

Association between medical male circumcision and HIV risk compensation among heterosexual men: a systematic review and meta-analysis

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Background

Medical male circumcision (MMC) reduces HIV infection among heterosexual men. There are concerns MMC may prompt higher risk sexual behaviors because of lower self-perceived of HIV infection. We reviewed the published literature to examine associations between MMC and both condom use and number of sex partners among heterosexual men.

Methods

We searched PubMed, Embase, and the Cochrane Library for studies published before May 5, 2020. Interventional and observational studies were included if they contained original quantitative data describing the association between MMC and condom use and/or number of sex partners among heterosexual men. We excluded data from men whose circumcisions were ritual/religious and data from men who have sex with men. We used the Mantel-Haenszel random effects model to calculate pooled odds ratios (OR) and 95% confidence intervals (CI). In subgroup analysis, the standardized mean differences' difference (SMDD) of condomless sex or multiple partners was calculated for cohort studies and randomized controlled trials (RCTs) and then pooled with a random effects model. We assessed bias with the Cochrane Handbook of Systematic Reviews of Interventions and the Newcastle-Ottawa Scale.

Findings

- From 27 eligible studies, we identified 99,292 men from 31 independent population samples. 24 (88.9%) studies were from Africa.
- We did not find statistically significant association between MMC and condomless sex (OR 0.91, 95% CI 0.80-1.05; $k=30$; $I^2=88.7%$) or multiple sex partners (OR 1.02, 95% CI 0.88-1.18; $k=27$; $I^2=90.1%$).
- Subgroup analysis of cohort and RCT studies showed that circumcised men were less likely to have multiple sex partners at 6 months (SMDD -0.12, 95% CI -0.19--0.04; $k=5$) and 12 months (SMDD -0.09, 95% CI -0.17--0.01; $k=5$;) post-MMC, but there was no statistically significant difference in number of sexual partners after 12 months post-MMC (18 months: SMDD 0.10, 95% CI -0.01-0.20; $k=3$; ≥ 24 months: SMDD 0.07, 95% CI -0.10-0.24; $k=4$).

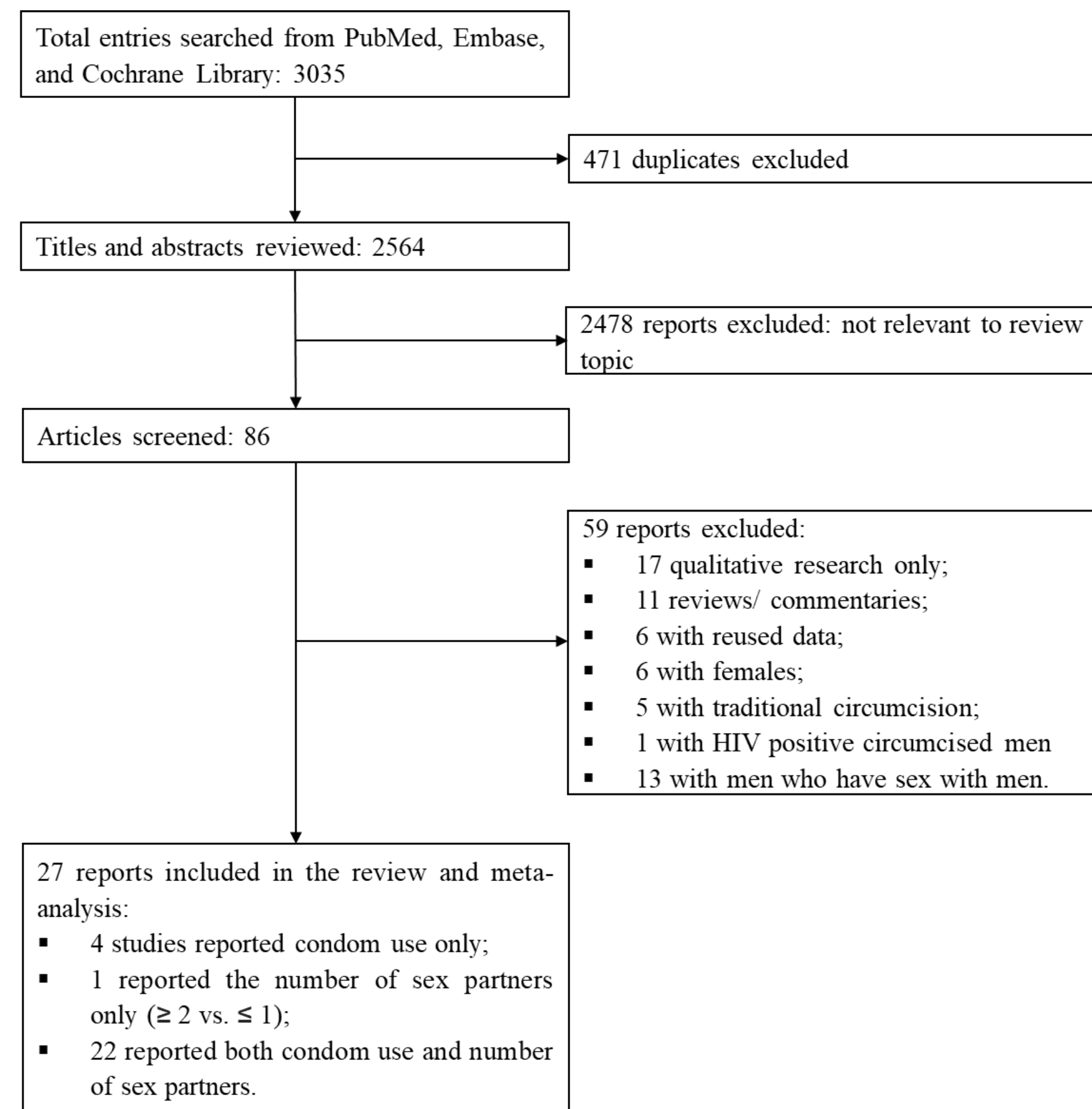


Figure 1. Flowchart of literature search

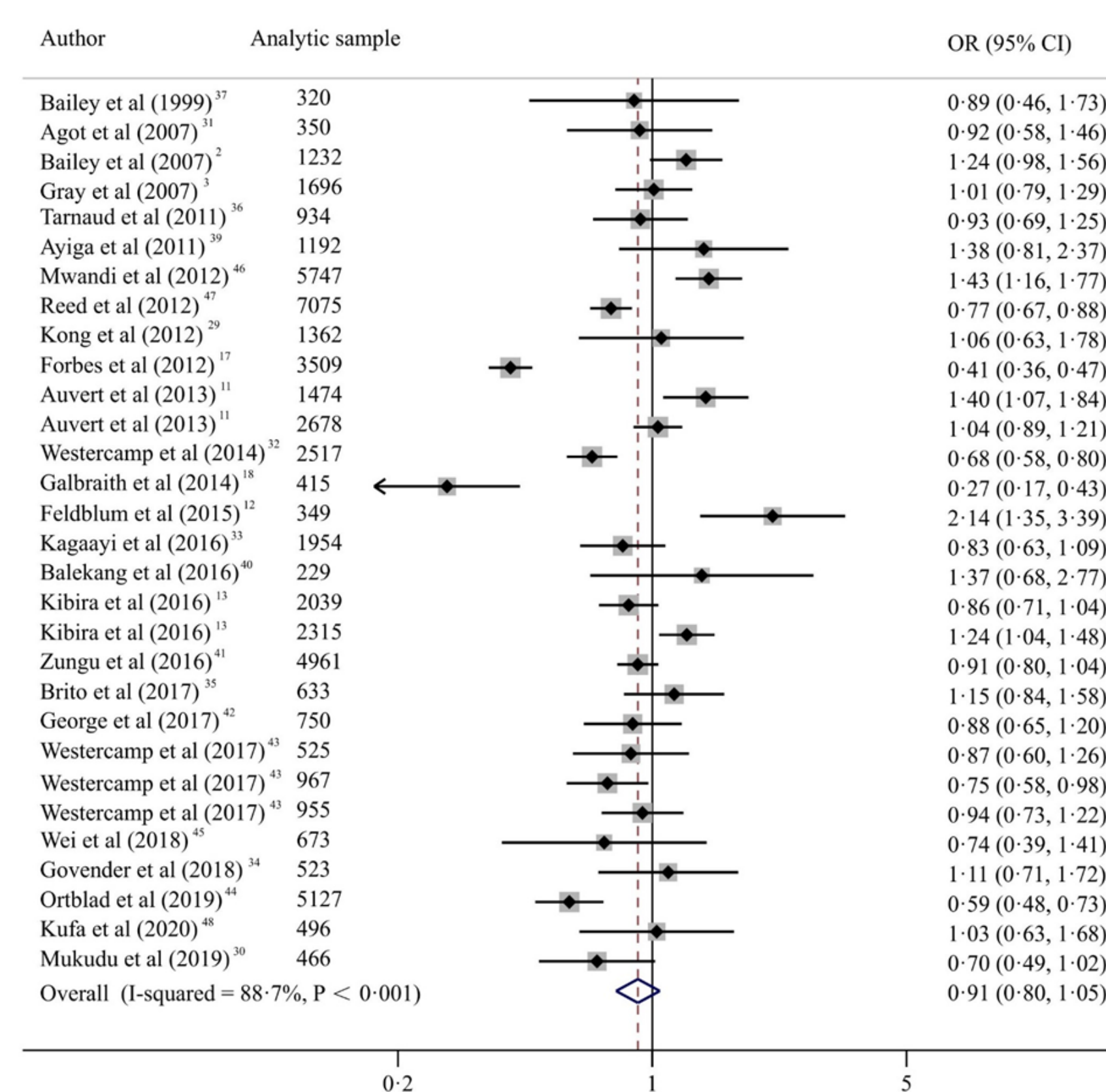


Figure 2. Meta-analysis of the association between circumcision and condomless sex among heterosexual men

OR=Odds ratio. CI=Confidence interval. A1 was calculated based on data from the Auvert's study 2007-2008; A2 was calculated based on data from the Auvert's study 2010-2011; B1 was calculated based on data from the Kibira's study 2004; B2 was calculated based on data from the Kibira's study 2011; C1 was calculated based on data from the Westercamp's study 2008-2009; C1 was calculated based on data from the Westercamp's study 2011; C1 was calculated based on data from the Westercamp's study 2013.

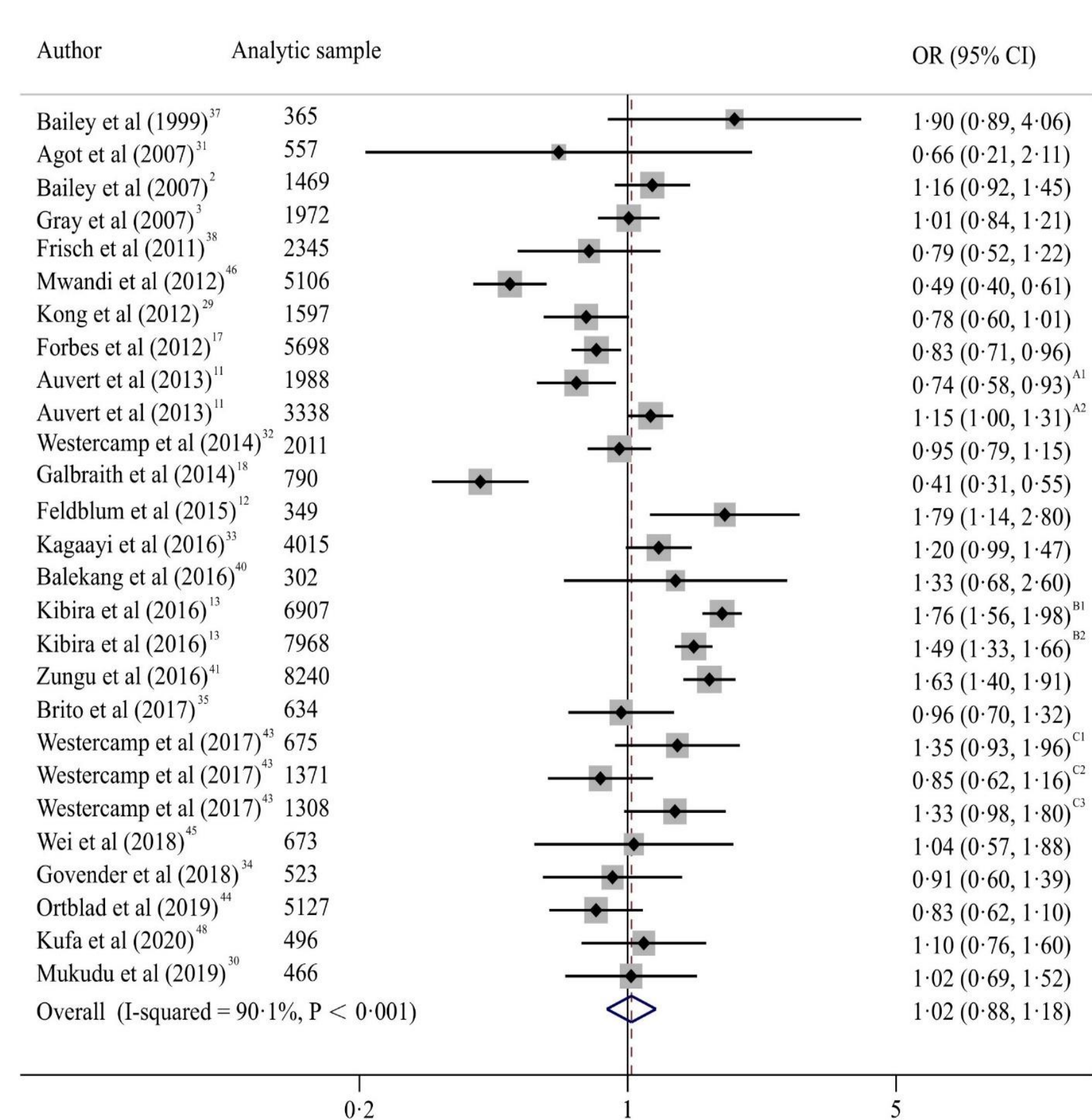


Figure 3. Meta-analysis of the association between circumcision and multiple sex partners among heterosexual men

OR=Odds ratio. CI=Confidence interval. A1 was calculated based on data from the Auvert's study 2007-2008; A2 was calculated based on data from the Auvert's study 2010-2011; B1 was calculated based on data from the Kibira's study 2004; B2 was calculated based on data from the Kibira's study 2011; C1 was calculated based on data from the Westercamp's study 2008-2009; C1 was calculated based on data from the Westercamp's study 2011; C1 was calculated based on data from the Westercamp's study 2013.

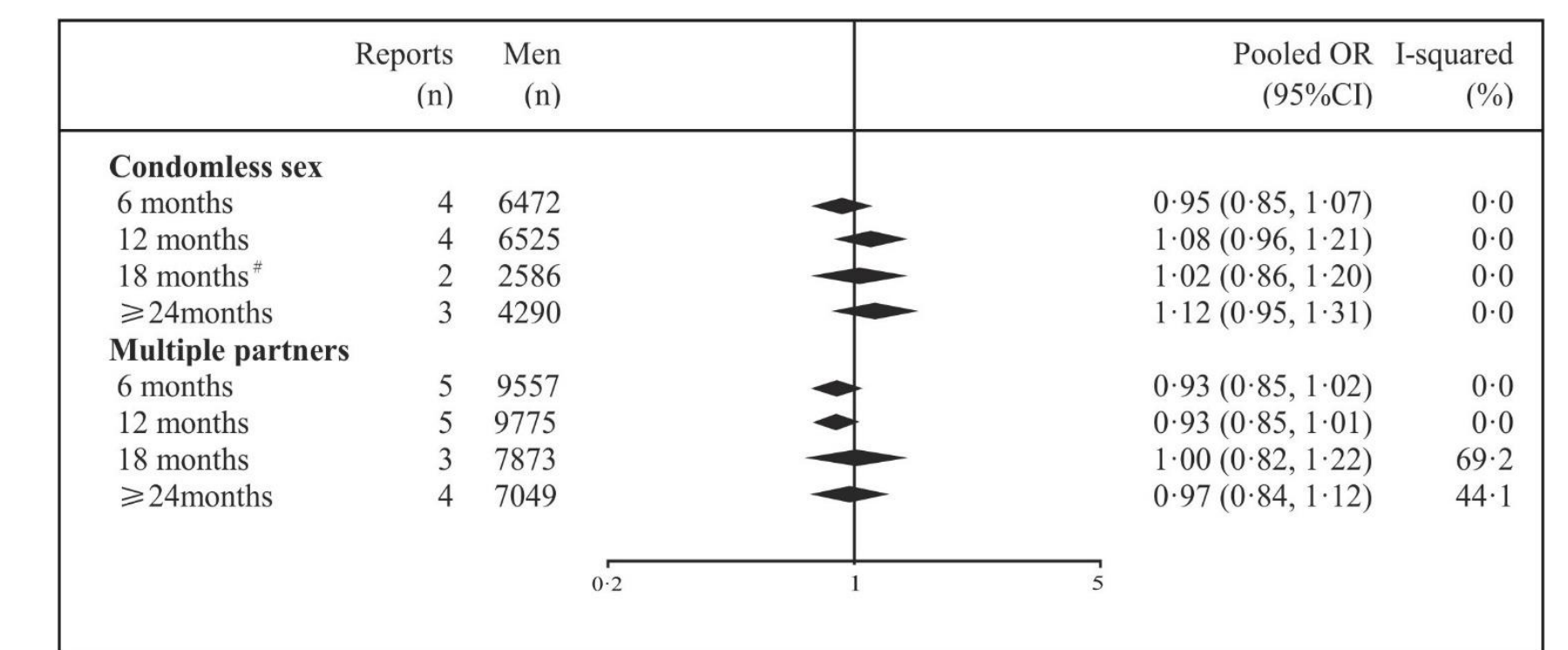


Figure 4. The pooled OR at different follow-up time points: impact of circumcision on condomless sex and multiple sex partners among heterosexual men

Pooled OR < 1.0 indicates reduction of outcomes in the circumcised group compared to the uncircumcised group. OR=Odds ratio

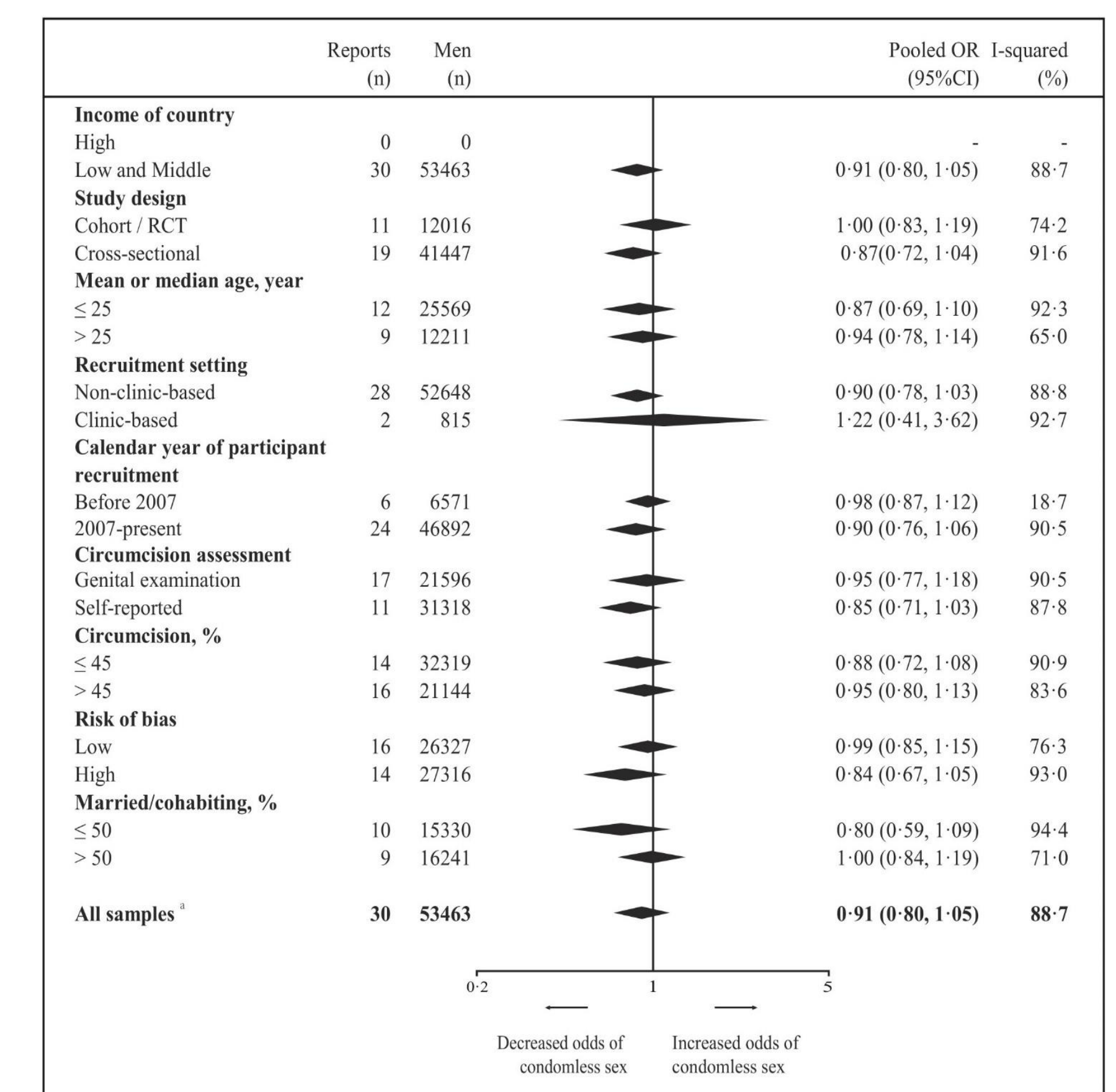


Figure 5. Subgroup meta-analyses of the association between MMC and condomless sex among heterosexual men

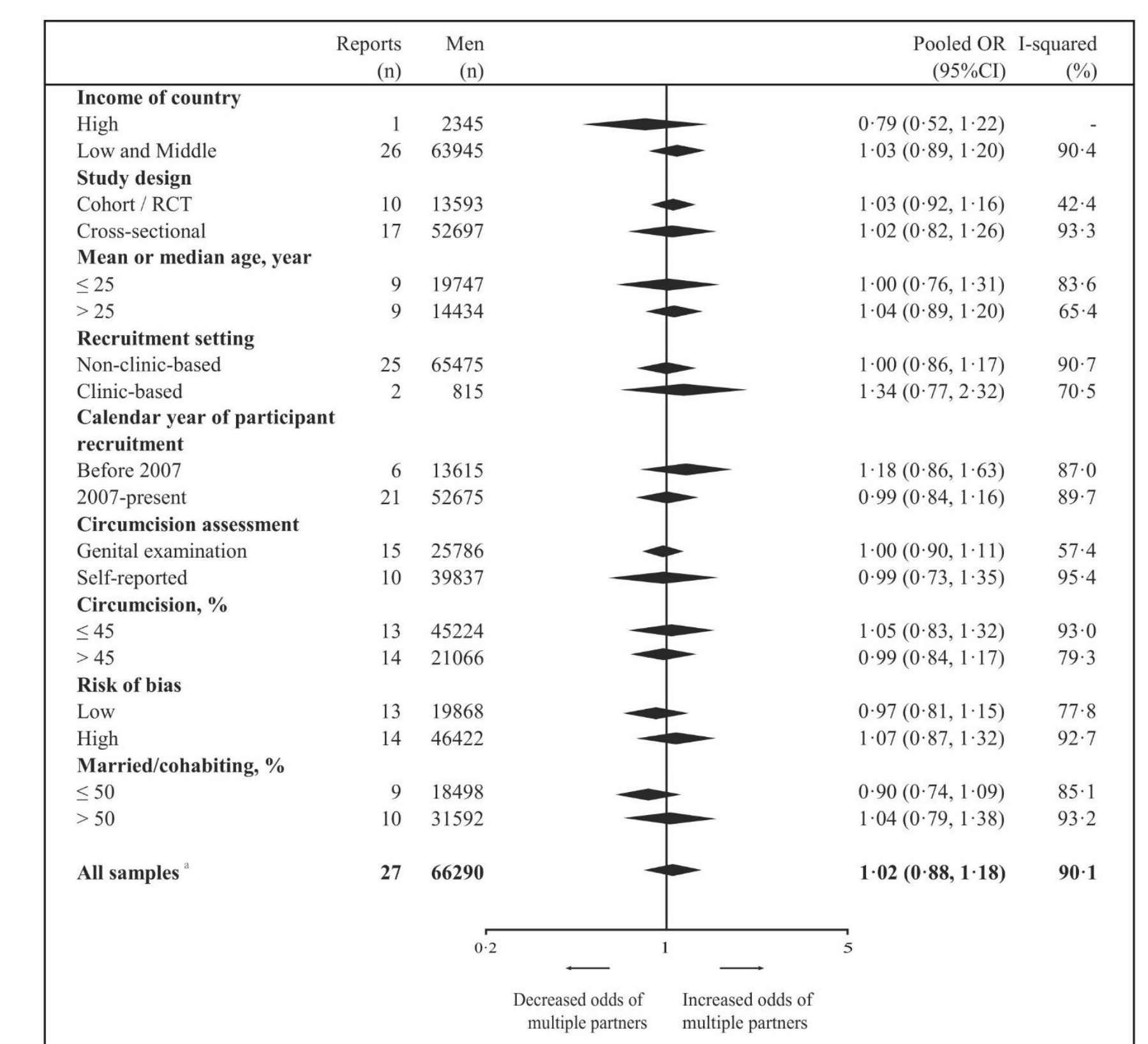


Figure 6. Subgroup meta-analyses of the association between MMC and multiple sex partners among heterosexual men

Interpretation

The promotion of circumcision as an HIV preventive measure does not appear to increase higher risk sexual behavior in heterosexual men. Ongoing sexual health education should be maintained as a vital component of effective MMC programs.