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Systematic Review of Interventions to Reduce Problematic Alcohol Use in Men who have Sex with Men

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Abstract

Issues—Rates of heavy drinking, alcohol problems, and alcohol-related disorders are high among men who have sex with men (MSM) and are an important public health issue. Associations between heavy drinking and HIV acquisition among MSM also suggest that drinking may have more severe and chronic consequences for this population relative to others. Consequently, effective interventions to reduce heavy drinking and alcohol-related risk factors among MSM are needed.

Approach—We conducted a systematic review of randomized controlled trials of interventions to reduce heavy drinking and/or alcohol-related problems among MSM. We searched five electronic databases, screened 3,722 records, and identified five studies involving 1,022 participants that satisfied inclusion criteria, which included having: (1) incorporated a comparison condition, (2) randomized participants to groups, and (3) reported quantitative outcomes.

Key findings—The methodological quality of studies varied, and meta-analysis was not conducted due to heterogeneity in intervention approaches and outcomes. Studies provided preliminary support for the use of motivational interviewing/motivational enhancement-based interventions (MI) and hybrid MI and cognitive-behavioral therapy (CBT) treatments for heavy drinking among MSM over no treatment. Perhaps the most important conclusion of this review, however, is that well-designed, theoretically-informed research focused on establishing the efficacy of interventions for hazardous drinking and alcohol use disorders among MSM is alarmingly scarce.

Conclusions—Effective interventions to reduce hazardous drinking among MSM and prevent key alcohol-related outcomes, including risk for HIV transmission and health problems among HIV-positive MSM, are needed to mitigate health disparities in this population.

Keywords

Alcohol; Alcohol abuse; Alcohol dependence; Homosexuality; male; Motivational interviewing

Introduction

Alcohol use disorders (AUDs) are among the most significant public health concerns globally because of their high individual and collective consequences, including poor health outcomes, lost productivity, and increased mortality [1, 2]. Despite the development of modestly effective treatments for AUD [3, 4], one persistent challenge involves translating those interventions for specific populations who may be at high risk for alcohol-related harm.

Rates of alcohol use among men who have sex with men (MSM) are high both in the United States and internationally [5, 6]. While there is little evidence to suggest that rates of alcohol use and AUDs are higher among MSM than in the general population, heavy drinking among MSM remains a significant public health problem [7–9]. In nationally representative samples, 90% reported having consumed alcohol in the past six months, 23% report binge drinking, and at least 12% exhibited signs of problematic alcohol use [7, 10]. Heavy drinking is also a known risk factor for HIV infection specifically among MSM [11, 12], due in part to a tendency for intoxication to increase unprotected anal intercourse [13–16]. These associations are particularly concerning, since MSM account for over half of all new HIV infections each year in United States [17]. Thus, high levels of alcohol use and heavy drinking among MSM may be one factor contributing to the expanding HIV epidemic among these individuals.

MSM also account for a substantial proportion of individuals living with HIV and AIDS in the United States [17–19]. Although the advent of effective antiretroviral therapy (ART) has offered considerable improvement in long-term outcomes for people living with HIV [20–22], alcohol use is associated with poorer adherence to ARTs as well as related outcomes, such as increased viral load and decreased CD4 cell counts [23, 24]. This relationship is important, as adherence rates of over 90% are necessary to ensure treatment success and avoid the development of viral resistance [25, 26]. Evidence suggests that the failure to suppress viral load associated with ART non-adherence may also increase the risk of sexual HIV transmission [27], providing yet another avenue for alcohol's potentially deleterious effects.

Given these relationships, several authors have highlighted the need for increased attention to co-factors of HIV transmission, including alcohol and substance use [28, 29]. Although systematic reviews of interventions for reducing alcohol use have been undertaken with respect to a number of at-risk populations, including youth, pregnant women, and illicit drug users, none has focused specifically on MSM. One recent review [30] described interventions available for non-injection substance use in MSM, but did not specifically

focus on interventions for problem drinking. The current review sought to systematically analyze the evidence for available interventions that have been rigorously tested (i.e., randomized controlled trials [RCTs]) for reducing problem drinking among MSM. Here, “problem drinking” refers to a range of use patterns and problems, including drinking above the recommended weekly levels for men [31], experiencing alcohol-related problems [32] and having diagnosed alcohol use disorder [33, 34]. Our study had three aims: (1) to describe the characteristics of the included studies, (2) to assess their methodological quality, and (3) to summarize the findings across the studies.

Method

Study Selection

This review included RCTs of interventions for reducing problem drinking in MSM. We interpreted “problem drinking” broadly and incorporated studies referring to a spectrum of drinking patterns and behaviors, including those designed to reduce use among MSM who are drinking above recommended weekly drinking levels (14+ drinks/week, drinking 5+ drinks on a single occasion in the past month), those targeted toward MSM experiencing alcohol-related problems, and those focused on MSM with alcohol use disorder (AUD) diagnoses. The primary outcomes of interest in this review were changes in alcohol use, as measured by biological markers or self-report. Eligible interventions could take a psychosocial, behavioral, structural, or medical approach, and could also address other co-morbid health issues (e.g., HIV, drug use), so long as the intervention had a *clear* and *specific* focus on changing alcohol use. Although several trials have examined HIV risk interventions for “substance using MSM” targeting the use of substances before/during sex, overall alcohol use and/or problems were not considered outcomes [35–37], so these studies were excluded from our review.

Included studies were those that targeted intervention activities specifically toward MSM. Studies that targeted MSM in addition to other populations were included if they disaggregated findings for MSM participants. Studies were excluded if they did not include a control or comparison condition, did not randomize participants to conditions, or did not report quantitative findings on alcohol use or problem variables. This review was conducted in accordance with the Cochrane guidelines for systematic reviews of interventions [38], and in accordance with American Psychological Association ethical standards [39].

Search strategy

We searched five electronic databases, Medline/Pubmed; PsycINFO; CINAHL, EMBASE; and CENTRAL, for studies published through September 2014. The search strategy included both MeSH terms (in Pubmed) and keywords for alcohol (e.g., alcohol, alcoholism, binge, intoxication, drink, drinking behavior), study design (e.g., randomized controlled trial, clinical trial, random allocation, double-blind, single-blind, comparative study, control group, comparison group), and MSM population (e.g., homosexuality, bisexuality, gay, men who have sex with men, MSM, same-sex, sexual minority). We cross-referenced previous reviews and primary studies for additional citations.

All identified records (n=3,722) were initially screened by one author to exclude citations that were not relevant. A total of 813 records met preliminary inclusion criteria based on information presented in the abstract or title. We were unable to retrieve the full paper for four records (unpublished conference abstracts) and obtained full-text copies of 809 papers, which were screened for further eligibility based on our *a priori* criteria. To arrive at the final list of included studies, two authors independently reviewed the list, and disagreements about inclusion were resolved via discussion with a third reviewer. This produced the final list of included studies (n=5; see Figure 1 for flowchart of systematic review)ⁱ.

Data Extraction

Data were extracted by one coder and verified by a second coder trained in conducting systematic reviews, and included details about study design, sampling approach, participant characteristics, self-report or biological indicators of alcohol use, analysis, and results (see Table 1). The authors were not blind to any aspect of the studies.

The Quality Assessment Tool for Quantitative Studies checklist (QATQS) was used to assess the methodological quality of included studies [40]. The following characteristics were appraised: (1) selection bias; (2) study design; (3) confounders; (4) blinding; (5) data collection method; (6) retention/attrition.

Results

Characteristics of Included Studies

Of the 809 screened for inclusion, five studies were selected for the systematic review reporting data from 1,022 participants (see Table 1). Studies were published between 2007 to 2012, samples ranged from 161 [41] to 253 MSM participants [32], and three recruited non-treatment-seeking MSM [33, 34, 41].

Intervention Design and Content

Given our review criteria, all five studies included were RCTs. All but one study (Croff et al. [41]) provided explicit evidence that intervention content was tailored specifically for MSM. However, the theoretical basis, content, and length of the interventions varied considerably across the included studies. Three of the interventions utilized tenants of motivational interviewing/enhancement (MI), cognitive-behavioral therapy (CBT), or both, albeit with substantial differences in application and delivery. For example, Velasquez and colleagues [32] compared a combined individual and group counseling intervention based on both MI and the transtheoretical model (TTM) of change with a control group that involved resource referrals. Morgenstern and colleagues [31] tested a hybrid MI and CBT intervention, delivered alone or in combination with a medication (naltrexone), against a shorter, adherence-oriented intervention within medication-only and placebo-only control

ⁱAn additional study by Fals-Stewart, O'Farrell & Lam (*Journal of Substance Abuse Treatment*. 2009 Dec; 37(4): 379–387) met the criteria for inclusion in the review, but was excluded based on advice from the Editor-in-Chief of the *Journal of Substance Abuse Treatment* that the journal has a general policy of advising authors to exclude the study from reviews due to concerns about the study's validity.

groups. Morgenstern and colleagues [31] also tested a similar amalgam MI and CBT intervention against a 4-session motivational enhancement-only intervention [33].

The remaining two studies were disparate in terms of their theoretical underpinnings. Reback and colleagues [34], tested a 24-week contingency management intervention against a treatment-as-usual control group. Croff and colleagues [41] examined whether a brief, personalized feedback intervention delivered in a bar setting would reduce intoxication the same night when compared to an attention control condition.

Identified studies were also disparate in terms of their alcohol-related inclusion criteria and the type of alcohol outcome measured or analyzed in their reports. With respect to inclusion criteria, two studies focused on MSM who met criteria for AUD (two based on a structured interview of AUD criteria, one using a screening tool [32]), and one included homeless MSM with any substance use disorder [34]. Others used drinking levels, with one targeting MSM who drank 24 drinks per week over the past 90 days [31] and another including patrons who were in line for a gay-oriented club who had plans to drink that night, but were currently sober [41]. With respect to outcomes, three studies focused on reducing self-reported alcohol use using various metrics (e.g., frequency of drinking, heavy drinking days) [31–33], but two explored the effects of intervention on breath alcohol concentration (BrAC) on a single occasion [41] or at many study visits [34]. There was also considerable heterogeneity in terms of those delivering interventions. While three studies used master's or doctoral-level clinicians and provided in-depth descriptions of the intensive process of training/supervision [31–33], two made no mention of credentials or required training [34, 41]. The “length” of interventions also varied considerably, but most were generally on the longer end of the continuum. Protocols ranged from a few minutes of interaction and treatment exposure [34, 41] to more than 12 hours [31, 33], and length in treatment varied from a few minutes [41] to six months [34].

Methodological Quality

Study authors rated the methodological “rigor” of each study along several dimensions (e.g., study design, confounders, retention) using the QATQS. Overall ratings suggested that the majority of studies were moderate/strong, with one study rated “weak” [41], one rated “moderate” [34], and three rated “strong” [31–33].

Selection bias, study design, and confounders—The sampling strategies employed ranged from moderate to strong, according to the QATQS checklist criteria, with all studies effectively recruiting samples similar to target populations with low rates of refusal. Study designs were rated as strong overall, with all utilizing appropriate randomization procedures. All but two [33, 34] employed comparable treatment or attention-matched conditions as control groups. Similarly, all studies employed appropriate procedures to account for potential confounding variables, including controlling for demographic factors and baseline alcohol use in outcome analyses, with the exception of Croff and colleagues [41], which did not control for these factors.

Blinding, data collection, and retention—Only two studies mentioned blinding research staff to some elements, including baseline assessments in Velasquez et al. [32] and

medication condition in Morgenstern et al. [31]. However, it is often difficult to blind participants in behavioral intervention studies, given that participants are typically inherently aware of the goals of the intervention and that experimenters often must serve as study therapists. Regarding data collection methods, three studies [31–33] were rated as strong. These studies utilized well-accepted self-report scales, questionnaires, and self-administered interviews to assess alcohol use outcomes, and included data on psychometric properties in their reports. However, the two remaining studies [34, 41] collected BrACs as their focal outcomes. While BrAC is a strong biological indicator of alcohol use, its detection window is short and is only useful for assessing alcohol use that has occurred hours before measurement. Thus, choosing BrAC as a focal outcome may have limited the strength of conclusions that could be drawn from these studies. For example, Reback and colleagues [34] collected BrACs at planned visits a minimum of two times per week, which may have allowed participants to plan their drinking around these visits. Croff and colleagues [41] also collected participants' BrACs when leaving the bar as their primary outcome for exploring treatment efficacy. While authors acknowledge that their intervention was targeted toward reducing intoxication levels on the same night of their intervention (as opposed to overall alcohol use), assessing BrAC as participants exit the bar only reflects drinking at that particular bar. Moreover, no data from other measures of alcohol use that night (or over longer intervals) were reported. All included studies yielded retention rates that were rated as either moderate or strong. However, these rates were likely affected by the length and intensity of treatment and follow-up. For example, Croff and colleagues [41] achieved retention rates of 94% for baseline and follow-up assessments, which were conducted only hours apart. All other studies conducted follow-up assessments for several months after intervention delivery, and most achieved retention rates around 70%. One notable exception is the study by Morgenstern and colleagues [33], which conducted monthly follow-up assessments for 12 months, and retained between 87–93% of participants at each follow-up. As such, the majority of selected studies achieved retention rates that are common in behavioral intervention research for substance abuse [4] and are acceptable for drawing substantive conclusions based upon the study results.

Summary of Intervention Treatment Effects

Due to heterogeneity in interventions and outcome variables across studies, meta-analysis was not conducted. Across the five studies selected for review, six treatments were examined. One study (Croff and colleagues [41]) found no effects of intervention on alcohol use outcomes among MSM [41]. Four studies testing five treatments, however, demonstrated significant reductions in alcohol-related outcomes.

Reback and colleagues [34] showed that contingency management may be effective in reducing alcohol use among homeless, out-of-treatment MSM ($d = 0.52$, $V_d = 0.03$). However, enthusiasm for these results is tempered by limitations in the assessment strategy and outcome used. Since this study assessed alcohol use only when participants were physically present, results may not generalize to participants' global patterns of alcohol use. This study also used CM to incentivize psychosocial, "health promoting behaviors" (e.g., enrolling in GED program, keeping a job), noting statistically significant increases in these behaviors among CM participants compared to controls.

The three remaining studies that demonstrated efficacy in reducing alcohol use tested various combinations of motivational interviewing/enhancement and CBT-based interventions. Velasquez and colleagues [32] showed that the number of standard drinks consumed (adj. OR = 0.62, 95% CI: 0.14 – 0.98) and number of heavy drinking days (adj. OR = 0.50, 95% CI: 0.01 – 0.92) per 30-day period were significantly reduced among HIV-positive MSM who received an eight-session intervention based on components of MI and the Transtheoretical Model of change, compared to control participants who received resource referrals. However, these results were more robust in the months immediately following treatment, and between-group differences were attenuated by 10 months. Although this intervention also addressed sexual risk behavior, there were no overall differences in UAI days across the two groups. However, among those who reported drinking and engaging in UAI on the same day (“at-risk behavior days”), those in the treatment condition reported fewer such days across the follow-up period.

Using a 2x2 design, Morgenstern and colleagues (2012) tested the efficacy of a hybrid MI and CBT (behavioral self-control training) intervention compared with a brief medication adherence intervention, with both conditions either combined with medication (naltrexone) or placebo. They found that receiving the MI+CBT intervention, regardless of having received medication or not, resulted in clinically significant reductions in number of drinks per week and number of heavy drinking days per week at the end of treatment, compared with those not receiving behavioral intervention. That is, there was no evidence that adding naltrexone to the behavioral intervention offered additional benefits. In the absence of the behavioral intervention, more participants in the naltrexone condition reported drinking < 14 drinks per week with no heavy drinking (5+ drinks) days during the follow-up period and reported fewer alcohol-related problems than placebo participants. However, intervention outcomes were assessed only during and immediately after treatment, so conclusions about the long-term effects of these treatments are uncertain.

Finally, in a trial comparing a brief (four-session) MI intervention with a longer (12-session) MI+CBT intervention, Morgenstern and colleagues (2007) found that, during the 12-week treatment period, MI alone was more effective in reducing weekly drinks per day and marginally more effective in reducing alcohol-related problems compared with MI+CBT and a group of non-treatment seekers (“assessment-only”). However, during the 15-month post-treatment follow-up period, there were no differences between the MI only and MI +CBT groups on either use or problems. Although both groups exhibited a potentially clinically significant reduction in drinking and consequences from baseline to post-treatment (ranging from 5.5–6.5 drinks per day during pre-treatment to 2–2.5 drinks per day post-treatment), data from the assessment-only group was not collected during this follow-up period. Given that all groups (assessment-only group included) exhibited reductions in drinking during the treatment period, it is difficult to infer that either treatment performed better than an “assessment only” during this time. Nevertheless, these results suggest that both interventions may convey clinically significant reductions in drinking from baseline, and that a shorter MI intervention performs at least as well as a lengthier MI+CBT intervention.

Overall, these results suggest that MI and other “goal choice” interventions may be effective in reducing alcohol use for several months after treatment termination, when compared with no intervention or the usual standard of care [32]. Combining MI with elements of CBT may also be effective compared to no treatment, but this more extensive protocol may not be any more efficacious than a briefer MI intervention [31, 33], providing evidence that intervention length itself is unlikely to sufficiently explain efficacy. Brief MI interventions may also be comparatively more effective than MI+CBT *during treatment* (particularly at the earlier stages), and may perform at least as well as MI+CBT after treatment [33].

Although these results provide important knowledge that can guide decisions about treatments that are likely to be efficacious among MSM, it is important to consider that the fit of treatment with participants’ motivation to change may be another source of variability in results. For example, treatments that focus most on *how* to change (e.g., CBT, other skills-based interventions), as opposed to *whether or not* to change, may be most efficacious when participants are already high in readiness to change, such as those recruited from existing alcohol treatment programs or those expressing an interest in studies that make the goals of the intervention clear (i.e., to reduce heavy drinking). Two of the three interventions tested that involved significant skills-based components recruited MSM from the community [31, 33] (although the former [31] was explicit about recruiting MSM who “wanted to reduce their drinking but not quit altogether”). This may partly explain the limited support for CBT-type interventions demonstrated by these two studies [31, 33].

Discussion

This systematic review evaluated the available evidence on interventions for reducing alcohol use among MSM. Our approach identified 5 RCTs involving 1,022 participants. These studies exhibited considerable variability in terms of the content of interventions tested, with several examining treatments utilizing MI-components, elements of CBT, or both. Results of the included studies generally provided preliminary support for the use of MI-based interventions for alcohol use among MSM over no treatment, suggesting that these treatments may be effective both while recipients are in treatment and at least several months thereafter [33]. These findings are consistent with the broader alcohol treatment literature, which provides support for the efficacy of MI more generally [42, 43]. Although more lengthy, hybrid MI and CBT treatments may be similarly efficacious compared to no treatment, one initial test of such a hybrid intervention against a briefer MI-only treatment suggests that it may offer few advantages. As such, the research conducted to date on interventions for alcohol use among MSM appears to offer the strongest support for MI, both in terms of its efficacy and potential future effectiveness, given practical resource considerations. Results of one study that examined the effects of naltrexone on alcohol-related outcomes provided support for its use compared with a placebo group receiving limited behavioral intervention, but that behavioral intervention groups appeared to be more efficacious overall [31]. Finally, although one study showed support for contingency management, methodological concerns limit a confident conclusion about its efficacy.

Perhaps the most important conclusion of this review, however, is that well-designed, theoretically-informed research focused on developing and identifying effective

interventions for alcohol use among MSM is alarmingly scarce. Moreover, while the studies included in this review all explicitly targeted MSM populations, many of the interventions employed draw their theoretical foundations from the general alcohol treatment literature. Although these theories may aptly address some of the basic processes involved, a number of MSM-specific theories have also been offered to account for problematic drinking among these individuals, such as the cognitive escape [44], syndemic theory [45], and minority stress [46] models. As such, existing interventions may benefit from incorporating content based on these theories. Moreover, given strong evidence that lesbian and bisexual women drink at higher rates than heterosexual women [47], evaluating the evidence for interventions to reduce heavy drinking among these women is needed.

Overall, addressing the disparity in research knowledge is critical in terms of promoting the health of the MSM populations in general. In addition, disseminating and implementing effective interventions to reduce high-level alcohol use may also be an essential step in curbing the HIV epidemic in the United States [48]. Indeed, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) has identified this goal as an essential priority in the coming years [49] because of the considerable evidence implicating alcohol use as a factor in HIV transmission [50]. Research aimed at developing and testing interventions designed to reduce heavy drinking among MSM should be accelerated in the near future.

Finally, ratings of the methodological quality of the included studies yielded some important considerations of future studies on alcohol use interventions for MSM. While the studies reviewed likely produced reliable findings as a result of strong design, randomization, and data collection procedures, the lack of methods for reducing demand characteristics was a notable limitation of all included studies. In addition, we raised concerns about the appropriateness of BrAC as an outcome variable given the design of two studies [34, 41]. While BrAC is a strong indicator of *recent* alcohol use and may be fitting for studies in which participants may have strong motivations to report no use (e.g., contingency management), its short detection window limits the ability to draw conclusions about participants' alcohol use when samples cannot be taken. As such, future studies should be careful to include blinding procedures when feasible and collect outcome data that best reflects outcomes of clinical interest.

Limitations

Although this review has many strengths, several limitations are worthy of note. First, our review only included RCTs, excluding studies testing interventions via single-group (e.g., pre- and post-intervention) designs. While these studies may suggest promise by showing improvement after treatment, we ultimately chose to exclude them because the absence of a comparison condition limits conclusions about the effects of a specific treatment (as opposed to common factors, being in *any* treatment) on drinking outcomes. Second, we chose to include only studies that had an explicit focus on MSM and reported outcomes specifically for these individuals. This may have excluded studies describing other interventions that are efficacious for MSM, but whose effects in MSM cannot be determined from published data.

In summary, we reviewed RCTs of interventions for reducing heavy drinking among MSM that are available to date. Synthesis based on such a small set of studies was difficult, but results provide preliminary support for interventions incorporating aspects of MI in reducing relevant alcohol-related outcomes. Venue-based interventions (e.g., at gay bars) represent a novel approach for engaging MSM in alcohol risk reduction interventions and could warrant further attention as a strategy for reaching higher-risk men. While several interventions addressing both substance use and HIV risk have been developed [e.g., 35, 37], these studies appear to focus mostly on HIV risk, and we identified only one such study that addressed alcohol use as a focal outcome [32]. Given the potential synergy between alcohol use and HIV-related outcomes for both infected and uninfected MSM, interventions explicitly focused on reducing drinking and HIV risk are urgently needed.

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Figure 1.
Systematic review flowchart

TABLE 1

Summary of Characteristics of Included Studies and Main Findings

Study	Participants	Inclusion Criteria ^a	Intervention	Intervention Length	Main Findings
Croff et al. (2012)	161 MSM recruited from gay bar	1 In line for gay club	Brief personalized feedback vs. attention-control	1 session	No difference
		2 Had plans to drink that night			
		3 Were sober at enrollment			
Morgenstern et al. (2007)	198 MSM with AUD	1 Positive diagnosis of AUD in past year (abuse /dependence) on CIDI ^b	MI vs. MI+CBT vs. No Tx	MI+CBT: 12 sessions; 1x/week, MI: 4 sessions, 1x/week	↓ drinks per day in MI group during Tx
		1 Average weekly consumption of 24 drinks per week over past 90 days			
Morgenstern et al. (2012)	200 MSM problem drinkers	1	MI&CBT+Placebo, MI&CBT+Naltrexone, Adherence+Placebo, Adherence+Naltrexone	12 sessions; 1x/week for 12 weeks	↓ drinks per week, ↓ heavy drinking days in MI&CBT groups compared with others, ↓ heavy drinking and ↓ problems in Naltrexone vs. placebo
Reback et al. (2010)	210 homeless MSM	1 “Substance dependent” on SCID ^c	Contingency Management vs. No Tx	2 visits/week for 24 weeks	↓ + BrAC readings at HIV prevention appointments
Velasquez et al. (2009)	253 HIV - infected MSM with AUD	1 Scored 8 on AUDIT ^d	MI+TTM vs. Resource Referrals	8 sessions; 1x/week	↓ drinks per 30-days, ↓ heavy drinking days in MI+TTM

Note. MI = Motivational Interviewing. CBT = Cognitive-Behavioral Therapy. TMM=Transtheoretical Model. Tx=Treatment.

^a Does not include other, non-alcohol-related inclusion criteria.

^b Composite International Diagnostic Interview.

^c Structured Clinical Interview for DSM-IV Disorders.

^d Alcohol Use Disorders Identification Test.

TABLE 2

Summary of Methodological Quality Ratings by Study

Study	Select. Bias	Study Design	Confounders	Blinding	Data Collection Methods	Retention	Overall
Croff et al. (2012)	MODERATE	STRONG	MODERATE	WEAK	WEAK	MODERATE	WEAK
Morgenstern et al. (2007)	STRONG	STRONG	STRONG	WEAK	STRONG	STRONG	STRONG
Morgenstern et al. (2012)	STRONG	STRONG	STRONG	MODERATE	STRONG	MODERATE	STRONG
Reback et al. (2010)	MODERATE	STRONG	STRONG	WEAK	STRONG	STRONG	MODERATE
Velasquez et al. (2009)	STRONG	STRONG	STRONG	MODERATE	MODERATE	MODERATE	STRONG

Note: Methodological assessments were determined according to the Quality Assessment Tool for Quantitative Studies checklist (QATQS; Natinal Collaborating Centre for Methods and Tools, 2008)