Condom avoidance and determinants of demand for male circumcision in Johannesburg, South Africa

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Background Circumcision is efficacious in reducing HIV acquisition in heterosexual males. The South Africa government has been reluctant to adopt a national circumcision programme, possibly due to concerns that circumcision may result in decreased condom use.

Objective To identify the determinants of demand for male circumcision, to examine variations by ethnicity, and to determine whether it is demanded to avoid condom use.

Methods 403 parents and 237 sons in Johannesburg, South Africa, were recruited through a randomized household survey, with oversampling to balance between blacks (n = 220), ‘coloured’ (mixed ethnicity) (n = 202) and whites (n = 218). The demand for male circumcision was estimated using a conjoint analysis, with each respondent randomly receiving four tasks comparing seven possible benefits—six identified through key informant interviews and one for condom avoidance. Respondents’ choices were analysed using logistic regression, including stratified analyses to test for homogeneity.

Results Overall, circumcision’s beneficial effects on HIV transmission (P < 0.001), sexually transmitted infection (STI) transmission (P < 0.001), hygiene (P < 0.05) and sex (P < 0.05) were identified as determinants of demand, but the condom avoidance hypothesis was rejected as it was ‘repulsive’ to respondents (P < 0.001). Consistent results were found for blacks (P < 0.001) and coloured (P < 0.001), but not for whites who found condom avoidance attractive (P < 0.04), a result not explained by variations in wealth, age or paternal circumcision status.

Conclusions Male circumcision programmes should be tailored to accommodate variations in the determinants of demand across the target population. We find that circumcision’s protective effect against HIV acquisition in men is the only determinant to be found consistently across all ethnic groups in Johannesburg. We also find that concerns over condom avoidance may have been overstated. This said, male circumcision strategies should reinforce a range of HIV prevention strategies, including condom use, as we find evidence that whites may view circumcision as a means to avoid condom use.

Keywords Male circumcision, demand, HIV, prevention, ethnicity
KEY MESSAGES
- While randomized trials of male circumcision show efficacy in reducing the risk of HIV transmission in heterosexual males (Auvert et al. 2005; Bailey et al. 2007; Gray et al. 2007). As a result, numerous public health advocacy organizations, including the World Health Organization, have argued for the inclusion of a male circumcision programme as an integral part of any large scale HIV prevention strategy (UNAIDS/WHO 2007; Potts et al. 2008; White et al. 2008). Kenya has since rolled out a nationwide programme to provide safe circumcision for all willing males in the country, while other sub-Saharan countries have taken steps to submit drafts of similar nationwide policies to their parliamentary bodies (UNAIDS 2009). Globally, South Africa bears the greatest incidence and burden of HIV and would benefit from any intervention that would reduce new infections (Connolly et al. 2004; Bärnighausen et al. 2009), yet a national programme to promote male circumcision has not been adopted.

In South Africa, and elsewhere, there has been concern that higher rates of circumcision among at-risk men may decrease rates of other HIV preventative measures, such as condom use (Cassell et al. 2006; Agot et al. 2007; Berer 2008). A reversal in uptake of proven preventative behaviours may diminish HIV incidence gains resulting from large-scale circumcision programmes. Such concerns have highlighted knowledge gaps in the determinants of circumcision demand. Several studies have attempted to address these gaps through survey and focus group methods in sub-Saharan Africa (Westercamp and Bailey 2006). These studies have identified attributes such as increased hygiene, a reduction in HIV and sexually transmitted infection (STI) transmission risk, and better sexual performance as facilitating determinants for circumcision. However, these methods are unable to provide information on how potential adopters perceive the competing beneficial attributes of circumcision and how these vary across ethnic groups.

The ranking and weighting of the potential determinants of circumcision demand is critical to assessing the potential of risk compensation (or, in economic parlance, moral hazard) due to the implementation of a large-scale circumcision programme. One way of eliciting beliefs about competing attributes is through conjoint analysis. This technique provides important information on what the determinants of circumcision demand are, but also quantifies how each attribute is valued by the respondent by forcing them to reveal their preferences through a series of discrete choice experiments (Louviere et al. 2000).

While its use has been a mainstay for market research firms for decades, its application in health care settings has only recently become more commonplace (Ryan and Gerard 2003; Bridges et al. 2008). We report the results of conjoint analysis conducted among relevant decision makers, including mothers and fathers of uncircumcised boys and uncircumcised sons themselves aged 14–30 years from Johannesburg, South Africa. We are the first to systematically examine ethnic variation in the determinants of demand, and in the absence of long-term effectiveness or cost-effectiveness data, we provide important information that extends beyond the current evidence base of anecdotal and qualitative findings. Our aim was to rank and weight the determinants of demand for male circumcision, to examine ethnic variation in these determinants and to test if demand for circumcision is motivated by a want to avoid condom use—a measure of moral hazard.

Introduction

Circumcision has been demonstrated to be efficacious in reducing the risk of HIV transmission in heterosexual males (Auvert et al. 2005; Bailey et al. 2007; Gray et al. 2007). As a result, numerous public health advocacy organizations, including the World Health Organization, have argued for the inclusion of a male circumcision programme as an integral part of any large scale HIV prevention strategy (UNAIDS/WHO 2007; Potts et al. 2008; White et al. 2008). Kenya has since rolled out a nationwide programme to provide safe circumcision for all willing males in the country, while other sub-Saharan countries have taken steps to submit drafts of similar nationwide policies to their parliamentary bodies (UNAIDS 2009). Globally, South Africa bears the greatest incidence and burden of HIV and would benefit from any intervention that would reduce new infections (Connolly et al. 2004; Bärnighausen et al. 2009), yet a national programme to promote male circumcision has not been adopted.

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While its use has been a mainstay for market research firms for decades, its application in health care settings has only recently become more commonplace (Ryan and Gerard 2003; Bridges et al. 2008). We report the results of conjoint analysis conducted among relevant decision makers, including mothers and fathers of uncircumcised boys and uncircumcised sons themselves aged 14–30 years from Johannesburg, South Africa. We are the first to systematically examine ethnic variation in the determinants of demand, and in the absence of long-term effectiveness or cost-effectiveness data, we provide important information that extends beyond the current evidence base of anecdotal and qualitative findings. Our aim was to rank and weight the determinants of demand for male circumcision, to examine ethnic variation in these determinants and to test if demand for circumcision is motivated by a want to avoid condom use—a measure of moral hazard.

Methods

Participants

This study was conducted in Greater Metropolitan Johannesburg, South Africa, the largest city in South Africa with a population of 3.8 million and the provincial capital of Gauteng Province. While circumcision prevalence is unavailable for Johannesburg, a nationwide sampling suggested that one-third of men are circumcised, with higher prevalence among older black men relative to whites and coloureds (Cywes 1989; Connolly et al. 2008).

Currently, no reliable sample size calculations exist for the application of conjoint analysis (Bridges 2004), but several rules of thumb have emerged in the marketing literature (Orme 2006). The most often cited rule is the so-called Choice-Based Conjoint rule, which posits that for aggregate conjoint analysis ntaic should be greater than or equal to 500, where n is the number of respondents, t is number of conjoint tasks, a is the number of alternatives per task and c is the number of analysis cells (Orme 2006). In this study, solving for n yields an optimal sample size of at least 125. Given that we aimed to power our study for the analysis for stratification by race, we utilized the ‘Orme’s rule of thumb’, which argues that at least 200 respondents per strata are needed (Orme 2006), suggesting that our sample size be greater than 600 given our three ethnicity-based strata. Such a sample is consistent with the
average sample size of all other health systems applications of conjoint analysis, which was estimated at 556 in a recent systematic review (Bridges et al. 2008).

Participants were recruited using a randomized household survey. Census enumerator areas were stratified by predominant ethnicity of inhabitants into black, ‘coloured’ (mixed ethnicity) and white groupings. If there were a national roll-out of circumcision in South Africa, it would be socially and politically important that all be targeted irrespective of ethnicity, hence blacks, whites and coloureds representing 79.2%, 9.2% and 9.0% of the total population of South Africa, respectively (Statistics South Africa 2009). Households were selected in a two-step random process: first, 10 enumerator areas (EA) from each ethnicity group were randomly selected; secondly, a starting household was randomly selected using aerial photos. Systematic selection of adjacent households to the left or right of the start household were then included in the study. A household was excluded if no suitable respondent was identified or if consent was not obtained. After EA selection, a systematic sampling of respondents was carried out by alternating the selection households which contained a mother/father of a son or a self-reported uncircumcised male. With only one respondent per household, no parent–son pairs exist in our data. While this avoids any potential bias or clustering, it does prevent us from directly estimating the concordance of parent–son beliefs. If the selected respondent type was not available in the household, the household was revisited. If they were still not present on the second attempt, the household was excluded.

Given a concern that our random sampling might not lead to an appropriate ethnic balance, due to either a lack of eligible respondents and/or low participation rates, we envisioned the need for oversampling. The most recent household survey assessing national HIV prevalence in South Africa, for example, experienced difficulties in accessing whites who cite security concerns and lack of immediately tangible benefit for non-participation (Shisana et al. 2009). We anticipated similar problems in recruiting, and prepared a plan for convenience sampling of shoppers at local shopping malls for the relevant population to use to ensure relatively similar sizes of ethnic groups within the study. Individuals that successfully completed the survey were given a 20 South African Rand (approximately US$2.75) telephone card.

The research protocol for the preliminary key informant interview and household survey was reviewed and approved by the University of Witwatersrand ethics committee. The preliminary key informant interview and the secondary data analysis of the survey data was reviewed and approved by the Johns Hopkins School of Public Health Institutional Review Board.

Procedures

Respondents who met the study criteria were randomly assigned to receive one of two versions of the survey instrument, containing a block of four paired comparison conjoint analysis tasks, outlining seven possible determinants of demand. Six of these determinants of demand were identified from key informant interviews involving a range of stakeholders, including nurses and doctors with experience in doing circumcisions, male circumcision experts, potential demanders (both parents and sons) and community leaders in the study area, purposively sampled to ensure ethnic variation.

The six possible determinants of demand were: (1) the reduction in risk of cervical cancer in women (denoted ‘reduces cervical cancer risk’ for the remainder of this paper), (2) the reduction in risk of sexually transmitted disease/infections (reduces STI risk), (3) that circumcision was viewed as a rite of passage into manhood or as a part of becoming a man (manhood), (4) the reduction in risk of HIV acquisition by men (reduced HIV risk), (5) the increased enjoyment of sexual intercourse, both from the perspective of the male and his female partner (more enjoyable sex), and (6) it improves penile hygiene (increases hygiene). Supplemental to these six determinants of demand grounded in our qualitative work, a seventh was added to test the condom avoidance (no condom needed).

An example of one of the paired comparison conjoint analysis tasks is illustrated in Figure 1. In each such task the seven possible benefits have been divided into two mutually exclusive and exhaustive subsets. Respondents were asked to consider the two competing sets benefits and select which was the more plausible justification for demanding male circumcision. Respondents were required to provide a choice (left or right), but no other answers or justifications were sought. A trained interviewer, required to be fluent in isiZulu or Sesotho and at least conversant in other local languages, provided simultaneous translation and collected other necessary demographic information. The interviewers were all experienced in administering surveys of this nature in Johannesburg. As seen in Figure 1, culturally relevant graphical representations of the attributes were added based on feedback we received when piloting the instrument, and these aided translation and comprehension.

We used a fractional factorial design to limit the number of possible pairs required to show respondents. As there were no hypotheses pertaining to any possible interactions between the seven possible benefits, we utilized a main-effects orthogonal array to ensure that there was no correlation between the possible benefits. The orthogonal array generated an experimental design of eight possible sets of possible benefits, which were then paired with their complement to ensure that all seven determinants appeared once, but not more than once, on each card. This ensured no overlap between benefits on the cards and ensured utility balance, implying a priori that the choice of either side had equal probability.

Prior to the population of the experimental design, the orthogonal array was randomized both vertically and horizontally, to ensure that the underlying symmetry in the design was not apparent to the respondents. These eight paired sets were then randomized into two blocks of four paired comparison conjoint analysis tasks.

In addition to completing the discrete choice survey, individuals were asked to provide age, gender, ethnicity, primary language spoken at home and years of education. Wealth indicators such as household monthly income, and ownership of a television, radio, mobile phone or refrigerator were also reported. For the purposes of multivariate regression, number of rooms in the household was used given that it was most reliably reported. Terriles were best approximated by houses
with less than five rooms, houses with five rooms and houses with more than five rooms. Self-reported circumcised status was reported in fathers only, as all sons had to be self-reported uncircumcised to be included.

**Statistical analysis**

Data were captured via a standardized survey response form that was filled out by a trained field worker. These forms were then electronically scanned, verified and entered into a separate, de-identified database for statistical analysis. Demographic characteristics were evaluated for differences across selected groupings using the F-statistic from an analysis of variance (ANOVA).

The primary outcome in our analysis was the set of benefits chosen for each task (i.e. did the respondent choose set A or B), producing a dichotomous variable equal to 0 if the respondents choose left and 1 if the respondent choose right. With regard to the independent variables, dichotomous variables were defined based on where the possible benefits were placed, with the relevant variable equal to 0 if the item was placed on the left and 1 if it was placed on the right. Logistic regression was used to estimate the parameters of the covariates in the analysis. The model was estimated using Stata version 10 (College Station, TX). Stratified analyses were estimated in a joint model so as to produce a robust test of homogeneity.

Odds ratios were used to indicate the determinants of demand, with a value greater than 1 indicating the respondent was attracted to circumcision by the factor, and a value less than 1 indicating that the respondent found the factor repulsive. When interpreting the magnitude of the odds ratios, there are two important factors to consider: the experimental design implies that, a priori, the expected utility of the two cards is equal and hence preference for one over the other unlikely and that heterogeneity in preferences or respondents who answered inconsistently or at random will bias parameter estimates towards 1 (i.e. towards the null hypothesis). Parameter estimates with P-values less than 5% were considered statistically significant based on two-tailed tests.

**Results**

Figure 2 shows the sampling profile for this study. After 50 consecutive refusals to participate among potential white respondents, a result consistent with findings of another recent household survey (Shisana et al. 2009), a decision was made to abandon the geographic-based household sampling for whites in lieu of a simpler, and safer, mall-based sampling strategy. Of the 980 black and coloured households that were randomized, 138 were not at home on the first or second visit, 57 refused to participate, 324 were ineligible to participate, and 39 household surveys were incomplete. Thus 220 black and 202 coloured households were eligible, successfully recruited and complete in their responses. In the oversampling strategy a further 1526 whites were contacted, with 218 respondents eligible, recruited and complete in their responses.

The demographic characteristics of respondents are reported in Table 1. Of the 640 competed participants in the study, 201 (31.4%) were fathers, 202 (31.6%) were mothers, 179 (28.0%) were sons 18 years and older, and 58 (9.1%) were sons under the age of 18. Median ages observed among these categories

![Figure 1](image-url) - An example of the paired comparison conjoint analysis tasks.
were 48, 47, 24 and 16 years old, respectively. The largest deviation from the average proportions of respondent categories was for whites, where sons 18 and over were included at a rate nearly twice that of the other races, a consequence of a different sampling strategy.

Of the 201 fathers, 94 were circumcised, of which 40 were black, 33 were coloured and 21 were white. This implied that the self-reported circumcision rates among fathers were 54% for blacks, 49% for coloureds and 35% for whites. Assuming that circumcised males might be more likely to circumcise their sons, and given that fathers needed to have an uncircumcised son to be eligible to participate, these estimates may provide a lower bound for circumcision rates in Johannesburg. Self-reported circumcision may be subject to social desirability bias, but the direction of this bias is a matter of debate in the literature (Urassa et al. 1997; Templeton et al. 2008).

As seen in Table 1, all demographic and socio-economic characteristics varied significantly among the respondents by ethnicity. Blacks and coloureds were of lower income and were less likely to own a television, radio or mobile phone than their white counterparts ($P < 0.001$). Among adult respondents, blacks and coloureds were also less educated than whites ($P < 0.001$). Zulu (54.1%), Tswana (11.8%) and Southern Sotho (20.0%) were the predominant primary languages in black households, while English and Afrikaans were spoken in 37.1% and 62.9% of coloured and 82.6% and 15.1% of white households, respectively.

Figure 3 presents the aggregate and stratified results by ethnic group. The graphic portion of Figure 3 presents the stratified results with a 95% confidence interval. The $P$-value tests for homogeneity across racial groups for each of the estimates. The pooled odds ratio and 95% confidence interval is also presented. As seen in Figure 3, coloured respondents were the only group attracted to male circumcision by its effect on reducing cervical cancer risk, while blacks were the only group who focused on its impact on reducing other STIs. No group thought that male circumcision was a rite of passage into manhood, yet every group associated reducing HIV acquisition in men with circumcision’s benefits.

While condom avoidance was rejected in aggregate with an odds ratio statistically below 1, it is also the only potential benefit where homogeneity across the racial groups is rejected ($P < 0.001$). Upon further examination of the issue, presented in Table 2, we found that while black and coloured respondents were strongly repulsed by the idea of demanding circumcision to avoid condom ($P < 0.001$), white respondents found it attractive ($P = 0.04$). Alternative hypotheses were also tested to see if this attraction to condom avoidance could be explained.

Using household size as a proxy for wealth, respondents with five or less rooms found condom avoidance repulsive, while
Table 1  Demographic characteristics

<table>
<thead>
<tr>
<th>Respondent categories (%)</th>
<th>Overall (n = 640)</th>
<th>Black (n = 220)</th>
<th>Coloured (n = 202)</th>
<th>White (n = 218)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fathers</td>
<td>31.4</td>
<td>33.6</td>
<td>33.2</td>
<td>27.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Mothers</td>
<td>31.6</td>
<td>32.3</td>
<td>37.1</td>
<td>25.7</td>
<td>0.003</td>
</tr>
<tr>
<td>Sons ≥18 years</td>
<td>27.9</td>
<td>21.4</td>
<td>22.3</td>
<td>39.9</td>
<td>0.001</td>
</tr>
<tr>
<td>Sons &lt;18 years</td>
<td>9.1</td>
<td>12.7</td>
<td>7.4</td>
<td>6.9</td>
<td>0.001</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Average age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers</td>
<td>47.8</td>
<td>47.9</td>
<td>45.0</td>
<td>50.7</td>
<td>0.029</td>
</tr>
<tr>
<td>Mothers</td>
<td>47.2</td>
<td>49.2</td>
<td>46.9</td>
<td>45.0</td>
<td>0.001</td>
</tr>
<tr>
<td>Sons ≥18 years</td>
<td>23.2</td>
<td>24.8</td>
<td>22.9</td>
<td>22.4</td>
<td>0.001</td>
</tr>
<tr>
<td>Sons &lt;18 years</td>
<td>15.6</td>
<td>15.4</td>
<td>15.1</td>
<td>16.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Primary language (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zulu</td>
<td>18.6</td>
<td>54.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.001</td>
</tr>
<tr>
<td>English</td>
<td>40.0</td>
<td>0.5</td>
<td>37.1</td>
<td>82.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Afrikaans</td>
<td>25.3</td>
<td>0.9</td>
<td>62.9</td>
<td>15.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Other</td>
<td>16.1</td>
<td>44.6</td>
<td>0.0</td>
<td>2.3</td>
<td>0.001</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean highest grade achieveda</td>
<td>10.9</td>
<td>10.3</td>
<td>10.3</td>
<td>12.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Economic indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean monthly household incomeb</td>
<td>3780</td>
<td>1777</td>
<td>2402</td>
<td>9051</td>
<td>0.001</td>
</tr>
<tr>
<td>Television ownership (%)</td>
<td>96.7</td>
<td>94.0</td>
<td>96.5</td>
<td>99.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Radio ownership (%)</td>
<td>89.8</td>
<td>89.5</td>
<td>79.7</td>
<td>99.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Mobile phone ownership (%)</td>
<td>86.1</td>
<td>81.7</td>
<td>79.7</td>
<td>96.3</td>
<td>0.001</td>
</tr>
<tr>
<td>Refrigerator ownership (%)</td>
<td>97.1</td>
<td>96.8</td>
<td>95.1</td>
<td>99.5</td>
<td>0.001</td>
</tr>
</tbody>
</table>

aAmong respondents 18 years of age or older.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Odds Ratioa</th>
<th>P-valueb</th>
<th>Odds Ratioa</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces cervical cancer risk</td>
<td>black</td>
<td>coloured</td>
<td>white</td>
<td>P = 0.065</td>
</tr>
<tr>
<td>Reduces STI risk</td>
<td>black</td>
<td>coloured</td>
<td>white</td>
<td>P = 0.106</td>
</tr>
<tr>
<td>Manhood</td>
<td>black</td>
<td>coloured</td>
<td>white</td>
<td>P = 0.796</td>
</tr>
<tr>
<td>Reduces HIV risk</td>
<td>black</td>
<td>coloured</td>
<td>white</td>
<td>P = 0.739</td>
</tr>
<tr>
<td>No condom needed</td>
<td>black</td>
<td>coloured</td>
<td>white</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>More enjoyable sex</td>
<td>black</td>
<td>coloured</td>
<td>white</td>
<td>P = 0.123</td>
</tr>
<tr>
<td>Increases hygiene</td>
<td>black</td>
<td>coloured</td>
<td>white</td>
<td>P = 0.061</td>
</tr>
</tbody>
</table>

aOdds ratios for race-specific preferences.
bP-values for the test of racial interactions.
cAggregated odds ratios.

Figure 3  Attribute preferences in aggregate and by race.
those with more than five rooms found it marginally repulsive, but with a 95% confidence interval spanning unity (0.85–1.15).

We also stratified by respondent type, given that whites had a disproportionate percentage of sons over the age of 18. This analysis revealed that fathers, mothers and sons over the age of 18 were statistically averse to condom avoidance, and sons under the age of 18 found it somewhat attractive (OR = 1.217), but not significantly so (P = 0.05). We also consider the impact of self-reported circumcision status on the issue of condom avoidance among fathers (the only groups where such status varied). Circumcised fathers found condom avoidance far more repulsive than average (P < 0.001). The estimate for uncircumcised fathers (OR = 1.03), while indicating that it was somewhat attractive, was not statistically significant (P = 0.76). Stratification on circumcision status highlighted other important differences that are not reported in Table 2. Circumcised fathers thought that it was beneficial because of its effect on the transmission of STIs (P = 0.02) and HIV (P < 0.001), but these failed to reach significance among the uncircumcised (P = 0.43 and P = 0.13, respectively). Finally, uncircumcised fathers found hygiene an attractive benefit of circumcision (P = 0.05), a result that was not significant among circumcised fathers (P = 0.67).

**Discussion**

We are the first to systematically examine ethnic variation in the determinants of circumcision demand in both potential clients of circumcision services and those likely to be involved in molding beliefs and decisions about circumcision. We provide important information that extends beyond the current evidence base of anecdotal and qualitative findings.

Our study in Johannesburg, South Africa, shows that demand for circumcision is largely determined by the perceived benefits of reduced HIV/STI transmission risk, better hygiene and better sex. Moreover, our analysis shows that—in the aggregate—condom avoidance is not perceived as a benefit of circumcision. Our findings suggest that moral hazard concerns related to risk compensation via condom avoidance associated with male circumcision are exaggerated. However, our stratified analyses show that there are important differences across socio-demographic categories that would need to be taken into account in executing a nation-level circumcision delivery service.

There are three significant limitations to this study. One is that it focuses on the intent of individuals, not their actions. Through the application of conjoint analysis we prepared a controlled experiment of competing determinants of demand, measured a priori. While our approach is consistent with the economic theory of demand, we have explicitly focused on the demand for circumcision and not the demand for condom use. Such a model would have required a rather different experimental design and research question. Thus, our analysis has focused on the role that desire to avoid subsequent condom use has on circumcision rates, and not necessarily the reverse which was measured in the clinical trials.

A second limitation is that our sample was restricted to neighbourhoods in Johannesburg, and may narrow the generalizability of our findings in sub-Saharan Africa. However, we believe that our sampling strategy captures a large degree of the heterogeneity in the population and still provides important insight into circumcision demand in a region with extremely high HIV burden.

A final limitation of this study is that condom avoidance is only one avenue through which one could engage in riskier sex practices. Others have focused on the number of sexual partners as a measure of sexual disinhibition resulting from male circumcision, but the evidence is mixed. Two studies from Kenya found no evidence that circumcision led to an increase in HIV risk behaviour (Agot et al. 2007; Mattson et al. 2007), but results from South Africa identified a slight increase in riskier behaviour within the circumcised group (Auvert et al. 2005).

We believe that number of sexual experiences is a complicated measure of the moral hazard associated with male circumcision for three reasons. First, circumcision can be viewed as a rite of passage into manhood or may occur just prior to sexual initiation. Secondly, circumcision may be associated with improved sexual functioning, especially given that male circumcision is currently only medically indicated in South Africa for males with abnormalities that affect functioning. Finally, circumcision may be ‘preferred’ by female partners or otherwise affect the quality of sex. We aimed to control for beliefs about such quality factors by explicitly incorporating ‘easier and more enjoyable sex’ as a potential benefit of circumcision.

**Policy conclusions**

Despite the limitations in this study, we conclude that the implementation of a national male circumcision programme in South Africa should not be delayed over concerns about its potential impact on condom avoidance. There is now strong evidence that the implementation of such a programme will reap large returns in communities that are at high risk for HIV transmission (Bailey et al. 2002; Rain-Taljaard 2003; Mattson...
et al. 2005; Scott et al. 2005; Ngalande et al. 2006; Westercamp and Bailey 2006; Wise 2006). Our findings indicate that while efforts to promote male circumcision in South Africa will find a ready audience when explaining the benefits on HIV transmission, they must also take into account that whites may value circumcision as a means to avoid subsequent condom use.

While social marketing should continue to strongly emphasize safe sex practices besides circumcision, we find no evidence that individuals seek circumcision as substitute for condom use. In terms of policy, the results indicate one less barrier for South Africa on the path to a nationally provided male circumcision programme, and form an integral part of policymaking situation analysis. Lastly, our results provide guidance as to which beneficial components of circumcision should be emphasized in marketing a circumcision programme.

National policies of male circumcision are moving ahead in some areas of sub-Saharan Africa, however, despite the fear of risk disinhibition. Kenya has embarked upon a campaign of providing safe circumcision to male newborns or willing 15–45 year olds, targeting 80% circumcision prevalence in all provinces by 2013 (UNAIDS 2009). While not adopting a stand-alone programme for male circumcision, Zambia plans to increase male circumcision delivery sites from 11 to 300 by 2014 as part of their HIV prevention programme (WHO 2009).

Both Kenya and Zambia conducted situation analyses to inform policy prior to implementation. This sort of analysis proves crucial in determining the shape that male circumcision policies will take within a specific country context. In Kenya, for instance, communications strategies are being developed to increase the acceptability of state-provided male circumcision services. In Zambia, on the other hand, health facility preparedness assessment has been a large part of policy development (UNAIDS 2009). South Africa, which is in the process of conducting its circumcision situation analysis, should consider the results offered here, as well as a variety of others, particularly in the formulation of marketing strategies, to implement well-developed mass medical male circumcision strategy.

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