴⁶ A 2007 study by Aydur et al in Turkey found age of childhood MC, assessed by the Golombok-Rust Inventory of Sexual Satisfaction, may affect some domains of sexual function, such as PE risk, in sexually active males, but not overall function.⁷⁷ In a study by Armagan et al of 32 men aged 30–40 years in Turkey, MC during the phallic period (age 3–6 years) did not affect psychosexual functions assessed by IIEF, PEDT, and Beck Depression Inventory scores.⁷⁸ Similarly, a Golombok-Rust Inventory of Sexual Satisfaction survey by Cüceloğlu et al in the Kayseri Military Hospital, Turkey, found MC at age ≥ 7 years was associated with an increased risk of PE compared to MC at < 7 years of age ($P < .001$).⁷⁹

In a 2016 survey in Turkey, Aydogmus et al examined 37 men using the Body Cathexis Scale, Liebowitz Social Anxiety Scale, and PEDT.⁸⁰ Scores of all scales improved significantly after MC, leading the authors to conclude that, “*social anxiety and anxiety levels decreased after circumcision*” and “*their body gratification increased*.”

STUDIES CLAIMING ADVERSE EFFECTS ON SEXUAL FUNCTION, SENSITIVITY, AND PLEASURE

Physiological Studies

(Level 2–, Grade C)

A 2007 study in San Francisco by Sorrells et al measured fine-touch sensitivity for 19 penile sites of 68 uncircumcised men, 9 of these sites also being on the penis of 91 circumcised men included in the study.⁸¹ The authors compared 4 foreskin sites with the ventral scar present on the penis of the circumcised men. They found that “*the orifice rim*” was the only site to exhibit higher sensitivity. The basis of the claim was a *P* value of just 0.014 after multivariate analysis. Although the data were age-adjusted, Waskett and Morris pointed out that the authors had failed to perform a correction for multiple comparisons.⁸² Waskett and Morris therefore performed a Bonferroni correction, and this rendered the difference nonsignificant.⁸² Further statistical naivety was also apparent. Waskett and Morris then used the data of Sorrells et al to compare, as those authors failed to do, the 9 locations found on both the circumcised and uncircumcised penis. No significant difference was found, even before undertaking a correction for multiple testing.⁸² The study design was also criticized for multiple reasons; one was modes used for recruitment of subjects. The discussion by Sorrells et al was deemed one-sided, and their claims about a role for fine touch in erogenous sexual sensation were questioned. Bossio et al also criticized the study, stating that, “*fine touch pressure, which was only 1 of 4 stimulus modalities assessed [in Bossio et al 2016⁶⁴], activates nerve fibers that are likely less relevant for sexual pleasure than fibers activated by the other stimuli used in this study (stimuli that did not exhibit significant between group differences)*”.⁶⁴ Critical comments concerning the study by Sorrells et al were repeated in the articles by Morris and Krieger¹⁵ and Cox et al.¹²

A 2011 study by Podnar in Slovenia of middle-aged men reported that it was more difficult to elicit the penilo-cavernosus reflex in circumcised men.⁸³ The study involved men with suspected neurogenic causes of bladder, bowel or sexual dysfunction. It examined the sacral (ie, bulbocavernosus) reflex by a technique Podnar devised of, “*brisk compression of the glans penis between the first three fingers.*” Using this idiosyncratic method, Podnar found that in 22/30 (73%) of circumcised men, 9/15 (60%) of uncircumcised men whose foreskin was retracted and 2/29 (7%) of control uncircumcised men, the reflex was clinically nonexcitable (*P* < .001 for circumcised vs control; *P* < .001 for foreskin retracted vs control). In contrast, Podnar found no differences between the 3 study groups by neurophysiological testing. He noted that his mechanical stimulation finding differed from US data. In the United States, where circumcision is common, clinical testing is able to elicit the penilo-cavernosus reflex in 98% of men.⁸⁴

Podnar included all circumcised men and all men with foreskin retraction who were referred to him, but Morris and Krieger

pointed out that he did not explain why he presented data for only 29 of the 202 control uncircumcised men with their foreskin in place, despite stating that he “*performed uro-neurophysiological examination of 247 men*”.¹⁵ Podnar was also criticized for not providing demographic information, so confounding was possible.¹⁵ Podnar’s manual compression test was suggested as being an inadequate mechanical stimulus for clinical testing compared to that provided by an electromechanical hammer or measured by an electromyography electrode. Morris and Krieger pointed out that the action Podnar described in his control uncircumcised males would have stimulated the foreskin, and it would likely compress the penis so as to force it toward the body, stretching the shaft skin in the process. In his circumcised males, the stimulation given would compress the *glans*. Podnar’s suggestion that MC be used to treat PE was also questioned. Although a small survey of Indian, Malay and Chinese men in a Malaysian primary care clinic reported a significant association between MC and elevated PE,⁸⁵ another small survey found immigrant men living in London and having an Islamic or Asian heritage experienced greater PE (*P* < .001).⁸⁶ Rather than MC, a sociosexual cause, such as sexual excitement provided in their new cultural environment, explained as being, “*like living in a pornographic shop*” was suggested as a reason. In a letter, Boyle interpreted Podnar’s findings as supporting various opinions and (discredited) data and speculated about a possible mechanism.⁸⁷ In response to Boyle, Podnar admitted to personal interpretation of his results, and that he “*could not differentiate absence of Meisners’ [sic] corpuscles in the foreskin or desensitisation of deep pressure and pain receptors in the glans as the reason for the reduced reflex excitability found in circumcised men*”.⁸⁸

Cohort Studies

(Level 2–, Grade D)

A small survey by Boyle and Bensley in 2001 investigated “*adverse sexual and psychological effects*” in 35 female and 42 “*gay*” men, aged 18–69 (mean 33) and 19–71 (mean 36) years, respectively, who had experiences of having had sexual partners who were circumcised in infancy and uncircumcised.⁸⁹ Their survey used 32 items which were presented in a 2-point forced choice response format. The study also surveyed 53 circumcised and 30 uncircumcised men aged 20–71 (mean 36) years. In the second survey, “*as compared with genitally intact men, circumcised men reported significantly greater dissatisfaction with their orgasms and a wide range of negative emotions associated with being circumcised.*” Morris and Krieger suggested that the self-selected participants likely came from Boyle’s psychology facility in Queensland, Australia, making the responses prone to bias.¹⁵ Instead of presenting the findings as a table, a few statistically significant findings were shown descriptively in the text of Boyle and Bensley’s 2-page article. The critics pointed out that in Boyle and Bensley’s first survey, rather than reporting results separately, findings were reported for the combined sample of women and

MSM. The data were, moreover, indirect, involving participants' recollections of issues experienced by *their partners*. Boyle and Bensley stated in their article that "*much larger representative samples are desirable*".⁸⁹

A 2007 survey in Korea by Kim and Pang used the BMSFI and other questions to evaluate masturbatory pleasure in 373 men who were aged 30–57 years, including 255 with a mean age of 37.1 years who were circumcised (68%) and 118 with a mean age 38.2 years who were uncircumcised (32%).⁹⁰ All the circumcised men had been circumcised after the age of 20 years. Masturbatory pleasure after MC was reported to be lower in 48% ($P < .05$) and greater in 8%. In 63% masturbation was more difficult after MC ($P < .05$), whereas 37% said it was easier. In 74% of these men, sexual pleasure was the same, in 20% it was worse ($P < .05$), and in 6% it was better (no P value given). No significant differences were found for sexual drive, erection, ejaculation, or ELT. The authors concluded, "*there was a decrease in masturbatory pleasure and sexual enjoyment after [adult] circumcision.*" The study was criticized by Willcourt for (i) its lack of subject recruitment information, (ii) the authors' statement that "*all Korean men are circumcised, although the numbers in the study add to >100%*," (iii) unstated country of origin of uncircumcised men ("*presumably not from Korea*"), (iv) sexual orientation not being stated, (v) that among the 255 circumcised men recruited only 138 had been sexually active before their MC so only those men were qualified to answer questions about whether their "*sex life*" had changed before vs after MC, (vi) the study's focus on masturbation, "*that may be secondary to a male's typical sexual expression, that is, vaginal intercourse*", but not the latter, (vii) no information on "*the sexual inclination nor sexual expression of the participants, which could severely bias the results if masturbation were the participants' main or sole means of sexual relief, vs vaginal or anal intercourse, or other means for that matter,*" (viii) no statement on type of MC, (ix) no definition of "*severe scarring*" (perhaps the 95 who had "*large scars*"?), (x) contradictory statements about scarring, and (xi) "*the use of 'sexuality' in the title*" being "*incorrect, as circumcision has not yet been invoked as a cause of sexual orientation or sexual expression,*" so that, "*More correctly, the title should have said 'male sexual response.'*"⁹¹ As mentioned above, an Internet survey of 3,980 Korean men in 2010 by Son et al using the DSM-IV-TR found MC status did not significantly influence PE.³²

A 2011 survey in Denmark by Frisch et al compared 125 circumcised and 2,220 uncircumcised men aged 16 to >60 years.⁹² The survey was developed by the authors and used categories that included absence of difficulties, occasional difficulties, and frequent difficulties in relation to overall sexual function, PE, erectile dysfunction, and orgasm. The study found that "*circumcision [had] little impact on most sexual domains in men*". There were no significant differences between circumcised and uncircumcised men in age at first intercourse, their perceived importance of a good sex life, sexual activity with their partner in the past year, frequency of sexual intercourse, overall sexual

function, PE, erectile difficulties, and dyspareunia. The only significant difference was that 11% (10 of 95) of men who were circumcised reported experiencing "*frequent*" orgasm difficulties vs a frequency of 4% (63 of 1,575) for uncircumcised men. Occasional orgasm difficulties did not differ significantly. Circumcised men also reported having had significantly more partners ($P = .04$).

In a critique of the study, Morris et al pointed to the low participation rate. They were also concerned that because of the large number of predictors in the statistical model used in the context of a relatively small number of 10 circumcised men who had "*frequent orgasm difficulties*" the model may have been prone to overfitting and, as a result may have suffered from instability, that correction for multiple testing was not undertaken, and using ORs to quantify extent of association was not appropriate in the context of an outcome of interest being common, so exaggerating apparent associations.⁹³ They suggested that the appropriate measure would instead be prevalence risk ratio. As well, the critics noted that MC in the 89% who were ethnic Danish men was likely for medical reasons, where in Denmark MC is partial, leaving residual foreskin tissue and associated nerve endings, so questioning Frisch's argument that the findings stemmed from reduced penile sensitivity. The critics also pointed to the strong evidence contradicting the latter claim. In response, Frisch et al admitted that statistical power was insufficient to address, "*whether the observed associations with sexual difficulties applied particularly to neonatal circumcisions or operations performed after infancy*".⁹⁴ In this regard, the critics pointed to the study by Mao et al of MSM in Sydney²¹ that, "*noted some associations between MC and sexual difficulties only among those men who had been circumcised after infancy,*" and that "*Because of their foreskin problems and associated penile pain and/or difficulties, these men had already acquired behavioral aversions and sexual practices that meant they engaged in less penetrative sex than men who had never had penile problems.*" Thus, "*the majority of the 'circumcised' men in the Frisch study would likely have been previously uncircumcised men who had had a lingering medical problem that one might suspect of causing them distress*".⁹³ The critics also wondered whether "*being aware that their penis looks different from most other Danish men, some may suffer anxiety during sex with a fellow countrywoman unused to a circumcised penis?*" In his reply, Frisch downplayed the criticisms, pointing out that adjustment for age gave ORs similar those obtained in the fully adjusted model, dismissed the need to correct for multiple testing, and agreed that it would be incorrect to claim that their OR of 3.26 suggested that "*frequent sexual difficulties*" were in fact 3.36 fold more common in women who had male partners who were circumcised.⁹⁴

A Danish epidemiologist criticized the Frisch study because the circumcised group were highly likely men circumcised for medical problems.⁹⁵ In a BBC radio interview, a psychiatry Professor at University College London, Michael King, stated that the effect found by Frisch et al was "*tiny*" and referred to the

results as having been “overanalysed.”⁹⁶ Frisch replied by conceding that “most circumcised males and their female partners were fine”.⁹⁶ Moreover, in a YouTube presentation that was one-sided, Frisch stated, “most circumcised men, and most women with circumcised spouses, do not encounter a whole lot of sexual trouble. That I want to stress to avoid stigmatisation”.⁹⁷

A 2013 survey by Bronselaer et al evaluated 1,369 in Belgium men, including 310 (23%) circumcised men aged 18–79 (mean 37) years, and 1,059 (77%) uncircumcised men aged 18–78 (mean 39) years recruited at railway stations.⁹⁸ Participants completed an online version of the Self-assessment of Genital Anatomy, and Sexual Function, Male in which a 5-point Likert scale generated scores for “penile sensitivity” for the dorsal, ventral, and lateral (left and right) sides of the glans, and, separately, the shaft of their penis for sexual pleasure, discomfort/pain, orgasm intensity, effort required to achieve orgasm, numbness, unusual sensations, and unusual sensations intensity when stimulated by themselves or their partners. Of 14 parameters across the dorsal, lateral, and ventral sides of the circumcised vs uncircumcised penis (n = 42 comparisons), 22 showed significant differences between each penis type ($P = .045$ to < 0.001). The authors concluded that there was lower sexual sensation in circumcised men.⁹⁸

A critical evaluation by Morris et al identified a number of problems with the study.⁹⁹ It was subsequently pointed out¹⁷ that the authors failed to disclose that the study was performed by Master of Medicine students and had been published in Flemish in 2011 for their degree.¹⁰⁰ It was curious that there was neither coauthorship nor even an acknowledgement of the students for their work later republished in English by Bronselaer et al. Morris et al noted that while the article showed rating of sexual pleasure and orgasm intensity as “‘mild’ to ‘very strong’” as a percentage for uncircumcised men, no such percentages were stated for circumcised men.⁹⁹ There was no correction for multiple testing in the statistical analyses. In contrast, Bonferroni correction *was* performed in the study that had formulated the questionnaire.⁷¹ While statistically significant, the critics considered it unlikely that differences of between 1% and 11% reported for all items but 2 (which showed “unusual sensations intensity” to be 37% lower for the dorsal penile shaft and 31% lower for lateral penile shaft of the circumcised men, ie, favoring the circumcised penis) of the 21 out of 42 items scored (and not corrected for multiple testing) would be *biologically* significant.⁹⁹ The critics also considered it would not be likely that a man might be capable of knowing accurately whether orgasm intensity varied according to the specific stimulation site, for example, whether intensity would be greater for stimulation of just the lateral shaft of his penis. Various anomalies in reporting included absence of n values pertaining to each of the 42 measurements made in each group and absence of values for variance (eg, \pm SD). Such data were included by the study in which the questionnaire was developed.⁷¹ It was also curious that while the

statistical significance of some differences of only 1% or 2% (and which favored the uncircumcised penis) were high, substantial differences (favoring the circumcised penis) were either not significant (namely, in *uncircumcised* men, 31% higher “unusual sensations intensity” of the lateral penile shaft) or marginally significant (namely, again in the *uncircumcised* men, 37% higher “unusual sensations intensity” of the dorsal shaft,” $P = .039$). The critics also noticed that the questionnaire (developed earlier by the article’s second author, Justine Schober) had included questions on the foreskin and were used in Schober’s 2009 US study.⁷¹ However, foreskin data were not reported in the Belgian study, nor did it report whether such data differed from values pertaining to other sites on the penis of uncircumcised men. It would have been valuable to have reported such data. The critics pointed out that the proportion of 22.6% of men who were circumcised was much higher than the MC prevalence in most of Europe. As well, MSM were overrepresented, in that 14% of participants with an active sexual relationship were homosexual and 2.4% bisexual. Such anomalies were suggested as indicating selection bias in the survey, which was comprised of a self-selected convenience sample. Self-selection is, moreover, highly likely to over-enrol men with an agenda or men with sexual problems. In Europe, MC performed for nonreligious reasons is most often to treat a medical condition, such as balanitis, lichen sclerosis, or phimosis, each of which can have a long-lasting adverse effect on sexual function.²¹ In this regard, 34% of the circumcised men reported that they had been circumcised in adulthood. Bronselaer et al said that men circumcised after 10 years of age had lower sexual pleasure and greater discomfort. MC for a medical reason was suggested by critics as an explanation for the differences reported.^{99,101} Results obtained from empirical testing by physiological measurements, discussed in sections previously, have found no difference in sensation between healthy circumcised and uncircumcised men. Wolff et al urged caution when interpreting the results, pointing out that the study found no reduction of sexual pleasure and orgasm intensity at the ventral penile shaft in circumcised men, whereas their sexual pleasure was slightly improved and orgasm intensity was significantly higher at this location.³⁴ Thus, serious flaws in study design, statistical analysis, and interpretation of data diminishes the study’s interpretation and validity.

In a reply,¹⁰² Bronselaer acknowledged that the study’s conclusions differed from other studies, but, as well as making factual errors (such as stating “non-religious” MC in the USA is “12.8%”), he failed to explain why correction for multiple testing was not done, despite adopting the second author’s protocol that had been used in a US study that involved “paired *t*-test using Bonferroni corrections for multiple comparisons”.⁷¹ His attempt to explain the statistical problems were unconvincing, leading him to suggest it “be left up to the readers to judge the biological relevance of these differences.” The authors of a meta-analysis of sexual function mentioned previously,¹⁸ pointed out “flaws in the retrospective study design”, “bias in demographic parameters”

(including a significantly lower proportion of single men being present in the circumcised group [$P < .005$], and where he stated “*married men are more likely to have regular sex lives, which could affect penile sensitivity*”, the high proportion of men who held a masters’ degree [47.1%], the high proportion of men who were homosexual [12.1%]), and “*missed details*” (eg, no data on interval between MC and completing the questionnaire, because sexual function improves with time after MC, and might explain the finding of less sexual pleasure in men circumcised during adolescence or later).¹⁰³ (Note that the latter reference¹⁰³ is the corrected version found on EMBASE¹⁰³ of an older version on PubMed.¹⁰⁴) Criticisms by Hegarty were that men with sexual problems may be more motivated to complete the questionnaire, that being cross-sectional, and since sensation early after MC may be unpleasant, the study should have documented the temporal changes in penile sensation, that MC in adulthood is commonly for a medical reason, and that despite the high global prevalence of MC, “*the issue of circumcision and penile sensation is not frequently seen in the clinical arena.*”¹⁰¹

A 2017 author-constructed survey by Hammond and Carmack of 1,008 neonatally circumcised men was used to document accounts of the men’s perceived adverse effects of their neonatal MC on their sexual function and pleasure.¹⁰⁵ Critics identified numerous errors in that study.¹⁰⁶ Participants were self-selected. Only men who believed that they had been harmed by neonatal MC were included in the study. The study involved a “loaded” sample unrepresentative of the circumcised male population, in that MSM were overrepresented. The publication contained obfuscation, selective citation of weak studies, as well as misleading and erroneous presentation of previous findings in the field. Most of the “*sexual harms*” Hammond and Carmack listed in their table 3 were the opposite of what has been found by high-quality studies. The problems identified appeared to be ones geared toward supporting the authors’ views. For example, the statement that “*There are no studies of long-term adverse physical, sexual, psychological or self-esteem effects on boys and men from foreskin excision*” is not true. Numerous high-quality studies have failed to find long-term adverse effects of neonatal or later-age MC on anatomy, sexual activity, psychological factors, or self-esteem. These were cited earlier in our review. The authors seemed to have *assumed* that MC is associated with long-term adverse effects, so begging the question. As discussed earlier, numerous high-quality studies have found little or no difference in sexual function and satisfaction between circumcised men and uncircumcised men. Men in many of the studies had been circumcised early in infancy, as is the custom when MC is requested in Anglophone countries. Data pertaining to men circumcised as adults from RCTs and longitudinal studies found that the bulk of men reported experiencing either no

difference or an improvement in sexual function and satisfaction after MC.

Hammond and Carmack cited claims made by the late Robert Darby in his criticisms of the 2012 American Academy of Pediatrics infant MC policy for failing to acknowledge, “*inherent harms associated with the loss of the prepuce itself or later recognised adverse outcomes to sexual/emotional health or self-esteem*”.¹⁰⁷ But they omitted to refer to an extensive critique of that article, in which Darby was accused of, “*speculative claims about the foreskin and obfuscation of the strong scientific evidence supporting pediatric policy development*”.¹⁰⁸

Hammond and Carmack stated that “*condoms were not an option for (neonatally circumcised men) due to exacerbated loss of sensation.*” As support they cited “*two recent studies (in which) Crosby confirmed that circumcised men were significantly less likely than intact men to wear a condom when engaged in penetrative intercourse.*” Contrary to their claim, Crosby and Charnigo firmly stated that there were no differences between circumcised and uncircumcised men in perception of sensation.¹⁰⁹ Rather, those authors explained that lower condom use by circumcised men was related to confidence, in that lower condom use was apparent only in men younger than 25 years, and found that as the men matured the difference disappeared. Crosby and Charnigo reported data relevant to sensation (as can be seen in their table 1). Scores for adverse perceptions were in fact higher for their *uncircumcised* men, although the difference was not statistically significant. A study of young heterosexual men that found erect penises were less sensitive to vibrotactile stimulation than flaccid penises, condoms were shown to decrease penile vibrotactile sensitivity.¹¹⁰ Psycho-physiological studies of young heterosexual men found that those who experienced erectile problems associated with condom use required greater time or higher intensity of stimulation, or both, to become aroused sexually.¹¹¹ An investigation involving Afro-American MSM failed to find any difference between those who were circumcised and the uncircumcised in experiencing problems with use of condoms or extent of perceiving condoms as detracting from sexual pleasure.¹¹²

A 2018 small 10-item “*penile anatomy and circumcision quiz*” by Earp et al of 999 US men circumcised as infants found that most of these circumcised men were satisfied with having been circumcised.¹¹³ But instead of accepting the findings as had been reported by the men, Earp et al suggested that the men had adopted “*false beliefs*” to “*justify their genitally altered state.*” In a critique, Moreton pointed out serious flaws in the study, including that (i) half of the 10 “*true/false*” statements used in the survey were questionable, (ii) all of the extensive literature contradicting the findings was ignored, and (iii) the pivotal issue regarding whether dissatisfied circumcised men have false beliefs concerning MC was ignored.¹¹⁴ Moreton concluded that because of the serious flaws he identified, readers should dismiss the study as misleading.

DISCUSSION

The present systematic review provides all of the evidence currently available to assist those in the field of sexual medicine to decide whether MC may be beneficial, detrimental or have no effect on sexual function, penile sensitivity, sexual satisfaction and pleasure. The findings complement those from recent systematic reviews of studies examining women's experiences of men of either MC status.^{115,116} Each of those reviews found an overall preference by women for the circumcised penis because of esthetics, ease of vaginal penetration, less frequent dyspareunia, better hygiene, and reduced risk of infection.

An important source of the controversy is what the appropriate age should be for performing MC. In Anglophone countries non-therapeutic MC is generally performed early in infancy. This is convenient as the baby often sleeps, the procedure is quick, risks are low, cosmetic outcome is optimal, local anesthesia can be used, costs are minimal, and benefits accrue almost immediately.¹¹⁷ On the other hand, MC in infancy leaves neonatally circumcised men vulnerable to persuasion by others that loss of their foreskin has deprived them of sexual pleasure. That is not to say that neonatal MC will never have an adverse outcome that might impact sexual function or pleasure. Although minor adverse events (excessive bleeding, infection, skin bridges, and need for repeat surgery that occur in 0.5% of medical neonatal circumcisions) can be immediately and easily treated with complete resolution, extremely rare serious complications such as damage to the penis can have long-lasting adverse sexual effects.

It is notable that robust secondary RCT data have shown that, with few exceptions, men born with a foreskin reported no adverse effect of MC on sexual function and pleasure after having had their foreskin removed by the procedure at the beginning of the trial.⁸ The RCTs, as well as other high quality studies we have reviewed, mostly find similar or greater sexual satisfaction after recovery from MC. Nevertheless, some might argue that having decided to get circumcised a man might tend to approve of the outcome of his decision, just as may be the case for a circumcised man who decides to undergo the arduous protracted process "foreskin restoration". The same or greater satisfaction was also generally the case in cohort studies comparing men who were circumcised with those who were not, irrespective of the age at which MC took place. In the circumcised penis, the most erogenous regions—the glans and distal ventral shaft—would, during sexual intercourse, have direct contact with the vaginal wall, and such contact has been suggested to enhance sexual pleasure.¹⁷

Data from low-quality studies has been used to fuel speculation that MC is detrimental to sexual function and pleasure, with such views often being posted on the Internet and social media.¹¹⁸ Men with sexual problems too embarrassed to consult a medical practitioner for advice and effective treatment may use "Dr Google", where they will find an abundance of websites

informing them that their infant MC is responsible for their problem.¹⁰⁶ Men whose sexual function is normal may also succumb to such fallacies, leading them to think their sex life has been diminished, so causing them anxiety and resentment of their parents' decision to have them circumcised. A systematic review has, moreover, found a strong correlation between depression and sexual dysfunction.¹¹⁹ The distress caused by belief in an erroneous narrative may therefore have detrimental effects on men's sexual function and mental health.¹⁰⁶

The field of sexual medicine would benefit from a large-scale meta-analysis on the psychophysiological studies investigating whether there is any psychosexual effect of MC on sexual function or pleasure. To date, there are not enough high-quality studies to do this. The data currently available nevertheless show that, based on quality, and also quantity, of studies, there are unlikely to be any serious adverse effects of MC, including of neonatal MC, on sexual function, sensation, and pleasure, in healthy, well-adjusted men. This includes meta-analyses^{18,19} of data from ten¹⁸ and twelve¹⁹ studies, respectively, showing an absence of any detrimental effect on sexual function. The most recent meta-analysis found lower dyspareunia, erectile dysfunction, and intravaginal ELT in circumcised men.¹⁹

Studies that have reported adverse effects of MC on sexual function generally lack scientific rigor. To move the MC debate toward a place of ever greater scientific rigor, it is the scientific community's responsibility to strive to publish strong, empirical research on the topic. This can be accomplished through the use of exceptional study design and sound science, such that firm conclusions can be drawn regarding long-term impacts of the surgical removal of the foreskin on sexual function and pleasure.

Scientific research on MC has a downside.¹¹⁸ While earlier stating, "*We will continue to report what the data show, regardless of whether that reflects the popular vote, and hope that others in this field do the same,*"⁶⁸ Jennifer Bossio later stated that the harassment she faced was the reason she is no longer pursuing research in the field of MC, saying: "*If I'd have known what I was getting into, I would not have done this important research in the first place*".¹²⁰ Thus, resilience is needed when researching any scientific topic that attracts polarized views. In this regard, MC is particularly prone to criticism because, despite having health benefits,¹¹⁷ it concerns young children, surgery, the possibility of pain, legal issues, ethics, and, for some, religion.

Confirmation bias and asymmetric Bayesianism are other issues to be aware of¹²¹ in the discussion of a topic such as MC that is contentious. It has been found that *ad hominem* attacks on the scientists, rather than the empirical basis of the scientific findings they generate, represent an effective means of promoting a particular unscientific or one-sided point of view for those who reject the scientific evidence on a particular topic.¹²² An evaluation of twitter posts using "#circumcision" found that "*circumcision is one of the hottest topics in urology and that discussion points on this social medium were mostly driven by the media*

and the activists".¹²³ The study recommended that "[social media] usage should be increased by medical professionals for true information for the public." A recent study of Facebook comments provided insights into the basis for the controversy.¹²⁴ In the current "post-truth" era, vocal minority groups may think that their opinions should count more than the evidence that medical and scientific experts rely on for their views.¹²⁵ 4 potential strategies to address this have been developed.¹²⁶ The advice may prove helpful to clinicians, scientists, health-care workers, and others, whatever their field.

CONCLUSIONS

The present systematic review of the effect of MC on sexual function, sensation, satisfaction, and pleasure shows overall consistency in conclusions from high- and moderate-quality physiological studies and survey data arising from RCTs, large longitudinal and cohort studies in diverse populations globally, as well as all systematic reviews and meta-analyses. These studies have found that, overall, there was no adverse effect of MC on these parameters. In contrast, data supporting MC having adverse effects were found to be of low quality, as explained by extensive published criticisms. The consensus of the highest quality literature is that for the vast majority of males, whether they were circumcised neonatally or at later ages, there is no adverse effect of MC on sexual function and pleasure.

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Conflict of Interest: B.J.M. is a member 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. J.N.K. is the coinventor of a circumcision device patented by the University of Washington. The authors have no financial, religious, or other affiliations that might influence the topic of male circumcision.

Funding: None.

STATEMENT OF AUTHORSHIP

Brian J. Morris: Writing - Original Draft, Formal Analysis; Brian J. Morris and John N. Krieger: Conceptualization, Methodology, Investigation, Resources, Writing - Review & Editing, Funding Acquisition.

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