Motivational Interviewing for Adolescent Substance Use: A Review of the Literature

Elizabeth Barnett, M.S.W.\textsuperscript{a}, Steve Sussman, Ph.D., FAAHB, FAPA\textsuperscript{a,b}, Caitlin Smith, M.A.\textsuperscript{b}, Louise A. Rohrbach, Ph.D.\textsuperscript{a}, and Donna Spruijt-Metz, Ph.D.\textsuperscript{a}

\textsuperscript{a}Department of Preventive Medicine, University of Southern California

\textsuperscript{b}Department of Psychology, University of Southern California

Abstract

Motivational Interviewing (MI) is a widely-used approach for addressing adolescent substance use. Recent meta-analytic findings show small but consistent effect sizes. However, differences in intervention format and intervention design, as well as possible mediators of change, have never been reviewed. This review of the literature summarizes the most up-to-date MI interventions with adolescents, looks at differences between intervention format and design, and discusses possible theory-based mechanisms of change. Of the 39 studies included in this review, 67\% reported statistically significant improved substance use outcomes. Chi square results show no significant difference between interventions using feedback or not, or interventions combined with other treatment versus MI alone. The need for systematic investigation in theory-based mechanisms of change is presented.

Keywords

Motivational Interviewing; Adolescent; Substance Use; Alcohol; Tobacco; Marijuana

1. Introduction

A recent review by Macgowan and Engle (2010) reports that Motivational Interviewing (MI) has met the American Psychological Association’s criteria for promising treatments of adolescent substance use. MI is a client-centered counseling style directed at exploring and resolving ambivalence about changing personal behaviors (Miller & Rollnick, 2002). It differs from other treatments in that its purpose is not to impart information or skills. Rather, it emphasizes exploring and reinforcing clients’ intrinsic motivation toward healthy...
behaviors while supporting their autonomy. The first meta-analytic review of MI’s use with adolescents shows an overall small effect size ($d = .173$, 95% CI [.094, .252] $N = 21$) (Jensen et al., 2011). Theoretically, MI appears to be a good fit with adolescents’ developmental need to exert their independence and make decisions for themselves, while it respects their heightened levels of psychological reactance and coincides with the development of their decision-making skills (Baer & Peterson, 2002; Naar-King & Suarez, 2011).

Despite the popularity of using MI among teens, outcomes vary and effect sizes tend to be small (Jensen et al., 2011). One explanation for this variation may be related to intervention characteristics. Interventions vary with respect to treatment format or modality (e.g., group, individual, telephone, in-person, internet), and intervention design (e.g., providing assessment and feedback, pre-treatment adjunct, or post-treatment follow-up.) Understanding the influence of these characteristics can help program developers design the most effective interventions and may facilitate larger effect sizes.

In addition to understanding the influence of intervention characteristics, understanding the possible mechanisms of change working in MI interventions can also help improve program effectiveness. Apodaca and Longabaugh’s (2009) recent meta-analysis of MI’s mechanisms of change includes only one study of adolescents (McCambridge & Strang, 2004) and finds evidence that client change language (Moyers, Martin, Manuel, Hendrickson, & Miller, 2005; Moyers et al., 2007), client experience of discrepancy (McNally, Palfai, & Kahler, 2005), and certain techniques, such as decisional balance (Strang & McCambridge, 2004; LaBrie, Feres, Kenney, & Lac, 2009) are positively related to improved outcomes.

However, Apodaca and Longabaugh (2009) find evidence for client readiness, client engagement, client resistance, and client confidence to be inconsistent. They conclude that although the theories underlying MI are rich, they are not integrated into a formal and comprehensive theory, making it difficult to pursue investigations of the mechanisms of change. Applying more theory-based structure to MI intervention design and content appears warranted.

This review sets out to 1) update existing reviews with recently published adolescent MI interventions; 2) review the ability of different intervention formats to influence outcomes; 3) review the ability of different intervention designs (e.g., feedback or adjunct treatment) to influence outcomes; and 4) explore possible underlying theory-based mechanisms of change.

## 2. Methods

### 2.1 Data Sources

The article search was conducted by the first author. EB identified articles by scanning those listed on the Motivational Interviewing website (www.motivationalinterviewing.org) and reviewing all existing literature reviews of MI with adolescent substance users. Reference lists of these articles were further reviewed for relevant studies. Next, literature searches were conducted between November 1, 2011 to January 15, 2012 using the online databases Google Scholar, Medline Ovid, and PsychINFO, using the following search terms: adolescent, teen, substance use, marijuana, tobacco, smoking, alcohol, drugs, motivational interviewing, motivational intervention, motivational enhancement and brief intervention. Only peer-reviewed papers published in English were considered; no geographical limits were used.
2.2 Inclusion Criteria

Inclusion criteria for this review were these: 1) study subjects with a mean age of <18.5 years old, 2) studies had to report interventions based in MI techniques, 3) studies had to be experimental or quasi-experimental designs, and 4) papers must have presented results from a quantitative investigation on the efficacy of MI to improve substance use outcomes. Substance use included alcohol, tobacco, marijuana, hard drugs, or any combination.

2.3 Data Classification and Analytic Plan

Studies were first coded for quality. A continuous measure was developed to reflect whether the article reported the presence or absence of 1) using a manual to guide the intervention, 2) training and supervision of interventionists, and 3) coding of recorded MI sessions to determine fidelity to MI. Studies were further coded as being either individual or group formats, and utilizing face to face, telephone, computer or a combination of these modalities. We also categorized papers based on intervention design types originally identified in published meta-analyses (Burke, Arkowitz, & Menchola, 2003; Hettema, Steele, & Miller, 2005; Lundahl & Burke, 2009). These three reviews identify interventions whereby MI is delivered alone (MIO), MI is delivered with feedback (MIF), MI is delivered with another intervention (MI +), and finally, where MI is delivered with feedback and another intervention (MIF +). Chi-square Goodness of Fit analysis was utilized to determine significant differences among intervention design types. All coding was conducted by two authors (EB and CS); all disagreements were resolved through discussion. If a program had positive and negative substance use outcomes it was coded as no-effect; if outcomes were positive but not maintained at a longer follow-up, it was coded as positive.

For this review, MIO is defined as interventions that a) do not begin with assessment feedback and b) do not explicitly attempt to combine treatments. These interventions attempt to enhance motivation through the use of MI to explore and resolve ambivalence about change, and elicit client change language. Such interventions frequently examine the costs and benefits of change, discuss client goals and values and how using substances fit with these, explore past successes at behavior change or character strengths that would assist with behavior change, and utilize importance, confidence and readiness rulers that encourage clients to articulate reasons for change (Miller & Rollnick, 2002).

MIF approaches are identifiable by the use of personalized assessment feedback given to the client. Feedback can be provided in-person, on paper, via a computer, or over the phone. In these interventions, participants complete some form of a problem behavior assessment (e.g., Drinker’s, Smoker’s, or Cannabis Check-Up; Miller & Sovereign, 1989). Assessment results are then a) reviewed with the client in person or by telephone, or b) given as written feedback or via a computer interface (e.g., Internet, laptop or kiosk) (Walker, Hoffman, Picciano, & Stephens, 2007). In addition to personal information about quantities, patterns and consequences of use, the results typically include a comparison to clinical or population norms. MIF interventions typically range from one session of feedback to the four-session manualized Motivational Enhancement Therapy (MET) developed in Project Match (Miller, Zweben, DiClemente, & Rychtarik, 1992).

MI + interventions either a) use MI to enhance client motivation to participate in a subsequent treatment (e.g., using MI to encourage Alcoholics Anonymous group attendance, or participation in group skill-based training (Brown & Miller, 1993), b) represent a follow-up to another treatment (e.g., after an inpatient treatment program) (Kaminer, Burleson, & Burke, 2008) or c) encourage movement back and forth between the use of MI and another treatment (e.g., a counselor would use an MI approach when ambivalence arises about using...
the skills being taught in a cognitive behavioral program (Simpson, Zuckoff, Page, Franklin, & Foa, 2008).

MIF + approaches include the skills of MI, the use of assessment feedback, and typically the inclusion of cognitive behavior skills training. Although the original four-session MET specifically prohibited the teaching of sobriety or refusal skills, current studies using MET often do include skills training. Hence it is important to clearly identify the components being used in interventions as intervention names are not consistently used or understood (Godley et al., 2010).

3. Results

3.1 Description of Included Studies

Forty-two articles met the inclusion criteria, although three publications reported additional outcomes from earlier trials. Therefore, the results from 39 unique MI trials were examined (see Figure 1 for Flow Chart). The trials targeted alcohol use \((n = 9)\), tobacco use \((n = 10)\), marijuana use \((n = 9)\), substance use \((n = 13)\), and other drugs \((n = 1)\) (see specific studies in Table 1). Sample size in the studies ranged from \(<50 (n = 6)\), 50–99 \((n = 6)\), 100–399 \((n = 21)\), \(> 400 (n = 6)\). Participants were recruited from educational settings \((n = 14)\), medical settings \((n = 12)\), community-based services/treatment centers \((n = 11)\), and juvenile correctional facilities \((n = 2)\).

3.2 Quality of Included Studies

The quality of studies reviewed in this article varied in terms of research design, substance use measures, statistical methods, and therapist training/fidelity to MI. Of the 39 trials, 37 were randomized controlled trials (31 randomized by individuals, six randomized by groups), and two had quasi-experimental designs. Twenty-seven of the studies measured substance use only through self-report, 10 combined self-report with biochemical measures of substance use, and two combined self-report with official or medical records of substance use. In order to account for missing data, 21 studies employed an intent-to-treat design, including all participants regardless of whether they dropped out of the study, two studies compared the missing group to the non-missing group to insure they did not differ, two studies used sophisticated statistical techniques to handle missing data (e.g., maximization likelihood estimation procedures), one study used logical imputation to replace missing data, and 13 did not use any strategy for handling missing data. Eleven studies reported using a manual to guide the intervention, 32 studies described some type of training and supervision of study counselors, and 15 studies used some sort of rating or coding tool for assessing fidelity from audio- or video-recordings of the MI sessions.

On our continuous measure of quality, which summed the presence of reported use of a manual, MI training/supervision, and coding for fidelity, two studies reported none, 19 reported having one, 15 reported two, and three reported all of these quality indicators. Both of the studies receiving the lowest possible quality score showed positive substance use outcomes, while among the other levels of quality, approximately the same percentage of programs had positive outcomes.

3.3 Program Effects

Twenty-six trials (67%) showed significant reductions in some type of substance use. Studies showed significant reductions in at least one alcohol \((n = 7)\); Bailey, Baker, Webster, & Lewin, 2004; Monti et al., 1999; Spirito et al., 2011; Spirito et al., 2004; Stein et al., 2011; Stein et al., 2006; Walton et al., 2010), tobacco \((n = 6)\); Woodruff, Conway, Edwards, Elliott, & Crittenden, 2007; Colby et al., 2005; Hollis, Polen, Whitlock, & Lichtenstein, 2005; Kelly
3.4 Comparison of Intervention Formats

Interventions were delivered in either group (n = 3), individual (n = 35), or a combination of group and individual formats (n = 1). All three of the group interventions showed a positive effect, while 22 (63%) of the individual studies did. The group/individual combination trial showed significant effects. Studies used a variety of modalities, including face-to-face only (n = 29), telephone only (n = 1), face-to-face + telephone (n = 4), and other modality combinations or comparisons (n = 5). Results from these studies showed 21 (72%) of the face-to-face only interventions demonstrated significant reductions in at least one substance use outcome, as did the one telephone-only intervention, one quarter of the face-to-face + telephone interventions, and 60% of the others. Due to uneven sample sizes, we were unable to conduct Chi Square Goodness of Fit analyses using modality data.

3.4a Comparing Different Treatment Modalities—Of particular interest are studies comparing different modalities. There was one test of a telephone vs. face-to-face booster (Kaminer et al., 2008), two tests of an adolescent alone vs. adolescent with parent intervention (Winters & Leitten, 2007; Spirito et al., 2011), and one test of in-person vs. computerized feedback (Walton et al., 2010). Kaminer and colleagues’ (2008) test of a face-to-face vs. telephone booster of an aftercare program for participants of a cognitive behavioral therapy intervention found no difference between the 50-minute in-person session compared to the 15–20-minute telephone intervention, and no significant effects for either group compared to the control. However, the authors note randomization failed and the control condition had significantly fewer persons with substance use disorders. In addition, when both the face-to-face and telephone groups were combined, youth who received some aftercare were less likely to relapse than youth who received no active aftercare.

In a three-group school-based intervention, Winters and Leitten (2007) tested the effect of MI with adolescents only vs. MI with adolescents + parents intervention and found the treatment conditions significantly outperformed the control, and the adolescent + parent condition significantly outperformed the adolescent only condition on most outcome variables. However, they further reported that 6-month abstinence rates did not differ across groups. Spirito and colleagues (2011) also found added significant effects of including parents in an MI intervention with alcohol-positive adolescents recruited in an emergency department. This intervention required families to return to the hospital one week later.

In a three-group randomized controlled trial of 756 urban adolescents seen in an emergency department, Walton et al. (2010) tested the use of providing feedback in face-to-face vs. computer-delivered format. They found that both intervention groups significantly outperformed the assessment-only control, and the face-to-face feedback condition significantly outperformed the computerized feedback condition. At three months, a significant decrease was found in self-reported alcohol consequences, aggression, and violence, and the effect on alcohol consequences was maintained at six months in the face-to-face condition.
Finally, in a three-group randomized controlled trial of a twelve-session classroom-based prevention program, a classroom-only condition, a classroom + three-session MI booster (one session in-person and two sessions via telephone), and an assessment-only control, Sussman and colleagues (2011) found that the MI booster did not significantly improve outcomes for any measured substance use outcome when compared to the classroom-only condition.

3.4b—Adolescent-Specific MI Adaptation represents a possible application for adolescents. For an example of including parents in MI, an inpatient psychiatric smoking cessation intervention provided parents up to four telephone counseling sessions. Compared to the brief advice condition, the study showed the MI intervention to be more effective at reducing substance use (Brown et al., 2009), but not more effective on smoking cessation (Brown et al., 2003). For an example of MI provided in a school setting, in a three-group randomized controlled trial of a twelve-session classroom-based prevention program, a classroom-only condition, a classroom + three-session MI booster (one session in-person and two sessions via telephone), and an assessment-only control, Sussman and colleagues (2011) found that the MI booster did not significantly improve outcomes for any measured substance use outcome when compared to the classroom-only condition.

3.5 Comparison of Intervention Design
In this review, studies represented MIO (n = 8), MIF (n =17), MI + (n = 9), and MIF + (n = 5) interventions. Six MIO (75%), 11 MIF (65%), seven MI + (78%), and two MIF + (40%) interventions showed a positive effect on outcomes. Chi Square Goodness of Fit analyses were used to test for differences in effectiveness based on the addition of a feedback component or the combination of other treatments with MI. The results from this comparison suggest very little difference between the intervention designs. However, caution should be used when interpreting these results due to the small number of studies represented in each category.

3.5a MI with Feedback—There was no difference between interventions containing feedback (MIF and MIF +) versus their non-feedback counterparts (MIO and MI +), \( \chi^2(1) = .64, p = .42 \). All 22 MI interventions with feedback (MIF and MIF+) included a face-to-face component, three added additional telephone contact, and one included additional contact with a parent. The number of sessions varied from one to more than three: one session (n = 9), two sessions (n = 6), and three or more sessions (n = 7).

3.5b MI with Additional Features—There was no significant difference between interventions with additional programs (MI + and MIF +) versus their stand-alone MI counterparts (MIO and MIF), \( \chi^2(1) = .06, p = .81 \). Of 14 programs where MI was added to another component (MI+ and MIF+), two interventions used MI as a post-treatment booster to maintain effects – one as an aftercare component to a CBT program (Kaminer et al., 2008), the other as motivational booster to a classroom-based prevention program (Sussman et al., 2011). Two followed advice presented by a doctor (Hollis et al., 2005) or video (Colby et al., 1998), one provided MIF to the adolescent and held a separate meeting with parents (Goti et al., 2010); one used MIF with a social network intervention component (Mason et al., 2011); one provided MI and made a skills-based class available for those who wanted to attend (Martin & Copeland, 2008); and seven used MI as a prelude to cognitive behavioral programs that included refusal skills, relapse prevention, and information about consequences of use (n = 5 MI + CBT; Waldron, et al, 2001; Battjes et al., 2004; Dennis et al., 2004; Woodruff et al., 2007; Peterson et al., 2009; n = 2 MIF + CBT Brown et al., 2003; Godley et al., 2010)
3.6 Potential Theory-Based Mechanisms

No studies reported mediation analyses. However, 71% of studies reported findings about potential mechanisms of change in MI interventions. Significant findings of MI’s effectiveness were reported for attitudinal constructs such as readiness/intention to change (n = 5) (Bailey et al., 2004; Colby et al., 2005; Grenard et al., 2007; D’Amico et al., 2008; Mason et al., 2011), client engagement in the treatment process (n = 2) (Peterson et al., 2006; Stein et al., 2006), implicit cognitions (Thush et al., 2009), and client perception of risk (Goti et al., 2010). Changes in behavioral constructs were found for improved drug refusal skills (Kelly & Lapworth, 2006), reduced dependence criteria (Martin & Copeland, 2008), participating in other risky behaviors (Monti et al., 1999), and client self-monitoring (McCambridge & Strang, 2005). However, non-significant findings were found for some of the same attitudinal measures: readiness/intention to change (n = 5) (Brown et al., 2003; Peterson et al., 2006; Woodruff et al., 2007; Peterson et al., 2009; Thush et al., 2009) and participation in additional treatment (Monti et al., 1999; Walker et al., 2011).

4. Discussion

4.1 Included Studies

Grenard and colleagues’ (2006) review of the MI literature (search date March 2005) found fewer than 10 studies with a mean age of less than 18, and less than 50% of these studies showed positive substance use effects. Jensen and colleagues’ (2011) meta-analysis (N = 21) does not provide search dates, however they included only one article published in as recently as 2009. The current review found more than 10 articles published since 2010. The number of MI studies published each year continues to grow. Inclusion criteria for this review differed from Grenard et al. (2006) by only focusing on adolescent literature, while criteria differed from Jensen et al. (2011) in that we had no requirement for data to calculate effect sizes. Of the studies included in this current review 67% showed a positive effect. There was no indication of a relationship between study quality and outcomes. Studies of very low quality may not have been published, however, and therefore publication bias, the “file drawer problem,” should be taken into consideration when interpreting these findings.

4.2 Intervention Format

Not surprisingly, the majority of studies represent MI interventions with individuals (n = 34), as opposed to groups (n = 4). This finding is likely due to 1) the origins of MI as a counseling style for working with individuals, 2) intervention design choices (for instance, all studies using feedback were conducted in individualized formats), and 3) recruitment setting (for instance, all interventions conducted in medical settings were conducted in person, while of the four group studies, three were conducted in community treatment centers and one was conducted on the Internet). The relationship between design, format, and other intervention characteristics, such as number and length of sessions, setting (e.g., emergency room, school, treatment program), target population (e.g., psychiatric inpatient smokers, adjudicated or rural youth) should be further explored in future reviews. Meanwhile, comparisons of different modalities suggest that 1) involving parents may improve results, 2) there is no difference between telephone or in-person follow-ups, and 3) providing feedback face-to-face is superior to computerized feedback. Future emphasis on conducting such comparisons would greatly assist the field.

4.3 Intervention Design

Although chi square statistics did not show statistical differences between intervention designs, this review highlights the need for studies to dismantle the effects of feedback with adolescents. A test of the importance of providing feedback (Walters et al., 2009) among college students (mean age 19.8 years) found that the MIF condition had significantly
reduced the composite drinking measure and drinks per week, compared to the assessment-only control, MIO, and written feedback alone conditions at 6-month follow-up. Furthermore, a meta-analysis of personalized feedback interventions targeting alcohol use \((n = 14; \text{college age } n = 9)\) found an overall effect size of \(d = .22, 95\% \text{ CI}[.16,.03]\), in reduced alcohol consumption (Riper et al., 2009). However, college students may differ from adolescents in significant ways, as the former tend to show lower levels of psychological reactance (Hong, Giannakopoulos, Laing, & Williams, 1994), possibly making them more receptive to normative feedback than their adolescent counterparts.

In a secondary analysis of Brown and colleagues (2003 & 2009), Apodaca and Longabaugh (2007) advised caution regarding use of feedback with adolescents. They argued that, as they found no relationship between health consequences and readiness to change, using feedback to highlight consequences may be misdirected and not important for cessation, a finding similar to results published in Colby et al. (1998). They further cited Amhrein, Miller, Yahne, Palmer, & Fulcher’s (2003) findings that while receiving feedback client change talk decreases, which suggests that feedback may inhibit change. Later results by Baer et al. (2008) suggest that change language can predict improved outcomes among adolescents, so that any activity that reduces change talk may negatively influence outcomes. Further consideration of the relationship between reactance and feedback warrants study.

### 4.4 Potential Mechanisms

This review revealed a pattern of investigation into attitudinal and behavioral mechanisms of change, with both factors being influenced by MI. There appears to be a prevailing interest in attitudinal measures of readiness to change (RTC), stages of change (Prochaska & DiClemente, 1982; Prochaska, DiClemente, & Norcross, 1992), and intention to change. This review identified 12 studies that measured some form of RTC and provided information about either 1) the ability of MI to influence RTC or 2) the relationship between RTC and improved substance use outcomes. Of the seven studies reporting RTC findings and having positive effects on substance use outcomes, four articles reported that the intervention also significantly influenced RTC (Bailey et al., 2004; Colby et al., 2005; Grenard et al., 2007; Mason et al., 2011); two studies showed no effect of the intervention on RTC (Peterson et al., 2006; Peterson et al., 2009); and three studies showed an effect of RTC on outcomes (Peterson et al., 2006; Peterson et al., 2009; Audrain-McGovern et al., 2011).

Two additional studies specifically addressed RTC among adolescent substance users, but did not meet criteria for inclusion in this review. Erol and Erdogan (2008) in a single group pre-post design with Turkish adolescents found that the MI condition significantly changed reported stage of change, and a randomized controlled study by Huang et al. (2010) reported significant effects of an MIF intervention on RTC among adolescent Taiwanese methamphetamine users. To further highlight the importance of RTC in MI research, some programs utilize an RTC-based protocol that dictates a different approach for interventionists depending on the individual’s stage of change (Erol & Erdogan, 2008; Hollis et al., 2004, Peterson et al., 2009). Despite contradictory findings, it appears that readiness to change should continue to be measured as a possible mechanism of change, though agreement on how to measure it should be sought.

To date, the search for mechanisms of change has been ad hoc with variables being selected by individual research teams when implementing a new intervention. A theory-based approach to determine the mechanisms of change in MI interventions is needed. Theory exists to guide the measurement of constructs related to the Process Model of MI, which proposes that the utilization of specific counseling and interpersonal skills will lead to...
increases in client change language, and that these client statements will predict improved substance use outcomes. These “technical” and “relational” aspects of MI (Miller & Rollnick, 2002; Miller & Rose, 2009) are clearly explicated and measurable with the use of valid and reliable MI specific coding systems (Moyers et al., 2007; Glynn & Moyers, 2009). To date there are only two investigations of the Process Model in the adolescent literature (Baer et al., 2008; Engle, Macgowan, Wagner, & Amrhein, 2010). Both studies found support for a significant relationship between client change language and substance use outcomes. Baer et al. (2008) conducted individual MI sessions in drop-in centers with homeless youth to encourage decreased substance use and increased service utilization and measured client language using the Motivational Interviewing Skills Code (2.0). Engle et al. (2010) applied the Process Model to a school-based substance use intervention group, whereby ratings of counselor empathy, group level commitment language and peer response were used to investigate associations with marijuana use outcomes at post-test, 1-, 3-, and 12-month follow-ups. They found that group leader empathy, measured with the Motivational Interviewing Treatment Integrity (2.0), was significantly related to group commitment and peer response, while group commitment language was significantly correlated with outcomes at post-test and 12-month follow-up, and peer response was significantly correlated with outcomes at 1- and 12-month follow-up.

However, no models exist to guide choices for measuring potential mechanisms of change. MI interventions are likely to target different mechanisms of change, depending on the intervention design. Where MI is combined with cognitive behavioral skills training, the program is likely focused on mediators such as perceived behavioral control or self-efficacy from the Theory of Planned Behavior (Ajzen, 1985) and Social Learning Theory (Bandura, 1977), respectively. Feedback interventions can be loosely tied to theories that use perceived norms as a determinant of a behavior (e.g., Theory of Planned Behavior), as the purpose of providing normative feedback is to address clients’ perception of their behavior in the context of others’ behavior. Finally, MIO interventions may influence cognitive dissonance by developing discrepancy between current behavior and client values and goals; self-efficacy by focusing on client past successes, strengths, and the confidence ruler; readiness to change by using the importance or readiness ruler; autonomy by emphasizing personal choice and control; and drug use expectancies by exploring pros and cons of continued use or quitting. However, a non-manualized MIO intervention may be so flexible that only through observational coding of recorded sessions could the active ingredients of the intervention actually be determined.

4.5 Conclusion

Clearly, there remains a great deal to learn about the efficacy of different designs and possible mechanisms of change in MI interventions for adolescent substance use. Perhaps findings from other health behavior areas (e.g., diet and exercise, or medication adherence) might have important insights to share. In order to move MI research forward in this area, we must develop and test theory-based models to enhance program effects. The authors of this review suggest that a working group of researchers be convened to develop a series of models that take design, target population/setting, and targeted substance into consideration so that systematic investigation can occur.

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Moyers, TB.; Martin, T.; Manuel, JK.; Miller, WR.; Ernst, D. Revised Global Scales: Motivational Interviewing Treatment Integrity 3.0 (MITI 3.0). University of New Mexico: Center on Alcoholism, Substance Abuse and Addictions (CASAA); 2007.


Spirito A, Monti PM, Barnett NP, Colby SM, Sindelar H, Rohsenow DJ, Myers M. A randomized clinical trial of a brief motivational intervention for alcohol-positive adolescents treated in an


Highlights

- Of the studies included in this review 67% showed a positive effect.
- No significant differences were found between interventions with or without feedback.
- No significant differences were found between interventions combined or not combined with additional treatments.
- There is a need for theoretical models to guide measurements of possible mechanisms of change in MI interventions.
Figure 1.
Flow chart for articles included in the review.
### Table 1
Description of Studies Included in the Review

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Sample Size</th>
<th>Drug</th>
<th>Mean Age</th>
<th>Gender (% Male)</th>
<th>Research Design</th>
<th>Follow-up</th>
<th>Finding</th>
<th>Outcome (sig at p &lt; .05)</th>
<th>Ind/Gr</th>
<th>Intervention Design</th>
<th>Format/Modality</th>
<th>Total Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audrain-McGovern et al.</td>
<td>2011</td>
<td>355</td>
<td>Tobacco</td>
<td>14–18</td>
<td>45%</td>
<td>RCT</td>
<td>3, 6 months</td>
<td>MI led to significantly fewer attempts to quit smoking and no differences in abstinence, but it did lead to significantly fewer cigarettes smoked.</td>
<td>No Effect</td>
<td>Ind</td>
<td>MBF</td>
<td>F2F + Tel</td>
<td>2</td>
</tr>
<tr>
<td>Baer, Garrett, Broidell, Wells, &amp; Peterson</td>
<td>2007</td>
<td>117</td>
<td>Substance Use</td>
<td>17.9</td>
<td>56%</td>
<td>RCT</td>
<td>1,3 months</td>
<td>MI did not significantly decrease substance use. MI did significantly increase service utilization. MI did not significantly increase engagement.</td>
<td>No Effect</td>
<td>Ind</td>
<td>MBF</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Bailey, Baker, Webster, &amp; Lewin</td>
<td>2004</td>
<td>34</td>
<td>Alcohol</td>
<td>15.44</td>
<td>50%</td>
<td>RCT</td>
<td>1,2 months</td>
<td>MI significantly increased readiness to change and alcohol knowledge. MI significantly decreased drinking frequency post-treatment and at 1-month follow-up.</td>
<td>Positive</td>
<td>Group</td>
<td>MB +</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Battjes, Gordon, O’Grady, Kinlock, Kitz, &amp; Sours</td>
<td>2004</td>
<td>194</td>
<td>Substance Use</td>
<td>15.9</td>
<td>85%</td>
<td>Quasi Experimental</td>
<td>6.12 months</td>
<td>Significant reductions in marijuana at 6 &amp; 12 months</td>
<td>Positive</td>
<td>Group</td>
<td>MB +</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>Brown et al.</td>
<td>2003, 2009</td>
<td>191</td>
<td>Tobacco &amp; Substance Use</td>
<td>15.4</td>
<td>38%</td>
<td>RCT</td>
<td>1.3, 6, 9, 12 months</td>
<td>MI did not significantly decrease smoking. MI significantly</td>
<td>No Effect</td>
<td>Ind</td>
<td>MIB +</td>
<td>F2F + Tel + Parent</td>
<td>1</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (% male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Finding</td>
<td>Outcome (sig at p &lt; .05)</td>
<td>Ind/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<tr>
<td>Colby et al.</td>
<td>2005</td>
<td>85</td>
<td>Tobacco</td>
<td>16.3</td>
<td>71%</td>
<td>RCT</td>
<td>1,3,6 months</td>
<td>MI significantly increased self-efficacy. MI was significantly more effective than BA for adolescents with little or not intention to quit.</td>
<td>Positive</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F</td>
<td>2</td>
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<tr>
<td>Colby et al.</td>
<td>1998</td>
<td>40</td>
<td>Tobacco</td>
<td>16.15</td>
<td>43%</td>
<td>RCT</td>
<td>3 months</td>
<td>MI did not significantly reduce smoking.</td>
<td>No Effect</td>
<td>Ind</td>
<td>MIF +</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>D'Amico, Miles, Stern, &amp; Meredith</td>
<td>2008</td>
<td>42</td>
<td>Substance Use</td>
<td>16</td>
<td>48%</td>
<td>RCT</td>
<td>3 months</td>
<td>MI significantly reduced self-reported marijuana use, perception of prevalence of marijuana use, number of friends using marijuana, and intentions to use marijuana.</td>
<td>Positive</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F + Tel</td>
<td>1</td>
</tr>
<tr>
<td>Dennis et al.</td>
<td>2004</td>
<td>300</td>
<td>Marijuana</td>
<td>13–18</td>
<td>81%</td>
<td>RCT</td>
<td>3,6,9,12 months</td>
<td>All conditions had significant pre/post results. MI interventions</td>
<td>Positive</td>
<td>Ind</td>
<td>M +</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (% male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Finding(s)</td>
<td>Outcome (sig at p &lt; .05)</td>
<td>Int/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<tr>
<td>Godley et al.</td>
<td>2010</td>
<td>320</td>
<td>Marijuana</td>
<td>13-18</td>
<td>76%</td>
<td>RCT</td>
<td>3, 6, 9, 12 months</td>
<td>MI group showed significantly increased abstinence and was most cost effective, but was not the most effective intervention in the trial.</td>
<td>Positive Both MIF + F2F 2</td>
<td></td>
<td>MIF + F2F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goti et al.</td>
<td>2010</td>
<td>103</td>
<td>Substance Use</td>
<td>15.2</td>
<td>24%</td>
<td>RCT</td>
<td>1 month</td>
<td>MI did not significantly decrease substance use. MI did significantly increase drug knowledge and perceptions of risks due to drug use.</td>
<td>No Effect Ind MIF + F2F 2</td>
<td></td>
<td>MIF + F2F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gray, McCambridge, &amp; Strang</td>
<td>2005</td>
<td>162</td>
<td>Substance Use</td>
<td>17.46</td>
<td>47%</td>
<td>Quasi Experimental</td>
<td>3 months</td>
<td>MI participants drinking on average two days per month less than controls after 3 months, a significant difference.</td>
<td>Positive Ind MIF F2F 1</td>
<td></td>
<td>MIF F2F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grenard et al.</td>
<td>2007</td>
<td>18</td>
<td>Substance Use</td>
<td>16.1</td>
<td>67%</td>
<td>RCT</td>
<td>3 months</td>
<td>Significant reductions in hard drugs, club drugs, # drinks in past week compared to controls.</td>
<td>Positive Ind MIF F2F 0</td>
<td></td>
<td>MIF F2F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hollis et al.</td>
<td>2005</td>
<td>234</td>
<td>Tobacco</td>
<td>15.433</td>
<td>41%</td>
<td>RCT</td>
<td>1.2 years</td>
<td>MI led to significantly greater abstinence after 2 years, particularly for those identifying as &quot;smokers.&quot;</td>
<td>Positive Ind MIF + F2F + Tel + Computer 1</td>
<td></td>
<td>MIF + F2F + Tel + Computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (% male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Finding</td>
<td>Outcome</td>
<td>Ind/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<tr>
<td>Horn, Dino, Hamilton, &amp; Noerachmanto</td>
<td>2007</td>
<td>75</td>
<td>Tobacco</td>
<td>17.8</td>
<td>43%</td>
<td>RCT</td>
<td>1,3,6 months</td>
<td>MI did not significantly reduce smoking</td>
<td>No Effect</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F + Tel</td>
<td>1</td>
</tr>
<tr>
<td>Kaminer, Burleson, &amp; Burke; Burleson, Kaminer, &amp; Burke</td>
<td>2008, 2012</td>
<td>144</td>
<td>Alcohol</td>
<td>15.9</td>
<td>67%</td>
<td>RCT</td>
<td>3,6,12 month</td>
<td>MI showed trends (p &lt; .10) toward fewer alcoholic beverages per month over 12 months compared to control. No difference between Tel vs. in person. Aftercare participants had reduced risk of relapse and fewer drinking days. No difference between Tel vs In.</td>
<td>Positive</td>
<td>Ind</td>
<td>MI +</td>
<td>F2F vs Tel</td>
<td>0</td>
</tr>
<tr>
<td>Kelly &amp; Lapworth</td>
<td>2006</td>
<td>56</td>
<td>Tobacco</td>
<td>15</td>
<td>66%</td>
<td>RCT</td>
<td>1,3,6 months</td>
<td>MI significantly decreased smoking at 1 month, but no significant differences at 3 months or 6 months.</td>
<td>Positive</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>Marsden et al.</td>
<td>2006</td>
<td>342</td>
<td>Ecstasy, cocaine, crack-cocaine</td>
<td>18.4</td>
<td>66%</td>
<td>RCT</td>
<td>6 months</td>
<td>No significant differences compared to controls</td>
<td>No Effect</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Martin &amp; Copeland</td>
<td>2008</td>
<td>40</td>
<td>Marijuana</td>
<td>16.5</td>
<td>68%</td>
<td>RCT</td>
<td>3 months</td>
<td>MI significantly decreased marijuana use and dependence symptoms</td>
<td>Positive</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Mason, Pate, Droppkin, &amp; Scrivno</td>
<td>2011</td>
<td>28</td>
<td>Substance Use</td>
<td>16</td>
<td>0%</td>
<td>RCT</td>
<td>1 month</td>
<td>MI led to significantly less trouble due to alcohol use, less substance use before sexual intercourse, less</td>
<td>Positive</td>
<td>Ind</td>
<td>MIF +</td>
<td>F2F</td>
<td>3</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (%male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Findings</td>
<td>Outcome (sig at p &lt; .05)</td>
<td>Ind/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<tr>
<td>Barnett et al.</td>
<td>2004, 2005</td>
<td>200</td>
<td>Substance Use</td>
<td>17.56</td>
<td>54%</td>
<td>GRT</td>
<td>3, 12 months</td>
<td>MI significantly decreased cigarette, alcohol, and marijuana use. The effects disappeared by 12 months.</td>
<td>Positive</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>McCannibridge, et al.</td>
<td>2008</td>
<td>326</td>
<td>Marijuana</td>
<td>17.95</td>
<td>69%</td>
<td>RCT</td>
<td>3.6 months</td>
<td>No significant differences between groups.</td>
<td>No Effect</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>McCannibridge, et al.</td>
<td>2011</td>
<td>416</td>
<td>Substance Use</td>
<td>17.6</td>
<td>54%</td>
<td>Cluster RCT</td>
<td>3, 12 months</td>
<td>MI significantly decreased drinking and driving, traffic violations, alcohol-related injuries, and alcohol-related problems. There was no difference in reduction of alcohol consumption between groups.</td>
<td>No Effect</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Monti et al.</td>
<td>1999</td>
<td>94</td>
<td>Alcohol</td>
<td>18.4</td>
<td>64%</td>
<td>RCT</td>
<td>3.6 months</td>
<td>MI significantly increased Positive</td>
<td>Positive</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Phent et al.</td>
<td>2006</td>
<td>1448</td>
<td>Tobacco</td>
<td>16.85</td>
<td>37%</td>
<td>GRT</td>
<td>6 wks, 3 months</td>
<td>MI significantly increased Positive</td>
<td>Positive</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (% Male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Findings</td>
<td>Outcome (sig at p &lt; .05)</td>
<td>Ind/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<tr>
<td>Barnett et al.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>smoking abstinence at 6 weeks and 3 months.</td>
<td></td>
<td></td>
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<tr>
<td>Peterson et al.</td>
<td>2009</td>
<td>2151</td>
<td>Tobacco</td>
<td>approx. 16-17</td>
<td>53%</td>
<td>GRT</td>
<td>7 days, 1, 3, 6 months</td>
<td>MI has marginally significant (p &lt; .10) and significant (p &lt; .05) effects on increased prolonged smoking abstinence and duration since last cigarette at 7 days, 1 month, and 3 months.</td>
<td>Positive Ind</td>
<td>MIF</td>
<td>Tel</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Peterson, Baer, Wells, Ginzler, &amp; Garrett</td>
<td>2006</td>
<td>285</td>
<td>Substance Use</td>
<td>17.4</td>
<td>55%</td>
<td>RCT</td>
<td>1,3 months</td>
<td>MI significantly reduced illicit drug use at 1 month. No differences for alcohol or marijuana.</td>
<td>Positive Ind</td>
<td>MIF</td>
<td>F2F</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Spirito et al.</td>
<td>2004</td>
<td>152</td>
<td>Alcohol</td>
<td>15.6</td>
<td>64%</td>
<td>RCT</td>
<td>3,6,12</td>
<td>Significantly reduced alcohol use for those reporting high problem severity at baseline. No effect on related behaviors and problems.</td>
<td>Positive Ind</td>
<td>MIF</td>
<td>F2F</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Spirito et al.</td>
<td>2011</td>
<td>125</td>
<td>Alcohol</td>
<td>15.45</td>
<td>29%</td>
<td>RCT</td>
<td>3,6,12</td>
<td>Drinking was significantly lower after MI at 3, 6, and 12 months, although the reductions were less dramatic over time. Family intervention improved outcomes over individual treatment.</td>
<td>Positive Ind</td>
<td>MIF</td>
<td>F2F</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (% male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Finding</td>
<td>Outcome (sig at p &lt; .05)</td>
<td>Ind/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<tr>
<td>Stein et al.</td>
<td>2011</td>
<td>162</td>
<td>Alcohol and Marijuana</td>
<td>17.1</td>
<td>84%</td>
<td>RCT</td>
<td>3 months</td>
<td>Positive</td>
<td>Led to significantly lower rates of alcohol and marijuana use.</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Stein, Colby, Barnett, Monti, Golemboke, &amp; Lebeau-Craven</td>
<td>2006</td>
<td>105</td>
<td>Alcohol and Marijuana</td>
<td>17.06</td>
<td>90%</td>
<td>RCT</td>
<td>3 months</td>
<td>Positive</td>
<td>MI led to significantly lower rates of drinking and driving, and riding in the car with a drunk driver. Similar trends were found for marijuana, but were nonsignificant.</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F</td>
<td>1</td>
</tr>
<tr>
<td>Sussman, Sun, Rohrbach, &amp; Spruijt-Metz</td>
<td>2011</td>
<td>1866</td>
<td>Substance Use</td>
<td>16.8</td>
<td>57%</td>
<td>GRT</td>
<td>12 months</td>
<td>No Effect</td>
<td>School-based curriculum (with or without MI), showed significant reductions in alcohol use, hard drug use, and cigarette smoking. MI did not lead to further reductions.</td>
<td>Ind</td>
<td>MI + F2F + Tel</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Thush et al.</td>
<td>2009</td>
<td>125</td>
<td>Alcohol</td>
<td>17.07</td>
<td>41%</td>
<td>RCT</td>
<td>1 month</td>
<td>No Effect</td>
<td>MI + showed some efficacy: significant change from heavy to minimal use from pretreatment to 4 month follow-up, although did not persist to 7 month follow-up.</td>
<td>No Effect</td>
<td>MEF</td>
<td>F2F</td>
<td>3</td>
</tr>
<tr>
<td>Waldron, Slesnick, Brody, Turner &amp; Peterson</td>
<td>2001</td>
<td>144</td>
<td>Marijuana</td>
<td>15.61</td>
<td>80%</td>
<td>RCT</td>
<td>4.7 months</td>
<td>Positive</td>
<td>MI + showed some efficacy: significant change from heavy to minimal use from pretreatment to 4 month follow-up, although did not persist to 7 month follow-up.</td>
<td>Positive</td>
<td>MEF</td>
<td>F2F</td>
<td>3</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (% male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Finding</td>
<td>Outcome (sig at p &lt; .05)</td>
<td>Ind/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<tr>
<td>Walker et al.</td>
<td>2011</td>
<td>310</td>
<td>Marijuana</td>
<td>16</td>
<td>61%</td>
<td>RCT</td>
<td>3, 12 months</td>
<td>MI led to significant reductions in marijuana use and consequences compared to educational feedback and waitlist controls at 3 months. At 12 months, MI still led to greater reductions in marijuana use and consequences compared to waitlist control.</td>
<td>Positive</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>Walker, Roffman, Stephens, Berghius, and Kim</td>
<td>2006</td>
<td>97</td>
<td>Marijuana</td>
<td>15.75</td>
<td>48%</td>
<td>RCT</td>
<td>3 months</td>
<td>No significant difference between groups in reducing marijuana use.</td>
<td>No Effect</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>Walton et al.</td>
<td>2010</td>
<td>726</td>
<td>Alcohol</td>
<td>16.8</td>
<td>44%</td>
<td>RCT</td>
<td>3.6 months</td>
<td>MI led to significantly reduced alcohol consequences in both the computer or in person condition.</td>
<td>Positive</td>
<td>Ind</td>
<td>MIF</td>
<td>F2F vs Computer</td>
<td>2</td>
</tr>
<tr>
<td>Winters &amp; Letten</td>
<td>2007</td>
<td>79</td>
<td>Substance Use</td>
<td>15.57</td>
<td>62%</td>
<td>RCT</td>
<td>1.6 months</td>
<td>MI led to significant reductions in drinking frequency, binge drinking, illicit drug use, and drug consequences at 6 months (with parent outperformed without parent).</td>
<td>Positive</td>
<td>Ind</td>
<td>MIO</td>
<td>F2F</td>
<td>2</td>
</tr>
<tr>
<td>Woodruff, Conway, Edwards, Elliott, &amp; Crittenden</td>
<td>2007</td>
<td>136</td>
<td>Tobacco</td>
<td>16</td>
<td>54%</td>
<td>GRT</td>
<td>post, 3, 12</td>
<td>Immediately post-treatment, MI significantly</td>
<td>Positive</td>
<td>Group</td>
<td>MI +</td>
<td>F2F + Internet</td>
<td>1</td>
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<tr>
<td>Author</td>
<td>Year</td>
<td>Sample Size</td>
<td>Drug</td>
<td>Mean Age</td>
<td>Gender (%male)</td>
<td>Research Design</td>
<td>Follow-up</td>
<td>Findings</td>
<td>Outcome (sig at p &lt; .05)</td>
<td>Ind/Gr</td>
<td>Intervention Design</td>
<td>Format/Modality</td>
<td>Total Quality</td>
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<td>reduced smoking and increased abstinence, but these results were not maintained over time</td>
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</tbody>
</table>

RCT, Randomized Controlled Trial; GRT, Group Randomized Controlled Trial; Ind, Individual; Gr, Group; MI, MI Only; M1+, MI + another treatment; MIF, MI with Feedback; MIF+, MI with feedback + another treatment; F2F, Face to Face; Tel, Telephone. Total Quality Indicates the reported use of a manual, training & supervision, and coding of recorded sessions, range of scores 0 meaning none present, 3 meaning all present.