



Published in final edited form as:

AIDS Behav. 2013 May ; 17(4): 1231–1244. doi:10.1007/s10461-013-0418-z.

A Systematic Review to Identify Challenges of Demonstrating Efficacy of HIV Behavioral Interventions for Gay, Bisexual, and Other Men who have Sex with Men (MSM)

Darrel H. Higa, Nicole Crepaz, Khiya Marshall, Linda Kay, H. Waverly Vosburgh, Pilgrim Spikes, Cindy Lyles, David W. Purcell

Prevention Research Branch, Division of HIV/AIDS Prevention, CDC, Atlanta, GA

Abstract

Gay, bisexual, and other men who have sex with men (MSM) are disproportionately affected by HIV but few MSM-specific evidence-based interventions (EBIs) have been identified for this vulnerable group. We conducted a systematic review to identify reasons for the small number of EBIs for MSM. We also compared study, intervention and sample characteristics of EBIs vs. non-EBIs to better understand the challenges of demonstrating efficacy evidence. Thirty-three MSM-specific studies were evaluated: Nine (27%) were considered EBIs while 24 (73%) were non-EBIs. Non-EBIs had multiple methodological limitations; the most common was not finding a significant positive effect. Compared to EBIs, non-EBIs were less likely to use peer intervention deliverers, include sexual communication in their interventions, and intervene at the community level. Incorporating characteristics associated with EBIs may strengthen behavioral interventions for MSM. More EBIs are needed for substance-using MSM, MSM of color, MSM residing in the South and MSM in couples.

Keywords

HIV prevention; men who have sex with men; behavioral interventions; systematic review

INTRODUCTION

In the fourth decade of the HIV/AIDS pandemic, gay, bisexual, and other men who have sex with men (MSM) continue to be the most vulnerable group for HIV infection in the U.S. MSM comprise 51% of the estimated 1.2 million people living with HIV in the U.S. [1] Although MSM comprise ~2% of the U.S. population [2], they account for 61% of all new HIV infections [3]. The rate of new HIV diagnoses for MSM is at least 44 times that of other men [2] and since the year 2000, MSM are the only group where new infections are rising annually [4]. Given these recent and alarming trends, it is critical to examine current HIV

Correspondence/Reprints: Darrel H. Higa, Prevention Research Branch, Division of HIV/AIDS Prevention, U.S. Centers for Disease Control and Prevention, 1600 Clifton Road, Mail Stop E-37, Atlanta, GA 30333, USA, dhiga@cdc.gov, Phone: 404 639-1968/Fax: 404 639-1950.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U.S. Centers for Disease Control and Prevention.

prevention approaches to better understand how efforts can be improved to help reverse the trends. One area that may benefit from this kind of examination is behavioral interventions for MSM.

Behavioral Interventions and HIV Prevention

Behavioral interventions dominated early HIV prevention efforts when effective biomedical and treatment options were not yet available and reducing risky behaviors was the best option [5, 6]. For MSM and other HIV risk groups, the majority of risk reduction behavioral interventions have been delivered to individuals 1-on-1 or in small groups, using cognitive-behavioral approaches [7]. These approaches attempt to change an individual's beliefs, attitudes, and behaviors to reduce HIV risk. Community-level behavioral interventions using popular opinion leaders, diffusion of innovation theory, or community mobilization have also been conducted [8, 9]. Behavioral interventions have demonstrated evidence of reducing risk behavior across different populations [10], including MSM [11–15], but have not shown substantial evidence for reducing biomedical outcomes such as STI or HIV infection [16, 17]. Like any single prevention approach, behavioral interventions may be insufficient as a stand-alone prevention strategy for producing an impactful and sustainable reduction in HIV infection [18].

With advances in HIV treatment and biomedical approaches to HIV prevention, and a growing awareness of the importance of structural and social determinants of health, HIV prevention is moving towards a high-impact, multi-level approach. This high-impact approach uses a mixture of different types and levels of interventions that is evidence-informed, cost-effective, and tailored for a particular community in order to make the greatest sustained impact on reducing new HIV infections [5]. Analogous to using antiretroviral therapy (ART) or a combination of different classes of HIV drugs to treat a person living with HIV, a high-impact prevention approach is based on the HIV epidemiological profile of a community and uses the most effective combination of biomedical, structural, and behavioral strategies [18]. Biomedical interventions such as ART and pre-exposure prophylaxis (PrEP) [19], in particular, have generated much excitement and reflect the increasing “medicalization” of HIV prevention. However, there are many behavioral and social implications of biomedical interventions that must be addressed for these interventions to be effective [20]. For example, increased risk behavior can outweigh the effectiveness of ART in reducing HIV incidence by as much as 30% [21] and the outcomes of recent PrEP trials highlight the importance of adherence behaviors in obtaining the most impact from PrEP [19]. Furthermore, the continued importance of efficacious behavioral interventions is underscored in the National HIV/AIDS Strategy (NHAS) that prioritizes scalable behavioral interventions for decreasing sexual and drug-use risk behaviors of MSM and other HIV vulnerable groups [22]. Given this emphasis on high-impact prevention in NHAS, the need for evidence-based behavioral interventions for MSM remains a crucial piece of a high-impact approach to HIV prevention among MSM.

Evidence-based HIV Behavioral Interventions

In 1996, the Centers for Disease Control and Prevention (CDC) created the Prevention Research Synthesis (PRS) team to systematically review and summarize HIV behavioral

intervention research literature with the goal of translating scientific evidence from the research literature into evidence-based HIV prevention recommendations [23]. PRS developed efficacy criteria to assess a study's design, quality of study implementation and analysis, and strength of findings through multiple consultations with internal and external HIV prevention researchers and methodology experts (http://www.cdc.gov/hiv/topics/research/prs/efficacy_criteria.htm). Mirroring the criteria used by other projects such as the Community Guide and Grades of Recommendation Assessment, Development and Evaluation (GRADE), PRS efficacy criteria focus on internal validity "to ensure a reasonable level of confidence that the observed changes can be attributed to the intervention" [23]. Interventions meeting PRS efficacy criteria are identified as evidence-based behavioral interventions (EBIs).

Although U.S. MSM are disproportionately affected by HIV, relatively few MSM-specific EBIs have been identified. Out of 74 US-based EBIs PRS identified as of May 2011 in the CDC's Compendium of Evidence-Based Behavioral Interventions (http://www.cdc.gov/hivtopics/research/prs/rr_chapter.htm), only 14 EBIs were listed for MSM. Of these, only 8, or 11%, of 74 were specifically designed for MSM. Considering that MSM comprise the majority of new HIV cases, it is puzzling that only 11% of the PRS-identified EBIs have explicitly focused on this vulnerable population. Is the small number of EBIs reflective of few behavioral HIV prevention interventions having been specifically designed for MSM or is it because many interventions have been developed for MSM but few have demonstrated sufficient evidence of efficacy? To answer these questions, we conducted a qualitative systematic review of behavioral HIV prevention interventions specifically designed for MSM. Our objectives were to (1) identify the number of behavioral HIV prevention interventions specifically designed for MSM, (2) understand the challenges of demonstrating efficacy for MSM behavioral interventions by examining the study design, implementation, analysis, and strength of findings of interventions that did not meet efficacy criteria (non-EBIs), and (3) compare study, intervention and sample characteristics of non-EBIs with EBIs. We believed a better understanding of these issues will facilitate the development of efficacious behavioral interventions for MSM.

METHODS

Search Strategy

We searched the CDC's PRS database for evaluations of MSM-specific behavioral interventions in January 2010. Another search was conducted in May 2011 to locate studies not captured in the initial search. The PRS database is annually updated by 2 research librarians who conduct systematic searches of several bibliographic databases including CINAHL, EMBASE, MEDLINE, PsycINFO, and Sociological Abstracts [24]. The last electronic systematic update of the PRS database was February 2011 for articles indexed in searched databases by December 2010. Quarterly hand searches of 38 crucial HIV/AIDS journals, reference lists checks, and contacting key authors are also implemented to supplement electronic database searches. We also examined online registries (i.e., Cochrane Library, ISI Web of Knowledge, RePORTER, and CRD databases) for any related research. The full search strategy for each database is available from the authors [24].

Eligible studies for this review were: (1) behavioral interventions to reduce HIV infection and transmission; (2) specifically designed for MSM; (3) conducted in the U.S.; (4) tested in randomized controlled trials with a comparison arm; (5) measured HIV behavioral or biological outcomes (e.g., condom use, number of sex partners, sexually transmitted infections, HIV infection); (6) and published between January 1988 and December 2010. We excluded studies not published in peer reviewed journals, studies not specifically designed for MSM even though they included a majority of MSM in their samples, and pilot studies if the full-scale efficacy trials were eligible. Adaptations of interventions were included but replications were excluded to avoid overweighting characteristics from previous interventions already included in the review.

Data Extraction and Analysis

Two trained coders independently coded eligible intervention studies, entered codes in the PRS database, and met to reconcile all discrepancies. If a study did not report critical information needed to determine intervention efficacy, we contacted the primary study investigator to obtain missing information or additional clarification. The final efficacy determination for each study was reached by PRS team consensus.

For each eligible study, we coded study characteristics (e.g., study date, location, eligibility), intervention content (e.g., behavioral determinants of risks), intervention characteristics (e.g., time span or duration of the intervention measured in weeks, number of sessions, level of delivery), and participant characteristics (e.g., racial/ethnic background, HIV status) on standardized coding forms. Following the standardized efficacy review procedure (http://www.cdc.gov/hiv/topics/research/prs/efficacy_criteria.htm), we evaluated research design, study implementation, analysis, and strength of findings of each eligible study against efficacy criteria established as good evidence for either individual- and group-level interventions (http://www.cdc.gov/hiv/topics/research/prs/efficacy_good-evidence.htm) or community-level interventions (http://www.cdc.gov/hiv/topics/research/prs/efficacy_good-evidence_CLIs.htm). An SPSS data file of final codes was generated from the PRS database.

Methodological and Analytic Approaches

Eligible interventions were classified into four categories based on the efficacy review:

- EBIs that met all efficacy criteria;
- “rigorous non-EBIs” that met all efficacy criteria except for a significant positive finding;
- “positive non-EBIs” that reported a significant positive finding but did not meet at least one other PRS criterion; and
- “other non-EBIs” that did not have a significant positive finding and did not meet at least one other PRS criterion.

Using SPSS Version 18, we examined study, intervention, and participant characteristics with descriptive statistics (e.g., medians, frequencies). We excluded community-level interventions when calculating median number of intervention sessions, session duration (length of an individual session measured in hours), intervention time spans (the duration of

the intervention measured in weeks), and total intervention hours (number of sessions multiplied by session duration) because intervention exposure at the community level is likely to differ at the individual level and estimates for these characteristics were not reported. To examine differences in study characteristics, intervention content, and participant characteristics between EBIs and non-EBIs, we conducted Fisher's exact tests and non-parametric independent samples median tests. We compared EBIs with all non-EBIs as a whole and with each non-EBI subgroup. We also compared studies that did not find a significant positive effect (a combined group of rigorous and other non-EBIs) to EBIs to identify potential characteristics that may contribute to a significant positive effect.

RESULTS

Literature Search

PRS evaluated 353 US-based behavioral interventions that were conducted between January 1988 and December 2010 (Figure 1). Out of this total, 47 interventions (13%) were specifically tailored for MSM or tested with majority of MSM in their samples. Of these, 14 were not eligible: 11 were interventions designed for persons living with HIV and had majority of MSM (over 50%) in their samples [25–35]. These studies were ineligible for the review because they were not specifically designed for MSM. The remaining three ineligible interventions included a replication [36], unpublished manuscript [37], and a pilot study whose full-scale trial was included in the review [38]. A total of 33 interventions met review eligibility criteria and were examined using PRS efficacy criteria. Descriptive characteristics of the studies are presented in Table 1.

Overall Characteristics of MSM Behavioral Interventions

Introduction of ART—Among the 33 studies we examined, 11 (33%) were conducted before ART or prior to 1996 while 22 studies (67%) were conducted after ART. The majority (82%) of pre-ART studies were conducted in small group settings while the remaining studies were implemented as community-level interventions (18%). No individual-level interventions for MSM were conducted in this time period. In the post-ART period, half of the interventions were conducted as individual-level interventions while the other half were delivered in small groups. No post-ART studies were conducted as community-level interventions.

Intervention Sites—The majority of studies ($n=26$, 79%) were single-site studies, while 4 (12%) were multi-site studies. The 3 remaining studies were conducted nationwide using the internet [39, 40] and telephone [41]. The most commonly reported intervention sites were urban settings where higher proportions of MSM congregate: New York City, San Francisco, Los Angeles, and Seattle. Regionally, most interventions were conducted in the West, followed by the Northeast. The fewest interventions were conducted in the South.

Targeted MSM Subpopulations—In terms of MSM subpopulations, 6 studies (18%) exclusively focused on MSM of color and 7 studies (21%) intervened with substance-using MSM. Nine (27%) studies concentrated on HIV-positive MSM and 6 (18%) targeted HIV-negative MSM; the majority of studies ($n=18$, 55%) did not include HIV status as an

eligibility criterion. A higher percent of MSM studies conducted post-ART focused on high-risk MSM when compared to the pre-ART period: 36% vs. 9% focused on HIV-positive MSM and 27% vs. 9% focused on substance-using MSM respectively.

Intervention Design—Approximately 42% of the studies used wait-list groups as comparisons (n=14) while 11 studies (33%) used HIV-related comparison groups and eight (24%) used non-HIV related comparison groups. The majority of interventions were conducted in small groups (n=20, 61%). Eleven (33%) were individual-level interventions while two (6%) were community-level interventions. No interventions focused on couples. Nine (27%) studies reported power analysis results [42–50] (not shown in a table).

PRS Categories of Interventions

Of the 33 eligible MSM intervention studies, 9 (27%) met all PRS efficacy criteria and are considered EBIs [8, 9, 43–45, 50, 51–53] while the remaining 24 (73%) interventions that did not meet PRS efficacy criteria were identified as non-EBIs [39, 41, 42, 46–49, 54–68]. The most commonly identified failed criteria among the 24 non-EBIs were not finding significant positive intervention effects on a relevant behavioral or biological outcome (n=13, 39%) [42, 46, 47, 49, 54, 58–60, 63–66, 68], having follow-up assessments less than 1 month after the intervention (n=6, 18%) [41, 47, 55, 56, 62, 66], having analytic sample sizes less than 40 study participants per arm, (n=5, 15%) [42, 48, 55, 64, 65] having less than a 60% retention rate of study participants per arm (n=3, 9%) [39, 57, 65]. In addition, several other limitations such as substantial missing data, significant negative findings, data analysis issues or inconsistent findings were problems for 6 interventions (18%) [40, 47, 59, 61, 63, 64].

The 24 interventions that did not meet at least 1 PRS efficacy criterion fell into 3 non-EBI groups. Seven interventions (21%) met all efficacy criteria except for a significant positive finding and were categorized as rigorous non-EBIs [46, 49, 54, 58, 60, 63, 68]. Eleven interventions (33%) reported a significant positive finding on a relevant behavioral or biological outcome but did not meet at least one other PRS criterion and were classified as positive non-EBIs [39–41, 48, 55–57, 61, 62, 67, 69]. Finally, the remaining 6 (18%) interventions did not have a significant positive finding on a relevant behavioral or biological outcome and did not meet at least one other PRS criterion [42, 47, 59, 64–66]. These interventions were identified as other non-EBIs.

Non-EBIs as a whole significantly differed from EBIs on study and intervention characteristics (Table 2). Non-EBIs were significantly more likely to exclusively focus on HIV-negative MSM and significantly less likely to be pilot tested, delivered by peers, and include intervention content on sexual communication (e.g., sexual negotiation) compared to EBIs. No EBIs included substance use as an eligibility criterion. Over half of the EBIs were conducted in the West and most EBIs used wait-list comparison groups. EBIs reported the most variety in terms of intervention delivery level (e.g., individual, small group, community) whereas the majority of non-EBIs were conducted in small groups. Excluding the 2 community-level interventions, EBIs reported the shortest median time span for an intervention and lowest median total number of hours allocated for an intervention.

Rigorous Non-EBIs—Seven studies that met all PRS efficacy criteria with the exception of finding a significant positive effect were classified as rigorous non-EBIs. All rigorous non-EBIs were conducted post-ART. When compared to EBIs, rigorous non-EBIs were significantly more likely to include substance use as an eligibility criterion and report study participants with a high school education or less. Also, rigorous non-EBIs were significantly less likely to be conducted in MSM settings and include sexual communication as part of the intervention in contrast to EBIs (Table 2).

Positive non-EBIs—Although these 11 studies found a significant positive effect, they did not meet other efficacy criteria. Having only an immediate follow-up assessment (n=4, 36%) [41, 55, 56, 62] was the most common reason for not meeting efficacy criteria. Other common reasons included having analytic sample sizes less than 40 per arm (n=2, 18%) [48, 55] and having less than 60% retention in at least 1 study arm (n=2, 18%) [39, 57]. The remaining interventions had other study limitations such as reported contradictory findings, substantial missing data, significant negative findings or re-assigned participants from the intervention arm to the control arm or excluded participants who missed intervention sessions from the analyses (n=4, 36%) [40, 61, 67, 69]. As shown in Table 1, the internet- and telephone-based interventions were classified as positive non-EBIs. Although not statistically significant, positive non-EBIs reported the lowest median number of intervention sessions, lowest median percent of blacks, and highest median percent of whites in their samples compared to EBIs, rigorous, and other non-EBIs. They also reported the lowest median percent of study participants with a high school education or less. When positive non-EBIs were compared to EBIs, no statistically significant differences in study characteristics, intervention content, or participant characteristics emerged.

Other non-EBIs—Besides lacking a significant positive effect for a relevant behavioral or biological outcome, these 6 studies also did not meet at least one other efficacy criterion. For other non-EBIs, reasons for not meeting PRS criteria were having analytic sample sizes less than 40 per arm (n=3, 50%) [42, 64, 65], having follow-up assessments less than 1 month (n=2, 33%) [47, 66], having significant negative findings (n=2, 33%) [47, 64] and biased allocation of participants to intervention and comparison arms [59]. Other non-EBIs reported the highest percent of interventions conducted in groups (n=5, 83%) compared to EBIs, rigorous non-EBIs, and positive non-EBIs. Other non-EBIs were also significantly less likely to pilot test interventions compared to EBIs (Table 2).

Rigorous & Other non-EBIs Combined—When we combined rigorous and other non-EBIs (n=13) or studies that did not find a significant positive intervention effect and compared this group with EBIs (not shown), we found similar results from previous comparisons. For example, rigorous and other non-EBIs combined were significantly more likely to include substance use (33% vs. 0, $p = 0.05$) and exclusively focus on HIV negative men (44% vs. 0, $p = 0.02$) as eligibility criteria compared to EBIs. In addition, the combined group of rigorous and other non-EBIs was significantly less likely to be pilot tested (8 vs. 67%, $p = 0.01$) and include sexual communication as part of the intervention (31 vs. 89%, $p = 0.01$) in contrast to EBIs. Finally, rigorous and other non-EBIs combined were more likely to use a non-HIV related comparison group in contrast to EBIs (46% vs. 0, $p = 0.05$).

DISCUSSION

Of the 353 funded behavioral intervention studies evaluated by PRS since 1996, only 13%, or 47, exclusively focused on MSM. Similarly, of the 74 EBIs identified by PRS, only 8 (11%) were specifically designed for MSM. These percentages are much smaller than would be expected given the cumulative impact of HIV on MSM. The similarity of proportions between studies funded exclusively for MSM (13%) and those found to be efficacious (11%) suggests that the low number of EBIs for MSM is more attributable to misaligned funding priorities than to particular issues with interventions for MSM. Another possible explanation may be that few MSM-focused intervention studies are being proposed. Although 24 (73%) of the 33 MSM-specific interventions included in this review were determined by PRS to be non-efficacious, they offer important lessons that can guide further research.

Lessons Learned from Non-efficacious MSM-specific Interventions

Not finding a significant positive effect—Findings from this study suggest that it may be difficult to demonstrate significant positive changes in sexual behavior with MSM who experience substance use issues. MSM with substance use issues often experience other psychosocial health problems like depression and partner violence [70]. From a “syndemics” perspective, it may be difficult for MSM who experience multiple interconnected issues such as substance use, depression, a history of sexual child abuse or partner violence to change sexual risk behaviors [46, 70, 71]. Efficacious interventions for substance-using MSM who experience multiple vulnerabilities may require a comprehensive approach that addresses substance use specifically (e.g., methadone treatment, individual therapy, contingency management) [72], accounts for various MSM populations (e.g., MSM who use injection drugs, MSM who use recreational drugs on the weekends), and targets venues combining sexual activity and substance use [71]. Addressing interconnected syndemic factors (e.g., treating depression, counseling for childhood sexual abuse or partner violence) while using biomedical strategies (e.g., PrEP and/or PEP) and structural interventions (e.g., decreasing stigma and discrimination related to being gay) should also be a part of this comprehensive approach [72, 73].

For substance-using and other high-risk MSM, it may be more efficacious to use individual-level interventions rather than group-level interventions. In our review, a larger proportion of non-EBIs (71%) used groups to deliver the intervention compared to EBIs (33%). Delivering interventions to high-risk MSM in a group setting may have some unintended outcomes. Some evidence indicates that small group formats may actually reinforce and sustain risk behaviors for high-risk MSM through meeting similarly or more-risky men [14]. An advantage of one-on-one interventions such as EXPLORE is that they can be tailored to meet a high-risk individual’s specific prevention needs [74]. However, to have maximum impact, it may be necessary to use a combination approach that includes other kinds of strategies such as biomedical or structural interventions to reinforce engaging in safer behaviors for high-risk MSM.

Another factor that may contribute to interventions not finding effects is the type of comparison group. In our review, interventions that did not find significant positive effects were more likely to use a non-HIV comparison group (i.e., served as attention control) while

EbIs were more likely to use wait-list or HIV-related comparison groups. In addition, the number of MSM studies that used wait-list controls decreased over time while more recent studies were more likely to use HIV-related comparison groups as demand controls. These findings suggest that using non-HIV specific comparison groups that focus on general health promotion or stress reduction may encourage comparison participants to think about and possibly make changes in sexual health behaviors [39, 68]. However, using wait-list and HIV-related comparison groups also have their disadvantages. Some researchers argue for using control groups with minimal or no treatment when conducting rigorous intervention evaluations [58], but the problem with this approach is that it does not control for attention or demand effects. Also, temporarily withholding interventions from individuals and communities severely impacted by HIV may be perceived as unethical. A potential disadvantage of using HIV-related comparison groups is the use of enhanced or exceptional HIV prevention programs or diluted versions of the new intervention as comparison groups that may greatly reduce the ability to detect effects [16]. Researchers should consider the advantages and disadvantages of using each type of comparison group and address issues related to controlling for attention and demand effects. Using a standardized comparison arm that the HIV prevention field could agree upon as a prevention standard for MSM can facilitate comparing intervention effects across studies.

Sample Sizes and Retention Rates—One of the major reasons why interventions in our review did not meet efficacy criteria was not having at least 40 study participants per arm at follow-up assessment. Some of the interventions were conducted as small scale pilot studies to test feasibility and thus started with small sample sizes at baseline [42, 64]. Other interventions suffered from attrition problems [48, 65]. A prior power analysis can help to determine the adequate sample size for detecting an intervention effect but only 28% of the studies in our review reported power analysis results. More transparent reporting of power analyses would facilitate evaluation of evidence. Finally, recruiting and retaining MSM in HIV behavioral prevention studies, especially studies with a substance use focus, may be more challenging than in the past [75]. The HIV prevention field would greatly benefit from comparative research and a compendium of “best practices” specifically focusing on recruiting and retaining MSM in intervention studies [75]. Newer recruitment methods such as respondent-driven, venue-day-time, and internet sampling show promise [76, 77] but more research is needed to evaluate their strengths and limitations.

Follow-up assessments—Having a follow-up assessment at least 1 month post-intervention was another common criterion that non-EbIs failed to meet in our review. These interventions only reported intervention effects immediately after the interventions were completed and thus the sustainability of the intervention effects is unclear. Given the emphasis on sustainable interventions in NHAS, HIV prevention researchers should consider longer follow-up assessments extending past immediate post-intervention to provide stronger evidence for sustainable changes in risk-reduction behavior.

Considerations for Future MSM Behavioral Interventions

MSM Inclusion and Focus in Interventions—A few intervention characteristics of EbIs that distinguished these interventions from those not meeting efficacy criteria might be

helpful to consider when designing future behavioral interventions for MSM. For example, involving MSM in the design and implementation of interventions may be important. In our review, pilot testing and delivering the intervention through peers were more often characteristic of EBIs than non-EBIs. Pilot testing the intervention in the MSM community can provide information to improve the intervention. Using peers as intervention deliverers may help create an intervention environment that is safe and socially comfortable for MSM.

Researchers should also consider including intervention content on sexual communication, as it was associated with efficacious interventions. Other studies have also found sexual communication as an important component in behavioral interventions for MSM [11, 13]. Sexual negotiation and other communication skills such as HIV disclosure are critical if MSM rely on serostatus-based prevention strategies such as serosorting and strategic positioning to reduce their HIV risk. Innovative interventions are particularly important to help men with sexual negotiation and HIV disclosure skills in public and commercial sex environments where silence may be the norm [78]. As technological sites such as websites and phone apps become more popular to meet sexual partners among MSM, appropriate messages and strategies to enhance sexual communication will need to be developed with these new environments in mind.

MSM of color—There was an increase in the number of interventions conducted with high-risk MSM post-ART compared to pre-ART, but compared to the number of interventions PRS has evaluated, the number of interventions specifically developed for MSM of color is relatively few. Developing efficacious behavioral interventions for these highly impacted MSM subgroups, especially African American and Latino MSM is urgently needed. EBIs and non-EBIs reported similar median percentages for including black, Latino, and white MSM in their samples, but only 2 EBIs in our review exclusively focused on MSM of color [51, 53]. One was developed for Asian and Pacific Islander MSM and was conducted in the pre-ART era, while the other EBI is a group intervention designed for HIV-negative African Americans. Currently, there are no efficacious behavioral interventions that have been specifically developed for Latino MSM or those that exclusively focus on HIV-positive MSM of color. Researchers should consider addressing the cultural and contextual factors that have been associated with risk behavior with MSM of color [79, 80]. Acknowledging and addressing the health disparities as well as the economic and social inequities confronting MSM of color are also needed as a part of a comprehensive approach for reducing HIV in these groups.

HIV Positive MSM—In this review, the percentage of interventions that exclusively focused on HIV-positive MSM were not significantly different between EBIs and non-EBIs, but EBIs were significantly more likely than non-EBIs to exclusively focus on HIV-negative MSM. This finding suggests that it may be challenging to demonstrate significant positive effects with HIV-positive MSM compared to HIV-negative MSM. Several efficacious behavioral interventions have been developed for HIV-positive persons in general (<http://www.cdc.gov/hiv/topics/research/prs/subset-best-evidence-interventions.htm#link2.6>) and a large percentage of study participants in these studies were MSM. In our review, however, only 2 [50, 52] out of 9 interventions for HIV-positive MSM were efficacious. A factor that

may contribute to non-efficacious behavioral interventions for HIV-positive MSM is the level of intervention. In this review, the majority of non-EBIs for HIV-positive MSM were group-level interventions. Intervening at the individual level reduces sexual risk for HIV-positive persons in general [81] and may be particularly important for HIV-positive MSM. As mentioned earlier, group-level interventions may inadvertently reinforce risky behavior for high-risk MSM and have fewer opportunities for specific tailoring that may be important for behavior change. Another factor that may explain why we found relatively few efficacious behavioral interventions for HIV-positive MSM is the intervention setting or where the intervention is delivered. Previous research shows behavioral interventions conducted in clinical settings where HIV-positive persons regularly receive medical or social services may be more effective in reducing sexual risk than non-clinical settings [81]. Future behavioral interventions to reduce sexual risk for HIV-positive MSM should consider individual-level interventions and delivering these interventions in settings where other services are also available.

Other Gaps—HIV is greatly impacting MSM in the South [82], but we found the fewest interventions conducted there in our review. Because many MSM interventions have been developed and conducted in the West and Northeast, researchers should consider the cultural differences in the South (e.g., being located in the Bible belt) that can make HIV prevention more challenging for MSM and other vulnerable populations.

Our review also found that efficacious technology-based behavioral interventions have yet to be developed for MSM. Retention in these interventions may be challenging [39, 83] but behavioral interventions for MSM using digital media via the Internet, mobile phones, and computers have demonstrated the potential for increasing HIV testing [84], increasing HIV disclosure [85], and reaching high-risk MSM [86] and rural MSM [87].

Another gap in the MSM intervention literature is the lack of interventions for couples [88]. Some evidence indicates that most HIV transmissions occur within primary partner relationships [89] and, thus, developing couple-based behavioral interventions for MSM should be a priority. A recent pre-posttest design study that evaluated a couple-based intervention for methamphetamine-using black MSM found encouraging results for reducing sexual risk and illicit drug use [90].

Finally, early interventions that were evaluated as efficacious pre-ART should be replicated to determine if they are still efficacious post-ART [91]. It is important to recognize that interventions that worked 10 years ago may not be comparably effective today and that they should be continually assessed for effectiveness as they are implemented in practice [92].

From Research to Practice

While the identification of EBIs is informative, several more steps are necessary to translate scientific knowledge into impactful practice. PRS efficacy criteria currently focus on internal validity to ascertain causality between the intervention and behavior change, but scalability, sustainability, and cost-effectiveness are additional critical factors to determine which EBIs and combinations of EBIs are likely to achieve high-impact outcomes [22]. Emphasizing these other qualities reflects the importance of examining an intervention's external or

“viable” validity - or the extent to which the intervention is “practical, affordable, suitable, evaluable, and helpful in the real world” [93]. Also, standards for evaluating external validity or the capacity for an intervention to generalize to other populations or settings would be helpful for effective intervention implementation in affected communities. More implementation research about how interventions work in the field and how to maximize their reach and impact is also important for facilitating the translation of research into best practices.

Limitations

Our study has several limitations that warrant caution when interpreting the results. Although we contacted primary investigators to confirm the efficacy evaluation, the coding of study and intervention characteristics are based on published reports that may not provide complete information about the intervention. While we observed some patterns that may explain differences among EBIs and non-EBIs, there are multiple factors that may contribute to an intervention’s lack of evidence and it is difficult to disentangle a specific reason or combination of reasons. Also, our review focused on original studies; replications were excluded from this review. Replications are informative especially when examining generalizability, but few were conducted. These issues should be further examined when more studies become available in the literature. We excluded interventions that were not specifically designed for MSM but had substantial numbers of MSM in their samples (e.g., HIV clinic patients). Future studies may want to compare characteristics of interventions tailored specifically to MSM with general interventions tested with a majority of MSM in their samples. Finally, we did not examine cost data because few original studies provided the information.

CONCLUSIONS

In the fourth decade of HIV prevention, behavioral interventions will continue to play an important role in HIV prevention efforts for MSM but need to be strengthened to make a substantial impact as part of a comprehensive HIV prevention package. They should target MSM at the highest risk of transmitting and acquiring HIV and consider the gaps in HIV behavioral intervention research for MSM. Behavioral interventions should also focus on relevant issues for MSM and include MSM in their design and implementation. In short, HIV behavioral interventions will need to continually evolve, as they have throughout the epidemic, to help reduce HIV vulnerability for gay, bisexual, and other men who have sex with men.

Reference List

1. CDC. CDC Factsheet: HIV and AIDS among gay and bisexual men. Published May 2012 <http://www.cdc.gov/hiv/topics/msm/pdf/msm.pdf>. Accessed 1 Feb 2013.
2. Purcell DW, Johnson CH, Lansky A et al. Estimating the Population Size of Men Who Have Sex with Men in the United States to Obtain HIV and Syphilis Rates. *Open AIDS J* 2012;6:98–107. [PubMed: 23049658]
3. Prejean J, Song R, Hernandez A et al. Estimated HIV incidence in the United States, 2006–2009. *PLoS One* 2011;6(8):e17502. [PubMed: 21826193]

4. Hall HI, Song R, Rhodes P et al. Estimation of HIV incidence in the United States. *JAMA* 2008;300(5):520–529. [PubMed: 18677024]
5. Hankins CA, de Zalduondo BO. Combination prevention: a deeper understanding of effective HIV prevention. *AIDS* 2010;24(Suppl 4):S70–S80. [PubMed: 21042055]
6. Mansergh G, Higa D. HIV/AIDS in lesbian, gay, bisexual, and transgender communities In: Hall JC, Hall BJ, Cockerell CJ, editors. *HIV/AIDS in the Post-HAART Era: Manifestations, Treatment, and Epidemiology*. Shelton, CT: People's Medical Publishing House; 2011 709–721.
7. Kelly JA, Kalichman SC. Behavioral research in HIV/AIDS primary and secondary prevention: recent advances and future directions. *J Consult Clin Psychol* 2002;70(3):626–639. [PubMed: 12090373]
8. Kegeles SM, Hays RB, Coates TJ. The Mpowerment Project: a community-level HIV prevention intervention for young gay men. *Am J Public Health* 1996;86(8):1129–1136. [PubMed: 8712273]
9. Kelly JA, St Lawrence JS, Stevenson LY et al. Community AIDS/HIV risk reduction: the effects of endorsements by popular people in three cities. *Am J Public Health* 1992;82(11):1483–1489. [PubMed: 1443297]
10. Noar SM. Behavioral interventions to reduce HIV-related sexual risk behavior: review and synthesis of meta-analytic evidence. *AIDS Behav* 2008;12(3):335–353. [PubMed: 17896176]
11. Herbst JH, Sherba RT, Crepaz N et al. A meta-analytic review of HIV behavioral interventions for reducing sexual risk behavior of men who have sex with men. *J Acquir Immune Defic Syndr* 2005;39(2):228–241. [PubMed: 15905741]
12. Herbst JH, Beeker C, Mathew A et al. The effectiveness of individual-, group-, and community-level HIV behavioral risk-reduction interventions for adult men who have sex with men: a systematic review. *Am J Prev Med* 2007;32(Suppl 4):S38–S67. [PubMed: 17386336]
13. Johnson WD, Hedges LV, Ramirez G et al. HIV prevention research for men who have sex with men: a systematic review and meta-analysis. *J Acquir Immune Defic Syndr* 2002;30(Suppl 1):S118–S129. [PubMed: 12107365]
14. Johnson WD, Holtgrave DR, McClellan WM, Flanders WD, Hill AN, Goodman M. HIV intervention research for men who have sex with men: a 7-year update. *AIDS Educ Prev* 2005;17(6):568–589. [PubMed: 16398578]
15. Johnson WD, Diaz RM, Flanders WD et al. Behavioral interventions to reduce risk for sexual transmission of HIV among men who have sex with men. *Cochrane Database Syst Rev* 2008; (3):CD001230. [PubMed: 18646068]
16. Padian NS, McCoy SI, Balkus JE, Wasserheit JN. Weighing the gold in the gold standard: challenges in HIV prevention research. *AIDS* 2010;24(5):621–635. [PubMed: 20179575]
17. Ross DA. Behavioural interventions to reduce HIV risk: what works? *AIDS* 2010;24(Suppl 4):S4–S14. [PubMed: 21042051]
18. Coates TJ, Richter L, Caceres C. Behavioural strategies to reduce HIV transmission: how to make them work better. *Lancet* 2008;372(9639):669–684. [PubMed: 18687459]
19. Grant RM, Lama JR, Anderson PL et al. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J Med* 2010;363(27):2587–2599. [PubMed: 21091279]
20. de Wit JB, Aggleton P, Myers T, Crewe M. The rapidly changing paradigm of HIV prevention: time to strengthen social and behavioural approaches. *Health Educ Res* 2011;26(3):381–392. [PubMed: 21536716]
21. Mei S, Quax R, van de Vijver D, Zhu Y, Sloot PM. Increasing risk behaviour can outweigh the benefits of antiretroviral drug treatment on the HIV incidence among men-having-sex-with-men in Amsterdam. *BMC Infect Dis* 2011;11:118. [PubMed: 21569307]
22. Office of National AIDS Policy. National HIV/AIDS strategy for the United States. Washington, DC: Office of National AIDS Policy; Published 7 2010 <http://www.whitehouse.gov/sites/default/files/uploads/NHAS.pdf>. Accessed June 8, 2012.
23. Lyles CM, Crepaz N, Herbst JH, Kay LS. Evidence-based HIV behavioral prevention from the perspective of the CDC's HIV/AIDS Prevention Research Synthesis Team. *AIDS Educ Prev* 2006;18(4 Suppl A):21–31. [PubMed: 16987086]

24. DeLuca JB, Mullins MM, Lyles CM, Crepaz N, Kay L, Thadiparthi S. Developing a comprehensive search strategy for evidence-based systematic review. *Evid Based Libr Inf Pract* 2011;3(1):3–32.
25. Antoni MH, Cruess DG, Klimas N et al. Stress management and immune system reconstitution in symptomatic HIV-infected gay men over time: effects on transitional naive T cells (CD4+CD45RA+CD29+). *Am J Psychiat* 2002;159(1):143–144. [PubMed: 11772706]
26. Carrico AW, Antoni MH, Pereira DB et al. Cognitive behavioral stress management effects on mood, social support, and a marker of antiviral immunity are maintained up to 1 year in HIV-infected gay men. *Int J Behav Med* 2005;12(4):218–226. [PubMed: 16262540]
27. Cosio D, Heckman TG, Anderson T, Heckman BD, Garske J, McCarthy J. Telephone-administered motivational interviewing to reduce risky sexual behavior in HIV-infected rural persons: a pilot randomized clinical trial. *Sex Transm Dis* 2010;37(3):140–146. [PubMed: 20118830]
28. Gilbert P, Ciccarone D, Gansky SA et al. Interactive “Video Doctor” counseling reduces drug and sexual risk behaviors among HIV-positive patients in diverse outpatient settings. *PLoS One* 2008;3(4):e1988. [PubMed: 18431475]
29. Ironson G, Antoni MH, Schneiderman N et al. Stress management and psychosocial predictors of disease course in HIV-1 infection In: Goodkin K, Visser AP, editors. *Psychoneuroimmunology: Stress, Mental Disorders, and Health*. Washington, DC: American Psychiatric Publishing Inc.; 2000 317–356.
30. Kalichman SC, Rompa D, Cage M et al. Effectiveness of an intervention to reduce HIV transmission risks in HIV-positive people. *Am J Prev Med* 2001;21(2):84–92. [PubMed: 11457627]
31. Kelly JA, Murphy DA, Bahr GR et al. Outcome of cognitive-behavioral and support group brief therapies for depressed, HIV-infected persons. *Am J Psychiatry* 1993;150(11):1679–1686. [PubMed: 8214177]
32. Lightfoot M, Tevendale H, Comulada WS, Rotheram-Borus MJ. Who benefited from an efficacious intervention for youth living with HIV: a moderator analysis. *AIDS Behav* 2007;11(1): 61–70. [PubMed: 17009122]
33. Morin SF, Shade SB, Steward WT et al. A behavioral intervention reduces HIV transmission risk by promoting sustained serosorting practices among HIV-infected men who have sex with men. *J Acquir Immune Defic Syndr* 2008;49(5):544–551. [PubMed: 18989221]
34. Richardson JL, Milam J, McCutchan A et al. Effect of brief safer-sex counseling by medical providers to HIV-1 seropositive patients: a multi-clinic assessment. *AIDS* 2004;18(8):1179–1186. [PubMed: 15166533]
35. Rotheram-Borus MJ, Swendeman D, Comulada WS, Weiss RE, Lee M, Lightfoot M. Prevention for substance-using HIV-positive young people: telephone and in-person delivery. *J Acquir Immune Defic Syndr* 2004;37(Suppl 2):S68–S77. [PubMed: 15385902]
36. Kelly JA, Murphy DA, Sikkema KJ et al. Randomised, controlled, community-level HIV-prevention intervention for sexual-risk behaviour among homosexual men in US cities. Community HIV Prevention Research Collaborative. *Lancet* 1997;350(9090):1500–1505. [PubMed: 9388397]
37. Goldbaum GM, Johnson W, Wolitski RJ et al. Sexual behavior change among non-gay-identified men who have sex with men: response to a community-level intervention. Unpublished manuscript.
38. Picciano J, Roffman R, Kalichman S, Rutledge S, Berghuis J. A telephone based brief intervention using motivational enhancement to facilitate HIV risk reduction among MSM: a pilot study. *AIDS and Behavior* 2001;5(3):251–262.
39. Carpenter KM, Stoner SA, Mikko AN, Dhanak LP, Parsons JT. Efficacy of a web-based intervention to reduce sexual risk in men who have sex with men. *AIDS Behav* 2010;14(3):549–557. [PubMed: 19499321]
40. Rosser BR, Oakes JM, Konstan J et al. Reducing HIV risk behavior of men who have sex with men through persuasive computing: results of the Men’s INternet Study-II. *AIDS* 2010;24(13):2099–2107. [PubMed: 20601853]

41. Roffman RA, Picciano JF, Ryan R et al. HIV-prevention group counseling delivered by telephone: an efficacy trial with gay and bisexual men. *AIDS Behav* 1997;1(2):137–154.
42. Coleman JD, Lindley LL, Annang L, Saunders RP, Gaddist B. Development of a framework for HIV/AIDS prevention programs in African American churches. *AIDS Patient Care STDS* 2012;26(2):116–124. [PubMed: 22149766]
43. Dilley JW, Woods WJ, Sabatino J et al. Changing sexual behavior among gay male repeat testers for HIV: a randomized, controlled trial of a single-session intervention. *J Acquir Immune Defic Syndr* 2002;30(2):177–186. [PubMed: 12045680]
44. Dilley JW, Woods WJ, Loeb L et al. Brief cognitive counseling with HIV testing to reduce sexual risk among men who have sex with men: results from a randomized controlled trial using paraprofessional counselors. *J Acquir Immune Defic Syndr* 2007;44(5):569–577. [PubMed: 17310937]
45. Koblin B, Chesney M, Coates T. Effects of a behavioural intervention to reduce acquisition of HIV infection among men who have sex with men: the EXPLORE randomised controlled study. *Lancet* 2004;364(9428):41–50. [PubMed: 15234855]
46. Mansergh G, Koblin BA, McKirnan DJ et al. An intervention to reduce HIV risk behavior of substance-using men who have sex with men: a two-group randomized trial with a nonrandomized third group. *PLoS Med* 2010;7(8):e1000329. [PubMed: 20811491]
47. Picciano JF, Roffman RA, Kalichman SC, Walker DD. Lowering obstacles to HIV prevention services: effects of a brief, telephone-based intervention using motivational enhancement therapy. *Ann Behav Med* 2007;34(2):177–187. [PubMed: 17927556]
48. Read SJ, Miller LC, Appleby PR et al. Socially optimized learning in a virtual environment: reducing risky sexual behavior among men who have sex with men. *Health Communication Research* 2006;32(1):1–34.
49. Velasquez MM, von SK, Johnson DH, Green C, Carbonari JP, Parsons JT. Reducing sexual risk behaviors and alcohol use among HIV-positive men who have sex with men: a randomized clinical trial. *J Consult Clin Psychol* 2009;77(4):657–667. [PubMed: 19634959]
50. Wolitski RJ, Gomez CA, Parsons JT. Effects of a peer-led behavioral intervention to reduce HIV transmission and promote serostatus disclosure among HIV-seropositive gay and bisexual men. *AIDS* 2005;19(Suppl 1):S99–S109.
51. Choi KH, Lew S, Vittinghoff E, Catania JA, Barrett DC, Coates TJ. The efficacy of brief group counseling in HIV risk reduction among homosexual Asian and Pacific Islander men. *AIDS* 1996;10(1):81–87. [PubMed: 8924256]
52. McKirnan DJ, Tolou-Shams M, Courtenay-Quirk C. The Treatment Advocacy Program: a randomized controlled trial of a peer-led safer sex intervention for HIV-infected men who have sex with men. *J Consult Clin Psychol* 2010;78(6):952–963. [PubMed: 20919760]
53. Wilton L, Herbst JH, Cury-Doniger P et al. Efficacy of an HIV/STI prevention intervention for black men who have sex with men: findings from the Many Men, Many Voices (3MV) project. *AIDS Behav* 2009;13(3):532–544. [PubMed: 19267264]
54. Carballo-Dieguez A, Dolezal C, Leu CS et al. A randomized controlled trial to test an HIV-prevention intervention for Latino gay and bisexual men: lessons learned. *AIDS Care* 2005;17(3):314–328. [PubMed: 15832879]
55. Coates TJ, McKusick L, Kuno R, Stites DP. Stress reduction training changed number of sexual partners but not immune function in men with HIV. *Am J Public Health* 1989;79(7):885–887. [PubMed: 2735479]
56. Kelly JA, St Lawrence JS, Hood HV, Brasfield TL. Behavioral intervention to reduce AIDS risk activities. *J Consult Clin Psychol* 1989;57(1):60–67. [PubMed: 2925974]
57. Mausbach BT, Semple SJ, Strathdee SA, Zians J, Patterson TL. Efficacy of a behavioral intervention for increasing safer sex behaviors in HIV-positive MSM methamphetamine users: results from the EDGE study. *Drug Alcohol Depend* 2007;87(2–3):249–257. [PubMed: 17182196]
58. Menza TW, Jameson DR, Hughes JP, Colfax GN, Shoptaw S, Golden MR. Contingency management to reduce methamphetamine use and sexual risk among men who have sex with men: a randomized controlled trial. *BMC Public Health* 2010;10:774. [PubMed: 21172026]

59. Miller RL. Assisting gay men to maintain safer sex: an evaluation of an AIDS service organization's safer sex maintenance program. *AIDS Educ Prev* 1995;7(Suppl 5):48–63. [PubMed: 8664098]
60. Morgenstern J, Bux DA Jr., Parsons J, Hagman BT, Wainberg M, Irwin T. Randomized trial to reduce club drug use and HIV risk behaviors among men who have sex with men. *J Consult Clin Psychol* 2009;77(4):645–656. [PubMed: 19634958]
61. Peterson JL, Coates TJ, Catania J et al. Evaluation of an HIV risk reduction intervention among African-American homosexual and bisexual men. *AIDS* 1996;10(3):319–325. [PubMed: 8882672]
62. Roffman RA, Stephen RS, Curtin L et al. Relapse prevention as an interventional model for HIV risk reduction in gay and bisexual men. *AIDS Educ Prev* 1998;10(1):1–18.
63. Rosser BR, Hatfield LA, Miner MH, Ghiselli ME, Lee BR, Welles SL. Effects of a behavioral intervention to reduce serodiscordant unsafe sex among HIV positive men who have sex with men: the Positive Connections randomized controlled trial study. *J Behav Med* 2010;33(2):147–158. [PubMed: 20101454]
64. Serovich JM, Reed S, Graftsky EL, Andrist D. An intervention to assist men who have sex with men disclose their serostatus to casual sex partners: results from a pilot study. *AIDS Educ Prev* 2009;21(3):207–219. [PubMed: 19519236]
65. Shoptaw S, Reback CJ, Peck JA et al. Behavioral treatment approaches for methamphetamine dependence and HIV-related sexual risk behaviors among urban gay and bisexual men. *Drug Alcohol Depend* 2005;78(2):125–134. [PubMed: 15845315]
66. Stall RD, Paul JP, Barrett DC, Crosby GM, Bein E. An outcome evaluation to measure changes in sexual risk-taking among gay men undergoing substance use disorder treatment. *J Stud Alcohol* 1999;60(6):837–845. [PubMed: 10606497]
67. Valdiserri RO, Lyter DW, Leviton LC, Callahan CM, Kingsley LA, Rinaldo CR. AIDS prevention in homosexual and bisexual men: results of a randomized trial evaluating two risk reduction interventions. *AIDS* 1989;3(1):21–26. [PubMed: 2496707]
68. Williams JK, Wyatt GE, Rivkin I, Ramamurthi HC, Li X, Liu H. Risk reduction for HIV-positive African American and Latino men with histories of childhood sexual abuse. *Arch Sex Behav* 2008;37(5):763–772. [PubMed: 18506611]
69. Rosser BR, Bocking WO, Rugg DL et al. A randomized controlled intervention trial of a sexual health approach to long-term HIV risk reduction for men who have sex with men: effects of the intervention on unsafe sexual behavior. *AIDS Educ Prev* 2002;14(3 Suppl A):59–71. [PubMed: 12092938]
70. Stall R, Mills TC, Williamson J et al. Association of co-occurring psychosocial health problems and increased vulnerability to HIV/AIDS among urban men who have sex with men. *Am J Public Health* 2003;93(6):939–942. [PubMed: 12773359]
71. Stall RD, Purcell DW. Intertwining epidemics: a review of research on substance use among men who have sex with men and its connection to the AIDS epidemic. *AIDS Behav* 2000;4(2):181–192.
72. Ostrow DG, Stall R. Alcohol, tobacco, and drug use among gay and bisexual men In: Wolitski RJ, Stall R, Valdiserri RO, editors. *Unequal Opportunity: Health Disparities Affecting Gay and Bisexual Men In The United States*. New York: Oxford University Press; 2008 121–158.
73. Shoptaw S, Reback CJ. Methamphetamine use and infectious disease-related behaviors in men who have sex with men: implications for interventions. *Addiction* 2007;102(Suppl 1):130–135. [PubMed: 17493062]
74. Chesney MA, Koblin BA, Barresi PJ et al. An individually tailored intervention for HIV prevention: baseline data from the EXPLORE Study. *Am J Public Health* 2003;93(6):933–938. [PubMed: 12773358]
75. Jenkins RA. Recruiting substance-using men who have sex with men into HIV prevention research: current status and future directions. *AIDS Behav* 2012;16(6):1411–1419. [PubMed: 22016329]
76. Hatfield LA, Ghiselli ME, Jacoby SM et al. Methods for recruiting men of color who have sex with men in prevention-for-positives interventions. *Prev Sci* 2010;11(1):56–66. [PubMed: 19731034]

77. Parsons JT, Vial AC, Starks TJ, Golub SA. Recruiting Drug Using Men Who Have Sex with Men in Behavioral Intervention Trials: A Comparison of Internet and Field-Based Strategies. *AIDS Behav* 2013; 17:688–99. [PubMed: 22684657]
78. Higa D Gay Men's Brief Sexual Connections: Settings, Processes, Meanings, and Ethics [dissertation]. Seattle, WA: University of Washington; 2008.
79. Mizuno Y, Borkowf C, Millett GA, Bingham T, Ayala G, Stueve A. Homophobia and racism experienced by Latino men who have sex with men in the United States: correlates of exposure and associations with HIV risk behaviors. *AIDS Behav* 2012;16(3):724–735. [PubMed: 21630014]
80. VanDevanter N, Duncan A, Burrell-Piggott T et al. The influence of substance use, social sexual environment, psychosocial factors, and partner characteristics on high-risk sexual behavior among young Black and Latino men who have sex with men living with HIV: a qualitative study. *AIDS Patient Care STDS* 2011;25(2):113–121. [PubMed: 21235387]
81. Crepaz N, Lyles CM, Wolitski RJ et al. Do prevention interventions reduce HIV risk behaviours among people living with HIV? A meta-analytic review of controlled trials. *AIDS* 2006;20(2): 143–157. [PubMed: 16511407]
82. CDC. HIV surveillance in men who have sex with men (MSM). Atlanta, GA <http://www.cdc.gov/hiv/topics/surveillance/resources/slides/msm/index.htm>. Accessed June 8, 2012.
83. Bull SS, Lloyd L, Rietmeijer C, McFarlane M. Recruitment and retention of an online sample for an HIV prevention intervention targeting men who have sex with men: the Smart Sex Quest Project. *AIDS Care* 2004;16(8):931–943. [PubMed: 15511725]
84. Rhodes SD, Vissman AT, Stowers J et al. A CBPR partnership increases HIV testing among men who have sex with men (MSM): outcome findings from a pilot test of the CyBER/testing internet intervention. *Health Educ Behav* 2011;38(3):311–320. [PubMed: 21393625]
85. Chiasson MA, Shaw FS, Humberstone M, Hirshfield S, Hartel D. Increased HIV disclosure three months after an online video intervention for men who have sex with men (MSM). *AIDS Care* 2009;21(9):1081–1089. [PubMed: 20024766]
86. Reback CJ, Ling D, Shoptaw S, Rohde J. Developing a text messaging risk reduction intervention for methamphetamine-using MSM: research note. *Open AIDS J* 2010;4:116–122. [PubMed: 20657827]
87. Bowen AM, Horvath K, Williams ML. A randomized control trial of Internet-delivered HIV prevention targeting rural MSM. *Health Educ Res* 2007;22(1):120–127. [PubMed: 16849391]
88. El-Bassel N, Gilbert L, Witte S, Wu E, Hunt T, Remien RH. Couple-based HIV prevention in the United States: advantages, gaps, and future directions. *J Acquir Immune Defic Syndr* 2010;55(Suppl 2):S98–S101. [PubMed: 21406997]
89. Sullivan PS, Salazar L, Buchbinder S, Sanchez TH. Estimating the proportion of HIV transmissions from main sex partners among men who have sex with men in five US cities. *AIDS* 2009;23(9):1153–1162. [PubMed: 19417579]
90. Wu E, El-Bassel N, McVinney LD et al. Feasibility and promise of a couple-based HIV/STI preventive intervention for methamphetamine-using, black men who have sex with men. *AIDS Behav* 2011;15(8):1745–1754. [PubMed: 21766193]
91. Elford J, Hart G. If HIV prevention works, why are rates of high-risk sexual behavior increasing among MSM? *AIDS Educ Prev* 2003;15(4):294–308. [PubMed: 14516015]
92. Sullivan PS, Wolitski RJ. HIV infection among gay and bisexual men In: Sullivan PS, Wolitski RJ, editors. *Unequal Opportunity: Health Disparities Affecting Gay and Bisexual Men in the United States*. New York: Oxford University Press; 2008 221–247.
93. Chen HT. The bottom-up approach to integrative validity: a new perspective for program evaluation. *Eval Program Plann* 2010;33(3):205–214. [PubMed: 19931908]

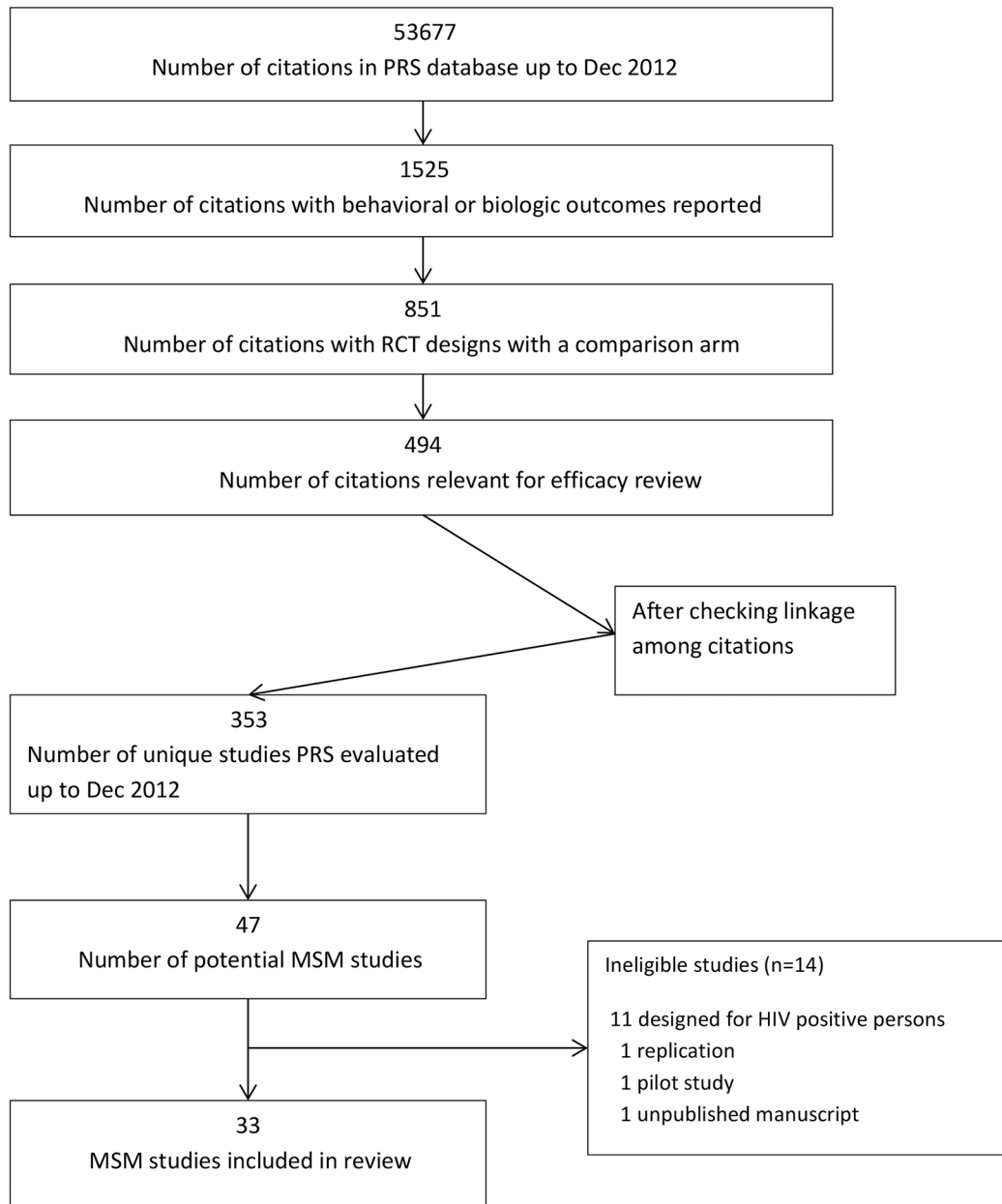


Figure 1.
Flow chart of search

Table 1.

Descriptive characteristics of 33 HIV Prevention Interventions for MSM

Primary author, reference	Study years	Region ^a	Intervention (# sessions/tot. hrs) ^b	Comparison Type	Level ^c	Sub population ^d (baseline sample size)
Evidence-based interventions (EBIs) ^e (k=9)						
Choi <i>et al.</i> [51]	1992–1995	W	Living Well (1/3)	Wait-list	G	Asian Pacific Islanders (329)
Dilley <i>et al.</i> [43]	1997–2000	W	Personal Cognitive Counseling (PCC) (1/1)	HIV-related	I	HIV– (248)
Dilley <i>et al.</i> [44]	2002–2005	W	PCC with Paraprofessionals (1/1)	HIV-related	I	HIV– (305)
Kegeles <i>et al.</i> [8]	Pub 1996	W	Mpowerment (NA/NA)	Wait-list	C	Young (300)
Kelly <i>et al.</i> [9]	1989–1992	S	Popular Opinion Leader (NA/NA)	Wait-list	C	Bar patrons (659)
Koblin <i>et al.</i> [45]	1999–2005	NE, MW, W	EXPLORE (17/17)	HIV-related	I	HIV– (4,295)
McKirnan <i>et al.</i> [52]	2004–2006	MW	Treatment Advocacy Program (4/9)	Wait-list	I	HIV+ (313)
Willton <i>et al.</i> [53]	2005–2007	NE	Many Men, Many Voices (1/18)	Wait-list	G	African American, HIV- (338)
Wolitski <i>et al.</i> [50]	2000–2001	NE, W	SUMIT (6/18)	HIV-related	G	HIV+ (811)
Non-evidence based interventions (non-EBIs) (k=24)						
Rigorous non-EBIs ^f (k=7)						
Carballo-Dieguez <i>et al.</i> [54]	1998–2002	NE	LEO (8/16)	Wait-list	G	Latino (180)
Mansergh <i>et al.</i> [46]	2004–2008	NE, MW, W	MIX (6/12)	Non-HIV	G	Substance users (1,686)
Menza <i>et al.</i> [58]	2007–2008	W	Contingency Management (36/NR)	Non-HIV	I	Meth users (127)
Morgenstern <i>et al.</i> [60]	2004–2007	NE	Motivational Interviewing (4/4)	HIV-related	I	Club drug users (150)
Rosser <i>et al.</i> [63]	2005–2007	NE, W,S	Positive Connections (1/16)	HIV-related	G	HIV+ (675)
Velasquez <i>et al.</i> [49]	1999–2003	NE	Motivational Interviewing (8/NR)	HIV-related	G	Alcohol users, HIV+ (253)
Williams <i>et al.</i> [68]	2003–2006	W	S-HIM (6/12)	Non-HIV	G	African American, Latino, HIV+ (137)
Positive non-EBIs ^h (k=11)						
Carpenter <i>et al.</i> [39]	2006–2007	I	Multi-media (1/2)	Non-HIV	I	Young, HIV– (112)
Coates <i>et al.</i> [55]	Pub 1989	W	Stress management (9/24)	Wait-list	G	HIV+ (64)
Kelly <i>et al.</i> [56]	Pub 1989	S	ARIES (12/18)	Wait-list	G	Not specified (104)
Mausbach <i>et al.</i> [57]	1999–2005	W	EDGE (8/12)	Non-HIV	I	HIV+, meth users (341)
Peterson <i>et al.</i> [61]	1989–1992	W	Risk reduction (3/9)	Wait-list	G	African American (318)
Read <i>et al.</i> [48]	Pub 2006	W	Interactive video (1/NR)	HIV-related	G	HIV– (136)
Roffman <i>et al.</i> [62]	1989–1991	W	Relapse Prevention (17/34)	Wait-list	G	Not specified (159)

Primary author, reference	Study years	Region ^a	Intervention (# sessions/tot. hrs) ^b	Comparison Type	Level ^c	Sub population ^d (baseline sample size)
Roffman <i>et al.</i> [41]	1992–1993	T	Telephone counseling (14/21)	Wait-list	G	Not specified (548)
Rosser <i>et al.</i> [69]	1997–1999	MW	Man-to-Man Sexual Health (2/8)	HIV-related	I	Not specified (422)
Rosser <i>et al.</i> [40]	2007–2009	I	Sexpulse (1/5)	Wait-list	I	Not specified (560)
Valdiserri <i>et al.</i> [67]	1986–1988	NE	Peer-led Skills Training (1/2)	HIV-related	G	Not specified (584)
Other Non-EBIs ⁱ (k=6)						
Coleman <i>et al.</i> [42]	2006–2007	NE	Social Cognitive (4/8)	Non-HIV	G	HIV+ African American (60)
Miller <i>et al.</i> [59]	1991–1993	NE	Keep it Up (1/5)	Wait-list	G	Not specified (150)
Picciano <i>et al.</i> [47]	2002–2005	W	Motivational Interviewing (3/5)	HIV-related	I	Not specified (391)
Serovich <i>et al.</i> [64]	2005–2006	MW	HIV-related disclosure (4/5)	Wait-list	G	HIV+ (77)
Shoptaw <i>et al.</i> [65]	1998–2001	W	Contingency manage. (48/72)	Non-HIV	G	Meth-users (162)
Stall <i>et al.</i> [66]	1990–1994	W	Relapse prevention (32/48)	Non-HIV	G	Substance users (147)

^aRegion: NE=Northeast, MW= Midwest, S=South, W=West, I=Internet based, T=Telephone based

^bTotal hours: NA=Not applicable because community intervention, NR=Not reported

^cLevel: I=Individual, G=Group, C=Community

^dSub population: Not specified=intervention did not focus on a specific MSM sub population

^eInterventions that met all PRS efficacy criteria

^fCurrently not listed in the Compendium of Evidence-Based Behavioral Interventions (http://www.cdc.gov/hiv/topics/research/prs/rr_chapter.htm)

^gInterventions that were evaluated as methodologically rigorous but did not find a significant positive effect

^hInterventions that found a significant positive effect but did not meet at least one PRS efficacy criteria

ⁱInterventions that did not find a significant positive effect and did not meet at least one other PRS efficacy criteria

Table 2. Percents and Medians of Select Characteristics of Evidence-Based Interventions (EBIs) and Non-EBIs

	EBIs (n=9) n (%)	All Non-EBIs (n=24) n (%)	Non-EBIs (n=24)			Other Non-EBIs (n=6) n (%)
			Rigorous Non-EBIs (n=7) n (%)	Positive Non-EBIs (n=11) n (%)		
Conducted pre or post ART						
Pre-ART	3 (33)	8 (33)	0	6 (55)	2 (33)	
Post-ART	6 (67)	16 (67)	7 (100)	5 (45)	4 (67)	
Eligibility criteria						
Substance use	0 ^{2,4}	7 (29)	4 (57) ^{2,4}	1 (9)	2 (33) ⁴	
Unprotected or Discordant Anal Sex	2 (22)	10 (42)	3 (43)	5 (45)	1 (17)	
Exclusive focus on HIV-positive MSM	2 (22)	7 (29)	3 (43)	2 (18)	2 (33)	
Exclusive focus on HIV-negative MSM	4 (44) ^{1,4}	2 (8) ¹	0 ⁴	2 (18)	0 ⁴	
Exclusive focus on MSM of color	2 (22)	4 (17)	2 (29)	1 (9)	1 (17)	
Region ^a						
Northeast	3 (33)	8 (33)	5 (71)	1 (9)	2 (29)	
South	1 (11)	2 (8)	1 (14)	1 (9)	0	
Midwest	2 (22)	3 (13)	1 (14)	1 (9)	1 (14)	
West	6 (67)	13 (54)	4 (57)	6 (55)	3 (43)	
Internet	0	2 (13)	0	2 (18)	0	
Telephone						
Study Design						
Comparison group						
Wait-list	5 (56)	9 (38)	1 (14)	6 (55)	2 (29)	
HIV-related	4 (44)	7 (29)	3 (43)	3 (27)	1 (14)	
Non-HIV	0 ⁴	8 (33)	3 (43) ⁴	2 (18)	3 (43) ⁴	
Intervention Characteristic						
Delivery level						
Individual	4(44)	7 (29)	2(29)	4(36)	1(14)	
Group	3(38)	17 (71)	5(71)	7(64)	5(83)	
Community	2(25)	0	0	0	0	

Intervention Characteristic	EBIs (n=9) n (%)		All Non-EBIs (n=24) n (%)		Non-EBIs (n=24)		Other Non-EBIs (n=6) n (%)	
	n	(%)	n	(%)	Rigorous Non-EBIs (n=7) n (%)	Positive Non-EBIs (n=11) n (%)	n	(%)
Median intervention time span (weeks) ^b	1.0		8.0		7.0	5.5	14.0	
Median total time of intervention (hours) ^b	6.0		12.0		12.0	12.0	6.5	
Median session duration (hours) ^b	2.0		2.0		2.0	2.0	2.0	
Median number of sessions ^b	3.5		6		7	3	4.5	
Pilot tested	6(67) ^{1,3,4}		6(25) ¹		1(14) ⁴	5(45)	0 ^{3,4}	
Conducted in a MSM setting	5(56) ²		4(17)		0 ²	2(18)	2(33)	
Delivered by peers	6(67) ¹		4(17) ¹		2(29)	2(18)	1(17)	
Focused on sexual communication	8(89) ^{1,2,4}		9(38) ¹		2(29) ^{2,4}	5(45)	2(33) ⁴	
Sample Characteristic								
Median % black	8.0		13.7		39.0	7.5	10.8	
Median % Latino	13.6		13.9		18.9	15.1	9.0	
Median % white	72.5		70.7		36.3	84.1	76.7	
Median average age	31.1		35.4		38.2	33.8	37.0	
Median % high school graduate or less	22.6 ²		29.2		39.4 ²	16.1	29.0	

^aSome studies were multi-regional studies

^bDoes not include community level interventions

¹Significant Fisher's Exact test for difference between EBIs and all non-EBIs (p<0.05)

²Significant Fisher's Exact test between EBIs and Rigorous non-EBIs (p<0.05)

³Significant Fisher's Exact test between EBIs and Other Non-EBIs (p<0.05)

⁴Significant Fisher's Exact test between EBIs and Rigorous and Other Non-EBIs combined (p<0.05)