The Efficacy of HIV/STI Behavioral Interventions for African American Females in the United States: A Meta-Analysis

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The HIV epidemic continues to disproportionately affect African American females in the United States. Although African Americans represent only 12% of the US female population,1 African American women and adolescents accounted for 64% of all HIV cases among women at the end of 2006.2 Sexual intercourse with high-risk men was the source of HIV infection in 75% of African American females living with HIV/AIDS in 2006.2 Various factors place African American females at high risk for HIV transmission. The highest rates of sexually transmitted infection (STI) are found among African Americans.2

Physical changes caused by STIs can serve as entry points for HIV and can increase one’s chance of acquiring HIV.3,4 Women are generally at greater risk of acquiring HIV and other STIs than are men because the female genital tract is more prone to injury and infection resulting from high-risk heterosexual contact.5 In addition to biological factors, relational, cultural, and socioeconomic factors also increase African American females vulnerability to HIV. Several studies suggest that some African American females perceive that they lack control over condom use because they have insufficient power in their relationships,6–8 which may be partly exacerbated by the low ratio of men to women in African American communities.9 Additionally, poverty may place African American females at increased risk for HIV/STIs because of the power imbalance created by their financial dependency on men.9,10

The need for gender-specific interventions to address empowerment is evident in light of the high HIV prevalence among African American females. HIV interventions may also need to be sensitive to African American culture to increase the relevance of the content and its subsequent effectiveness among African American females.

Numerous interventions targeting high-risk sex behaviors among African American females have been evaluated in recent years. Although previously published meta-analyses have evaluated the efficacy of HIV behavioral interventions for women,11–12 Black and Hispanic STI clinic patients,13 and African American heterosexuals,14 the empirical findings specifically for African American females have not been examined as a whole. In this meta-analysis, we located and described available behavioral interventions for African American females, assessed the overall efficacy of these behavioral interventions, and identified factors associated with intervention efficacy for this high-risk population. Our review expands the scope of previously published meta-analyses11–14 by including more recently published studies; directly testing whether intervention components that were culture-specific, gender-specific, empowerment-focused, and skills-training–focused were associated with intervention efficacy; and identifying research gaps with regard to HIV prevention among African American females in the United States.

Objectives. We evaluated the efficacy of HIV behavioral interventions for African American females in the United States, and we identified factors associated with intervention efficacy.

Methods. We conducted a comprehensive literature review covering studies published from January 1988 to June 2007, which yielded 37 relevant studies. Data were analyzed using mixed-effects models and meta-regression.

Results. Overall, behavioral interventions had a significant impact on reductions in HIV-risk sex behaviors (odds ratio [OR]=0.83; 95% confidence interval [CI]=0.54, 0.75; n=11239; Cochrane Q32=84.73; P<.001) and sexually transmitted infections (STIs; OR=0.81; 95% CI=0.67, 0.98; n=8760; Cochrane Q16=22.77; P=.12). Greater intervention efficacy was observed in studies that specifically targeted African American females used gender- or culture-specific materials, used female deliverers, addressed empowerment issues, provided skills training in condom use and negotiation of safer sex, and used role-playing to teach negotiation skills.

Conclusions. Behavioral interventions are efficacious at preventing HIV and STIs among African American females. More research is needed to examine the potential contribution of prevention strategies that attend to community-level and structural-level factors affecting HIV infection and transmission in this population.


METHODS

As part of the Centers for Disease Control and Prevention’s HIV/AIDS Prevention Research Synthesis project,15 we developed multiple search strategies to identify relevant intervention reports available between January 1988 to June 2007.16 We developed a systematic search using standardized search terms cross-referenced in 3 areas: (1) HIV, AIDS, or STIs; (2) intervention evaluation; and (3) behavior or biological outcomes. This search was performed in the following electronic bibliographic databases: AIDSLINE (discontinued in 2000), EMBASE, MEDLINE, PsycINFO, and Sociological Abstracts. Using the same constructs as those found in the electronic database searches, we manually searched 35 key journals that regularly publish HIV or STI prevention research. Additionally, we scanned reference lists of pertinent reports.

Study Selection

Studies were included if they met all of the following criteria: (1) they were evaluations of
US-based behavioral interventions intended to reduce the risk of HIV or STI transmission; (2) they targeted women or stratified data by gender; (3) more than 50% of their female participants were African American, or data were stratified by ethnicity; (4) they were randomized controlled trials or controlled studies that minimized systematic bias associated with nonrandomization;17 (5) they measured at least 1 HIV-risk sex behavior (i.e., unprotected vaginal or anal intercourse, condom use), or they measured clinical diagnosis or laboratory confirmation of STI; (6) they reported at least 1 postintervention outcome; and (7) they provided data necessary for calculation of effect size. Authors of the studies were contacted to obtain additional information as needed (N. El-Bassel, DSW, written communication, November 2007; M. Kamb, MD, MPH, written communication, September 2005; A. Nyamathi, PhD, written communication, February 2008; T. Peterman, MD, written communication, October 2005).

Data Abstraction

Pairs of trained reviewers (all of the study authors) independently abstracted information from eligible studies. Multiple citations describing the same intervention evaluation study (e.g., description of intervention, baseline data, outcome assessments at different time points) were identified and included in the coding. Citations that provided outcome assessments at different time points were used in data abstraction. We used standardized coding forms to code each intervention for study information (i.e., intervention dates, location), participant characteristics (i.e., age, percentage of participants who were African American, baseline drug and sex risk), outcomes (i.e., sex behavior or STI outcomes, recall period, follow-up time), and intervention features (i.e., theory, intervention components, delivery method, duration, setting). We also coded female participants’ socioeconomic status including income level, housing status, and employment, and relationship status, including incidence of childhood sexual abuse, incidence of intimate partner violence, and relationship/marital status.

Features for culture- and gender-specific intervention components were coded as culture- or gender-specific materials and ethnic- or gender-matched deliverer. Culture-specific materials were those consistent with the values, norms, and beliefs of the target population. Such materials can be developed using cultural theory, existing African American literature, or formative work conducted with the target population, and they can use culturally bound ways of communication or culturally specific symbols in intervention materials.

Borrowing the basic principles of the theory of gender and power18,19 and empowerment theories,20,21 we operationalized “empowerment” as building self-efficacy, decreasing self-blame, assuming personal responsibility, increasing assertiveness, and developing communication and negotiation skills to ensure power sharing and equality within a relationship. Empowerment was coded for an intervention if it addressed self-efficacy for risk-reduction behavior, assertiveness, and power imbalances in relationships.

To test whether an intervention that addressed culture, gender, empowerment, and skills building was more efficacious than an intervention without all these components, we created a culture-, gender-, empowerment-, and skills-building indicator. If a study used culture- and gender-specific materials, used female deliverers, empowered women, provided skills training on correct condom use and negotiation of condom use, and taught women negotiation skills through role-playing, it was coded “1” for the culture-, gender-, empowerment-, and skills-building indicator. If a study missed any of those specified intervention elements, it was coded “0”.

We coded the following variables describing the studies’ methodological quality: study design (i.e., randomized controlled trials vs nonrandomized controlled trials), allocation method (i.e., sequence generation, concealment, blinding), unit of assignment, unit of analysis, type of control group, retention rate, and intent-to-treat analysis (i.e., participants analyzed as originally assigned and regardless of exposure to the intervention). There was 90% agreement among reviewers across all variables. Coding discrepancies were reconciled through discussion.

Effect Size Calculation

Effect sizes were estimated with odds ratios (ORs), as the OR allows the estimated effect sizes to be expressed in terms of relative odds of change for each outcome. For studies reporting means and standard deviations on continuous outcomes, standardized mean differences were calculated and then converted into OR values.22 An OR of less than 1 indicates a greater reduction in odds of HIV-risk sex behavior or STI rates in the intervention group relative to the comparison group.

We used standard meta-analytical methods.23,24 For each study, we first used the natural logarithm to obtain log odds ratio (lnOR) and calculated its corresponding weight (i.e., inverse variance). In estimating the overall effect size, we multiplied each lnOR by its weight, summed the weighted lnORs across studies, and then divided by the sum of the weights. The aggregated lnOR was then converted back to OR by exponential function, and a 95% confidence interval (CI) was derived.

Analytic Approach

We calculated the overall intervention effect as follows:

1. To meet the assumption of independence of effect size, for studies with multiple arms we selected the contrast between the intervention arm that was most theoretically potent and the comparison arm that was typically a standard of care or wait-list control.

2. Multiple effect sizes were calculated for each study if more than 1 relevant outcome was provided and the overall effect sizes were conducted for sex behavior and STI outcomes separately.

3. For the HIV-risk sex behavior analyses, if both unprotected sex and condom use outcomes were reported, the effect sizes were averaged after first reversing the direction of the condom use measures.

4. In calculating individual effect size, we controlled for baseline differences between the intervention and comparison groups when preintervention outcome data were available (i.e., by subtracting the lnOR observed at baseline from the lnOR observed at follow-up).

5. For studies that reported multiple follow-up assessments, we selected the longest follow-up to assess the sustainability of intervention effect.

After calculating the overall effect size, we first examined whether all studies were
evaluating the same effect (i.e., homogeneity) by using the Cochran’s Q statistic. 24 A significant Q statistic indicates that the variability of effect sizes is larger than expected from sampling error. To address the source of variance across studies, we conducted a mixed-effects model24 where between-study differences (stratified by intervention features, methodological quality, study characteristics, and sample characteristics) were systematically tested using Qh tests with the estimated random-effects variance component added to the standard error variance associated with each effect size.24 The Qh test is analogous to the analysis of variance; it groups effect sizes into mutually exclusive strata on the basis of an independent variable and tests the homogeneity among the effect sizes within the strata and the differences between the strata.24 We used Comprehensive Meta-Analysis software version 2 (Biostat Inc, Englewood, NJ)25 to calculate the mixed-effects model. Also, variables identified as significantly (P<.05) associated with intervention efficacy on the basis of the Qh tests were entered in a multivariate random-effects meta-regression model using Stata version 9 (StataCorp LP, College Station, TX)26 with the “meta-reg” command.

We conducted sensitivity analyses to determine whether the results were sensitive to the aforementioned steps used for the overall effect size calculation. In particular, we examined whether intervention efficacy was affected by outliers, type of sex outcome measures, and length of follow-up periods. To determine whether outliers are present, we first examined the distribution of effect sizes.27 For any effect size more than 2.5 standard deviations from the mean of all the effect sizes, we Winsorized the effect size by recoding it to the value at 2 standard deviations.24 We calculated the effect size estimates separately for studies reporting unprotected sex outcomes and for studies reporting condom use outcomes. To examine whether intervention efficacy varied by length of follow-up period, we conducted 3 sensitivity tests: (1) we recalculated the overall effect size separately for 3 follow-up periods (1–4 months, 5–8 months, and 9–12 months), (2) we selected the first follow-up time reported in a single study in the analyses, and (3) we used data collected at or close to 3 months postintervention in the analysis.

Publication bias, which may favor studies with significant findings, was ascertained by visual inspection of funnel plots.28 A plot of standard error versus effect size from individual studies should be shaped like a funnel if there is no publication bias. We conducted an additional statistical test with a linear regression in which we regressed the standardized effect size (effect size divided by corresponding standard error) against the precision (i.e., the inverse of the standard error).26 If the intercept used to measure asymmetry is significantly different from zero, evidence of publication bias is indicated.

RESULTS

We identified 37 individual- and group-level intervention studies30–66 and 4 community-level intervention studies67–70. A close examination showed that community-level interventions were different theoretically and practically from the individual- and group-level interventions. Including community-level interventions resulted in substantial heterogeneity among studies. Consequently, our review focused only on the 37 individual- and group-level interventions (Figure 1).

The 37 studies30–66 included a total of 13,354 participants. The median age of study participants across studies was 27 years, with a range from 12 to 63 years. Participants’ median education level was high school or less. The majority of participants across studies were low-income women who were unemployed or received public assistance. Two studies provided information on child sexual abuse, and another 2 studies provided information on intimate-partner violence.

Eighty-four percent of the studies reported that interventions were based on 1 or more behavioral change theories.71–75 Five studies were also based on theory of gender and power.18 More than half of the 37 studies had at least 1 of the following intervention features: formative research that guided the development of interventions (23 studies), culture-specific materials (23 studies), ethnic-matched deliverers (23 studies), gender-specific materials (20 studies), and female deliverers (26 studies).

Most studies contained multiple intervention components aimed at reducing the risk of heterosexual transmission of HIV. All interventions provided information to increase HIV/STI knowledge. Skills-training components usually took specific forms, including correct use of male condoms or negotiating safer sex practices through demonstration, practice, or role-playing. Several common constructs of behavioral change theories were addressed, including motivation; positive attitude toward condoms; normative influence; self-efficacy for protective behavior; personal responsibility to protect oneself, family, significant others, or community; and personal risk or vulnerability. Most interventions were delivered in small groups, had more than 1 session, and lasted longer than 240 minutes.

With respect to methodological quality, 33 studies were randomized controlled trials, 32 utilized intent-to-treat analysis, 23 reported retention rates of at least 70% at the longest follow-up, and 14 reported power analysis.

![Figure 1—Selection process for meta-analytic review of evaluations of HIV/STI behavioral interventions for African American females: United States, 1988–2007.](Image)

Note. STI = sexually transmitted infection.
Thirty-four studies reported at least 2 of these 4 methodological features.

**Effect Sizes for Self-Reported HIV-Risk Sex Behavior and STI Outcomes**

The overall effect size of 33 studies reporting any HIV-risk sex behavior was statistically significant (OR=0.63; 95% CI=0.54, 0.75; n=11,239; Q=84.73; P<.001), indicating a 37% reduced odds of engaging in any unprotected sex among intervention participants relative to comparison participants at the longest follow-ups (median=6 months postintervention assessment; range=1–12 months; Figure 2). For the STI outcome, the overall effect size of 17 studies was also statistically significant (OR=0.58; 95% CI=0.47, 0.70; 8760; Q=22.77; P<.01), indicating a 19% reduced odds of any STI diagnosis among intervention participants relative to comparison participants at the longest follow-ups (median=9 months postintervention assessment; range=3–12 months; Figure 3).

**Findings of Sensitivity Analyses**

We did not identify any extreme effect sizes (i.e., outliers) that seemed unrepresentative in the context of the distribution of the effect sizes, and no effect size was more than 2.5 standard deviations from the mean of all the effect sizes. We found that the effect size estimated from studies reporting condom use (OR=0.57; 95% CI=0.47, 0.69; 27 studies) was comparable to the effect size estimated from studies reporting unprotected vaginal or anal intercourse (OR=0.75; 95% CI=0.65, 0.88; 20 studies). Significant intervention effects for HIV-risk sex behaviors were observed at each of the follow-up periods: 1–4 months (OR=0.72; 95% CI=0.62, 0.83; 26 studies), 5–8 months (OR=0.75; 95% CI=0.65, 0.88; 20 studies), and 9–12 months (OR=0.58; 95% CI=0.43, 0.78; 13 studies). For the STI outcome, significant intervention effects were observed in studies with a follow-up at around 12 months postintervention (OR=0.60; 95% CI=0.42, 0.86; 8 studies) but not in studies with a follow-up at around 6 months postintervention (OR=1.03; 95% CI=0.83, 1.29; 7 studies). Additionally, the effect size calculated on the basis of the first follow-up time and

![Figure 2](image_url)
the effect size calculated on the basis of the follow-up time at or close to 3 months post-intervention did not differ from the effect size calculated on the basis of the longest follow-up we selected for the presentation of findings.

**Stratified Analyses of HIV-Risk Sex Behaviors and STI Outcomes**

No single methodological quality feature was associated with intervention efficacy (Table 1). However, intervention effects did vary by intervention characteristics. For the HIV-risk sex behaviors, significantly greater efficacy was found among studies that specifically targeted African Americans, adolescents, or African American females; used female deliverers; or had longer intervention durations (>12 hours). When those significant stratified variables were entered along with the follow-up time period in the multivariate metaregression model, the only significant predictor of the intervention effect was using a peer as the deliverer.

The funnel plots for the HIV-risk sex outcome and the STI outcome were symmetrical. Based on the linear regression test, we found no evidence of publication bias for the 33 studies that provided the HIV-risk sex behavior outcome ($t = 0.25; P = .80$) or for the 17 studies that provided the STI outcome ($t = 1.24; P = .23$).

**DISCUSSION**

We were very encouraged to find that HIV/STI behavioral interventions were efficacious not only in reducing self-reported HIV-risk sex behaviors but also in reducing STI rates among African American females. The magnitude of intervention effects observed here is comparable to those reported in other meta-analyses.12,13,78–80 Even more encouragingly, we found that significant intervention effects were sustained for up to 12 months in some studies.

Several intervention features were associated with reduction of HIV risk. Consistent with the recommendations of previous qualitative and quantitative reviews on women,12,78–80 efficacious interventions were those specifically directed toward African American females, delivered by women, and focused on self-efficacy, assertiveness, and negotiation skills intended to empower women to seek equality in their relationships. Additionally, culture-specific interventions showed great success in reducing HIV-risk sex behavior. These findings support the notion that interventions for African American females should be gender- and culture-specific and should be particularly focused on empowerment. Additional intervention components contributing to behavior change were skills training in correct condom use and negotiation of safer sex. Many interventions providing condom use practice and condom negotiation practice...
also had cultural- and gender-specific components. Our multivariate finding provided additional evidence that interventions with all the culture-, gender-, empowerment-, skills-building components are significantly associated with success in reducing HIV-risk sex behavior.

Although it is important to address psychological processes, behavioral skills, and communication within a relationship, individual behavioral change does not occur in a vacuum. Thus, it is also essential to attend to socio-ecological factors that affect HIV risk, including sexual networks, concurrent partnership, intimate partner violence, ratio of men to women in African American communities, and economic oppression. We only identified 4 community-level interventions, and those interventions aimed at changing social norms about safer sex rather than other contextual factors. Recently, there has been increasing interest in using microenterprise as an HIV/AIDS prevention model. Additionally, given the high rates of STIs among African American females and STIs as cofactors for HIV infection, treating male partners’ STIs could be an effective strategy for preventing HIV and STIs among African American females. Although medical interventions are beyond the scope of this review, we suggest that future research should closely examine the synergy between medical, behavioral, community-level, and structural-level interventions to achieve optimal HIV-prevention results.

Some limitations of this review warrant comment. First, the majority of the studies targeted inner-city low-income women. It is not clear to what extent our findings are generalizable to low-income women residing in rural areas or African American females of other socioeconomic status. It may be that with careful adaptation, the important intervention components identified here can be made applicable to rural settings and to other subgroups of women who have a similar level of risk. Further research on how interventions can be adapted to different settings and subpopulations would be valuable.

An intriguing finding is that interventions with fewer sessions are as efficacious at reducing HIV-risk sex behaviors as are interventions with more sessions. Several 1-session interventions were culturally specific and provided skills training, so it may be that the

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<td>HIV-Risk Sex Behaviors</td>
</tr>
<tr>
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<tr>
<td>Yes</td>
<td>13</td>
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<td>No</td>
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<tr>
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<td>4</td>
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<tr>
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</tr>
<tr>
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<td>Empower women by addressing self-efficacy, assertiveness, and power in relationships</td>
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Continued
success of an HIV behavioral intervention depends more on the intervention components and the quality of the intervention than on the number of sessions. Future research should consider using factorial designs to appropriately test the independent contributions and additive effect of individual intervention components.

We used odds ratio as the effect size indicator because it has several mathematical properties that are advantageous for use as a summary statistic in a meta-analysis, but odds ratio cannot compare across populations with different baseline risks. Although the baseline risk varied across studies, the average sex risk for the study population was at around 50% prevalence.

Additionally, it is challenging to synthesize studies that differed in terms of intervention components, type of outcomes, and analyses conducted. We performed various sensitivity analyses to ensure that the findings were consistent. However, it is important to interpret our findings in the context of the guiding steps for effect size calculation.

Our findings suggest that behavioral interventions addressing empowerment issues with culture- and gender-specific materials and offering opportunities for practicing condom use and negotiation skills provide an efficacious means of HIV/STI prevention for African American females. Additional research should focus on the potential contribution of prevention strategies that attend to community-level and structural-level factors affecting HIV infection and transmission in this population. Comprehensive efforts that intervene in HIV risk behaviors should be considered an HIV-prevention priority for African American females.

### About the Authors

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**Note.** The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
Articles cited in this chapter are available in the reference section.

TABLE 1—Continued

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<td>19</td>
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<td>Follow-up times, ( a ) mo</td>
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<td>7</td>
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<td>0.58 (0.43, 0.78)</td>
<td>8</td>
<td>0.60 (0.42, 0.86)</td>
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</table>

Note. CI = confidence interval; OR = odds ratio; STI = sexually transmitted infection.

\( a \)Cochrane Q\( \alpha \) is shown only if significant at the 0.05 level.

\( b \)Some studies did not report this information.

\( c \)Not mutually exclusive.

Contributors
All authors contributed to the conceptualization of the review and provided material support. N. Crepaz scope-screened studies, contacted authors for additional information, abstracted qualitative and quantitative data, led data analyses, led interpretation of results, and wrote and revised the article. K. J. Marshall and L. W. Aupont abstracted qualitative and quantitative data, helped with data analyses, and provided graphic support and critical review of the article. E. D. Jacobs, Y. Mizuno, L. S. Kay, P. Jones, D. H. Mccree, and A. O'Leary abstracted qualitative and quantitative data and provided critical review of the article.

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Human Participant Protection
No protocol approval was required because data were obtained from secondary sources.

References


