Research on Social Work Practice
20(2) 137-160

DOI: 10.1177/1049731509347850
rswp.sagepub.com
SAGE

A Meta-Analysis of Motivational Interviewing: Twenty-Five Years of Empirical Studies

Brad W. Lundahl,[1] Chelsea Kunz,[1] Cynthia Brownell,[1] Derrik Tollefson,[2] and Brian L. Burke[3]

Abstract

Objective: The authors investigated the unique contribution motivational interviewing (MI) has on counseling outcomes and how MI compares with other interventions. **Method:** A total of 119 studies were subjected to a meta-analysis. Targeted outcomes included substance use (tobacco, alcohol, drugs, marijuana), health-related behaviors (diet, exercise, safe sex), gambling, and engagement in treatment variables. **Results:** Judged against weak comparison groups, MI produced statistically significant, durable results in the small effect range (average $g = 0.28$). Judged against specific treatments, MI produced nonsignificant results (average $g = 0.09$). MI was robust across many moderators, although feedback (Motivational Enhancement Therapy [MET]), delivery time, manualization, delivery mode (group vs. individual), and ethnicity moderated outcomes. **Conclusions:** MI contributes to counseling efforts, and results are influenced by participant and delivery factors.

Keywords

motivational interviewing; meta-analysis; review

Introduction

Motivational interviewing (MI), which originated in the early 1980s, has become a well-recognized brand of counseling. A simple literature search using the term "motivational interviewing" as the keyword in one database, PsycInfo, revealed three references during the 10-year span of 1980 to 1989, 35 references from 1990 to 1999, and 352 from 2000 to December of 2008. Interest in MI continues to grow at a rapid pace (Prochaska & Norcross, 2007), perhaps because it is short-term, teachable, and has a humanistic philosophy.

Only a brief definition of MI is given here as many other sources provide thorough explanations (e.g., Arkowitz, Westra, Miller, & Rollnick, 2008; Miller, & Rollnick, 2002; Rollnick, Miller, & Butler, 2008). MI is a counseling approach that is, at once, a philosophy and a broad collection of techniques employed to help people explore and resolve ambivalence about behavioral change. In brief, the philosophy of MI is that people approach change with varying levels of readiness; the role of helping professionals is thus to assist clients to become more aware of the implications of change and/or of not changing through a nonjudgmental interview in which clients do most of the talking. A central tenet of MI is that helping interventions are collaborative in nature and defined by a strong rapport between the professional and the client. MI is unmistakably person-centered in nature (cf., Rogers, 1951), while also being directive in guiding clients toward behavioral change.

Professionals trained in MI generally gain knowledge and skills in four areas, consistent with the overall philosophy of MI: (a) expressing empathy, which serves many goals such as increasing rapport, helping clients feel understood, reducing the likelihood of resistance to change, and allowing clients to explore their inner thoughts and motivations; (b) developing discrepancy, which essentially means that clients argue, to themselves, reasons why they should change by seeing the gap between their values and their current problematic behaviors; (c) rolling with resistance, which means that clients' reluctance to make changes is respected, viewed as normal rather than pathological, and not furthered by defensive or aggressive counseling techniques; and (d) supporting clients' self-efficacy, which means that clients' confidence in their ability to change is acknowledged as critical to successful change efforts.

[1] University of Utah
[2] Utah State University
[3] Fort Lewis College

Corresponding Author:
Brad W. Lundahl, 395 South 1500 East, Salt Lake City, UT 84121.
Email: Brad.Lundahl@socwk.utah.edu

Through meta-analysis, the current article examines the degree to which MI is able to help clients change. Considerable research has been applied to the question of whether MI is effective or efficacious, including primary studies, literature reviews, and meta-analyses. Indeed, many gold-standard trials have examined the question of efficacy of MI (e.g., Project Match, 1997, 1998) and several previous meta-analyses on MI have been published (Burke, Arkowitz, & Menchola, 2003; Hettema, Steele, & Miller, 2005; Vasilaki, Hosier, & Cox, 2006). While we believe these efforts have done much to enhance our understanding of MI's efficacy, we believe further investigation through meta-analytic techniques is warranted for several reasons. First, we believe a different approach to conducting a meta-analysis may reveal a "cleaner" picture of the unique contribution of MI as we delineate further below. Second, many new primary studies bearing on the effectiveness of MI have been published since the last meta-analysis, and our search yielded several articles not included in previous reviews. (Note: Studies included in this meta-analysis included both efficacy and effectiveness trials; we use the term "effectiveness" here for consistency.)

Prior to reviewing previously published meta-analyses, we briefly review the goals and methods used to conduct these types of studies (see Cooper & Hedges, 1994; Lipsey & Wilson, 2001; Lundahl & Yaffe, 2007). Meta-analysis is a method for quantitatively combining and summarizing the quantitative results from independent primary studies that share a similar focus. As most primary studies vary in the number of people who participated and the measurement tools used to assess outcomes, a meta-analysis utilizes a metric that can standardize results onto a single scale: an effect size. An effect size refers to the magnitude of the effect or the strength of the intervention. For the current meta-analysis, we used Hedge's g (a nonbiased estimate of Cohen's (1988) d) as our effect size, which is a measure of group differences expressed in standard deviation units. For example, an effect size of $d = 1.00$ would suggest positive movement of a full standard deviation of clients in the treatment group relative to the comparison group, whereas an effect size of $d = 0.50$ would suggest positive movement of a half of a standard deviation. In meta-analyses, convention holds that an effect size around the "0.20" range is small, yet statistically significant, whereas effect sizes in the "0.50" and "0.80" are moderate and large, respectively (Cohen, 1988).

In a meta-analysis, effect sizes are calculated from primary studies and then statistically combined and analyzed. In addition to describing the basic characteristics of the empirical studies of MI interventions, our review attempts to answer three questions that are commonly explored via a meta-analysis (Johnson, Mullen, & Salas, 1995). First, meta-analysis investigates the central tendency of the combined effect sizes. Second, meta-analysis is interested in understanding variability around the overall effect size. If variability is low, then the overall effect size is considered a good estimate of the average magnitude of effect across studies. If variability is high, then the overall effect size is not considered a good estimate, which leads to the third common question in meta-analysis: what predicts the variability. To predict or understand high variability, two types of moderator analyses can be conducted: (a) an analog to the analysis of variance (ANOVA), wherein effect size differences are examined based on categorical variables within studies (e.g., treatment format, type of comparison group used), and (b) a weighted multiple regression, which uses continuous variables (e.g., treatment length) as potential predictors of the mean effect size (Borenstein, Hedges, Higgins, & Rothstein, 2005).

We now turn to a brief review of the three existing meta-analyses in the field of MI. Burke et al. (2003) published the first of these studies. These authors included 30 controlled clinical trials that focused primarily on the implementation of MI principles in face-to-face individual sessions. In terms of comparative efficacy, MI treatments were superior to no-treatment or placebo controls for problems involving alcohol, drugs, and diet and exercise, with effect sizes ranging from $d = 0.25$ to 0.57. There was no support for the efficacy of adaptations of MI in the areas of smoking cessation and HIV-risk behaviors in the two studies available at that time. Results were near zero (0.02) in the seven studies that compared MI treatments to other active treatments, although the MI treatments were shorter than the alternative treatments by an average of 180 min (three or four sessions). Interestingly, MI effects were found to be durable across sustained evaluation periods. While only a few studies were included in the moderator analyses, Burke et al. (2003) found that higher doses of treatment and using MI as a prelude to further treatment were associated with better outcomes for MI in substance abuse studies.

Hettema et al. (2005) published the second meta-analysis that included 72 studies in which the singular impact of MI was assessed or in which MI was a component of another active treatment. Among groupings with three or more studies, effect sizes ranged from a low of $d = 0.11$ to a high of $d = 0.80$ (p. 97) across all studies, all outcomes (e.g., alcohol use, treatment compliance), and all time frames. While an overall effect sizes was provided, it may have been unduly influenced by a single outlier study that had an effect size that was more than 400% larger ($d = 3.40$) than the next largest value ($d = 0.80$). The authors also investigated several possible correlates or moderators of the outcomes, finding no relationship between outcomes and the following variables: methodological quality, time of follow-up assessment, comparison group type, counselor training, participants' age, gender composition, problem severity, or problem area. The only significant predictors of effect size for MI were as follows: manualized interventions yielded weaker effects and benefits from MI decreased significantly as follow-up times increased.

Vasilaki and colleagues (2006) published the third meta-analysis. Unlike the previous two meta-analyses that examined a wide range of behaviors, this study focused exclusively on studies of interventions that targeted excessive alcohol consumption. To be included, studies needed to claim that MI principles were adopted as well as include a comparison group and utilize random assignment. The aggregate effect size for the 15 included studies, when compared to no-treatment control

groups, was $d = 0.18$ and, when compared to other treatment groups, it was $d = 0.43$, although this difference by comparison group was not statistically significant.

Considering the converging outcomes across these three previous meta-analyses, there is sufficient evidence to support MI as a viable and effective treatment method. In many respects, the three studies point to a similar picture: outcomes tend to be in the low-to-moderate range of effect sizes and are not homogeneous. Key differences between these three meta-analyses include the fading of MI effects over time (supported by only two of the three reviews) and the moderating variables that emerged, ranging from dose and format of the treatment to manual guidance and sample ethnicity.

In the current meta-analysis, we sought to address two common shortcomings in the previous meta-analyses: (a) they ran moderator analyses with small numbers of studies and (b) they included studies that could not specifically isolate the unique effect of MI without being confounded by other treatments or problem feedback. Thus, the primary goal of the current meta-analysis was to investigate the unique effect of MI compared with other treatments or control conditions. While it can be argued that ''pure'' MI is not possible, given the likelihood of including other components, some studies utilize designs that allow for isolation of the unique contribution of MI or provide a direct comparison of MI to other treatments. Our review only included such studies in an effort to overcome the potential confounds found in prior meta-analyses. Furthermore, our review sought to examine and clarify the possibility of moderator effects.

Method

Literature Search

Three basic strategies were used to identify possible studies. First, we utilized a bibliography of outcome research assessing MI that was compiled by the co-founder of MI, Dr. William Miller. At the time of the literature search (2007), 167 articles were cited in the bibliography, all of which were secured and screened for eligibility. Second, we identified articles using the references cited in other meta-analyses and review studies. Third, we conducted a broad literature search using various article databases; this strategy had the most emphasis. Four search terms were used to identify articles reporting on MI. The two ''brand names'' most commonly used with MI were used, namely ''motivational interviewing'' and ''motivational enhancement.'' To ensure that we did not miss other articles, we also included more generic terms that involve motivational interventions, even though such interventions may not have used MI proper; the other terms were ''motivational intervention'' and ''motivation intervention.'' These four terms were entered using the connector ''OR'' so that any one of these terms would generate a hit.

The following 11 databases were searched: Psycinfo, PsycARTICLES, Psychology and Behavior, Medline, CINHAL, ERIC, Business Source Premier, Pub Med Academic Search Premier, Social Services Abstracts, and Sociological Abstracts. We note that the other three meta-analyses, as far as we can discern, searched no more than four databases, which may account for the larger number of studies included in the current study.

In total, this strategy yielded 5,931 potential articles. These references were exported using Endnote software. In this process, references were categorized by author and 861 duplicates were identified and discarded. Using Endnote, the remaining 5,070 articles were screened and discarded if they were published before 1984 or were dissertations. Articles before 1984 were discarded because MI was not introduced until this date. This step removed 85 articles. We then used the Endnote to search within the remaining articles. Articles were excluded if they did not have the terms ''motivational interviewing'' or ''motivational enhancement'' in the keywords, leaving 1,288 articles. We then cross-referenced the 167 articles previously ordered from the bibliography with the articles retrieved in the basic literature search, which produced 1,128 articles that were screened for inclusion.

Screening Articles for Inclusion

The 1,128 articles were screened by their source and abstracts. Articles were retained if the abstract indicated that (a) the main principles of Motivational Enhancement Therapy (MET; see below for description) or MI were used; (b) a treatment group and a comparison group were included; (c) the intervention was delivered by humans; (d) the study was published in a peer-reviewed journal (Note: This was done to establish a more homogenous sample of studies, to facilitate potential replication by other researchers, and because searching the ''gray'' literature can introduce systematic sampling error); and (d) the study was reported in English. This screening strategy yielded 183 articles that were then retrieved and combined with the 167 articles taken from Miller's bibliography.

Once the articles were obtained, they were subjected to a more rigorous screening using two criteria. First, the study design had to isolate the impact of MI on client behavior change or to provide a clear head-to-head comparison of MI to another intervention. A study was therefore included if (a) there was a comparison with waitlist or control groups, even when the effects of attention (talk time) were not controlled for (such as by mere dissemination of written materials); (b) an intervention used MI as an additive component and the comparison group also used the same intervention minus MI; (c) MI was compared to a ''treatment as usual'' (TAU) condition as this represents a head-to-head comparison of MI and other treatments even though the design cannot precisely isolate the impact of MI; or (d) the intervention was MET, even though this subdivision of MI includes feedback from standardized assessment measures (we used this subdivision as a possible moderator described below); or (e) the comparison group included the dissemination of written materials, such as an information pamphlet, as we reasoned that this type of comparison group is likely a hybrid between a waitlist and a TAU comparison group. Studies were excluded from this review if MI was specifically combined with another, identified intervention

and the comparison group was only a waitlist or control group. Finally, studies originating from the Project MATCH Research Group (1997, 1998) were excluded from this review, even though they represented head-to-head comparisons, because the result sections of these reports most consistently reported interaction effects whereas our meta-analysis required reporting of main effects. Thus, if we were to extract effect sizes, they would not be representative of the entire sample across all Project MATCH sites and participants resulting in systematic sampling bias.

Coding Studies: Reliability

Following the screening process, all articles were independently coded for participant characteristics and for study characteristics. Coding was conducted by graduate-level research assistants (CK and CB) under the supervision of the primary author. Average interrater reliability was high $r = .89$ for continuous variables and for categorical variables $\kappa = .86$ (Landis & Koch, 1977).

Dependent Variables: Outcomes Assessed

MI interventions have targeted a wide range of behaviors and, as expected, a wide range of measurement tools have been used to assess outcomes. Among the studies included in our review, we identified eight broad outcomes related to health. Of these, seven addressed observable behaviors: alcohol use, marijuana use, tobacco use, miscellaneous drug use (e.g., cocaine, heroin), increases in physically healthy behavior (e.g., exercise, eating patterns), reductions in risk-taking behavior (e.g., unprotected sex), and gambling. The other category included indicators of emotional or psychological well-being (e.g., depression or stress). Three other outcomes were also assessed that related more directly to client motivation: engagement in treatment (e.g., keeping appointments, participation in treatment), self-reported intention to change (e.g., movement in the Stages of Change model; Prochaska & Norcross, 2007), and self-reported confidence in one's ability to change. Finally, three other outcome groups were identified but not included beyond initial results because fewer than three studies contributed to each of the outcome groups: eating disorder behavior (binging/purging), parenting practices, and drinking potable water.

Within each broad category above, the specific dependent measures we identified were multifaceted. For example, indicators related to alcohol use include, but are not limited to, abstinence rates, relapse rates, number of drinking days per week, number of drinks consumed, number of binging episodes, blood alcohol concentration, dependency on alcohol, and/or problems arising from alcohol consumption (e.g., drinking and driving). Each indicator provides a nuanced perspective of alcohol use patterns, and different measurement tools may examine slightly different aspects of each perspective. In our review, we grouped the multifaceted aspects of a particular outcome into its broader category (e.g., alcohol use) so that the reader will have a general understanding of the value of MI.

Potential Moderators

We examined eight categorical variables and seven continuous variables as potential moderators to the effects of MI across these studies. The seven categorical variables were coded as follows.

Comparison group. Coded as one of five types: (a) waitlist/control groups that did not receive any treatment while MI was being delivered; (b) treatment as usual (TAU) without a specific treatment mentioned (e.g., groups received the typical intervention used in an agency); (c) TAU with a defined or specifically named program (e.g., 12-step program or cognitive behavioral therapy); (d) written materials given to the comparison group (e.g., pamphlet discussing the risks of unprotected sex, drug use, etc.); or (e) an attention control group wherein the comparison group received nonspecific attention.

Clients' level of distress. In an effort to estimate the degree to which MI works with populations with varying levels of distress, studies were coded into three groups: (a) significant levels of distress or impairment, which meant that most of the sample (i.e., above 50%) would qualify for a diagnosis (e.g., alcohol dependency) in a system such as the Diagnostic and Statistical Manual of Mental Disorders (*DSM*) or the International Classification of Disease (*ICD*); (b) moderate levels of distress, when a problematic behavior was targeted even though the behavior probably had not caused significant impairment in everyday functioning (e.g., occasional marijuana use, overweight college students); or (c) community sample, when the targeted behaviors were important, but the sample likely functioned well (e.g., increasing adherence to a medicine or exercise regime or increasing fruit and vegetable intake in an otherwise health sample of participants).

MI type. MI is usually delivered in one of two methods. First, "standard" or "pure" MI involves helping clients change through skills basic to MI as described above. A second way to deliver MI is one in which the client (often alcohol or drug addicted) is given feedback based on individual results from standardized assessment measures, such as the Drinker's Check Up (Miller, Sovereign, & Krege, 1988) or a modification of it; this approach is sometimes termed MET (Miller & Rollnick, 2002).

Use of a manual. Hettema et al. (2005) found that outcomes tended to be weaker when studies used a manual-guided process. If the study explicitly stated that a manual was used, above and beyond basic training in MI or MET, then it was coded as such; otherwise, studies were coded as not having used a manual.

Role in treatment. MI has been used in a variety of roles/formats in the treatment process, three of which were coded for this study as follows: (a) additive, when MI was integrated with

another treatment to provide an additive component. Again, if used in an additive fashion, the study design needed to be such that the role of MI could be isolated. For example, additive would be coded if two comparison groups examined the value of a nicotine patch and only one group used MI; (b) prelude, when MI was used as a prelude to another treatment. The format of prelude treatments was conceptually similar to an additive model, except that the MI component came before another intervention; or (c) stand-alone, when MI was used as the only treatment for that group of participants.

Fidelity to MI. Confidence that an intervention is linked to outcomes is increased when adherence or fidelity to the intervention can be established. Research teams have developed tools to measure fidelity to key principles of MI (e.g., Welch et al., 2003). Among the studies included in our meta-analyses, three levels of fidelity assessment were coded: (a) no assessment of fidelity; (b) fidelity was assessed or monitored, often through some form of taping or recording, with a qualitative system that did not produce a standardized score; (c) fidelity was assessed, often through some form of recording, using a standardized system (e.g., the MI skill code, MISC; Miller, 2002) that produced a numeric score.

Who delivered MI. As MI is being used by a variety of professional groups, we investigated whether educational background influenced outcomes. The following groups were coded whenever sufficient information was provided: (a) medical doctor; (b) registered nurse or registered dietician; (c) mental health provider with either a master's degree or a PhD; (d) mental health counselor with a bachelor's degree; or (e) student status, which generally indicates that the student was being supervised by someone with a master's or PhD degree.

Delivery mode. MI is traditionally delivered via individual counseling, though it is occasionally delivered via group format.

Continuous variables. The seven continuous variables we coded as potential moderators of MI effects can be divided into two broad categories: sample characteristics and study characteristics. Most of the continuous moderators need little explanation. Three different characteristics of the sample were coded: *participants' average age*, percentage of participants who were *male or female*, and the percentage of the sample who were *White, African American*, or *Hispanic*. (Note that we also coded for other racial groups but too little information existed to support analyses).

For study characteristics, we coded the *number of sessions* in which MI was delivered, the *total dosage* of MI in minutes, and *durability* by listing the longest time period in which post-treatment measures were administered. Finally, *study rigor* was also coded using an 18-point methodological quality scale (see Appendix for details).

Effect Size Calculation

Effect sizes were calculated and analyzed through Comprehensive Meta-Analysis, a software package that was produced by Borenstein, Hedges, Higgins, and Rothstein (2005). We used *Hedge's g* as our main measure of effect size, the standardized mean difference that uses an unbiased pooled standard deviation similar to *Cohen's d* but corrects for bias through calculating the pooled standard deviation in a different manner (Cooper & Hedges, 1994; Lipsey & Wilson, 2001). A random effects model was used for all analyses, which is more conservative than fixed effects models and assumes that effect sizes are likely to vary across samples and populations (Hunter & Schmidt, 2000). Effect size extraction and calculation were performed by the primary and secondary authors. Thirty-one percent of the effect sizes were double coded, with interrater reliability being very high (98% agreement).

Results

Study Characteristics

In total, 119 studies met the inclusionary criteria for this review. Of these, 10 compared two conditions of MI or two different comparison groups within the same study, and one study compared four MI groups to a single comparison group. Thus, a total of 132 MI groups were contrasted. Across these 132 group comparisons, a total of 842 effect sizes were computed because almost all of the studies reported on multiple outcomes, multiple indictors of an outcome, or multiple measurements of an outcome across time. With the exception of the meta-regression analyses (see below), multiple measures of a particular construct were averaged within studies to prevent violations of independence.

As we expected, this large body of literature varied in populations of focus, outcomes of interest, and how MI was presented to clients. Table 1 details some of the variability found in the studies, including the number of participants in the study, outcomes assessed, type of MI delivered, and the effect size for each individual study. Effect sizes in Table 1 are collapsed across dependent variables and moderators.

Overall Findings

We organized our results around the three goals of meta-analytic inquiries: central tendency, variability, and prediction (Johnson, Mullen, & Salas, 1995).

What is the overall magnitude of effect of MI interventions? The average effect size across the 132 comparisons and all outcomes was $g = 0.22$ (confidence interval [CI] 0.17-0.27), which was statistically significant, $z = 8.75$, $p < .001$. This value is consistent with Cohen's classification of a small but statistically meaningful effect. The lowest effect size for MI was -1.40 and the highest was 2.06, neither of which were outliers. To gain a more complete picture of the distribution of effect sizes, percentile ranks are reported. The effect

Table 1. Selected Study Characteristics and Average Effect Sizes

Study Name	*N*: Tx/Comp	Compare Group	MI or MET	Session/ Minutes	Longest Follow-up (Months)	Targeted Behavior Change	Effect Size	CI
Ahluwalia et al. (2006)	189/189	Strong	MI	6/120	7–9	Cig	−0.35	−0.66/−0.06
Anton et al. (2005)	39/41	Strong	MET	4/-	1–3	AI, Eng	−0.15	−0.70/0.41
Baer, Kivlahan, Blume, MacKnight, and Marlatt (2001)	164/164	Weak	MET	1/-	4 years	AI	0.31	0.06/0.56
Baker et al. (2002)	11/8	Weak	MET	1/-	10–12	AI, Mar, OD	0.01	−0.56/0.57
Baker, Heather, Wodak, Dixon, and Holt (1993)	25/27	Weak	MI	1/75	4–6	Risks	−0.01	−0.55/0.52
Ball et al. (2007)	34/25	Strong	MET	3/-	IM	AI	0.09	−0.37/0.56
Ball et al. (2007)	34/29	Weak	MET	3/-	IM	AI	0.21	−0.28/0.70
Baros, Latham, Moak, Voronin, and Anton (2007)	80/80	Strong	MET	4/-	1–3	AI	−0.16	−0.47/0.15
Beckham (2007)	12/13	Weak	MET	1/52.5	1–3	AI	0.86	0.06/1.65
Bennett et al. (2005)	66/45	Weak	MI	1/60	7–9	Health	0.18	−0.20/0.56
Bernstein et al. (2005)	70/48	Weak	MI	1/20	4–6	OD	0.13	−0.19/0.45
Bien, Miller, and Boroughs (1993)	9/12	Weak	MI	1/60	4–6	AI	0.45	−0.34/1.24
Booth, Kwiatkowski, Iguchi, Pinto, and John (1998)	95/97	Strong	MI	4/-	IM	Eng	−0.07	−0.38/0.25
Booth, Corsi, and Mikulich-Gilbertson (2004)	283/294	Strong	MI	4/-	1–3	Eng	−0.03	−0.26/0.19
Borrelli et al. (2005)	76/96	Strong	MET	4/80	10–12	Cig	0.28	−0.32/0.89
Bowen et al. (2002)	82/82	Strong	MI	3/-	10–12	Eng	0.40	−0.04/0.85
Brodie and Inoue (2005)	22/18	Strong	MI	8/480	4–6	Health	0.49	−0.14/1.11
Brown and Miller (1993)	67/64	Strong	MET	1/-	1–3	AI	1.19	0.36/2.03
Brown et al. (2006)	13/13	Strong	MET	4/-	4–6	AI, IC/SC, OD	−0.18	−0.53/0.18
Butler et al. (1999)	202/210	Weak	MI	1/60	4–6	Cig, IC/SC	0.24	−0.15/0.62
Carey et al. (2000)	24/22	Weak	MET	4/360	1–3	IC/SC	0.48	0.00/0.96
Carroll et al. (2005)	37/42	Weak	MET	1/60	1–3	AI, Eng, IC/SC, OD, Risks	0.03	−0.80/0.86
Carroll, Libby, Sheehan, and Hyland (2001)	31/29	Weak	MI	1/105	1–3	Eng	0.55	−0.09/1.18
Channon et al. (2007)	27/20	Weak	MI	4/250	13–24	Health	0.63	0.05/1.21
Colby et al. (2005)	18/20	Weak	MET	2/47.5	4–6	Cig	0.37	−0.16/0.91
Colby et al. (1998)	43/42	Weak	MI	2/52.5	4–6	Cig, IC/SC	0.48	−0.43/1.38
Connors, Walitzer, and Dermen (2002)	38/38	Strong	MET	1/90	IM	Eng	0.23	−0.22/0.67
Connors et al. (2002)	38/50	Weak	MET	1/90	10–12	AI, Eng, GWB, OD	0.44	0.02/0.87
Curry et al. (2003)	156/147	Weak	MI	5/-	10–12	Cig	0.34	−0.22/0.90
Daley, Salloum, Zuckoff, Kirisci, and Thase (1998)	11/12	Weak	MET	9/-	1–3	Eng	1.82	0.38/3.26
Davidson, Gulliver, Longabaugh, Wirtz, and Swift (2006)	76/73	Strong	MET	4/180	IM	AI	−0.09	−0.41/0.23
Davis, Baer, Saxon, and Kivlahan (2003)	Total = 73	Weak	MET	1/57	1–3	AL, Eng, GWB	0.14	−0.33/0.60
Dench and Bennett (2000)	27/24	Weak	MI	2/67.5	IM	Eng, IC/SC	0.19	−0.61/0.98
Dunn, Neighbors, and Larimer (2006)	45/45	Weak	MET	1/45	IM	ED Bx, Eng, IC/SC	0.18	−0.24/0.59
Elliot et al. (2007)	168/186	Strong	MET	4/12.5	10–12	Health	−0.13	−0.34/0.08
Elliot et al. (2007)	168/135	Weak	MET	4/12.5	10–12	Health	0.26	0.04/0.49
Emmen, Schippers, Wollersheim, and Bleijenberg (2005)	61/62	Weak	MET	2/150	4–6	AI, IC/SC	0.18	−0.21/0.57
Emmons et al. (2001)	116/120	Weak	MET	1/37.2	4–6	Cig	0.30	0.04/0.55
Galbraith (1989)	12/12	Strong	MI	1/45	10–12	A/C	0.51	−0.27/1.30
Gentilello et al. (1999)	66/307	Weak	MET	1/30	10–12	AI, Risks	0.15	−0.02/0.32
Golin et al. (2006)	30/35	Strong	MI	2/-	1–3	A/C, AI, Mar., Eng, OD	0.19	−0.28/0.66

Table 1. (continued)

Study Name	*N*: Tx/Comp	Compare Group	MI or MET	Session/ Minutes	Longest Follow-up (Months)	Targeted Behavior Change	Effect Size	CI
Graeber, Moyers, Griffith, Guajardo, and Tonigan (2003)	15/13	Strong	MI	3/180	4–6	AI	0.69	−0.18/1.56
Gray McCambridge, and Strang (2005)	90/48	Weak	MI	1/-	1–3	AI, Mar., Cig	0.13	−0.30/0.57
Grenard et al. (2007)	11/7	Weak	MI	1/25	1–3	AL, Mar., Cig, IC/SC, OD	0.53	−0.92/1.98
Handmaker, Miller, and Manicke (1999)	7/7	Weak	MET	1/60	10–12	AI	0.21	−0.64/1.05
Harland et al. (1999)	88/89	Weak	–	3/-	10–12	Health	0.40	−0.01/0.81
Haug, Svikis, and DiClemente (2004)	30/23	Weak	MET	4/-	1–3	Cig, IC/SC, OD	0.34	−0.36/1.04
Helstrom, Hutchison, and Bryan (2007)	38/29	Strong	MET	1/-	4–6	Cig	−0.07	−0.94/0.80
Hillsdon, Thorogood, White, and Foster (2002)	302/285	Weak	MET	3/48	10–12	Health	0.09	−0.07/0.25
Hodgins, Currie, El-Guebaly, and Peden (2004)	28/24	Weak	MET	1/25	13–24	Gam	0.32	−0.26/0.91
Hodgins, Currie, El-Guebaly (2001)	31/34	Weak	MET	1/32.5	<1	Gam	0.54	0.05/1.03
Hodgins et al. (2001)	31/33	Weak	MI	1/32.5	10–12	Gam	0.20	−0.45/0.84
Hulse and Tait (2003)	47/37	Weak	MET	1/45	4–6	AI	0.75	0.30/1.20
Hulse and Tait (2002)	58/62	Weak	MI	1/-	5 years	AI	0.14	−0.27/0.54
Humfress et al. (2002)	45/45	Weak	MET	1/-	<1	IC/SC	0.09	−0.32/0.50
Ingersoll et al. (2005)	94/105	Weak	MET	1/67.5	1–3	AI	0.34	−0.21/0.88
Jaworksi and Carey (2001)	26/26	Strong	MET	1/150	1–3	IC/SC, risks	0.03	−0.51/0.57
Johnston, Rivara, Droesch, Dunn, and Copass (2007)	82/92	Weak	MI	1/20	4–6	Risks	0.19	−0.21/0.58
Juarez, Walters, Daugherty, and Radi (2006)	21/15	Weak	MET	/70	1–3	AI	0.20	−0.46/0.85
Juarez et al. (2006)	21/18	Weak	MET	/60	1–3	AI	0.52	−0.13/1.17
Juarez et al. (2006)	20/15	Strong	MET	/35	1–3	AI	−0.27	−0.94/0.40
Juarez et al. (2006)	20/18	Strong	MET	/35	1–3	AI	−0.04	−0.68/0.60
Kahler et al. (2004)	24/24	Weak	MET	1/60	10–12	AI, Eng	0.00	−0.56/0.56
Kelly and Lapworth (2006)	28/22	Weak	MI	1/60	4–6	A/C	0.57	−0.03/1.17
Kidorf et al. (2005)	98/96	Strong	MI	1/50	IM	Eng	0.00	−0.28/0.28
Kreman et al. (2006)	12/12	Weak	MI	1/35	1–3	Health	0.22	−0.60/1.04
Kuchipudi, Hobein, Flickinger, and Iber (1990)	45/49	Weak	MI	3/-	1–3	AI	−0.02	−0.47/0.42
Larimer et al. (2001)	64/52	Weak	MET	2/120	10–12	AI	0.19	−0.18/0.56
Litt, Kadden, and Stephens (2005)	137/128	Weak	MET	2/-	4–6	Eng	0.82	0.57/1.07
Longabaugh etal. (2001)	182/188	Weak	MET	1/50	10–12	AI	0.05	−0.15/0.26
Longabaugh et al. (2001)	169/188	Weak	MET	1/50	10–12	AI	0.16	−0.05/0.37
Longshore and Grills (2000)	40/41	Weak	MI	1/-	10–12	AI	0.41	−0.06/0.88
Maisto et al. (2001)	73/85	Weak	MET	1.5/72.5	10–12	AI	0.81	0.47/1.14
Maisto et al. (2001)	73/74	Strong	MET	1/72.5	10–12	AI	0.17	−0.17/0.52
Maltby and Tolin (2005)	7/5	Strong	MI	4/-	IM	Eng	0.73	−0.58/2.04
Marijuana tx project (2004)	128/137	Weak	MET	2/120	4–6	Mar.	0.35	0.04/0.66
Marsden et al. (2006)	166/176	Weak	MET	1/52.5	4–6	AI, Eng	−0.02	−0.23/0.19
Martino, Carroll, Nich, and Rounsaville (2006)	24/20	Strong	MET	2/120	1–3	AI, Eng, IC/SC, OD	0.00	−0.58/0.58
McCambridge and Strang (2004a)	65/81	Weak	MI	1/60	1–3	AI, Mar., Cig, OD	0.47	0.01/0.92
McCambridge and Strang (2004b)	84/78	Weak	MI	1/-	10–12	AI, Mar., Cig, OD	0.38	−0.19/0.96
Mhurchu, Margetts, and Speller (1998), 165	47/50	Weak	MI	3/-	1–3	Health	0.13	−0.27/0.53
Michael, Curtin, Kirkley, and Jones (2006)	47/44	Weak	MI	1/100	<1	AI	0.22	−0.19/0.63
Miller, Benefield, and Tonigan (1993)	14/14	Weak	MET	2/180	10–12	AI	0.35	−0.38/1.07

(continued)

Table 1. (continued)

Study Name	*N*: Tx/Comp	Compare Group	MI or MET	Session/ Minutes	Longest Follow-up (Months)	Targeted Behavior Change	Effect Size	CI
Miller et al. (1993)	14/14	Strong	MET	2/180	10–12	AI	0.02	−0.71/0.75
Miller, Yahne, and Tonigan (2003)	108/104	Weak	MET	1/120	1–3	Eng	0.00	−0.27/0.27
Mitcheson, McCambridge, and Byrne (2007)	12/17	Weak	MI	1/-	1–3	OD	0.25	−0.47/0.98
Monti et al. (1999), 171	Total = 62	Weak	MET	1/37.5	4–6	AI	0.45	−0.01/0.91
Morgenstern et al. (2007)	33/74	Weak	MET	4/-	10–12	AI	0.54	0.12/0.96
Mullins, Suarez, Ondersma, and Page (2004)	36/35	Strong	MI	3/180	1–3	Eng, OD	0.15	−0.89/1.20
Murphy et al. - 1 (2001)	14/12	Weak	MET	1/50	7–9	AI	0.78	0.00/1.57
Murphy et al. - 2 (2001)	14/14	Strong	MET	1/50	7–9	AI	0.94	0.18/1.71
Naar-King et al. (2006)	25/26	Weak	MET	4/240	1–3	AI, Risks, Mar.	0.41	−0.14/0.96
Nock and Kazdin (2005)	39/37	Strong	MET	6/60	IM	Eng	0.45	−0.01/0.91
Peterson, Baer, Wells, Ginzler, and Garrett (2006)	57/67	Weak	MET	3/135	1–3	AI, Mar., OD	0.01	−0.32/0.34
Picciano et al. (2001)	46/43	Weak	MET	1/105	1–3	IC/SC, Risks	0.27	−0.14/0.69
Rohsenow, Monti, Colby, and Martin (2002)	43/43	Strong	MI	2/65	<1	Cig	−0.89	−1.88/0.09
Rosenblum, Cleland, Magura, Mahmood, and Kosanke (2005)	95/91	Strong	MET	20/1800	4–6	AI, OD	−0.14	-0.42/0.15
Saitz et al. (2007)	141/146	Weak	MI	1/30	1–3	AI, Eng	0.10	−0.17/0.37
Saunders Wilkinson, and Phillips (1995)	52/49	Weak	MI	1/60	4–6	A/C, IC/SC, Eng, OD	0.20	−0.21/0.61
Schermer, Moyers, Miller, Miller, and Bloomfield (2006)	64/62	Weak	MI	1/30	3 years	AI	0.43	−0.11/0.97
Schmaling, Blume, and Afari (2001)	16/16	Weak	MET	1/45	IM	IC/SC	0.49	−0.30/1.29
Schneider, Casey, and Kohn (2000)	30/30	Strong	MET	1/60	4–6	AI, OD	0.02	−0.46/0.51
Secades–Villa, Fernánde-Hermida, and Arnáez-Montaraz (2004)	20/20	Weak	MET	3/180	4–6	Eng	0.48	−0.21/1.17
Sellman, Sullivan, Dore, Adamson, and MacEwan (2001)	40/42	Strong	MET	4/-	4–6	AI, GWB	0.29	−0.22/0.79
Sellman et al. (2001)	40/42	Strong	MET	6/-	4–6	AI, GWB	1.20	0.64/1.76
Smith, Kratt, Heckenmeyer, and Mason (1997)	6/10	Strong	MET	19/-	4–6	Eng, Health	0.82	−0.20/1.84
Smith et al. (2001)	40/42	Weak	MI	6/-	10–12	Cig	0.09	−0.48/0.65
Soria, Legido, Escolano, Yeste, and Montoya (2006)	114/86	Weak	MET	3/60	10–12	Cig	1.00	0.32/1.69
Spirito et al. (2004)	64/60	Weak	MET	1/40	10–12	AI	0.09	−0.42/0.61
Stein, Colby, et al. (2006)	20/15	Strong	MI	1/60	1–3	AI, Mar.	0.22	−0.37/0.79
Stein, Anderson, Charuvastra, Maksad, and Friedmann (2002)	45/50	Weak	MI	2/100	4–6	AI	0.11	−0.26/0.48
Stein, Monti, et al. (2006)	69/61	Strong	MET	2/150	1–3	Eng	0.21	−0.14/0.55
Stein, Charuvastra, Maksad, and Anderson (2002)	60/49	Weak	MI	2/100	4–6	AI, risks	0.36	−0.09/0.80
Steinberg, Ziedonis, Krejci, and Brandon (2004)	32/34	Strong	MET	1/40	1–3	Eng, IC/SC	1.00	−0.02/2.02
Stephens, Roffman, and Curtin (2000)	75/79	Weak	MET	2/180	4–6	Mar.	1.20	0.81/1.59
Stephans (2004)	75/95	Strong	MET	2/180	13–24	Mar.	−0.08	−0.39/0.22
Stotts, Schmitz, Rhoades, and Grabowski (2001)	25/25	Weak	MET	2/120	IM	Eng, IC/SC, OD	0.30	−0.24/0.83
Stotts, DeLaune, Schmitz, and Grabowski (2004)	19/19	Weak	MET	4/-	IM	A/C, GWB, IC/SC	0.66	0.02/1.30
Stotts, DiClemente, and Dolan-Mullen (2002)	83/83	Weak	MET	3/54.5	4–6	Cig	0.11	−0.23/0.45
Stotts, Potts, Ingersoll, George, and Martin (2006)	17/14	Weak	MET	2/120	<1	OD	0.77	−0.06/1.60
Tappin, Lumsden, Gilmour, et al. (2000)	48/49	Strong	MET	1/-	1–3	Cig	−0.12	−0.88/0.63
Tappin, Lumsden, Mckay, et al. (2000)	48/49	Weak	MI	4/150	<1	Cig	−0.32	−1.17/0.53
Tappin et al. (2005)	351/411	Weak	MI	3.5/105	1–3	Cig	0.08	−0.27/0.43
Thevos, Kaona, Siajunza, and Quick (2000)	91/93	Strong	MI		IM	WSDP	0.73	0.31/1.15
UKAAT (2005)	293/214	Strong	MET	3/150	10–12	AI, GWB	0.04	−0.13/0.20
Valanis et al. (2002)	127/127	Weak	MI	–	13–24	Eng	0.12	−0.18/0.41

Table 1. (continued)

Study Name	*N*: Tx/Comp	Compare Group	MI or MET	Session/ Minutes	Longest Follow-up (Months)	Targeted Behavior Change	Effect Size	CI
Valanis et al. (2003)	126/127	Weak	MI	–	13–24	Eng	0.34	0.05/0.62
Walker, Roffman, Stephens, Berghuis, and Kim (2006)	47/50	Weak	MET	2/90	1–3	Mar.	0.31	0.11/0.74
Watkins et al. (2007)	167/172	Weak	MI	4/180	1–3	A/C	−0.01	−0.22/0.20
Weinstein, Harrison, and Benton (2004)	120/120	Weak	MI	7/-	10–12	Parenting	0.31	0.05/0.56
Westra and Dozois (2006)	25/30	Weak	MI	3/180	IM	A/C, Eng	0.54	−0.03/1.10
Wilhelm, Stephans, Hertzog, Rodehorst, and Gardener (2006)	20/20	Weak	MI	6/-	4–6	Parenting	0.21	−0.41/0.83

Note. Within a single study, authors often assessed several outcomes and the number of participants often varied; in such cases, we reported on the smallest number of participants in both the treatment and the comparison group. Strong indicates the comparison group was a specific intervention. Weak indicates the comparison group was one of the following: control, waitlist, reading materials, or TAU that was not specified. Effect sizes averaged across measures and outcomes within each study. A/C = ability or confidence to change; Al = alcohol; Cig = cigarettes and tobacco; Comp = comparison group; Ed Bx = eating disorder behavior; Eng = engagement or compliance; Gam = gambling; GWB = general well-being; IC/SC = intention to change/stages of change; IM = immediately after treatment; Health = increase healthy behavior; OD = other drugs; Risks = reduce risk taking behavior; WSDP - water—safe drinking practices. C.I. = Confidence Interval; Tx = treatment group.

size at the 25th percentile was 0.00, at the 50th percentile the effect size was 0.22, and at the 75th percentile the effect size was 0.50. Thus, 25% of the effect sizes were either neutral or negative, 50% of the effect sizes were greater than Cohen's classification of a small effect size, and 25% were larger than a medium effect size.

Given the wide variability of outcomes examined, populations targeted, and methods used to deliver and study MI, the overall effect size is likely too broad to guide clinical or administrative decision making. For that, we need to examine effect size variability.

How representative or homogeneous is the overall MI effect size? The overall effect size contained significant heterogeneity as evidenced by the within-class goodness of fit statistic, Q_w (131) = 228.71, $p < .001$. The presence of heterogeneity suggests that the findings vary based on features of participants and/or study characteristics, which can be further studied via moderator analyses.

What variables can account for the observed differences in MI effect sizes across these studies?

Step 1: Subdividing effect sizes using potential categorical moderators.

Based on findings from previous MI meta-analyses, we systematically examined potential moderators until between-group variance was eliminated, leaving homogeneous effect sizes that can confidently be interpreted.

Comparison group. We first examined the effect comparison group had on outcomes as the meta-analysis by Burke et al. (2003) suggested results varied based on this variable. In fact, significant heterogeneity was found, $Q_w = 14.75$ (4), $p < .01$. Further analyses (see Table 2) revealed that when MI was compared to a TAU program that involved a specific program (e.g., 12-step or cognitive-behavioral) effects were significantly lower than when compared against a waitlist/comparison group ($Q_b = 18.95$, $p < .001$), a generic TAU without a specific program ($Q_b = 11.72$, $p < .005$), or written material groups ($Q_b = 4.90$, $p < .05$). Group difference analyses revealed no other significant differences among or between other types of comparison groups. Next, all the "weak" comparison groups were combined ($g = 0.28$, $k = 88$) and compared to those studies that pitted MI against a specific treatment or a "strong" comparison group ($g = .09$, $k = 39$). Studies that compared MI to a weak comparison showed significantly higher effect sizes, $Q_b = 13.58$, $p < .001$. In addition to being interesting in its own right, this finding suggests further analyses should be run separately for those that used a strong comparison group and those that used a weak comparison group.

Dependent variable. Next, we explored whether effect sizes would differ based on the dependent variable, as it has previously been shown that MI was not equally effective for all problem types (e.g., Burke et al., 2003). Table 2 presents effect sizes organized across the 14 outcome groups with subdivisions for strong and weak comparisons. The preponderance of studies examined outcomes related to substance use, where MI originated: alcohol ($k = 68$), miscellaneous drugs ($k = 27$), tobacco ($k = 24$), and marijuana ($k = 17$). Of the 14 outcome groups, all yielded statistically significant positive effects for MI with the exception of emotional or psychological well-being, eating problems, and confidence in being able to succeed in change. The test of heterogeneity across the 11 dependent variable groupings was nonsignificant, $Q_b = 11.34$ ($df = 10$), $p = 0.34$, suggesting that the outcomes across dependent variables were, on the whole, statistically homogenous. Exploratory between group analyses were conducted, and no significant group differences were found.

In line with the finding that comparison group type moderates outcomes, MI did not show significant advantage over strong comparison groups for any outcome. When positioned against a weak comparison group, outcomes for substance use-related outcomes ranged from a low of $g = 0.16$ for miscellaneous drugs to a high of $g = 0.35$ for tobacco. These values are in the small but significant range. Of the remaining health-related behavior outcomes, the strongest effect was for gambling ($g = 0.39$), though the small number of studies also made these variables the least stable as evidenced by wide confidence intervals. The effect for increases in healthy behaviors, which comprised outcomes related to diet, exercise, and compliance with medical recommendations, was in the small range ($g = 0.19$). The effect size for reducing risky behaviors, which most often comprised outcomes related to sexual behavior and drug use, was also small ($g = 0.15$). When positioned against a weak comparison group effect sizes for the three variables that concern clients' engagement in treatment ranged from a low of g = 0.15 for confidence to a high of g = 0.35 for engagement.

As was mentioned, when compared to other active, specific treatments such as 12-step or cognitive behavioral therapy MI did not produce significant nonzero effect sizes in any outcome. In the case of tobacco ($g = -0.21$) and miscellaneous drugs ($g = -0.12$), effect sizes were in the negative range, though nonsignificant. Among substance use outcomes, then, MI is certainly better than no treatment and not significantly different from other specific treatments with some effects being greater than nil and some being negative.

Client distress level. We next questioned whether clients' level of distress or impairment would moderate MI effects. Among the three different levels of distress, between group heterogeneity was not significant, $Q_b = 2.39$ (2), $p = .67$, meaning that distress did not moderate MI effectiveness. As can be seen in Table 2, the same pattern tended to hold where outcomes were not significant if the comparison was made against a specific treatment program.

Moderators Among Studies Comparing MI to Weak Comparison Groups. The next moderator analysis examined whether results for MI compared to weak comparison groups (i.e., nonspecific TAU, waitlist control, written materials) would depend on the method of delivery—that is, MI in its basic form versus MET, which adds specific problem feedback to MI as described

Table 2. Effect Sizes for Overall Effect and Initial Moderators

Variable	*k*	Effect Size	CI	*z* Value/*p* Value	Heterogeneity *Q* Value (*df*)/*p* Value
Overall effectiveness (across studies)	132	0.22	0.17/0.27	8.75/.001*	228.71 (131)/.001*
Moderator: comparison group type					14.75 (4)/.01*
Attention	1	0.48	0.01/0.96	1.97/.050*	
Treatment as usual—nonspecific	42	0.24	0.17/0.31	6.40/.000*	
Treatment as usual—specific	39	0.09	−0.01/0.18	1.77/.080, *ns*	
Waitlist/control	35	0.32	0.22/0.42	6.49/.000*	
Written material	10	0.24	0.09/0.38	3.10/.002*	
Comparisons: combined weak	88	0.28	0.22/0.34	9.85/.000*	
Comparisons: strong	39	0.09	−0.01/0.18	1.77/.080, *ns*	13.58 (1)/.001*
Moderator: dependent variables					18.58 (13)/.14, *ns*
Health-related behaviors					
Alcohol-related problems	68	0.15	0.09/0.21	4.76/.001*	
Strong comparison	21	0.03	−0.08/0.13	0.53/.597, *ns*	
Weak comparison	47	0.20	0.12/0.27	5.31/.000*	6.90 (1)/.009*
Marijuana-related problems	17	0.26	0.10/0.43	3.17/.002*	
Strong comparison	3	0.07	−0.15/0.29	0.64/.525, *ns*	
Weak comparison	14	0.30	0.11/0.49	3.10/.002*	2.35 (1)/.125, *ns*
Tobacco-related problems	24	0.25	0.10/0.41	3.18/.002*	
Strong comparison	5	−0.21	−0.53/0.11	−1.29/.196, *ns*	
Weak comparison	18	0.35	0.22/0.48	5.20/.000*	10.60 (1)/.001*
Miscellaneous drug problems	27	0.08	−0.03/0.20	1.46/.145, *ns*	
Strong comparison	7	−0.12	−0.27/0.04	−1.45/.146, *ns*	
Weak comparison	10	0.16	0.02/0.29	2.28/.023*	6.70 (1)/.010*
Increase healthy behavior	11	0.21	0.06/0.36	2.78/.006*	
Strong comparison	4	0.30	−0.19/0.79	1.20/.229, *ns*	
Weak comparison	7	0.19	0.08/0.30	3.30/.001*	0.20 (1)/.658, *ns*
Reduce risky behavior	10	0.14	0.04/0.25	2.77/.005*	
Strong comparison	1	0.10	−0.44/0.64	0.36/.716, *ns*	
Weak comparison	9	0.15	0.04/0.26	2.66/.008*	0.03 (1)/.855, *ns*
Gambling	3	0.39	0.06/0.71	2.33/.020*	
Strong comparison			Not applicable		
Weak comparison	3	0.39	0.06/0.71	2.33/.020*	Not applicable
Emotional/psychological well-being	7	0.14	−0.02/0.30	1.67/.095, *ns*	
Strong comparison	3	0.05	−0.07/0.16	0.83/.408, *ns*	
Weak comparison	4	0.33	−0.03/0.68	1.80/.072, *ns*	2.11 (1)/.146, *ns*
Eating problems	1	0.18	−0.23/0.59	0.87/.390, *ns*	
Strong comparison	Not applicable				
Weak comparison	1	0.18	−0.23/0.59	0.87/.390, *ns*	Not applicable
Parenting practices	2	0.29	0.06/0.53	2.43/.015*	
Strong comparison	Not applicable				
Weak comparison	2	0.29	0.06/0.53	2.43/.015*	Not applicable
Drinking safe water	1	0.73	0.31/1.15	3.39/.001**	
Strong comparison	Not applicable				
Weak comparison	1	0.73	0.31/1.15	3.39/.001**	Not applicable
Approach to treatment					
Engagement	34	0.26	0.15/0.37	4.78/.001**	
Strong comparison	14	0.12	0.00/0.25	1.94/.053, *ns*	
Weak comparison	20	0.35	0.21/0.50	4.80/.000*	5.56 (1)/.018*
Intention to change	23	0.24	0.13/0.34	4.35/.001**	
Strong comparison	6	0.23	−0.09/0.55	1.40/.161, *ns*	
Weak comparison	17	0.24	0.13/0.35	4.15/.000*	0.01 (1)/.944, *ns*
Confidence/ability	11	0.18	−0.06/0.42	1.44/.149, *ns*	
Strong comparison	2	0.33	−0.08/0.74	1.50/.114, *ns*	
Weak comparison	9	0.15	−0.13/0.43	1.07/.286, *ns*	0.51 (1)/.473, *ns*
Moderator: clients' level of distress					2.39 (2)/.674, *ns*
Community sample	19	0.19	0.06/0.37	2.87/.004**	
Strong comparison	5	−0.01	−0.27/0.25	−0.09/.927, *ns*	
Weak comparison	14	0.28	0.17/0.39	5.12/.000*	4.14 (1)/.042*

(continued)

Table 2. (continued)

Variable	*k*	Effect Size	CI	*z* Value/*p* Value	Heterogeneity *Q* Value (*df*)/*p* Value
Moderate levels of distress	50	0.21	0.14/0.27	5.83/.001*	
Strong comparison	15	0.12	−0.01/0.25	1.79/.073, *ns*	
Weak comparison	35	0.24	0.15/0.32	5.55/.000*	2.40 (1)/.302, *ns*
Significant levels of distress	44	0.19	0.10/0.28	4.22/.001*	
Strong comparison	14	0.03	−0.12/0.17	0.35/.729, *ns*	
Weak comparison	30	0.26	0.16/0.35	5.08/.000*	6.47 (1)/.011*

Note. Numbers of studies vary because not all studies examined certain outcomes or reported on certain moderators. CI = confidence interval; *df* = degrees of freedom; *k* = number of studies; *ns* = nonsignificant. * $p < .05$.

above. Table 3 presents detailed information. MET ($g = 0.32$) was significantly more likely to produce positive change compared to typical MI ($g = 0.19$), $Q_b = 4.97$ (1), $p < .03$. Furthermore, between group comparisons were made by subdividing the groups that involved typical MI ($k = 33$) and those that involved MET ($k = 50$). Table 3 presents these results among MI studies with weak comparison groups.

Four other potential moderators were examined: whether a manual was used, format/role of MI in the treatment process, how fidelity to MI was assessed, and who delivered MI. Analyses revealed no significant heterogeneity in any of these four variables, suggesting that they did not moderate outcomes (all *p*s > .05). Because homogeneity was found within these four moderators, further between group comparisons were not conducted.

Moderators Among Studies Comparing MI to Strong Comparison Groups (Specific TAU). Moderator analyses for MI compared to specific TAU were run in the same order as those that did not involve a specific intervention above. Table 4 presents detailed data. Given the relatively smaller number of studies ($k = 40$), the power to detect moderators was reduced and the confidence intervals thus tended to be wider.

If the comparison group included a specific intervention, no significant difference was found whether MI was delivered via its typical format or MET, Q_b (1) = 0.03, *ns*. Thus, further moderator analyses were collapsed across these two groups. The use of a training manual ($k = 25$, $g = 0.00$) was associated with significantly smaller outcomes compared to when a manual was not used ($k = 11$, $g = 0.45$; $Q_b = 5.96$, $p < .05$), which is similar to the finding by Hettema et al. (2005). Given this difference, further moderator analyses were divided into those that did and did not use a manual. In both subgroups, the format of MI did not moderate outcomes nor did assessment of fidelity to MI or who delivered the MI intervention (all *p*s > .06).

Step 2: Examining potential continuous moderators via meta-regression. Analyses of continuous moderators were subdivided into those studies that compared MI interventions to a weak versus a strong comparison condition, as with the categorical analyses above. These results can be viewed in Table 5. Five *participant characteristics* were submitted to meta-regression: participants' average age, the percent of male participants within a sample (and by converse female), and three indicators of ethnicity. With regard to ethnicity, we assessed the percentage of the sample who was White, African American, or Hispanic. Four *study characteristics* were submitted to meta-regression: overall study rigor, the number of sessions in which MI was delivered, the number of minutes MI was delivered to the sample, and durability (the longest length of time that a follow-up assessment was taken, which replicates the categorical analysis of time since treatment). Note that the meta-regression analyses involved all possible comparisons across studies and all moderator groups. Thus, each effect size drawn from a study was entered into the regression analyses; while this does not technically violate assumptions of independence because each effect size was compared independently, some studies contributed more data than other studies because they reported on more outcome indicators.

Studies Comparing MI to Weak Comparison Groups. Only one of the participant characteristics was significantly associated with MI outcomes: Studies that included a higher percentage of African American participants in their sample had significantly better outcomes with MI, $z = 2.90$, q value = 8.43 (1, 226), $p < .01$. Average age, percentage of male participants, and percentage of White or Hispanic participants did not significantly influence MI outcomes. With regard to study characteristics, rigor, number of sessions, and durability (measurement interval beyond completion of treatment) were not related to outcomes. By contrast, the amount of services delivered was positively related to outcomes with a significant effect ($z = 4.23$) for the total number of minutes, q value = 17.89 (1, 428), $p < .01$, such that longer treatments produced higher effect sizes for MI.

Studies Comparing MI to Strong Comparison Groups (Specific TAU). Three of the participant characteristics were significantly associated with higher effect sizes. Studies that included older participants were more likely to have positive outcomes, q value = 6.22 (1, 152), $p < .01$. Contrary to the previous regression analyses, in studies that used a TAU with a specific program, a higher percentage of African American participants was negatively associated with outcomes (q value = 29.70, $p < .001$). Moreover, a significant negative relationship was

Table 3. Moderators Among Studies Comparing MI to Weak Comparison Groups (Waitlist, Written Materials, Nonspecific Treatment as Usual)

Variable	*k*	Effect Size	CI	*z* Value/*p* Value	Heterogeneity *Q* Value (*df*)/*p* Value
Moderator: motivational interviewing (MI) or Motivational Enhancement Therapy (MET)					4.97 (1)/.032*
MI	33	0.19	0.11/0.27	4.76/.001*	
MET	50	0.32	0.23/0.40	7.51/.001*	
Moderator: use of manual					
Motivational interviewing					0.53 (1)/.459, *ns*
Manual not used	10	0.24	0.08/0.40	2.94/.003*	
Manual used	23	0.17	0.08/0.26	3.82/.001*	
Motivational Enhancement Therapy					
Manual not used	10	0.34	0.16/0.51	3.81/.001*	0.23 (1)/.891, *ns*
Manual used	39	0.32	0.22/0.41	6.26/.001*	
Moderator: role of MI in treatment					
Motivational interviewing					3.07 (2)/.218, *ns*
Additive	14	0.12	0.01/0.24	2.09/.040*	
Prelude	3	0.43	0.03/0.83	2.10/.040*	
Head-to-head	16	0.23	0.12/0.33	4.12/.001*	
Motivational Enhancement Therapy					3.69 (2)/.160, *ns*
Additive	13	0.36	0.17/0.55	3.65/.001*	
Prelude	7	0.16	−0.01/0.33	1.84/.070, *ns*	
Head-to-head	31	0.34	0.23/0.45	6.11/.001*	
Moderator: fidelity to MI model examined					
Motivational interviewing					5.02 (2)/.083, *ns*
No assessment	22	0.24	0.14/0.35	4.47/.001*	
Assessed, not scored	6	0.23	0.07/0.39	2.76/.010*	
Assessed, standardized score	5	0.03	−0.13/0.19	0.36/.720, *ns*	
Motivational Enhancement Therapy					3.15 (2)/.256, *ns*
No assessment	21	0.42	0.27/0.56	5.59/.001*	
Assessed, not scored	16	0.28	0.12/0.43	3.53/.001*	
Assessed, standardized score	12	0.25	0.14/0.37	4.38/.001*	
Moderator: Who Delivered MI					
Motivational interviewing					3.09 (3)/.389, *ns*
Mental health: Bachelors	1	0.19	−0.21/0.58	0.92/.360, *ns*	
Mental health: Masters/PhD	5	0.39	0.13/0.65	2.98/.001*	
Nurse	4	0.10	−0.11/0.31	0.93/.350, *ns*	
Student	3	0.23	−0.09/0.54	1.43/.150, *ns*	
Motivational Enhancement Therapy					0.47 (3)/.933, *ns*
Mental health: Bachelors	7	0.27	0.07/0.46	2.67/.008*	
Mental health: Masters/PhD	7	0.39	0.06/0.72	2.29/.022*	
Nurse	1	0.30	0.04/0.55	2.28/.022*	
Student	3	0.23	−0.13/0.59	1.25/.212, *ns*	

Note. Numbers of studies vary because not all studies examined certain outcomes or reported on certain moderators. CI = confidence interval; *df* = degrees of freedom; *k* = number of studies; *ns* = nonsignificant. * $p < .05$.

found for the percentage of White participants (q value = 6.27, $p < .01$). Thus, the higher the relative number of African American or White participants in the study (i.e., the lower the number of participants from other ethnic groups), the lower the overall mean MI effect sizes. Only one significant relationship emerged for the study characteristics in this subgroup. There was a significant negative relationship between study rigor and outcomes, q value = 8.80 (1, 253), $p < .01$, such that studies with higher rigor ratings yielded lower effect sizes for MI.

Step 3: Three further questions—treatment length, durability, and group MI

Time in treatment. To investigate whether MI is efficient compared to specific TAU or strong comparison groups, we assessed the number of appointments and total amount of time (minutes) spent in treatment. With regard to number of appointments, MI groups ($M = 3.70$, $SD = 3.82$) did not significantly differ from specific TAU groups ($M = 4.37$, $SD = 4.81$), t (51) = 1.38, *ns*. With regard to total time spent with clients (measured in minutes), specific TAU groups ($M = 308$, $SD = 447$) tended to meet for a longer time than MI groups ($M = 207$, $SD = 332$), t (30) = 1.84, $p < .08$, though this difference did not reach statistical significance.

Table 4. Moderator Analyses for Studies Compared to Treatment as Usual Groups With a Specific Treatment Program

Variable	*K*	Effect Size	CI	z Value/*p* Value	Heterogeneity *Q* Value (*df*)/*p* Value
Moderator: motivational interviewing (MI) or Motivational Enhancement Therapy					0.03 (1)/.867, *ns*
Motivational interviewing	15	0.05	−0.10/0.19	0.64/.534, *ns*	
Motivational Enhancement Therapy	23	0.06	−0.04/0.17	1.16/.245, *ns*	
Moderator: use of training manual					5.96 (1)/.049*
Manual used	25	0.00	−0.07/0.07	−0.08/.931, *ns*	
Manual not used	11	0.45	0.09/0.81	2.46/.024*	
Moderator: role of MI in treatment					
Manual used					0.95 (1)/.624, *ns*
Additive	11	−0.03	−0.16/0.10	−0.43/.667, *ns*	
Prelude	6	0.07	−0.08/0.22	0.91/.362, *ns*	
Head-to-head	8	0.02	−0.10/0.14	0.27/.392, *ns*	
Manual not used					5.75 (2)/.056, *ns*
Additive	4	0.10	−0.43/0.62	0.36/.721, *ns*	
Prelude	3	1.06	0.47/1.66	3.52/.001*	
Head-to-head	4	0.54	0.13/0.96	2.57/.014*	
Moderator: fidelity to MI model examined					
Manual used					1.28 (2)/.533, *ns*
No assessment	7	0.08	−0.06/0.21	1.12/.261, *ns*	
Assessed, not scored	7	−0.03	−0.22/0.17	−0.29/.767, *ns*	
Assessed, standardized score	11	−0.01	−0.11/0.09	−0.24/.806, *ns*	
Manual not used					Not applicable
No assessment	11	0.45	0.09/0.81	2.46/.013*	
Insufficient studies to make comparisons on: assessed, not scored and assessed, standardized score					
Moderator: who delivered MI					
Manual used					3.76 (3)/.294, *ns*
Mental health: Bachelors	5	−0.00	−0.21/0.21	−0.01/.989, *ns*	
Mental health: Masters/PhD	2	−0.04	−0.24/0.17	−0.36/.721, *ns*	
Nurse	2	0.36	0.01/0.72	1.98/.045*	
Student	2	0.05	−0.19/0.28	0.38/.715, *ns*	
Manual not used					1.34 (2)/.511, *ns*
Mental health: Masters/PhD	1	0.69	−0.18/1.56	1.56/.115, *ns*	
Nurse	1	0.52	−0.27/1.30	1.28/.204, *ns*	
Student	2	1.06	0.49/1.62	3.66/.001*	

Note. Numbers of studies vary because not all studies examined certain outcomes or reported on certain moderators. CI = confidence interval; *df* = degrees of freedom; *k* = number of studies; *ns* = nonsignificant. * $p < .05$.

Durability. To support continuous analyses of durability, outcomes were grouped into five different time frames: immediately following treatment ($g = 0.15$, $k = 15$), 3 months beyond treatment ($g = 0.14$, $k = 45$), between 4 and 12 months beyond treatment ($g = 0.29$, $k = 32$), up to 2 years beyond treatment ($g = 0.24$, $k = 3$), and 25 months or more ($g = 0.24$, $k = 2$). No significant differences emerged between time frames, $Q_b = 5.27$ (4), $p = .38$, *ns*. With the exception of the longest time frame, all effect sizes were significantly greater than zero (all *p*s < .02).

Delivery mode. Interest in group-delivered MI exists, yet no meta-analysis has investigated delivery mode as a moderator. We found very few studies that delivered MI in a group format (see Table 6), so we ran this analysis separately from the other moderators. Whereas no statistically significant differences were found, visual inspection suggests that delivering MI through a group format only may dilute effects compared to when MI is also delivered individually. The small number of studies addressing this question certainly warrants caution when making inferences from these results.

Discussion

From a broad perspective, a robust literature exists that examines the ability of MI to promote healthy behavior change across a wide variety of problem areas. That 119 studies met our inclusion criteria is remarkable and suggests MI is an approach that will be part of the treatment landscape for the foreseeable future. To guide practitioners and researchers, we now pose and answer several practical questions that flow from this meta-analysis below.

Does MI Work?

To the degree that MI is rooted in health care, social work, and psychology settings, the question of "does it work" is relevant. Our analyses strongly suggest that MI does exert small though

Table 5. Meta-Regression: Continuous Moderator Analyses

	Slope	z Value	q Value (df)	p Value
Comparison groups: waitlist, TAU, and written materials				
Participant characteristics				
Average age	−0.001	−0.63	0.41 (1, 234)	.53, *ns*
% Male	−0.001	−0.89	0.80 (1, 224)	.37, *ns*
% White	0.001	0.67	0.44 (1, 319)	.51, *ns*
% African American	0.003	2.90	8.43 (1, 226)	.004*
% Hispanic	0.002	0.76	0.58 (1, 186)	.45, *ns*
Study characteristics				
Rigor	−0.010	−1.50	2.26 (1, 485)	.13, *ns*
Dose: # of sessions	0.015	1.30	1.68 (1, 516)	.20, *ns*
Dose: # of minutes	0.001	3.85	14.82 (1, 403)	.001*
Durability: F/U time	0.002	0.18	0.03 (1, 543)	.85, *ns*
Comparison groups: TAU with specific treatment				
Participant characteristics				
Average age	0.006	2.49	6.22 (1, 152)	.01*
% Male	−0.000	−0.19	0.05 (1, 133)	.85, *ns*
% White	−0.003	−2.51	6.27 (1, 213)	.01*
% African American	−0.007	−5.45	29.70 (1, 130)	.001*
% Hispanic	−0.001	−0.39	0.15 (1, 80)	.70, *ns*
Study characteristics				
Rigor	−0.028	−2.97	8.80 (1, 253)	.01*
Dose: # of sessions	0.003	0.30	0.09 (1, 260)	.77, *ns*
Dose: # of minutes	0.000	0.07	0.01 (1, 177)	.94, *ns*
Durability: F/U time	−0.017	−1.04	1.09 (1,278)	.30, *ns*

Note. Degrees of freedom of studies vary because not all studies examined certain outcomes or reported on certain moderators. * $p < .05$.

Table 6. Mode of Delivery: Group, Individual, or Combined Delivery

	N	Effect Size	CI	z Value/p Value
Collapsed across weak and strong comparisons				
Combined	3	0.45	−0.46/1.36	0.96 (.34, *ns*)
Group	5	0.05	−0.19/0.28	0.38 (0.38, *ns*)
Individual	104	0.23	0.17/0.28	7.76 (.001*)
MI compared to weak comparison groups				
Combined	2	0.76	−1.02/2.55	0.84 (.40, *ns*)
Group	2	0.33	0.02/0.64	2.09 (0.04*)
Individual	76	0.28	0.22/0.34	8.89 (.001*)
MI compared to strong comparison groups				
Combined	1	0.15	0.89/1.20	0.29 (.77, *ns*)
Group	3	0.13	0.33/0.08	2.09 (0.23, *ns*)
Individual	29	0.06	0.04/0.16	1.12 (.25, *ns*)

Note. CI = confidence interval. Numbers of studies vary because not all studies examined certain outcomes or reported on certain moderators. * $p < .05$.

significant positive effects across a wide range of problem domains, although it is more potent in some situations compared to others, and it does not work in all cases. When examining all the effect sizes in this review, the bottom 25% included effect sizes that ranged from zero to highly negative outcomes, which means MI was either ineffective or less effective when compared to other interventions or groups about a quarter of the time. Remember, a negative effect size does not necessarily suggest that participants receiving MI were directly harmed—just that the comparison group either progressed more or regressed less. Conversely, a full 75% of participants gained some improvement from MI, with 50% gaining a small but meaningful effect and 25% gaining to a moderate or strong level. Our results resemble findings from other meta-analyses of treatment interventions. Specially, Lipsey and Wilson (1993) generated a distribution of mean effect sizes from 302 meta-analyses of psychological, behavioral, or educational interventions, reporting the mean and median effect sizes to be around 0.50 ($SD = 0.29$). The results of our meta-analysis are generally within one standard deviation of this mean effect size, indicating that MI produces effects consistent with other human change interventions.

Should I or My Agency Consider Learning or Adopting MI?

On the whole, the data suggest "yes." While we did not perform a cost-benefit analysis, adopting MI is very likely to produce a statistically significant and positive advantage for clients and may do so in less time. Note that, when compared to other active treatments such as 12-step and cognitive behavioral therapy (CBT), the MI interventions took over 100 fewer minutes of treatment on average yet produced equal effects. This holds across a wide range of problem areas, including usage of alcohol, tobacco, and marijuana. Furthermore, MI is likely to lead to client improvement when directed at increasing healthy behaviors and/or decreasing risky or unhealthy behaviors as well increasing client engagement in the treatment process. Of course, in MI fashion, the decision to adopt or even consider adopting MI requires considerable thought and is ultimately an individual (or agency) choice.

Is MI Only Indicated for Substance Use Problems?

No. Although MI originated in substance abuse fields, its effectiveness is currently much broader. While most of the studies included in this analysis were related to substance use problems, MI was also effective for other addictive problems such as gambling as well as for enhancing general health-promoting behaviors. Furthermore, MI was associated with positive gains in measures of general well-being (e.g., lower stress and depression levels), which is interesting because MI is geared toward motivating clients to make some form of change and directly targets clients' engagement in the change process. Thus, it may be that MI increased client well-being indirectly, after they had made successful changes in certain areas of their life.

Is MI Successful in Motivating Clients to Change?

Yes. MI significantly increased clients' engagement in treatment and their intention to change, the two variables most closely linked to motivation to change. MI certainly shows potential to enhance client change intentions and treatment engagement, as well as possibly boost their confidence in their ability to change.

Is MI Only Successful With Very Troubled Clients?

No. Our results suggest MI is effective for individuals with high levels of distress as well as for individuals with relatively low levels of distress. In fact, a recent study comparing MI to CBT for generalized anxiety disorder revealed that receiving MI was substantively and specifically beneficial for those reporting high worry severity at baseline, compared to those reporting severity not receiving MI (Hal Arkowitz, personal communication, November 2008).

Is MI as Successful as Other Interventions?

To begin, MI is certainly better than no treatment and weak treatment such as a written materials or nonspecific TAU groups as judged by the significant positive changes. Furthermore, MI mostly held its own with specific TAU groups. While MI was not significantly better than such groups, it was at least as successful except in the case of tobacco use and miscellaneous drug-use problems. This finding mirrors the general "Dodo bird verdict" from psychotherapy reviews and meta-analyses that no one intervention model or theory is clearly superior (see Prochaska & Norcross, 2007). If MI is as successful as other interventions, then decision making about whether to adopt MI rests more with practical and theoretical considerations. Ease of learning MI and costs are practical concerns, whereas theoretical issues pertain to whether the individual or agency can adopt a client-centered model that emphasizes collaboration with clients over directing and pushing people to change. Of interest, MI does not require more resources, such as number of sessions or amount of time, and may require less time to achieve results similar to other specific treatments.

Are the Effects of MI Durable?

Our analyses suggest that they are. Results did not significantly differ when participants' improvements were measured immediately following treatment, 3 months beyond treatment, or up to a year following treatment completion. This finding comes from over 97 comparisons with a minimum of 15 for each time frame; furthermore, our regression analyses showed a nonsignificant relationship across 842 effect sizes where time could be classified. Our results also suggest MI was durable at the 2-year mark and beyond, though so few studies evaluated such long-term outcomes that confidence has to be tempered pending further research.

Should Practitioners Learn "Basic MI" or "MET?"

The answer to this question depends on many factors, such as whether standardized assessment tools exist for the target problem area under consideration and whether another specific intervention is already being used. First, if the main goal of the practitioner is to combine MI with other psychotherapy techniques such as CBT (e.g., Anton et al., 2006) or use MI as in integrative framework throughout treatment for clinical problems like depression (e.g., Arkowitz & Burke, 2008), then basic MI is the best choice. If the goal is to target specific behavior changes, however, then our review suggests that if another specific program is not currently being used, employing MET will produce significantly better results than only using MI. This makes theoretical sense because MET is "MI plus," adding a problem feedback component to the MI paradigm that could constitute an effective treatment in its own right. Furthermore, if one considers the findings originating from Project MATCH (1997, 1998), where MET produced results equal to CBT and 12-step in considerably less time, adopting MET seems like the right choice to specifically target addictive or other problem behaviors. Finally, MET may be easier to learn/train because it is more focused than basic MI.

Is Manual-Guided MI Superior to the Alternative?

Our results suggest not. When MI was compared to a weak comparison group, the use of a manual did not matter, whereas when MI was compared to a specific TAU, the use of a manual was significantly less effective. Hettema et al. (2005) found the use of a manual detracted from outcomes; our results suggest that this may be the case only when MI is being compared to a specific TAU. On one hand, treatment manuals should encourage fidelity to the MI approach, although fidelity also showed no significant correlations with MI outcome. Yet, MI by definition strives toward a humanistic, client-centered approach where a manual may interfere with truly centering on the client by causing practitioners to focus unduly on the manual. To our knowledge, no primary study has explicitly tested this question in a MI context and we hope future research into the process of MI will do so.

Does the Format or Role of MI Influence Outcomes?

MI is a versatile approach. It has been used as additive to other interventions, as a prelude to another treatment where the assumption is that MI will serve a preparatory role, and as a stand-alone intervention. Our data suggest that MI format does not matter as judged by homogenous effect sizes. However, visual inspection revealed a fair amount of variability across different conditions, suggesting that basic MI may work best as a prelude to further treatment (as in Burke et al., 2003), whereas MET may be optimal as an additive or stand-alone intervention.

The overall finding that format of MI does not significantly influence its outcome fits with its basic philosophy. MI aims to improve the working alliance with a client, to manage resistance, to express empathy, and to build motivation to change while addressing ambivalence about change. These targeted goals seem broadly acceptable to most change efforts and are likely useful at any stage of an intervention process. Thus, it appears that one of the strengths of MI lies in its portability across many different treatment formats or roles.

Does Level of Training Influence Success of MI?

Our data suggest "no." However, very few studies contributed data to this question, and any inferences must be made tentatively. Of note, William Miller has stated (personal communication, December 2006) that what is most important is a helping professional's ability to empathize with clients and not their training background (e.g., nursing, social work, psychology). Moreover, research has often suggested that little difference can be attributed to professional training in psychological arenas (e.g., Berman & Norton, 1985).

Does MI Dosage Matter?

Our answer is that it likely does. When MI conditions were compared to weak (and shorter) alternatives, a significant positive relationship was found, suggesting a dose effect—i.e., more treatment time was related to better outcomes for MI. The data therefore suggest that it cannot hurt to provide more MI and that it is unreasonable to assume that a very short MI intervention will lead to lasting change. That said, our data cannot suggest minimum or maximum levels of MI-related contact. Many MI practitioners anecdotally report that MI becomes integrated within much of their treatment, such that it cannot be separated from other interventions, which thereby makes the question of dosage less pertinent.

Does MI Work for Most Clients?

We cannot provide a simple response to this important question based on our review, although our data do suggest a few insights in that regard. On the whole, MI appears broadly capable of helping across many problem domains ranging from addictive to health-promoting behaviors. We also looked at two participant characteristics: age and ethnicity. Regression analyses showed a significant relationship between participants' average age and outcomes only when MI was compared to specific TAU, where studies with older participants yielded better results for MI. Considering developmental issues, MI is conducted within a cognitive medium and requires some degree of abstract reasoning that should be present after the age of 12 years (based on Piaget's (1962) model) and thus may not be as helpful for preteen children.

Our data also provide a mixed picture with regard to race. When MI was compared with a weak alternative, a significant positive correlation was found between percentages of African American participants and, to a lesser degree, Hispanic Americans for MI outcomes. Furthermore, when MI was compared to a strong alternative (specific TAU), a lower percentage of Whites and a lower percentage of African Americans (i.e., a higher percentage of other minorities) was significantly related to better MI outcomes. Taken together, these findings suggest that MI may be particularly effective with clients from minority ethnic groups (but not necessarily African Americans), a pattern similar to that reported by Hettema et al. (2005). We conjecture that MI may be particularly attractive to groups who have experienced social rejection and societal pressure because MI adopts a humanistic approach that prizes self-determination, although why results would differ by comparison group type is not clear to us at this juncture.

Does MI Work in Group Formats?

Limited data can be applied to this question because only eight studies used some form of group delivery; however, our interpretation of the data is that relying solely on group-delivered MI would be a mistake. While no statistically significant differences emerged based on delivery mode (individual, group, or combined), visual inspection of Table 6 seems to discourage group-only delivery and may favor a combined approach instead.

In summary, the combined results of the present meta-analysis as well as those previously published meta-analyses suggest a relatively low risk in implementing MI because it

works across a wide range of problem behaviors/types and is unlikely to harm clients. Compared to other active and specific treatments, MI was equally effective in our review and shorter in length. When compared to weaker alternatives—such as waitlist, control groups, nonspecific TAU, or written material—MI provides a small yet significant advantage for a diverse array of clients regardless of symptom severity, age, and gender, with possibly an even stronger advantage for minority clients.

It is our sense that MI enjoys a clear and articulate theoretical frame accompanied by specific techniques that can readily be learned (e.g., Arkowitz & Miller, 2008; Markland, Ryan, Tobin, & Rollnick, 2005; Miller & Rollnick, 2004; Vansteenkiste & Sheldon, 2006). Indeed, a rather large body of training materials and trainers for MI has emerged along with mounting research addressing training effectiveness (e.g., see Burke, Dunn, Atkins, & Phelps, 2004), resulting in a rather standardized training approach (see motivationalinterviewing.org). Moreover, MI researchers are also investing much time and energy into best practices in training MI (Teresa Moyers, personal communication, November 2008) and efforts to assess fidelity to MI are well underway (e.g., Miller, 2002). Furthermore, MI has been judged to be an evidenced-based practice by organizations such as SAMHSA (Substance Abuse and Mental Health Service Administration). In sum, 25 years of MI research has generated broad scientific inquiry and deep scrutiny, and the MI approach has clearly passed the initial test.

The results of our meta-analysis suggest several potentially fruitful avenues for future MI research. In this review, we made the point that MI may well be more cost-effective than viable alternative treatments even if they are not more clinically effective. While only a handful of MI studies have examined this important variable to date, cost-effectiveness research would certainly add significantly to the MI literature and would be of special interest to policy makers and clinical administrators alike.

Furthermore, although a substantial amount of thought, practice, and research has already been devoted to MI, we still do not understand the precise links between its processes and outcomes (Burke et al., 2002). MI may work via increasing a specific type of client change talk—what they say in session about their *commitment* to making behavioral changes—and decreasing client speech that defends the status quo (Amrhein, Miller, Yahne, Palmer, & Fulcher et al., 2003). Consistent with its client-centered background, MI may also work through therapist interpersonal skills (such as accurate empathy as measured by the MISC; Miller, 2002), which are positively associated with client involvement as defined by cooperation, disclosure, and expression of affect (Moyers, Miller, & Hendrickson et al., 2005). Thus, there may be two specific active components underlying the MI mechanism: a *relational* component focused on empathy and the interpersonal spirit of MI, both of which minimize client resistance, and a *technical* component involving the differential evocation and reinforcement of client change talk (Miller & Rose, 2009).

Finally, a considerable body of theory and research suggests that MI may be effective for clinical areas beyond the addictions, such as for depression and anxiety disorders (Arkowitz et al., 2008). Our review is supportive of such an assertion because virtually anytime MI has been tested empirically in new areas (e.g., health-promoting behaviors); it has shown positive and significant effects. Thus, we have likely not yet found the limits of the types of problems and symptoms to which MI can be profitably applied.

Authors' Note

The first and last authors are affiliated with the MINT group and may, therefore, be biased. To control for this bias we explicitly instructed our research team that positive and negative findings were welcomed and expected. Further, we consciously determined to present the results regardless of whether they supported or undermined MI's effectiveness. Lastly, we strove to clearly detail our methodology to be transparent and to encourage possible replication.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

Funding

The Utah Criminal Justice Center, housed within the University of Utah, funded two research assistants (CK, CB) for this project.

Acknowledgments

Thanks to the Utah Criminal Center who paid for the RAs; thanks to the J. Willard Marriott Library.

Appendix

Rating Study Rigor

Studies received 1-point if they did the following: reported on three or more demographic indicators of the sample, collected data at a follow-up period beyond immediate completion of the study, included more than one site, reported data from all dependent variables they assessed, utilized coders who were "blind" to participants' group assignment, utilized objective measurement tools (e.g., records, physiological indicators) instead of relying solely on client self-report, utilized a manual to direct training or standardized delivery, reported on dropouts, and included more than 20 participants in the intervention and comparison groups. Studies earned up to 2 points if the data used to calculate effect sizes came from means, standard deviations, and/or numbers of participants (percentages), 1 point if an exact statistic was used (e.g., *t* test), and no point if effect sizes were derived from *p* values. Studies earned 2 points if measurement of outcomes came from at least two sources (e.g., participant and collateral source), 1 point if collateral only, and no point if participant only. Studies earned 2 points if fidelity was assessed and considered high, 1 point if fidelity was assessed but not scored, and no point if fidelity was not measured. Lastly, studies earned 3 points if true randomization was used, 2 points if matched groups were used, 1 point if the

groups were tested for pretreatment equivalence, and no point if groups were not equivalent or equivalence could not be determined.

References

References marked with an asterisk "*" indicate studies included in the meta-analysis.

*Ahluwalia, J. S., Okuyemi, K., Nollen, N., Choi, W. S., Kaur, H., Pulvers, K., et al. (2006). The effects of nicotine gum and counseling among African American light smokers: A 2 x 2 factorial design. *Addiction*, *101*, 883-891.

Amrhein, P. C., Miller, W. R., Yahne, C. E., Palmer, M., & Fulcher, L. (2003). Client commitment language during motivational interviewing predicts drug use outcome. *Journal of Consulting and Clinical Psychology*, *71*, 862-878.

*Anton, R. F., Moak, D. H., Latham, P., Waid, L. R., Myrick, H., Voronin, K., et al. (2005). Naltrexone combined with either cognitive behavioral or motivational enhancement therapy for alcohol dependence. *Journal of Clinical Psychopharmacology*, *25*, 349-357.

Anton, R. F., O'Malley, S. S., Ciraulo, D. A., Cisler, R. A., Couper, D., & Donovan, D. M. et al. (2006). Combined pharmacotherapies and behavioral interventions for alcohol dependence. The COMBINE study: A randomized controlled trial. *Journal of the American Medical Association*, *295*, 2003-2017.

Arkowitz, H., & Burke, B. L. (2008). Motivational interviewing as an integrative framework for the treatment of depression. In H. Arkowitz, H. A. Westra, W. R. Miller, & S. Rollnick (Eds.), *Motivational interviewing in the treatment of psychological problems,* (pp. 145-172). New York: Guilford.

Arkowitz, H., & Miller, W. (2008). Learning, applying, and extending motivational interviewing. In H. Arkowitz, H. A. Westra, W. R. Miller, & S. Rollnick (Eds.), *Motivational interviewing in the treatment of psychological problems,* (pp. 1-25). New York: Guilford.

Arkowitz, H., Westra, H. A., Miller, W. R., & Rollnick, S. (2008). *Motivational* interviewing in the treatment of psychological problems. New York: Guilford.

*Baer, J. S., Kivlahan, D. R., Blume, A. W., MacKnight, P., & Marlatt, G. A. (2001). Brief intervention for heavy-drinking college students: 4-year follow up and natural history. *American Journal of Public Health*, *91*, 1310-1316.

*Baker, A., Heather, N., Wodak, A., Dixon, J., & Holt, P. (1993). Evaluation of a cognitive-behavioral intervention for HIV prevention among injecting drug users. *AIDS*, *7*, 247-256.

*Baker, A., Lewin, T., Reichler, H., Clancy, R., Carr, V., Garret, R., et al. (2002). Evaluation of a motivational interview for substance use within psychiatric in-patient services. *Addiction*, *97*, 1329-1337.

*Ball, S. A., Todd, M., Tennen, H., Armeli, S., Mohr, C., Affleck, G., et al. (2007). Brief motivational enhancement and coping skills interventions for heavy drinking. *Addictive Behaviors*, *32*, 1105-1118.

*Baros, A. M., Latham, P. K., Moak, D., Voronin, K., & Anton, R. F. (2007). What role does measuring medication compliance play in evaluating the efficacy of Naltrexone? *Alcoholism: Clinical and Experimental Research*, *31*, 596-603.

*Beckham, N. (2007). Motivational interviewing with hazardous drinkers. *Journal of the American Academy of Nurse Practitioners*, *19*, 103-110.

*Bennett, J. A., Perrin, N. A., Hanson, G., Bennett, D., Gaynor, W., Flaherty-Robb, M., et al. (2005). Healthy aging demonstration project: Nurse coaching for behavior change in older adults. *Research in Nursing and Health*, *28*, 187-197.

Berman, J. S., & Norton, N. C. (1985). Does professional training make a therapist more effective? *Psychological Bulletin*, *98*, 401-407.

*Bernstein, J., Bernstein, E., Tassiopoulus, K., Heeren, T., Levenson, S., & Hingson, R. (2005). Brief motivational intervention at a clinic visit reduces cocaine and heroin use. *Drug and Alcohol Dependence*, *77*, 49-59.

*Bien, T. H., Miller, W. R., & Boroughs, J. M. (1993). Motivational interviewing with alcohol outpatients. *Behavioral and Cognitive Psychotherapy*, *21*, 347-356.

*Booth, R. E., Corsi, K. F., & Mikulich-Gilbertson, S. K. (2004). Factors associated with methadone maintenance treatment retention among street-recruited injection drug users. *Drug and Alcohol Dependence*, *74*, 177-185.

*Booth, R. E., Kwiatkowski, C., Iguchi, M., Pinto, F., & John, D. (1998). Facilitating treatment entry among out-of-treatment injection drug users. *Public Health Reports*, *113*, 117-129.

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2005). Comprehensive Meta-Analysis (Version 2) [Computer software]. Englewood, NJ: Biostat.

*Borrelli, B., Novak, S., Hecht, J., Emmons, K., Papandonatos, G., & Abrams, D. (2005). Home health care nurses as a new channel for smoking cessation treatment: Outcomes from project CARES (Community-nurse Assisted Research and Education on Smoking). *Preventive Medicine*, *41*, 815-821.

*Bowen, D., Ehret, C., Pedersen, M., Snetselaar, L. Johnson, M., Tinker, L., et al. (2002). Results of an adjunct dietary intervention program in the woman's health initiative. *Journal of the American Dietetic Association*, *102*, 1631-1637.

*Brodie, D. A., & Inoue, A. (2005). Motivational interviewing to promote physical activity for people with chronic heart failure. *Journal of Advanced Nursing*, *50*, 518-527.

*Brown, J. M., & Miller, W. R. (1993). Impact of motivational interviewing on participation and overcome in residential alcoholism treatment. *Psychology of Addictive Behavior*, *7*, 211-218.

*Brown, T. G., Dongier, M., Latimer, E., Legault, L., Seraganian, P., Kokin, M., et al. (2006). Group-delivered brief intervention versus standard care for mixed alcohol/other drug problems: A preliminary study. *Alcoholism Treatment Quarterly*, *24*, 23-40.

Burke, B., Arkowitz, H., & Dunn, C. (2002). The efficacy of motivational interviewing. In W. R. Miller, & S. Rollnick (Eds.), *Motivational interviewing: Preparing people for change* (2nd ed. pp. 217-250). New York: Guilford.

Burke, B. L., Arkowitz, H., & Menchola, M. (2003). The efficacy of motivational interviewing: A meta-analysis of controlled clinical trials. *Journal of Consulting and Clinical Psychology, 71,* 843-861.

Burke, B. L., Dunn, C. W., Atkins, D., & Phelps, J. S. (2004). The emerging evidence base for motivational interviewing: A meta-analytic & qualitative inquiry. *Journal of Cognitive Psychotherapy*, *18*, 309-322.

*Butler, C. C., Rollnick, S., Cohen, D., Bachman, M., Russell, I., & Stott, N. (1999). Motivational consulting versus brief advice for smokers in general practice: A randomized trial. *British Journal of General Practice*, *49*, 611-616.

*Carey, M. P., Baaten, L. S., Maisto, S. A., Gleason, J. R., Forsyth, A. D., Durant, L. E., et al. (2000). Using information, motivational enhancement, and skills training, to reduce the risk of HIV infection for low-income urban women: A second randomized clinical trial. *Health Psychology*, *19*, 3-11.

*Carroll, K. M., Ball, S. A., Nich, C., Martino, S., Frankforter, T. L, Farentinos, C, et al. (2005). Motivational interviewing to improve treatment engagement and outcome in individuals seeking treatment for substance abuse: a multisite effectiveness study. *Drug and Alcohol Dependence*, *81*, 301-312.

*Carroll, K. M., Libby, B., Sheehan, J., & Hyland, N. (2001). Motivational interviewing to enhance treatment initiation in substance abusers: An effectiveness study. *The American Journal on Addictions*, *10*, 335-339.

*Channon, S. J., Huws-Thomas, M. V., Rollnick, S., Hood, K., Cannings-John, R. L., Rogers, C., et al. (2007). A multicenter randomized controlled trial of motivational interviewing in teenagers with diabetes. *Diabetes Care*, *30*, 1390-1395.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

*Colby, S. M., Monti, P. M., Barnett, N. P., Rosenhow, D. J., Weissman, K., & Spirito, A. et al. (1998). Brief motivational interviewing in a hospital setting for adolescent smoking: A preliminary study. *Journal of Consulting and Clinical Psychology*, *66*, 574-578.

*Colby, S. M., Monti, P. M., Tevyaw, T. O., Barnett, N. P., Spirito, A., Rosenhow, D. J., et al. (2005). Brief motivational intervention for adolescent smokers in medical settings. *Addictive Behaviors*, *30*, 865-874.

*Connors, G. J., Walitzer, K. S., & Dermen, K. H. (2002). Preparing clients for alcoholism treatment: Effects on treatment participation and outcomes. *Journal of Consulting and Clinical Psychology*, *70*, 1161-1169.

Cooper, H., & Hedges, L. V. (1994). *The handbook of research synthesis.* New York: Russell SAGE.

*Curry, S. J., Ludman, E. J., Graham, E., Stout, J., Grothaus, L., & Lozano, P. (2003). Pediatric-based smoking cessation intervention for low-income based women. *Archives of Pediatrics and Adolescent Medicine*, *157*, 295-302.

*Daley, D. C., Salloum, I. M., Zuckoff, A., Kirisci, L., & Thase, M. E. (1998). Increasing treatment adherence among outpatients with depression and cocaine dependence: Results of a pilot study. *American Journal of Psychiatry*, *155*, 1611-1613.

*Davidson, D., Gulliver, S. B., Longabaugh, R., Wirtz, P. W., & Swift, R. (2006). Building better cognitive-behavioral therapy: Is broad-spectrum treatment more effective then motivational-enhancement therapy for alcohol-dependent patients treated with Naltrexone? *Journal of Studies on Alcohol and Drugs*, *68*, 238-247.

*Davis, T. M., Baer, J. S., Saxon, A. J., & Kivlahan, D. R. (2003). Brief motivational feedback improves post-incarceration treatment contact among veterans with substance use disorders. *Drug and Alcohol Dependence*, *69*, 197-203.

*Dench, S., & Bennett, G. (2000). The impact of brief motivational intervention at the start of an outpatient day programme for alcohol dependence. *Behavioral and Cognitive Psychotherapy*, *28*, 121-130.

*Dunn, E. C., Neighbors, C., & Larimer, M. E. (2006). Motivational enhancement therapy and self-help treatment for binge eaters. *Psychology of Addictive Behaviors*, *20*, 44-52.

*Elliot, D. L., Goldberg, L., Kuehl, K. S. Moe, E. L., Breger, R. K. R., & Pickering, M. A. (2007). The PHLAME (Promoting Healthy Lifestyles: Alternative Model's Effects) firefighter study: Outcomes of two models of behavior change. *Journal of Occupational and Environmental Medicine*, *49*, 204-213.

*Emmen, M. J., Schippers, G. M., Wollersheim, H., & Bleijenberg, G. (2005). Adding psychologist's intervention to physician's advice to problem drinkers in the outpatient clinic. *Alcohol & Alcoholism*, *40*, 219-226.

*Emmons, K. M., Hammond, K., Fava, J. L. Velicer, W. F., Evans, J. L., & Monroe, A. D. (2001). A randomized trial to reduce passive smoke exposure in low income households with young children. *Pediatrics*, *108*, 18-24.

*Gailbraith, I. G. (1989). Minimal intervention with problem drinkers: A pilot study of the effect of two interview styles on perceived self-efficacy. *Health Bulletin*, *47*, 311-314.

*Gentilello, L. M., Rivara, F. P., Donovan, D. M., Jurkovich, G. J., Daranciang, E., Dunn, C. W., et al. (1999). Alcohol interventions in a trauma center as a means of reducing the risk of injury recurrence. *Annals of Surgery*, *230*, 473-483.

*Golin, C. E., Earp, J., Tien, H. C., Stewart, P., Porter, C., & Howie, L. (2006). A 2-arm, randomized, controlled trial of a motivational interviewing-based intervention to improve adherence to antiretroviral therapy (ART) among patients failing or initiating ART. *Journal of Acquired Immune Deficiency Syndromes*, *42*, 42-51.

*Graeber, D. A., Moyers, T. B., Griffith, G., Guajardo, E., & Tonigan, S. (2003). A pilot study comparing motivational interviewing and an educational intervention in patients with schizophrenia and alcohol use disorders. *Community Mental Health Journal*, *39*, 189-202.

*Gray, E., McCambridge, J., & Strang, J. (2005). The effectiveness of motivational interviewing delivered by youth workers in reducing drinking, cigarette and cannabis smoking among young people: Quasi-experimental pilot study. *Alcohol & Alcoholism*, *40*, 535-539.

*Grenard, J. L., Ames, S. L., Wiers, R. W., Thush, C., Stacy, A.W., & Sussman, S. (2007). Brief intervention for substance use among at risk adolescents: A pilot study. *Journal of Adolescent Health*, *40*, 188-191.

*Handmaker, N. S., Miller, W. R., & Manicke, M. (1999). Findings of a pilot study of motivational interviewing with pregnant drinkers. *Journal of Studies on Alcohol*, *60*, 285-287.

*Harland, J., White, M., Drinkwater, C., Chinn, D., Farr, L., & Howel, D. (1999). The Newcastle exercise project: a randomized controlled trial of methods to promote physical activity in primary care. *British Medical Journal*, *319*, 828-832.

*Haug, N. A., Svikis, D. S., & DiClemente, C. (2004). Motivational enhancement therapy for nicotine dependence in methadone-maintained pregnant women. *Psychology of Addictive Behaviors*, *18*, 298-292.

*Helstrom, A., Hutchison, K., & Bryan, A. (2007). Motivational enhancement therapy for high-risk adolescent smokers. *Addictive Behaviors*, *32*, 2404-2410.

Hettema, J., Steele, J., & Miller, W. (2005). Motivational interviewing. *Annual Review of Clinical Psychology, 1,* 91-111.

*Hillsdon, M., Thorogood, M., White, I., & Foster, C. (2002). Advising people to take more exercise is ineffective: A randomized controlled trial of physical activity promotion in primary care. *International Journal of Epidemology*, *31*, 808-815.

*Hodgins, D. C. Currie, S. R., & El-Guebaly, N. (2001). Motivational enhancement and self-help treatments for problem gambling. *Journal of Consulting and Clinical Psychology*, *69*, 50-57.

*Hodgins, D. C., Currie, S. El-Guebaly, N., & Peden, N. (2004). Brief motivational treatment for problem gambling: A 24-month follow-up. *Psychology of Addictive Behaviors*, *18*, 293-296.

*Hulse, G. K., & Tait, R. J. (2002). Six month outcomes associated with a brief alcohol intervention for adult in-patients with psychiatric disorders. *Drug and Alcohol Review*, *21*, 105-112.

*Hulse, G. K., & Tait, R. J. (2003). Five year outcomes of a brief alcohol intervention for adult inpatients with psychiatric disorders. *Addiction*, *98*, 1061-1068.

*Humfress, H., Igel, V., Lamont, A., Tanner, M., Morgan, J., & Schmidt, U. (2002). The effect of a brief motivational intervention on community psychiatric patients' attitudes to their care, motivation to change, compliance and outcome: A case control study. *Journal of Mental Health*, *11*, 155-166.

Hunter, J. E., & Schmidt, F. L. (2000). Fixed effects versus random effects meta-analysis models: Implications for cumulative research knowledge. *International Journal of Selection and Assessment*, *8*, 275-292.

*Ingersoll, K. S., Ceperich, S. D., Nettleman, M. D., Karanda, K., Brocksen, S., & Johnson, B. A. (2005). Reducing alcohol-exposed pregnancy risk in college women: Initial outcomes of a clinical trial of a motivational intervention. *Journal of Substance Abuse Treatment*, *29*, 173-180.

*Jaworski, B. C., & Carey, M. P. (2001). Effects of a brief, theory-based STD-prevention program for female college students. *Journal of Adolescent Health*, *29*, 417-425.

Johnson, B. T., Mullen, B., & Salas, E. (1995). Comparison of three major meta-analytic approaches. *Journal of Applied Psychology*, *80*, 94-106.

*Johnston, B. D., Rivara, F. P., Droesch, R. M., Dunn, C., & Copass, M. K. (2007). Behavior change counseling in the emergency department to reduce injury risk: A randomized controlled trial. *Pediatrics*, *110*, 267-274.

*Juarez, P., Walters, S. T., Daugherty, M., & Radi, C. (2006). A randomized trial of motivational interviewing and feedback with heavy drinking college students. *Journal of Drug Education*, *36*, 233-246.

*Kahler, C. W., Read, J. P., Ramsey, S. E., Stuart, G. L., McCrady, B. S., & Brown, R. A. (2004). Motivational enhancement for a 12-step involvement among patients undergoing alcohol detoxification. *Journal of Consulting and Clinical Psychology*, *72*, 736-741.

*Kelly, A. B., & Lapworth, K. (2006). The HYP program- targeted motivational interviewing for adolescent violations of school tobacco policy. *Preventive Medicine*, *43*, 466-471.

*Kidorf, M., Disney, E., King, V., Kolodner, K., Beilenson, P., & Brooner, R. K. (2005). Challenges in motivating treatment enrollment in community syringe exchange participants. *Journal of Urban Health*, *82*, 457-465.

*Kreman, R., Yates, B. C., Agrawal, S., Fiandt, K., Briner, W., & Shurmur, S. (2006). The effects of motivational interviewing on physiological outcomes. *Applied Nursing Research*, *19*, 167-170.

*Kuchipudi, V., Hobein, K., Flickinger, A., & Iber, F. L. (1990). Failure of a 2-hour motivational intervention to alter recurrent drinking behavior in alcoholics with gastrointestinal disease. *Journal of Studies on Alcohol*, *51*, 356-360.

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*, 159-174.

*Larimer, M. E., Turner, A. P., Anderson, B. K., Fader, J. S., Kilmer, J. R., Palmer, R. S., et al. (2001). Evaluating a brief alcohol intervention with fraternities. *Journal of Studies on Alcohol*, *62*, 370-380.

Lipsey, M., & Wilson, D. (1993). The efficacy of psychological, educational, and behavioral treatment: Confirmation from meta-analysis. *American Psychologist*, *48*, 1181-1209.

Lipsey, M. W. & Wilson, D. B. (2001). *Practical meta-analysis.* Applied Social Research Methods Series (Vol. 49). Thousand Oaks, CA: SAGE Publications.

*Litt, M. D., Kadden, R. M., & Stephens, R. S. (2005). Coping and self-efficacy in marijuana treatment: Results from the marijuana treatment project. *Journal of Consulting and Clinical Psychology*, *73*, 1015-1025.

*Longabaugh, R., Woolard, R. F. Nirenberg, T. D., Minugh, A. P., Becker, B., Clifford, P.R., et al. (2001). Evaluating the effects of a brief motivational intervention for injured drinkers in the emergency department. *Journal of Studies on Alcohol*, *62*, 806-817.

*Longshore, D., & Grills, C. (2000). Motivating illegal drug use recovery: Evidence for a culturally congruent intervention. *Journal of Black Psychology*, *26*, 288-301.

Lundahl, B. W., & Yaffe, J. (2007). Use of meta-analysis in Social Work and allied disciplines. *Journal of Social Service Research, 33,* 1-11.

*Maisto, S. A., Conigliaro, J., McNeil, M., Kraemer, K., Conigliaro, R. L., & Kelley, M. E. (2001). Effects of two types of brief intervention and readiness to change on alcohol use in hazardous drinkers. *Journal of Studies on Alcohol*, *62*, 605-614.

*Maltby, N., & Tolin, D. F. (2005). A brief motivational intervention for treatment-refusing OCD patients. *Cognitive Behavioral Therapy*, *34*, 176-184.

*Marijuana Treatment Project Research Group. (2004). Brief treatments for cannabis dependence: Findings from a randomized

multisite trial. *Journal of Consulting and Clinical Psychology*, *72*, 455-466.

Markland, D., Ryan, R., Tobin, V., & Rollnick, S. (2005). Motivational interviewing and self-determination theory. *Journal of Social & Clinical Psychology*, *24*, 811-831.

*Marsden, J., Stillwell, G., Barlow, H., Boys, A., Taylor, C., Hunt, N., et al. (2006). An evaluation of a brief motivational intervention among young ecstasy and cocaine users: No effect on substance and alcohol use outcomes. *Addiction*, *101*, 1014-1026.

*Martino, S., Carroll, K. M., Nich, C., & Rounsaville, B. J. (2006). A randomized controlled pilot study of motivational interviewing for patients with psychotic and drug use disorders. *Addiction*, *101*, 1479-1492.

*McCambridge, J., & Strang, J. (2004a). Deterioration over time in effect of motivational interviewing in reducing drug consumption and related risk among young people. *Addiction*, *100*, 470-478.

*McCambridge, J., & Strang, J. (2004b). The efficacy of a single-session motivational interviewing in reducing drug consumption and perceptions of drug related risk and harm among young people: Results from a multi-site cluster randomized trial. *Addiction*, *99*, 39-52.

Mhurchu, C. N., Margetts, B. M., & Speller, V. (1998). Randomized clinical trial comparing the effectiveness of two dietary interventions for patients with hyperlipidaemia. *Clinical Science*, *95*, 479-487.

*Michael, K. D., Curtin, L., Kirkley, D. E., & Jones, D. L. (2006). Group-based motivational interviewing for alcohol use among college students: An exploratory study. *Professional Psychology: Research and Practice*, *37*, 629-634.

Miller, W. R. (2002). *Motivational interviewing skill code (MISC) coder's manual*. Retrieved November 2, 2008, from http://motivationalinterview.org/training/MISC2.pdf

*Miller, W. R., Benefield, G., & Tonigan, J. S. (1993). Enhancing motivation for change in problem drinking: A controlled comparison of two therapist styles. *Journal of Consulting and Clinical Psychology, 61*, 455-461.

Miller, W. R., & Rollnick, S. (2002). *Motivational interviewing: Preparing people for change* (2nd ed.). New York: Guilford.

Miller, W. R., & Rollnick, S. (2004). Talking oneself into change: Motivational interviewing, stages of change, and the therapeutic process. *Journal of Cognitive Psychotherapy*, *18*, 299-308.

Miller, W. R., & Rose, G. S. (2009). Toward a theory of motivational interviewing. *American Psychologist, 64,* 527-537.

Miller, W. R., Sovereign, R. G., & Krege, B. (1988). Motivational interviewing with problem drinkers: II. The drinker's check-up as a preventive intervention. *Behavioural Psychotherapy*, *16*, 251-268.

*Miller, W. R., Yahne, C. E., & Tonigan, S. (2003). Motivational interviewing in drug abuse services: A randomized clinical trial. *Journal of Counseling and Clinical Psychology*, *71*, 754-763.

*Mitcheson, L., McCambridge, J., & Byrne, S. (2007). Pilot cluster-randomized trial of adjunctive motivational interviewing to reduce crack cocaine use in clients on methadone maintenance. *European Addiction Research*, *13*, 6-10.

*Monti, P. M., Colby, S. M., Barnett, N. P., Spirito, A., Rohsenow, D. J., & Myers, M. et al. (1999). Brief intervention for harm reduction with alcohol-positive older adolescents in a hospital emergency department. *Journal of Consulting and Clinical Psychology*, *67*, 989-994.

*Morgenstern, J., Parsons, J. T., Bux Jr., D. A., , Irwin, T. W., Wainberg, M. L., Muench, F., et al. (2007). A randomized controlled trial of goal choice interventions for alcohol use disorders among men who sex with men. *Journal of Counseling and Clinical Psychology*, *75*, 72-84.

Moyers, T. B., Miller, W. R., & Hendrickson, S. M. L. (2005). How does motivational interviewing work? Therapist interpersonal skill predicts client involvement within motivational interviewing sessions. *Journal of Consulting and Clinical Psychology*, *73*, 590-598.

*Mullins, S. M., Suarez, M., Ondersma, S. J., & Page, M. C. (2004). The impact of motivational interviewing on substance abuse treatment retention: A randomized control trial of women involved with child welfare. *Journal of Substance Abuse Treatment*, *27*, 51-58.

*Murphy, J. G., Duchnick, J. J., Vuchinich, R. E., Davison, J. W., Karg, J. W., Olson, A.M., et al. (2001). Relative efficacy of a brief motivational intervention for college student drinkers. *Psychology of Addictive Behaviors*, *15*, 373-379.

*Naar-King, S., Wright, K., Parsons, J. T., Frey, M., Templin, T., Lam, P., et al. (2006). Healthy choices: Motivational enhancement therapy for health risk behaviors in HIV-positive youth. *AIDS Education and Prevention*, *18*, 1-11.

*Nock, M. K., & Kazdin, A. E. (2005). Randomized controlled trial of a brief intervention for increasing participation in parent management training. *Journal of Consulting and Clinical Psychology*, *73*, 872-879.

*Peterson, P. L., Baer, J. S., Wells, E. A., Ginzler, J. A., & Garrett, S. B. (2006). Short-term effects of a brief motivational intervention to reduce alcohol and drug risk among homeless adolescents. *Psychology of Addictive Behaviors*, *20*, 254-264.

Piaget, J. (1962). The stages of the intellectual development of the child. *Bulletin of the Menninger Clinic*, *26*, 120-128.

*Picciano, J. F., Roffman, R. A., Kalichman, S. C., Rutledge, S. E., & Berghuis, J. P. (2001). A telephone based brief intervention using motivational enhancement to facilitate HIV risk reduction among MSM: A pilot study. *AIDS and Behavior*, *5*, 251-262.

Prochaska, J. O., & Norcross, J. C. (2007). *Systems of psychotherapy: A transtheoretical approach.* South Melbourne, Australia: Thompson Brooks/Cole.

Project MATCH Research Group. (1997). Matching alcoholism treatment to client heterogeneity: Project MATCH post treatment drinking outcomes. *Journal of Studies on Alcohol*, *58*, 7-29.

Project MATCH Research Group. (1998). Matching alcoholism treatment to client heterogeneity: Project MATCH three-year drinking outcomes. *Alcoholism: Clinical and Experimental Research*, *23*, 1300-1311.

Rogers, C. R. (1951). *Client centered therapy.* Boston: Houghton-Mifflin.

*Rohsenow, D. J., Monti, P. M., Colby, S. M., & Martin, R. A. (2002). Brief interventions for smoking cessation in alcoholic smokers. *Alcoholism: Clinical and Experimental Research*, *26*, 1950-1951.

Rollnick, S., Miller, W. R., & Butler, C. C. (2008). *Motivational interviewing in health care: Helping patients change behavior.* New York: Guilford.

*Rosenblum, A., Cleland, C., Magura, S., Mahmood, D., & Kosanke, N. (2005). Moderators of effects of motivational enhancements to cognitive behavioral therapy. *The American Journal of Drug and Alcohol Abuse*, *31*, 35-58.

*Saitz, R., Palfal, T. P., Cheng, D. M., Horton, N. J., Freedner, N., Dukes, K., et al. (2007). Brief intervention for medical inpatients with unhealthy alcohol use. *Annals of Internal Medicine*, *146*, 167-176.

*Saunders, B., Wilkinson, C., & Phillips, M. (1995). The impact of a brief motivational intervention with opiate users attending a methadone programme. *Addiction*, *90*, 415-424.

*Schermer, C. R., Moyers, T. B., Miller, T. B., Miller, W. R., & Bloomfield, L. A. (2006). Trauma center brief interventions for alcohol disorders decrease subsequent driving under the influence arrests. *The Journal of Trauma Injury, Infection, and Critical Care*, *60*, 29-34.

*Schmaling, K. B., Blume, A. W., & Afari, N. (2001). A randomized controlled pilot study of motivational interviewing to change attitudes about adherence to medications for asthma. *Journal of Clinical Psychology in Medical Settings*, *8*, 167-171.

*Schneider, R. J., Casey, J., & Kohn, R. (2000). Motivational versus confrontational interviewing: A comparison of substance abuse assessment practices at employee assistance programs. *The Journal of Behavioral Health Services and Research*, *27*, 60-74.

*Secades-Villa, R., Fernánde-Hermida, J. R., & Arnáez-Montaraz, C. (2004). Motivational interviewing and treatment retention among drug user patients: A pilot study. *Substance Use and Misuse*, *39*, 1369-1378.

*Sellman, J. D., Sullivan, P. F., Dore, G. M., Adamson, S. J., & MacEwan, I. (2001). A randomized controlled trial of motivational enhancement therapy (MET) for mild to moderate alcohol dependence. *Journal of Studies on Alcohol*, *62*, 389-396.

*Smith, D. E., Kratt, P. P., Heckenmeyer, C. M., & Mason, D. A. (1997). Motivational interviewing to improve adherence to a behavioral weight-control program for older obese women with NIDDM. *Diabetes Care*, *20*, 52-53.

*Smith, S. S., Jorenby, D. E., Fiore, M. C., Anderson, J. E., Mielke, M. M., & Beach, K. E. et al. (2001). Strike while the iron is hot: Can stepped-care treatments resurrect relapsing smokers? *Journal of Counseling and Clinical Psychology*, *699*, 429-445.

*Soria, R., Legido, A., Escolano, C., Yeste, A. L., & Montoya, J. (2006). A randomised controlled trial of motivational interviewing for smoking cessation. *British Journal of General Practice*, *56*, 768-774.

*Spirito, A., Monti, P. M., Barnett, N. P., Colby, S. M., Sindelar, H., & Rosenhow, D. J. (2004). A randomized clinical trial of a brief motivational intervention for alcohol-positive adolescents treated in an emergency department. *The Journal of Pediatrics*, *145*, 396-402.

*Stein, M. D., Anderson, B., Charuvastra, A., Maksad, J., & Friedmann, P. D. (2002). A brief intervention for hazardous drinkers in a needle exchange program. *Journal of Substance Abuse Treatment*, *22*, 23-31.

*Stein, M. D., Charuvastra, A., Maksad, J., & Anderson, B. J. (2002). A randomized trial of a brief alcohol intervention for needle exchangers (BRAINE). *Addiction*, *97*, 691-700.

*Stein, L. A. R., Colby, S. M., Barnett, N. P., Monti, P. M., Golembeske, C., & Lebeau-Craven, R. (2006). Effects of motivational interviewing for incarcerated adolescents on driving under the influence after release. *The American Journal on Addictions*, *15*, 50-57.

*Stein, L. A. R., Monti, P. M., Colby, S. M., Barnett, N. P. Golembeske, C., & Lebeau-Craven, R. (2006). Enhancing substance abuse treatment engagement in incarcerated adolescents. *Psychological Services*, *3*, 25-34.

*Steinberg, M. L., Ziedonis, D. M., Krejci, J. A., & Brandon, T. H. (2004). Motivational interviewing with personalized feedback: A brief intervention for motivating smokers with schizophrenia to seek treatment for tobacco dependence. *Journal of Consulting and Clinical Psychology*, *72*, 723-728.

*Stephens, R. S., Roffman, R. A., & Curtin, L. (2000). Comparison of extended versus brief treatments for marijuana use. *Journal of Consulting and Clinical Psychology*, *68*, 898-908.

*Stotts, A. L., DeLaune, K. A., Schmitz, J. M., & Grabowski, J. (2004). Impact of a motivational intervention on mechanisms of change in low-income pregnant smokers. *Addictive Behaviors*, *29*, 1649-1657.

*Stotts, A. L., DiClemente, C. C., & Dolan-Mullen, P. (2002). One-to-one: A motivational intervention for resistant pregnant smokers. *Addictive Behaviors*, *27*, 275-292.

*Stotts, A. L., Potts, G. F., Ingersoll, G., George, M. R., & Martin, L. E. (2006). Preliminary feasibility and efficacy of a brief motivational intervention with psychophysiological feedback for cocaine abuse. *Substance Abuse*, *27*, 9-20.

*Stotts, A. L., Schmitz, J. M., Rhoades, H. M., & Grabowski, J. (2001). Motivational interviewing with cocaine with cocaine-dependent patients: A pilot study. *Journal of Consulting and Clinical Psychology*, *69*, 858-862.

*Tappin, D. M., Lumsden, M. A., Gilmour, W. H., Crawford, F., McIntyre, D., Stone, D. H., et al. (2005). Randomised controlled trial of home based motivational interviewing by midwives to help pregnant smokers quit or cut down. *British Medical Journals*, *331*, 373-377.

*Tappin, D. M., Lumsden, M. A., McIntyre, D., McKay, C., Gilmour, W. H., Webber, R., et al. (2000). A pilot study to establish a randomized trial methodology to test the efficacy of a behavioural intervention. *Health Education Research: Theory and Practice*, *15*, 491-502.

*Tappin, D. M., Lumsden, M. A., Mckay, C., McIntyre, D., Gilmour, H., Webber, R., et al. (2000). The effect of home-based motivational interviewing on the smoking behavior of pregnant women: A pilot randomized controlled efficacy study. *Ambulatory Child Health*, *6*, 34-35.

*Thevos, A. K., Kaona, F. A. D., Siajunza, M. T., & Quick, R. E. (2000). Adoption of safe water behaviors in Zambia: Comparing educational and motivational approaches. *Education for Health*, *13*, 366-376.

*UKAAT (United Kingdom Alcohol Treatment Trial) Research Team. (2005). effectiveness of treatment for alcohol problems: Findings of the randomised UK alcohol treatment trial. *British Medical Journal*, *331*, 541-544.

*Valanis, B., Glasgow, R. E., Mullooly, J., Vogt, T., Whitlock, E. E., Boles, S. M., et al. (2002). Screening HMO women overdue for both mammograms and pap tests. *Preventive Medicine*, *34*, 40-50.

*Valanis, B., Whitlock, E. E., Mullooly, J., Vogt, T., Smith, S., Chen, C., et al. (2003). Screening rarely screened women: Time-to-service and 24-month outcomes of tailored interventions. *Preventive Medicine*, *37*, 442-450.

Vansteenkiste, M., & Sheldon, K. (2006). There's nothing more practical than a good theory: Integrating motivational interviewing and self-determination theory. *British Journal of Clinical Psychology*, *45*, 63-82.

Vasilaki, E., Hosier, S., & Cox, W. (2006). The efficacy of motivational interviewing as a brief intervention for excessive drinking: A meta-analytic review. *Alcohol and Alcoholism, 41,* 328-335.

*Walker, D. D., Roffman, R. A., Stephens, R. S., Berghuis, J., & Kim, W. (2006). Motivational enhancement therapy for adolescent marijuana users: A preliminary randomized controlled trial. *Journal of Consulting and Clinical Psychology*, *74*, 628-632.

*Watkins, C. L., Auton, M. F., Deans, C. F., Dickinson, H. A., Jack, C. I. A., Lightbody, E., et al. (2007). Motivational interviewing early after acute stroke: A randomized, controlled trial. *Stroke*, *38*, 1004-1009.

*Weinstein, P., Harrison, R., & Benton, T. (2004). Motivating parents to prevent caries in their young children: One year findings. *Journal of the American Dental Association*, *135*, 731-738.

Welch, G., Rose, G., Hanson, D., Lekarcyk, J., Smith-Ossman, S., Gordon, T., et al. (2003). Changes in Motivational Interviewing Skills Code (MISC) scores following motivational interviewing training for diabetes educators. *Diabetes*, *52*, A421.

*Westra, H. A., & Dozois, D. J. A. (2006). Preparing clients for cognitive behavioral therapy: A randomized pilot study of motivational interviewing for anxiety. *Cognitive Therapy and Research*, *30*, 481-498.

*Wilhelm, S. L., Stephans, M. B. F., Hertzog, M, Rodehorst, T. K. C., & Gardener, P. (2006). Motivational interviewing to promote sustained breastfeeding. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *35*, 340-348.