Mechanisms of change in Motivational Interviewing: A review and preliminary evaluation of the evidence

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Abstract

Aims—Motivational interviewing (MI) is an efficacious treatment for substance use disorders. However, little is known about how MI exerts its therapeutic effects. This review is a first attempt to summarize and evaluate the evidence for purported within-session mechanisms of change. The primary question of interest was: Which MI constructs and variables appear to be the most promising candidates for mechanisms of change?

Methods—Literature searches were conducted to identify studies delivering MI in an individual format for the treatment of substance use disorders. Our search identified a total of 152 studies for review; 19 studies met inclusion criteria by providing data on at least one link in the causal chain model under examination. Effect size estimates were calculated for every possible step in the causal model where sufficient data were provided by study authors.

Results—Four constructs of therapist behavior were evaluated: MI Spirit, MI-Consistent behaviors, MI-Inconsistent behaviors, and therapist use of specific techniques. Five constructs of client behavior were evaluated: change talk/intention, readiness to change, involvement/ engagement, resistance, and the client's experience of discrepancy. The absence of experimental and full mediation studies of mechanisms of change was notable. Effect sizes were generally mixed.

Conclusions—The most consistent evidence was found for three constructs: client change talk/ intention (related to better outcomes); client experience of discrepancy (related to better outcomes); and therapist MI-Inconsistent behavior (related to worse outcomes). Regarding therapist use of specific techniques, use of a decisional balance exercise showed the strongest association to better outcomes.

Keywords

Motivational interviewing; brief intervention; mechanisms of change; mediator; therapy process; active ingredients of treatment

Motivational interviewing (MI) is a client-centered, directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence [1]. Several meta-analyses have provided strong evidence for the efficacy of MI for substance use disorders, with effect sizes versus controls in the medium to large range, with evidence of sustained gains over periods of up to four years [2,3]. However, the processes by which MI works remain unclear [4].

A number of potential within-session causal mechanisms of MI have been proposed [1]. Some of these pertain to counselor's overall style, specific behaviors or use of specific

techniques, while some pertain to client variables, such as engagement, resistance, intention, and experience of discrepancy. Although these theory-driven processes are plausible, there has been no systematic review to date that examines their role as mechanisms of action for MI [2]. The purpose of the current review is to evaluate the existing evidence regarding potential within-session mechanisms of change in MI with alcohol or other drug use disorders. As conceptualized in the present review, a mechanism of change is a variable temporally intervening between assignment to MI treatment and measured substance abuse outcome and at least partially explaining the relationship. The central question we sought to answer in this review was: Which MI constructs and variables appear to be the most promising candidates for mechanisms of change?

We are using the term "mechanism of change" in a more inclusive way than do Kazdin and Nock [5] or Nock [6]. To quote Nock, "The search for actual mechanisms must examine changes in the client that persist or generalize outside of the treatment setting to be able to explain the relation between treatment and lasting changes in clinical outcome [6, p.8s]." By intention Nock's definition excludes the treatment process itself, including therapist and in-session client behaviors. As our focus is on what is happening within the treatment process itself, we could have perhaps substituted "active ingredients of treatment" for "mechanisms of change". However, a discussion of such nuances is beyond the scope of the present review, and are available elsewhere [6,7]. We do accept Kazdin and Nock's [5] seven criteria for an intervening variable reaching the status of a "mechanism of change." A previous review of mechanisms of change for one of the most well-researched treatments for alcohol dependence – cognitive-behavioral therapy – revealed that no intervening variable has even approached meeting these criteria [8]. Therefore, the current review seeks to examine an important lower threshold question: *which MI constructs and variables appear to be the most promising candidates for mechanisms of change?*

Figure 1 displays the overall conceptual model we will examine in this review.

For each MI construct, we will examine the evidence to evaluate the extent to which MI is associated with the intervening variable hypothesized to be a mechanism of change. This intervening variable may be therapist behavior or client behavior, (Links 1a and 1b); the relationship between therapist behaviors and client behaviors, as viewed from an MI perspective (Link 2); and the extent to which the hypothesized intervening variable (therapist behavior or client behavior) is predictive of outcome (Links 3a and 3b). Studies that report mediation analyses also allow for an examination of the extent to which the hypothesized intervening variable accounts for the relationship between MI and outcome.

For variables identified as potential mechanisms of change of MI, we will also discuss whether the variable is unique to MI or distinctive to MI in comparison with other evidence-based treatments or whether the variable is a factor that is likely to be common to all evidence-based treatments. Evidence for uniqueness or distinctiveness of the variable to MI would be present if it were demonstrated that the variable was present only in MI ("unique"), or while present in other evidence based treatments, accounted for more of the relationship between treatment and outcome in MI than in other evidence based treatments ("distinctive"). In contrast, a common factor is present across evidence-based treatments, and accounts for the relationship between treatment and outcome equivalently, irrespective of treatment modality.

Method

Inclusion Criteria

Studies were included if they met the following criteria: (1) clients received a therapeutic intervention for problematic alcohol use or any use of illegal substances; (2) the therapeutic intervention was referred to as "motivational interviewing," "motivational enhancement," "motivational intervention," or "brief intervention" (and was described by the authors as being based upon the principles of motivational interviewing); (3) the intervention was delivered individually, and not in a group setting; (4) the potential mechanism was measured either during the intervention or immediately following.

Literature Search

We searched for studies meeting these criteria using several methods through November, 2007. A computer database search of PubMed, Psychlit and Google Scholar was conducted, using the following keywords: motivational interviewing, motivational enhancement therapy, brief intervention, mechanisms of action, mediator, moderator, and therapy process. We also reviewed the online MI bibliography posted on the official motivational interviewing web site (www.motivationalinterview.org [9]), which is updated regularly and includes citations from 1983–2007. Next, a request for relevant articles was also posted to the listserv of the Motivational Interviewing Network of Trainers (MINT), an international group of individuals who have participated in William Miller and Stephen Rollnick's Training of Trainers workshops, and who remain updated in recent developments through a listserv and by attending annual meetings. Finally, we reviewed all articles cited in several recent reviews and meta-analyses of motivational interviewing [2–4,10,11] and brief interventions [12,13]. Our search identified a total of 152 studies of Motivational Interviewing for review; 19 met inclusion criteria. Table 1 reports and defines mechanisms identified in the literature, as well as how they were measured.

Measurement Issues and Effect Size Calculation

Studies that have examined potential causal mechanisms of MI have often done so through the use of self-report measures, completed by either the client or the therapist. Studies including potential mediators have often measured and reported these as dependent measures rather than mediating variables (e.g., evaluating whether MI is more effective than a control condition at increasing self-reported readiness to change, with no subsequent testing of the relationship of readiness to subsequent substance use). Investigators have also made use of observational coding systems designed to measure client and therapist behaviors during therapy sessions.

Effect size estimates were calculated for every possible step in the causal model (see Figure 1) where sufficient data were provided by study authors. The correlation coefficient is a widely used measure of effect size [14], and the effect size statistic type within a particular review or meta-analysis should remain the same across studies [15]. As such, we calculated all effect sizes in terms of correlation coefficients (r) for comparability. A convention for appraising the magnitude of correlation coefficients (r) effect sizes has been established by Cohen [16], who suggests the following: small (r = .10), medium (r = .30), large (r = .50). Additionally, MacKinnon, Fairchild, and Fritz [17] have recently suggested that a correlation coefficient appropriately serves as an estimate of effect size for individual paths in the causal model depicting a mediated effect.

For studies that included multiple measurements of the same construct, we calculated an effect size for each measure, then calculated an average effect size. Where effect sizes have been combined, this is noted in Table 3. A problem encountered in any review or meta-

analysis is eligible findings for which insufficient information is available to calculate an effect size. Most commonly this happens when a study simply reports that the relationship between two variables was not statistically significant. There are two main ways to deal with this problem. One way is to consider only those effect sizes for which all of the necessary information is available. We decided to take a more conservative approach to the problem, which was to impute a value of zero for missing values. If a study merely reported that the relationship between two variables was non-significant, the effect size was coded as zero, as recommended by Lipsey and Wilson [15].

We also calculated mean weighted effect sizes for each construct. For the sake of editorial brevity, only effect size results are presented here; detailed information regarding each study is available upon request from the first author. We report statistical significance of the mean weighted effect sizes for each construct where more than one comparison was available to allow for such calculation. We provide the small, medium, and large guidelines of Cohen [16] at the bottom of Table 3 to facilitate interpretation of effect sizes.

Results

Study Characteristics

Study characteristics are presented in Table 2. Here we note whether the target population was treatment seeking or volunteered for the study; what was the target substance, sample size, whether or not there was a main effect of treatment on reducing substance use, whether the MI was added-on to existing treatment, or used as a stand-alone treatment; type of measurement; how mechanisms data were collected (client report, therapist report, or observer), and comparison condition.

Effect Sizes

A total of 15 studies provided enough information for calculation of therapist effect sizes, with individual effect size estimates ranging from −0.42 to 0.98. We also calculated mean weighted effect sizes for each link in the causal chain within each construct, using inverse variance methodology, in which the weight applied to each effect size represents both subject-level sampling error and an additional random variance component representing variance between studies [15]. The mean weighted effect sizes for each therapist link ranged from 0.13 to 0.64. A total of 11 studies examined client variables, with individual effect size estimates ranging from −0.38 to 0.58. Mean weighted effect sizes were also calculated for constructs containing a sufficient number of studies to allow such calculation. These ranged from 0.05 to 0.31. A full report of these effect sizes is presented in Table 3.

It was also of interest whether the type of comparison condition had any relationship to effect size estimates. To examine this question, we calculated mean weighted effect sizes across comparison treatment condition: active treatment (eg., cognitive-behavioral therapy, n = 2), no comparison condition (n = 5), minimal/placebo (eg., relaxation training, education, n = 7), and standard care (n = 5). Results were as follows: MI compared to an active treatment, r = 0.06; MI compared with no control condition, r = 0.23; MI compared with a minimal or placebo condition, r = 0.32; MI compared with standard care, r = 0.36.

We also calculated the pooled effect sizes for each link examined in the conceptual model presented earlier. These are displayed in Figure 2.

Discussion

Our overall aim of this review was to assess the extent to which hypothesized mechanisms of change in MI are empirically supported. Although 19 studies yielded effect sizes for

individual links, we were disappointed to identify only two studies that tested full causal chains. Because the bulk of this review focuses on individual links in the causal chain, the two studies testing full causal chains deserve special mention. The first of these two studies tested mediation for a subset of clients, and found that lower levels of therapist MIIN (specifically directiveness) mediated the superiority of MI over CBT for high anger patients [18]. The second study to undertake a full mediation analysis failed to support the full causal chain, in that the client experience of discrepancy did not mediate the relationship between treatment condition and outcome [19]. Based on these two studies alone we would have to conclude that there is virtually no evidence that any hypothesized *mediators* of MI's effectiveness have been identified.

We focused on three questions: 1) To what extent are the mechanisms of change hypothesized for MI in fact distinctive to MI? 2) To what extent are certain therapist behaviors associated with client behaviors as would be predicted from MI theory? 3) To what extent are certain aspects of MI predictive of client substance use outcomes? While this step-by-step approach is a long way from research that would establish these variables as mediators of MI's effectiveness, the current review seeks to examine an important lower threshold question: which MI constructs and variables appear to be the most promising candidates as mediators of MI's relationship to substance abuse outcomes?

Therapist Behaviors as Potential Mediators

MI Spirit—Variables comprising MI Spirit do not by themselves appear to be candidates for accounting for MI's effectiveness. In Link 1 studies such variables as empathy and rapport do not reliably differentiate MI from minimal/placebo comparisons involving client interaction with a therapist, such as alcohol education [20,21] or relaxation training [22]. Only in one study did MI Spirit have a large effect size distinguishing MI from a minimal/placebo comparison, which involved a brief assessment followed by a time control of reading non-alcohol related magazines [19]. For Link 1, MI was not reliably different from standard care [23]. Two studies have found that higher levels of MI Spirit are associated with desired within-session client behaviors (Link 2) with a medium effect size [24,25]. However, in two studies, variables of MI Spirit's relationship to outcomes (Link 3) showed medium effect sizes in different directions: MI Spirit related to better outcomes in one study [19], while MI Spirit was related to worse outcomes in another [26].

MI-Consistent Behaviors (MICO)—Results in Link 1 are consistent in demonstrating that MI-based interventions are associated with higher levels of therapist MICO behavior, both when compared to a minimal/placebo condition [27], and when compared with standard care [28,29]. Whether MICO is associated with within session client pro-change behaviors (Link 2) is not established at this point [25]. Link 3 has not yet been tested for MICO.

MI-Inconsistent behaviors (MIIN)—In Link 1 studies, MIIN consistently differentiates MI from minimal/placebo comparisons [27], standard care [28,29] and active treatment conditions such as CBT and TSF [18]. There is also evidence that higher levels of therapist MIIN behaviors are associated with important client within-session behaviors (Link 2) such as higher levels of resistance [27], while lower levels of therapist MIIN are associated with greater client engagement [24], although one study finds no relationship [25]. When MIIN behavior is examined as a predictor of outcomes (Link 3), evidence is strong and consistent that higher levels of MIIN lead to worse outcomes, and that lower levels of MIIN lead to better outcomes regardless of whether MI is being compared to minimal/placebo [27], standard care [29], or active treatments [18,30]. Hence, we conclude that the strongest

evidence for a presumptive mediator of MI is found in studies of MI-Inconsistent behaviors by the therapist.

Specific Therapist Techniques—For Link 1, a number of specific therapist techniques have been examined and consistently differentiate MI from a placebo condition [19]. Regarding Link 3, only the techniques of decisional balance, feedback, responsibility and change options are predictive of substance use outcomes [19,26,31]. Notable from Table 3 is that the use of decisional balance techniques is most strongly related to outcomes in two studies [26,31], showing medium to large effect sizes.

Client Behaviors as Potential Mediators

Change Talk/Intention—MI leads to higher levels of intention to change substance use (Link 1) in comparison with a standard care control group [23]. Client change talk also has a small [26] to medium [32] effect on outcome (Link 3). Among the client variables as potential mediators of change, change talk appears to be consistent and a promising candidate for future study.

Readiness to change—In Link 1 studies, MI only resulted in increased readiness when compared with a minimal/placebo condition (education control, [33]). However, in two other studies, MI patients failed to show a greater increase in readiness than patients receiving standard care [23,34]. Finally, when MI as a stand-alone treatment was compared to two active treatments, the other two treatments were shown to be more effective in increasing readiness than was MI alone [35]. As a central goal of MI is to increase client readiness to change (Link 1) it was surprising that most studies focusing on this link have not supported this hypothesis. Because increased readiness is hypothesized to lead to better outcomes, it was surprising that no studies in this review reported on the relationship of post-treatment readiness to substance use outcomes (Link 3).

Client Engagement/Involvement—For Link 1 studies, MI demonstrated greater involvement, both when compared to a minimal/placebo control (alcohol education, [20]) or standard care [23]. Greater client engagement also seems to have a small effect on outcome (Link 3) based on one study [24].

Client Resistance—Because "rolling with resistance" is a key MI strategy, the small amount of research on this topic was also surprising. For Link 1, Miller [27] reported that MI had a small effect on reducing resistance when compared with a minimal/placebo comparison (confrontational therapist behavior). The sole evidence for the effect of resistance on outcomes (Link 3) came from this same study and showed a large effect of client resistance on outcome: clients who exhibited more resistance during the session had worse substance use outcomes. This central component of MI is currently understudied.

Client Confidence—While increasing client self-confidence is a stated aim of MI, research to date does not suggest that confidence is a strong candidate for mediating MI's effectiveness. Only Link 1 has been examined to date, and results are mixed. In a study of MI compared to a minimal/placebo condition (relaxation/meditation control group) those in the MI group showed greater increases in confidence [36]. In contrast, in a study where MI as a stand-alone treatment was compared to MI enhanced with two other active treatments, MI-only clients reported decreases in confidence compared with clients in the other treatments [35]. The relationship between client confidence and substance use outcomes has not been studied.

Experience of Discrepancy—MI has a stated therapeutic goal to increase a client's sense of discrepancy, a discomfort with how current behavior (e.g., substance use) fits in with broader life goals and values. In two Link 1 studies comparing MI to a minimal/ placebo control condition, MI has been shown to have a small to medium effect on increasing the client's experience of discrepancy more than assessment-only [19] and relaxation/meditation [36]. An increase in the client's experience of discrepancy has a small-to-medium effect on better substance use outcomes (Link 3, [19]). As increasing discrepancy is a distinctive aim of MI, it would be important to further study this construct as a potential mediator of MI's effectiveness.

An Overall Perspective

Despite the well-documented effectiveness of MI in the treatment of substance use disorders, we know very little about the mechanisms through which change occurs. The present review has examined the ingredients of MI delivery, therapist behaviors and within-session client behaviors and response in an attempt to identify elements that make MI treatment effective. This first attempt to do so offers few definitive answers to either support or refute MI theory offered by Miller and Rollnick [1]. Not only are studies of mediation rare, information available regarding the separate links in the causal chain depicted in Figure 1 is also limited. Nevertheless, emergent from this review are findings supportive of MI theory as well as surprising findings that raise questions. Overall, as seen in Figure 2, pooled effect sizes reported among the causal model are supportive of MI theory: MI implementation is predictive of MI therapist behaviors (Link 1a), which in turn are associated with in-session client behaviors in ways predicted by MI theory (Link 2). These client behaviors are also, to a lesser extent associated with assignment to MI treatment (Link 1b). Both in-session therapist and client behaviors are in turn predictive of client substance abuse outcomes, in-session client behaviors (Link 3b) more so than therapist behaviors (Link 3a).

Of interest is that the size of effect obtained in these comparisons was related to the putative strength of the comparison treatment condition. Effect sizes were noticeably smaller when the comparison condition was an active (and empirically validated) treatment, as opposed to standard care, minimal/placebo condition, or no comparison. As only a few studies included empirically validated treatments, it is generally not possible to evaluate to what extent these potential mediators were distinctive of MI as opposed to shared among empirically validated treatments.

When the focus is narrowed to specific potential mediators, some are more promising than others. Therapist use of MIIN behaviors is predictive of poorer outcomes, and MI therapists are less likely to use MIIN behaviors than therapists in other treatment modalities. Among client behaviors, clients receiving MI are more likely to engage in change talk, and client change talk is predictive of better outcomes. The client's experience of discrepancy also appears to be a promising candidate as a mediator of MI effectiveness in that it may be distinctive of MI, and may also be predictive of better SUD outcomes of change of MI, and thus, how these outcomes occur. A notable finding of this review is that MI does not result in increases in client readiness more so than other treatments.

The current study has a number of limitations. Most notable is the paucity of data available for analysis, despite an abundance of studies supporting MI's effectiveness for treating substance abuse. A related limitation is that the number of constructs evaluated is large, relative to the number of studies included in the review. As such, evidence pertinent to constructs may be affected disproportionately by studies. As our study sample was too small to do so, we were unable to quantitatively analyze potential relationships between effect

sizes for constructs and study characteristics. There was also a lack of comparability across studies due to the use of modified and idiosyncratic measures of constructs.

Future Research Directions

Because most of the studies in this review involved comparisons of MI with placebo conditions, it has not been possible to assess whether the putative mediators of change are distinctive to MI, or are factors common to most evidence-based treatments. For example, a recent study raises the question of whether change talk is a distinctive feature of MI's relationship to outcome. Moyers and colleagues [37] examined a sample of 45 first-session therapy tapes from Project MATCH, with 15 tapes for each therapy modality (MET, TSF, and CBT). They found that client change talk in all three modalities was predictive of outcome up to 15 months later, suggesting that the relationship between client change talk and treatment outcomes occurs in other treatments, and may not be distinctive to MI. (It should be noted that this study is *not* included in Table 2 as it did not meet inclusion criteria for the current review because it reported pooled data across three different treatment modalities, with no data reported separately for MI.) It would enhance the knowledge base if more studies were conducted that compared potential mechanisms of change in MI with those of other evidence-based treatments, where the full causal chains are tested not only within each treatment but also across the different treatments.

Given the abundance of studies documenting MI's effectiveness, the lack of full mediation analyses or experimental studies of ingredients of MI treatment is discouraging. Our review turned up several studies in which the data appeared to be readily available to conduct a mediation analysis, yet none was conducted or reported. In addition to the use of existing collected data to examine potential mediators of MI, new dismantling and componential experimental studies would help to identify MI's mechanisms of change.

A barrier to studying mediation has been the historical belief that mediation would be possible only when there was a between-treatment difference in outcomes to mediate. However, MacKinnon and colleagues [38] provide methodologies for testing mediation in the absence of such between-treatment differences. Treatments may not differ in their outcomes because each may involve mechanisms of change that work differently for achieving equivalent outcomes. We suspect that many databases of completed studies (that showed no between-group differences) still have the potential to be studied for mechanisms of change using MacKinnon's methods.

Not only have procedures for testing simple mediation been improved, analytic methodologies are continually being advanced to allow for testing more complex theoretical models of mediation [39,40]. These may well be necessary to advance knowledge regarding underlying mechanisms of change. The theory underlying MI's effectiveness involves a clinically rich and complex set of variables and hypothesized relationships which sometimes are explicit, but not integrated into a formal and comprehensive theory. Moreover, theoretical constructs have been operationally defined in various ways. What is likely to be required for more sensitive tests of MI's mechanisms of change is explicit identification of underlying causal chains explicating the process by which MI works, and as importantly, specification of the conditions (i.e. moderators), which affect the robustness of the process.

Our review also suggests that such studies should pay more attention to measurement issues. As noted above, it was difficult to draw inferences across aggregated studies because of the non-comparability of instruments used to measure mechanisms of change. Eight studies used standard instruments but eight others used revisions of standard instruments, while six studies used measures idiosyncratic (i.e., "home-grown" or created from scratch) to the study. To permit aggregations across studies, we would recommend that in addition to any

idiosyncratic measures used to measure these constructs in future investigations, researchers also use standardized instruments.

In conclusion, this first review of potential mechanisms of change in Motivational Interviewing has highlighted that research is needed to examine questions about how this treatment actually works. It may require more sophisticated theory and the application of more recent analytic techniques to identify how MI works, for whom, and under what set of conditions.

Acknowledgments

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Figure 1.
Causal Model
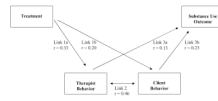
Figure 2.
Pooled effect sizes for each link in causal model

Table 1

Mechanisms of Action for Motivational Interviewing Included in Review

Construct	How Measured in Studies		
	Self-Report	**Therapist-Rated**	**Observer-Rated**
Therapist			
MI Spirit (empathy, acceptance, warmth, genuineness)	X	-	X
MI-Consistent behaviors (affirming, reflective listening)	X	-	X
MI-Inconsistent behaviors (confronting, directing, warning)	-	-	X
Specific techniques (decisional balance, personalized feedback)	X	X	-
Client			
Change talk/intention (commitment, intention, or plan for change)	-	X	X
Readiness to change (readiness ladder, stage of change)	X	-	-
Involvement/engagement (cooperation, engagement, disclosure)	X	X	X
Resistance (commitment to alcohol/drug use, resistance to change)	-	-	X
Experience of discrepancy (general discomfort, negative affect)	X	-	-

Note: Specific information regarding which studies used which form of measurement can be found in Table 2, under the column "Data Source"

Table 2

Study Characteristics

Study	Population	Substance	N	Tx. Effect	MI	Measurement	Data Source	Comparison Condition
Amrhein, 2003	Tx. Seeking	Heroin	84	n/a	Add-on, pre	Idiosyncratic	Observer	No Comparison
		Cocaine						
		Amphetamines						
		Marijuana						
Baird, 2007	Volunteers	Alcohol	210	n/a	Stand-alone	Standardized	Therapist	Standard Care
Bien, 1993	Tx. Seeking	Alcohol	32	Yes/No	Add-on, pre	Idiosyncratic	Observer	Standard Care
Borsari, 2005	Volunteers	Alcohol	64	Yes/No	Stand-alone	Standardized	Observer	Minimal/Placebo
Budney, 2000[1]	Tx. Seeking	Marijuana	40	No	Stand-alone	Revised	Client	Active Treatment
Carroll, 2006	Tx. Seeking	Alcohol	423	No	Add-on, pre	Revised	Observer	Standard Care
		Marijuana						
		Methamphetamines						
		Cocaine						
		Opiates						
		Benzodiazepines						
Dench, 2000	Tx. Seeking	Alcohol	51	No	Add-on, pre	Standardized	Client	Minimal/Placebo
Kamo, 2004[2]	Tx. Seeking	Alcohol	33	Yes/No	Add-on, post	Standardized	Observer	Active Treatment
Kamo, 2005	Tx. Seeking	Alcohol	61	n/a	Add-on, post	Standardized	Observer	No Comparison
LaBrie, 2006	Volunteers	Alcohol	30	Yes	Add-on, pre	Idiosyncratic	Client	No Comparison
Longshore, 1999	Volunteers	Heroin	222	n/a	Stand-alone	Idiosyncratic	Client	Standard Care
		Cocaine						
McNally, 2005[3]	Volunteers	Alcohol	73	Yes	Stand-alone	Revised	Client	Minimal/Placebo
						Idiosyncratic		
Miller, 1993	Volunteers	Alcohol	42	No	Stand-alone	Revised	Observer	Minimal/Placebo
Moyers, 2005[4]	Unknown	Unknown	103	n/a	Unknown	Standardized	Observer	No Comparison
Rohsenow, 2004	Tx. Seeking	Cocaine	149	Yes/No	Add-on, pre	Standardized	Client	Minimal/Placebo
						Revised		
Saunders, 1995[5]	Tx. Seeking	Opiates	101	Yes/No	Add-on, pre	Revised	Client	Minimal/Placebo

Study	Population	Substance	N	Tx. Effect	MI	Measurement	Data Source	Comparison Condition
Stein, 2006	Volunteers	Alcohol Marijuana	130	n/a	Add-on, pre	Revised	Client	Minimal/Placebo
Strang, 2004	Volunteers	Marijuana	44	Yes	Stand-alone	Idiosyncratic	Therapist	No Comparison
Stotts, 2001	Tx. Seeking	Cocaine	51	Yes	Add-on, pre	Standardized	Client	Standard Care

Notes:

Tx. Effect: n/a = not reported in the study; Yes = MI yielded better substance use outcomes than comparison condition in the study; No = MI yielded equal or worse substance use outcomes than comparison condition in the study; Yes/No = MI yielded better outcomes on at least one measure of substance use outcome and equal or worse outcomes on a different measure of substance use outcomes (eg., MI > Minimal/Placebo on reducing overall alcohol consumption, and MI = Minimal/Placebo condition on reducing negative consequences associated with alcohol use).

Measurement: Standardized = use of standardized measure with established reliability and validity with target population; Revised = use of a standardized measure, but which authors report having modified for use in the current study; Idiosyncratic = use of a measure created specifically for the current study with no reliability or validity data reported.

Data Source: Client = paper and pencil measure completed by client following intervention; Therapist = paper and pencil measure completed by therapist following intervention; Observer = use of an observational coding system with ratings assigned by independent observers

[1] Budney, 2000: Compared MI to two other Active treatments; MBT = MI + Cognitive Behavioral Therapy; MBTV = MI + Cognitive Behavioral Therapy + Vouchers

[2] Karno, 2004: Compared MI to two other Active Treatments; CBT = Cognitive Behavioral Therapy; TSF = Twelve-Step Facilitation

[3] McNally, 2005 used two measures of discrepancy. The first was assessed using "an actual-ideal discrepancy gauge constructed for the present research," described as a single Likert-scale question. The second measure was a modified version of the Dissonance Thermometer, a 24-item self-report measure comprising two subscales: general discomfort, and self-focused negative affect.

[4] Moyers 2005 was designed primarily to study within-session processes of MI. The population was made up of 103 pairs of therapists who had received different levels of MI training and clients from a variety of unspecified treatment settings.

[5] Saunders, 1995 also reported a significant effect of MI over education control on a measure of client readiness, and no significant effect of MI versus education control on measures of client intention, client experience of discrepancy, and client self efficacy. However, effect sizes could not be calculated for these results due to lack of sufficient data reported by the authors.

Table 3

Effect Size Estimates

Construct	Treatment → Mediator	Therapist → Client	Mediator → Outcome
Study	Link 1	Link 2	Link 3
Therapist MI Spirit			
Baird, 2007	-	0.40	-
Borsari, 2005	0.00[†]	-	-
Longshore, 1999	0.03	-	-
McNally, 2005	0.86	-	0.34
Moyers, 2005	-	0.26	-
Saunders, 1995	0.05	-	-
Stein, 2006	0.19	-	-
Strang, 2004	-	-	− 0.25
Mean weighted effect size	*0.22*[**]	*0.36*[**]	*0.13*[*]
Therapist MI-Consistent Behavior (MICO)			
Bien, 1993	0.98	-	-
Carroll, 2006	0.61[avg]	-	-
Miller, 1993	0.20 [avg]	-	-
Moyers, 2005	-	0.05	-
Mean weighted effect size	*0.64*[**]	*n/a*	*n/a*
Therapist MI-Inconsistent Behavior (MIIN)			
Baird, 2007	-	0.60	-
Bien, 1993	0.93	-	-
Carroll, 2006	0.21[avg]	-	-
Karno, 2004 (MI vs. CBT)	0.45	-	0.26
Karno, 2004 (MI vs. TSF)	0.16	-	0.18
Karno, 2005	-	-	0.41
Miller, 1993	0.33[avg]	0.83[avg]	0.58[avg]
Moyers, 2005	-	− 0.03	-
Mean weighted effect size	*0.30*[**]	*0.49*[**]	*0.43*[**]
Therapist Specific Techniques			
LaBrie, 2006 (decisional balance)	-	-	0.58
McNally, 2005 (feedback)	0.56	-	0.36
McNally, 2005 (responsibility)	0.33	-	0.23
McNally, 2005 (change options)	0.72	-	0.25
McNally, 2005 (self-efficacy)	0.48	-	0.05
Strang, 2004 (decisional balance)	-	-	0.46
Strang, 2004 (decision-making)	-	-	− 0.42
Strang, 2004 (feedback)	-	-	0.00[†]

Construct Study	Treatment → Mediator Link 1	Therapist → Client Link 2	Mediator → Outcome Link 3
Strang, 2004 (risks/problems)	-	-	0.00[†]
Strang, 2004 (hypotheticals)	-	-	0.00[†]
Strang, 2004 (controlled drug use)	-	-	0.00[†]
Strang, 2004 (plans for change)	-	-	0.00[†]
Mean weighted effect size	*0.52***	*n/a*	*0.19**
Client Change Talk/Intention			
Amrhein, 2003	-	-	0.39
Longshore, 1999	0.25	-	-
Strang, 2004	-	-	0.07[avg]
Mean weighted effect size	*n/a*	*n/a*	*0.29***
Client Readiness			
Budney, 2000 (vs. MBT)	− 0.38	-	-
Budney, 2000 (vs. MBTV)	− 0.33	-	-
Dench, 2000	0.27[avg]	-	-
Longshore, 1999	0.07	-	-
Stotts, 2001	0.03	-	-
Mean weighted effect size	*0.05, n.s.*	*n/a*	*n/a*
Client Engagement/Involvement			
Baird, 2007	-	-	0.13
Borsari, 2005	0.39[avg]	-	-
Longshore, 1999	0.28[avg]	-	-
Mean weighted effect size	*0.31***	*n/a*	*n/a*
Client Resistance			
Miller, 1993	0.12[avg]	-	0.58[avg]
Mean weighted effect size	*n/a*	*n/a*	*n/a*
Client Confidence			
Budney, 2000 (MI vs. MBT)	− 0.34	-	-
Budney, 2000 (MI vs. MBTV)	− 0.16	-	-
Rohsenow, 2004	0.35	-	-
Mean weighted effect size	*0.25***	*n/a*	*n/a*
Client Experience Discrepancy			
McNally, 2005	0.21[avg]	-	0.20[avg]
Rohsenow, 2004	0.16[avg]	-	-
Mean weighted effect size	*0.18***	*n/a*	*n/a*

Notes:

All effect sizes are presented as correlation coefficients (r). Cohen (1988) suggests the following ranges for evaluating the magnitude of effect sizes: small (r = .10), medium (r = .30), large (r = .50). In most cases, effect sizes are positive, indicating that the variable under consideration performed in a consistent with what would be predicted by MI theory. A negative effect size indicates that the variable performed in a way contradictory to what would be predicted by MI theory.

*
 For mean weighted effect sizes, indicates $p < .05$

**
 indicates $p < .01$

avgIndicates studies included more than one measurement of the same construct; hence we calculated an effect size for each individual measure, then calculated an average effect size for the construct, which is reported in the table.

It should be noted that none of the averaged coefficients was calculated with an imputed zero value. A supplementary table that reports all individual effect size estimates used to calculate an average effect size is available upon request from the first author. It was not reported in the original manuscript due to space limitations.

†
Indicates that study tested this path, but reported only "not significant." Conservatively, we present an effect size estimate of $r = 0.00$ in these cases.

n/a indicates that there were either no studies (or only one study) in a link particular construct, rendering calculation of a mean weighted effect size none applicable.