Explaining disparities in HIV infection among black and white men who have sex with men: A meta-analysis of HIV risk behaviors

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Explaining disparities in HIV infection among black and white men who have sex with men: a meta-analysis of HIV risk behaviors

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**Objective:** To identify factors that contribute to the racial disparity in HIV prevalence between black and white men who have sex with men (MSM) in the United States.

**Methods:** A comprehensive literature search of electronic databases, online bibliographies, and publication reference lists yielded 53 quantitative studies of MSM published between 1980 and 2006 that stratified HIV risk behaviors by race. Meta-analyses were performed to compare HIV risks between black and white MSM across studies.

**Results:** Compared with white MSM, black MSM reported less overall substance use \(\text{OR} = 0.71; \text{CI} = 0.53–0.97\), fewer sex partners \(\text{OR} = 0.64; \text{CI} = 0.45–0.92\), less gay identity \(\text{OR} = 0.29; \text{CI} = 0.17–0.48\), and less disclosure of same sex behavior \(\text{OR} = 0.42; \text{CI} = 0.30–0.60\). HIV-positive black MSM were less likely than HIV-positive white MSM to report taking antiretroviral medications \(\text{OR} = 0.43; \text{CI} = 0.30–0.61\). Sexually transmitted diseases were significantly greater among black MSM than white MSM \(\text{OR} = 1.64; \text{CI} = 1.07–2.53\). There were no statistically significant differences by race in reported unprotected anal intercourse, commercial sex work, sex with a known HIV-positive partner, or HIV testing history.

**Conclusions:** Behavioral risk factors for HIV infection do not explain elevated HIV rates among black MSM. Continued emphasis on risk behaviors will have only limited impact on the disproportionate rates of HIV infection among black MSM. Future research should focus on the contribution of other factors, such as social networks, to explain racial disparities in HIV infection rates.

**Keywords:** black, gay, HIV/AIDS, homosexual, MSM, risk behavior

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**Introduction**

Since the early 1980s, the HIV epidemic in the United States has exacted a severe toll on men who have sex with men (MSM). This HIV burden has most disproportionately impacted black men, who represent an increasingly large percentage of AIDS cases among MSM \[1–4\]. HIV prevalence and incidence are significantly higher among black MSM than other MSM and rival corresponding rates in the developing world \[5–8\]. Moreover, HIV prevalence and incidence are considerably higher both in younger \(15–22\) years) and older \(18–49\) years) US samples of black MSM than in MSM of all other racial or ethnic groups \[9–10\].

Explanations remain elusive for the racial disparity in HIV infection between black MSM and other racial/ethnic groups of MSM. Although unprotected anal intercourse (UAI), which is a leading risk factor for HIV infection among MSM \[11\], has been considered a prime candidate for the disparate rates of HIV infection between black and other MSM \[12\], several studies have found greater HIV
prevalence among black MSM despite comparable or lower rates of UAI than MSM of other races or ethnicities [5,6,13–15].

Recent evidence suggests that racial differences in HIV infection rates among MSM may potentially depend on factors other than behavioral risks. A recently published literature review examined 12 hypotheses (Table 1) for the greater prevalence of HIV among black MSM [16]. The authors of the qualitative review found that black MSM were no more likely than MSM of other races or ethnicities to engage in sexual risk behavior, nor were black MSM more likely than other MSM to report substance use. However, the investigators also found that black MSM were more likely to have had a sexually transmitted disease (STD). In addition, although black MSM were as likely as other MSM to ever be tested for HIV, black MSM tested less frequently and were more likely to have an unrecognized HIV infection than other MSM.

The qualitative nature of the literature review was one of its limitations. Accordingly, the current study extends the earlier review through a quantitative examination of possible explanations for the disparate rates of HIV infection by comparing the risk behaviors of black MSM and white MSM.

### Methods

#### Article sources and selection

The search strategy used several sources for identifying relevant reports, replicating the search strategy described in the qualitative review. Using MEDLINE, ERIC, Sociofile and PsychInfo, articles were identified that had been published from the beginning of online indexing of scientific articles (1974) through December 2006. In addition, HIV-related online bibliographic resources

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**Table 1. Hypotheses for greater HIV infection rates among black men who have sex with men.**

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sexual risk. Black MSM are more likely than other MSM to engage in high-risk sexual behavior</td>
<td>a. Unprotected anal intercourse</td>
</tr>
<tr>
<td>2. Identity/disclosure. Black MSM are less likely than other MSM to identify as gay or to disclose their sexual identity, which may lead to increased HIV risk behavior</td>
<td>b. No. sex partners</td>
</tr>
<tr>
<td>3. Substance use. Black MSM are more likely than other MSM to abuse substances, especially injection drugs, that increase their risk for HIV infection</td>
<td>c. Commercial sex work activity</td>
</tr>
<tr>
<td>4. STD history. Black MSM are more likely than other MSM to contract STD that facilitate the acquisition and transmission of HIV</td>
<td>d. Nondisclosure of sexuality</td>
</tr>
<tr>
<td>5. HIV testing. Black MSM are less likely than other MSM to be tested for HIV or to know their HIV status, and they may unknowingly expose their sexual partners to HIV</td>
<td>e. Nongay identity and HIV risk</td>
</tr>
<tr>
<td>6. Black MSM are genetically more susceptible to HIV than other MSM</td>
<td>f. Nondisclosure of sexuality and HIV risk</td>
</tr>
<tr>
<td>7. Black MSM are less likely than other MSM to be circumcised, increasing their risk for HIV infection</td>
<td>g. General drug use</td>
</tr>
<tr>
<td>8. ART use. HIV-positive black MSM are infectious for a longer time than other HIV-positive MSM</td>
<td>h. Alcohol use</td>
</tr>
<tr>
<td>9. Sex with HIV-positive partners. Black MSM are more likely than other MSM to have sex with partners known to be HIV positive</td>
<td>i. Marijuana</td>
</tr>
<tr>
<td>10. The sexual networks of black MSM place them at greater risk for HIV infection than the sexual networks of other MSM</td>
<td>j. Injection drug use</td>
</tr>
<tr>
<td>11. Black MSM are more likely than other MSM to be incarcerated, which increases the likelihood of exposure to HIV</td>
<td>k. Amphetamines</td>
</tr>
<tr>
<td>12. Black MSM are more likely than other MSM to engage in anorectal douching, which increases their risk for HIV infection</td>
<td>l. Cocaine (including crack)</td>
</tr>
</tbody>
</table>

MSM, men who have sex with men; UAI, unprotected anal intercourse; STD, sexually transmitted diseases; ART, antiretroviral therapy.

Source: Millett et al. [16]; Note that these authors found no support for hypotheses 1–3, support for 4 and 5, and insufficient or inconclusive support for 6–12. The present study addresses hypotheses 1–5, 8, and 9 (bolded).

*Denotes subtopics in a hypothesis for which there were insufficient quantitative data (i.e., < 3 effect sizes from unrelated studies) to perform a meta-analysis.
(specifically, http://www.metrokc.gov/health/apu/new-art/namenu.htm and http://www.medadvocates.org/marg/MSM/main.html), which contained indexed articles dating back to 2000, were searched and the reference lists of pertinent articles were checked for additional citations.

The initial search yielded a total of 1042 citations that referenced blacks and MSM. After eliminating articles that were not written in English, dissertation abstracts, conceptual papers, and review articles, 768 articles remained. Next articles unrelated to HIV or AIDS were eliminated, which reduced the sample to 457 articles. Last, qualitative articles, duplicate references, and articles that were not relevant to our hypotheses were removed, resulting in a sample of 117 articles.

To be included in the meta-analysis, articles needed to (a) be based in the United States, (b) recruit both black and white MSM, (c) be responsive to at least 1 of the 12 hypotheses, and (d) provide quantitative data for MSM stratified by race for an outcome relevant to one of the hypotheses. The comparison in HIV risk data was limited to black MSM and white MSM because data for other ethnic groups are less frequently given and their categorizations vary.

These criteria resulted in the selection of 53 peer-reviewed articles [5,13,14,17–66] for the meta-analyses, which allowed seven hypotheses from the qualitative findings. These criteria resulted in the selection of 53 peer-reviewed articles [5,13,14,17–66] for the meta-analyses, which allowed seven hypotheses from the qualitative findings.

Data abstraction and preparation

Pairs of reviewers independently abstracted data from eligible articles. Abstracted data included the study authors, publication year, overall sample size, sample size of black MSM and white MSM, data collection methods (self-administered or interviewer administered), sampling methodology (random, nonrandom), data collection setting(s), data collection period, relevant hypotheses, types of analysis (univariate, multivariate), and findings. Any disagreements during the abstraction process were resolved by discussion.

Several decision rules guided the preparation of data for analyses.

1. Only data from black MSM and white MSM were used to calculate effect sizes; data from other groups (e.g., women, heterosexuals, Latino MSM or Asian MSM, etc.) in eligible articles were not used.
2. Given a zero cell, 0.5 was added to each cell before computing the odds ratio (OR) [67,68].
3. Articles could contribute more than one effect size as data were analyzed separately for each outcome of interest to ensure independence.
4. Multiple effect sizes that addressed the same outcome of interest in a given article were aggregated so that each article contributed only one effect size for each outcome of interest.
5. When both univariate and multivariate results were provided, the univariate results were selected for the meta-analyses. Univariate results were more comparable across studies since covariates varied widely across multivariate models.
6. Only the most recent and most generalizable study was selected when there were multiple publications from the same database for a given outcome of interest.

Data synthesis

Abstracted data for black MSM and white MSM were converted into percentages that represented ‘yes’ versus ‘no’ responses for a given outcome of interest and placed into a summary table (available on request). For those few outcomes that only reported percentages, means, an F score or t statistic, a standardized mean difference was calculated and then converted into an OR value. Data were aggregated across studies for each outcome of interest to estimate an overall effect size. To estimate the overall effect size, the logarithm of each OR was weighted by the inverse of its variance, and the weighted log values were summed across samples and then divided by the sum of the weights. For the purpose of presenting the results, effect sizes and 95% confidence intervals (CI) were converted back to OR values.

A random-effects model for aggregating individual effect sizes was used because it provided a conservative estimate of the variance and generated more accurate inferences about a population of studies beyond those included in the review [69]. An OR > 1 indicated an increased likelihood of an outcome of interest among black MSM compared with white MSM; while an OR < 1 indicated a decreased likelihood of a given outcome among black MSM compared with white MSM.

Results

Of the 53 studies, 48 (91%) exclusively recruited MSM, four (8%) recruited men and women, and one (2%) recruited men of various sexual orientations. Most of the studies (68%) recruited participants through nonprobability methods. In addition, although 20 studies (38%) recruited a general sample of MSM from bars, clubs, and community organizations, the remaining studies targeted specific populations including HIV-positive participants (23%), young men [aged 15–29 years (15%)], STD clinic attendees (9%), drug-using men (4%), bisexual men (4%), HIV-negative men (4%), and incarcerated men (3%).

The meta-analysis results for the outcomes of interest are shown in Table 2. There were no significant differences between black MSM and white MSM across studies in reported UAI, commercial sex work activity, substance
use by drug (except amyl nitrates), history of HIV testing, or sex with known HIV-positive partners. However, black MSM reported significantly fewer sex partners across studies than white MSM and were less likely than whites to identity as gay or to disclose their homosexuality to others. Among HIV-positive MSM, black MSM were less likely than white MSM to report taking antiretroviral therapy (ART). The only outcome of interest that was significantly greater among black MSM than white MSM was the occurrence of STD.

Stratified analyses

Several stratified analyses were performed to determine whether overall effect sizes differed among subgroups of studies. For 17 studies addressing UAI, the effect sizes were recategorized based upon reporting timeframe, date of publication, and sample characteristics. There were no differences by race among MSM who reported UAI in the past year (OR, 1.25; 95% CI, 0.90–1.76; k = 4) and comparable rates of UAI for studies published after HAART was introduced (OR, 0.95; 95% CI, 0.64–1.39; k = 13). There were no differences by race in receptive UAI (OR, 1.03; 95% CI, 0.55–1.93; k = 5). There were also comparable rates of UAI by race in studies that recruited a general sample of MSM (OR, 1.06; 95% CI, 0.59–1.91; k = 8), but young black MSM were significantly less likely than young white MSM to report engaging in UAI (OR, 0.66; 95% CI, 0.57–0.77; k = 4).

OR, odds ratio; CI, confidence interval; UAI, unprotected anal intercourse; k, number of effect sizes; STD, sexually transmitted diseases.

*Odds ratios > 1 indicate a greater likelihood of an outcome among black MSM than white MSM.

General substance use includes abstracted data that did not delineate between specific drugs for analyses, or identified specific drugs but grouped them together in analyses.

*p < .05.
Reports of STD were recategorized as either ‘lifetime’ infections (based upon self-report) or ‘current’ infections (based upon laboratory tests). There were no statistically significant differences among MSM by race in reported lifetime STD infections (OR, 1.29; 95% CI, 0.63–2.66; \( k = 5 \)). However, across studies, black MSM were 2.12 times more likely to be diagnosed with a current STD than white MSM (95% CI, 1.68–2.67; \( k = 5 \)). The results remained consistent with the overall findings when studies were stratified by type of STD: Black MSM were significantly more likely than white MSM to report ever having had or to be currently diagnosed with gonorrhea (OR, 1.53; 95% CI, 1.25–1.87; \( k = 4 \)), syphilis (OR, 2.14; 95% CI, 1.70–2.69; \( k = 4 \)), or hepatitis B (OR, 2.48; 95% CI, 1.27–4.86; \( k = 4 \)).

### Discussion

Individual risk behaviors do not appear to be driving the disparity in HIV/AIDS among black MSM (Fig. 2). Despite comparable rates of UAI and fewer sex partners, STD prevalence and HIV prevalence remained greater among black MSM than white MSM. Moreover, black MSM were significantly less likely than white MSM to report engaging in any substance use irrespective of drug type (Fig. 1), and significantly less likely to report using any drugs associated with HIV infection.

Previous studies have reported that nongay-identified or nondisclosing MSM have fewer male sex partners than gay-identified or ‘out’ MSM [22,54,70]. It is possible that...
black MSM have fewer sex partners across studies than white MSM because black MSM overall are less likely than white MSM to identify as gay or to disclose their sexual behavior [71]. However, having fewer sex partners, being nongay-identified and nondisclosure of sexuality are also each associated with a lower likelihood of HIV infection [7,22,70]; yet HIV infection rates remain greater among black MSM than white MSM.

Our meta-analyses suggest several factors that may be contributing to the high HIV infection rates among black MSM. The first factor is the occurrence of STD, as infections of this type facilitate acquisition and transmission of HIV [72,73] and black MSM in our meta-analysis were more likely than white MSM to be diagnosed with a current STD and to have (or have had) gonorrhea, syphilis, or hepatitis B. Although gonorrhea and syphilis are both associated with HIV infection or transmission, hepatitis B is not. However, hepatitis B is transmitted through HIV risk behavior (i.e., unprotected sex or intravenous drug use), and black MSM across studies were more likely than white MSM to have hepatitis B in spite of comparable sexual and intravenous use behaviors.

The second factor is the high rates of UAI among black MSM early in the HIV/AIDS epidemic. Studies that solely recruited black MSM during the first decade of the epidemic also documented high rates of UAI [12,74], and high HIV prevalence among black gay and bisexual men were already being reported in Centers for Disease Control and prevention (CDC) surveillance data [75] and prospective studies [59] from that time period. Since black MSM tend to have sex with other black partners [18,76], greater rates of UAI early in the epidemic may have increased the background prevalence of HIV among black MSM, which has continued to rise to the disproportionately high HIV rates observed today in spite of comparable rates of UAI as white MSM since the 1990s.

The third factor is ART usage. It has been demonstrated that ART use decreases viral load, which lowers HIV infectivity [77]. HIV-positive individuals who are not taking ART are more likely to transmit HIV to uninfected sex partners during unprotected episodes than are individuals who are taking therapy. However, despite markedly higher HIV prevalence and the widespread availability of ART, we found that HIV-positive black

Fig. 2. Study-specific and overall effect size estimates for unprotected anal intercourse (UAI), number of sex partners, and sexually transmitted disease history in comparative studies of black and white men who have sex with men (MSM). Odds ratios > 1 indicate a greater likelihood of an outcome among black MSM than white MSM. Bars indicate the 95% confidence intervals. Reference sources given by first author and year only.
MSM were less likely than HIV-positive white MSM to be taking ART. This is concerning because studies report that black MSM are more likely to be diagnosed later in the progression of HIV infection, when ART is recommended, than white MSM [78,79].

Another possible factor for the disproportionately high rates of HIV infection among black MSM is undiagnosed HIV infection [21,43]. Although our meta-analyses showed that black MSM were just as likely as white MSM to report ever being tested for HIV across studies, an additional analysis (not reported in Table 2) found that black MSM were seven times more likely than white MSM to have an unrecognized HIV infection (OR, 7.67; 95% CI, 6.05–9.71; k = 2). High rates of unrecognized HIV infection among black MSM increase the odds of HIV transmission to sexual partners. Compared with MSM who know that they are HIV negative or MSM who do not know their HIV status, MSM who know that they are HIV positive engage in fewer sexual risk behaviors with partners at-risk for HIV infection [80,81]. Moreover, a recent CDC study estimated that most new HIV infections in the United States are attributable to HIV-positive individuals who are unaware of their infection [82]. However, the contribution of unrecognized HIV infection to the disparate rates among black MSM must be interpreted cautiously since the meta-analysis was based on two studies and not eligible for our study. Nevertheless, the preliminary evidence for these data are strong given the large overall sample size in the analysis (1293 black and 2545 white), the similar direction of the outcome for each of the two studies, and the large overall effect size.

There are several limitations in the current study. First, the results in this paper cannot be generalized beyond black MSM and white MSM. It is not known whether the hypotheses examined would show similar effects if we compared black MSM with other MSM of color. Second, it is important to note that some findings are based on a small set of studies. These should be viewed as preliminary and need to be addressed when more data become available. Third, all of the studies of young MSM shared the same probability-based recruitment method and the meta-analysis results for young MSM may be a function of the recruitment methodology rather than actual behavioral differences by race. Fourth, there were too few studies to examine by meta-analysis the role of circumcision, genetics, incarceration, social networks, healthcare access, ART adherence or anorectal douching to disparate rates of HIV infection among MSM. These subject areas need to be addressed in subsequent studies and may provide further explanation for high rates of HIV infection among black MSM. Fifth, meta-analyses are subject to the biases of the selected studies and this must be considered in the interpretation of the results. Last, there is a possibility that our results reflect underreporting among black MSM. However, it is unlikely that reporting bias was evident only among black MSM and not white MSM across studies, years, regions, and demographic characteristics. Moreover, several other racial comparative studies have also reported greater HIV/STD prevalence despite low-risk behaviors among black adolescents [83–85], young black adults [86], and blacks generally [87].

The HIV/AIDS epidemic among black MSM is more complex and multifactorial than individual risk behavior [88]. Future research should examine the degree to which other factors, such as social networks, in conjunction with high HIV/STD background prevalence impact HIV infection rates among black MSM.

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