A Meta-analysis of Motivational Interviewing:

Twenty Five Years of Empirical Studies

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Abstract

Objective: This meta-analysis investigated outcome studies that tested the counseling method of Motivational Interviewing (MI) compared with other interventions. **Method**: 119 quasi or experimental studies met inclusionary criteria and were subjected to a random effects meta-analysis. Targeted outcomes included substance use (tobacco, alcohol, drugs, marijuana), health related behaviors (diet, exercise), and engagement in treatment variables. **Results**: Judged against weak comparison groups, MI produced durable, clinically significant though small effects (g = 0.28). Judged against specific treatments, MI produced non-significant results (g = 0.09). MI was robust across many moderators, although feedback (Motivational Enhancement Therapy), delivery time, manualization, delivery mode, and ethnicity moderated outcomes. **Conclusions**: MI contributes to counseling efforts and results are influenced by participant and delivery factors.

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 6 references during the 10 year span of 1980 to 1989, 78 references from 1990 to 1999, and 733 from 2000 to April of 2009. Interest in motivational interviewing continues to grow at a rapid pace (Prochaska & Norcross, 2007), perhaps because it is short-term, teachable, and has humanistic philosophical underpinnings.

Motivational Interviewing 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 (e.g., Arkowitz, Westra, Miller, & Rollnick, 2008; Miller, & Rollnick, 2002; Rollnick, Miller, & Butler, 2008). 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 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 that are consistent its overall philosophy: (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.

The present article examines the degree to which MI is able to help clients change via a systematic quantitative review termed a meta-analysis. 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 MI's efficacy (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 these efforts have done much to enhance our understanding of MI's efficacy, 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 because many of the previous meta-analyses included studies that could not isolate the impact of MI from other treatment features. This point is discussed in further detail 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; including these studies allows us to examine moderators with greater statistical power and reach more robust conclusions. (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 meta-analyses (see Cooper & Hedges, 2004; 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 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 clinically 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 motivational interviewing interventions, our review attempts to answer three questions that are commonly explored meta-analytically (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 to be a stable estimate of the average magnitude of effect across

studies. If variability is high, however, this 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 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 (Bornstein, Hedges, Higgins, & Rothstein, 2004).

We now turn to a brief review of the three existing meta-analyses in the field of motivational interviewing. Burke et al. (2003) meta-analyzed 30 controlled clinical trials that focused primarily on the implementation of motivational interviewing 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 minutes (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 which 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 size was provided, it may have been unduly influenced by a single outlier study that had an effect size that was more than 300% 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 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 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 reviews paint 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 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. Further, there is some question as to whether MI presented in its basic form is more or less effective than a variation of MI, known as Motivational Enhancement Therapy, which includes feedback from standardized assessment measures (Miller & Rollnick, 2002).

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 treatment ingredients or problem feedback. Thus, the primary goal of the current meta-analysis was to investigate studies that utilized designs capable of differentiating the effects of MI from other treatment or setting variables or directly compared MI with other active treatments. Our review only included such studies in an effort to overcome the potential confounds found in prior meta-analyses. Further, 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

motivational interviewing, 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 motivational interviewing 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 between the years 1984 and November of 2007: 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 present study.

In total, this strategy yielded 5,070 potential articles. Articles were excluded if they did not have the terms "motivational interviewing" or "motivational enhancement" in the keywords, leaving 1288 articles. We then cross-referenced the 167 articles previously ordered from the bibliography with the articles retrieved in the basic literature search, which produced 1128 articles that were screened for inclusion.

Screening articles for inclusion

The 1128 were screened by their source and abstracts. Articles were retained if the abstract indicated that: (1) the main principles of MI or Motivational Enhancement Therapy (MET; see below for description) were used; (2) a treatment group and a comparison group were included; (3) the intervention was delivered by humans; (4) the study was reported in English; and (5) the study was published in a peer reviewed journal. This last criterion was included to establish a more homogenous sample of studies, to facilitate potential replication by other researchers, and because searching the "grey" literature can introduce systematic sampling error. Our screening strategy yielded 183 articles that were then retrieved.

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" 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; (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 as is 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 treatment as usual

comparison group. Second, 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. Studies that did not explicitly use random assignment of participants to comparison or treatment groups were not necessarily excluded. 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). Coding was routinely monitored with disagreements being resolved first through renewed independent and "blind" coding. If differences in coding remained, the coders discussed decisions and, if agreement was still not reached, the two primary authors made final decisions.

Dependent variables: Targeted problems and behaviors

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 clients approach to treatment: 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 of these broad categories, 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. Further, if a particular study reported multiple data points for a specific outcome (e.g., alcohol use, risky behavior), each effect size was extracted

and then averaged for group comparisons so that each study ended up reporting only one effect size per dependent variable.

Potential Moderators

We examined 8 categorical and 7 continuous variables as potential moderators to the effects of MI. The 7 categorical variables were coded as follows:

Comparison group. Comparison groups were coded into one of five categories: (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. The comparison groups were eventually grouped into a "strong" comparison group and a "weak" comparison group. The strong comparison category included only TAU programs that employed a specific intervention whereas the weak comparison group category was comprised of the remaining comparison groups above.

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 dependence) 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" 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); this approach is termed Motivational Enhancement Therapy or 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. For example, additive would be coded if two comparison groups examined the value of a nicotine patch and only one group used MI in addition to the patch; (b) prelude, when MI was used prior 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 increases 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 Motivational interviewing 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 Ph.D.; (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 Ph.D. degree.

Delivery mode. MI is traditionally delivered via individual counseling, though it is occasionally delivered via group format. No other meta-analysis has specifically compared group versus individual delivery.

Continuous Variables. The 7 continuous variables we coded as potential moderators of MI effects can be divided into two broad categories: sample characteristics and study characteristics. Three different characteristics of the sample were coded: *age* (participants' average age), *gender* (percentage of participants who were male or female), and *ethnicity* (percentage of the sample who were White, African American, or Hispanic; we also coded for other ethnic 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 its *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 as some questions have arisen about the possibility of study quality being negatively correlated with effect size value (Cooper & Hedges, 1994; Lipsey & Wilson, 2001). The rigor scale we used was similar to that used in Hettema et al. (2005) and Burke et al. (2003). 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 drop-outs, 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 to be 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 pre-treatment equivalence, and no point if groups were not equivalent or equivalence could not be determined.

Effect size calculation

Effect sizes were calculated and analyzed through Comprehensive Meta-Analysis, a software package that was produced by Bornstein, Hedges, Higgins, & Rothstein (2004). For the current meta-analysis, we used Hedge's *g* (Cohen, 1988) effect size, which is a nonbiased estimate of Cohen's (1988) *d*. Both statistics measure group differences expressed in standard deviation units. Cohen's recommended cut points for the *d* statistic for clinical significance are identical when using Hedge's *g* (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 1 study compared four MI groups to a single comparison group. Thus, a total of 132 MI groups were contrasted with a comparison group and used in these analyses. 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 1details 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, with confidence intervals illustrating the accuracy of a given combined effect size estimate. In considering the results, note that the number of studies (represented by *k*) contributing to a particular effect size influences confidence in its stability.

Overall findings

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

What is the overall magnitude of effect of motivational interviewing interventions?

The average effect size across the 132 comparisons and all outcomes was $g = 0.22$ (Confidence Interval 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 clinically 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 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 whether MI outcomes differed by comparison group as Burke et al. (2003) reported. Significant heterogeneity was found, $Q_w = 14.75$ (4), $p < .01$. As Table 2 shows, when MI was compared to a treatment as usual (TAU) program that involved a specific program (e.g., 12-step or cognitive-behavioral), effects were significantly lower than when it was 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 of 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 ($g = 0.09$, $k = 39$). 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 that further analyses should be run separately for studies 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, the field of practice 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.

When contrasted with a weak comparison group, MI outcomes for substance use 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). Effect sizes of MI on the three variables that concern clients' approach to treatment (e.g., engagement, intention to change, and confidence to change) ranged from *g* = 0.15 for confidence to *g* = 0.35 for engagement.

In line with our findings by comparison group above, 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 variable. 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.

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.

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: MI in its basic form versus MET which adds specific problem feedback to MI as described above. As shown in Table 3, MET ($g = 0.32$) was significantly more likely to produce positive change compared to typical MI ($g = 0.19$), $Q_b = 4.97$ (1), $p < .03$. Further moderator analyses were made by subdividing the groups that involved typical MI ($k = 33$) and those that involved MET ($k = 50$). 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).

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. As seen in Table 4, 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. Table 5 shows the five *participant characteristics* that were submitted to meta-regression: age, gender, and ethnicity. Four *study characteristics* were also included in the meta-regression: overall study rigor, the number of session(s) in which MI was delivered, the number of minutes of MI that were delivered to the sample, and the durability of the MI (i.e., 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 others 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 when compared to weak comparison groups: 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), $p < .01$. With regard to study characteristics, only the total number of minutes in which MI was delivered was positively related to outcomes $z = 4.23$, *q-value* = 17.89 (1, 428), $p < .01$, indicating that longer treatments produced significantly higher effect sizes for MI.

Studies comparing MI to strong comparison groups (*specific TAU).*

When compared to a strong comparison group, three 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 also 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 sessions and total amount of time (minutes) spent in treatment. With regard to session number, 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*. However, specific TAU groups ($M = 308$, $SD = 447$) showed a nonsignificant trend toward meeting for a longer total time (i.e., more minutes) than MI groups ($M = 207$, $SD = 332$), $t(30) = 1.84$, $p < .08$.

Durability. To support continuous analyses of durability, outcomes were grouped into 5 different time frames as follows: immediately following treatment ($g = 0.15$, $k = 15$) or 3 months ($g = 0.14$, $k = 45$), between 4 and 12 months ($g = 0.29$, $k = 32$), between 1 and 2 years ($g = 0.24$, $k = 3$), or 25 months or more ($g = 0.24$, $k = 2$) post-treatment. 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, so we ran this analysis separately from the other moderators. Although no statistically significant differences were found, reviewing the pattern of effect sizes (in Table 6) suggests that delivering MI through a group format may dilute effects compared to when MI is

also delivered individually. The small number of studies addressing this group delivered MI certainly cautions against definitive inference making.

Prior to moving to the discussion of our results, we comment on the possibility of publication bias given that we did not search the "grey literature." We conducted two analyses commonly used to assess for the presence of publication bias: the classic fail-safe N and funnel plot analyses (Lipsey & Wilson, 2001). The fail-safe N is the number of unpublished or future studies averaging null results that would be necessary to reduce our overall effect size for MI to a nonsignificant value, which is 5,031 for our review. This large number—over 40 times the number of studies included herein—bolsters our confidence that our conclusions are not tainted by publication bias. Next we ran a funnel plot of Standard Error by Fisher's Z, which also does not suggest publication bias as the distribution appears symmetric (see Figure 1).

Discussion and Applications to Social Work

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. In order to guide practitioners and researchers, we now pose and answer several practical questions that flow from the results of this meta-analysis.

Does MI work? Our analyses strongly suggest that MI exerts small though 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 of 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. 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. Specifically, Lipsey & 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 than other standard treatments. When compared to other active treatments such as 12-step and CBT, the MI interventions took about 100 less minutes of treatment on average yet produced equal effects across a wide range of problem areas, including usage of alcohol, tobacco, and marijuana. Further, 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 or approach to 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. Further, 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' approach to 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 to possibly boost their confidence in their ability to change.

Is MI only successful with very troubled clients or with clients with minor problems? No. Level of distress did not moderate MI outcomes in this review, indicating that MI is effective for individuals with high levels of distress as well as for individuals with relatively low levels of distress.

Is MI as successful as other interventions? To begin, MI is certainly better than no treatment and weak treatments such as a written materials or nonspecific TAU groups. Further, 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 is consistent with psychotherapy reviews and meta-analyses which report 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. 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 as noted above.

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 comparisons for each time frame; further, 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 to 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. Further, 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 rendered the treatment significantly less effective. On the 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 (Miller & Rollnick, 2004). 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 given the tensions of promoting fidelity to the approach and the combined results of Hettema et al. (2005) and the present study.

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 influence outcomes as judged by homogenous effect sizes. However, visual inspection of the effect sizes reveals 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. In fact, one of the strengths of MI may lie 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. 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. On the whole, MI appears broadly capable of helping across many problem domains ranging from addictive to health-promoting behaviors. 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. Hettema et al. (2005) found that the effects of MI were significantly larger for minority samples than for non-minority white samples. Accordingly, when MI was compared with a weak alternative in our review, studies that included a higher percentage of African American participants in their sample had significantly better outcomes with MI. Yet when MI was compared to a strong alternative treatment (e.g., 12-step), a lower percentage of Whites and 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 certain ethnic minority groups—but not necessarily African Americans. We conjecture that MI may be 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 and specific ethnic minority group is not clear to us at this juncture.

One possibility is that African Americans may respond especially well to the specific treatments used as strong alternatives to MI in our review (e.g., Alcoholics Anonymous and other 12-step approaches; Kingree & Sullivan, 2002), thereby diminishing the relative effects of MI in those comparisons. For instance, Humphreys, Mavis, & Stofflemayer (1991) found a significantly higher rate of attendance for African-Americans (65.3%) than Caucasians (54.7%) in 12-step programs (AA or NA), and further analysis of Project MATCH's (1998) outpatient sample revealed a trend for African Americans to attend AA more than Hispanic or White participants (Tonigan, Connors, and Miller, 1998). Moreover, two studies reported a higher level of AA affiliation for African Americans versus Caucasians (Humphreys, Kaskutas, & Weisner, 1998; Kingree, 1997), further bolstering our tentative explanation for why results differ by comparison group type in the current review.

Does MI work in group formats? Limited data can be applied to this question because only 8 studies used some form of group delivery; however, our interpretation of the data is that relying solely on group delivered MI could 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 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. 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 certain minority clients.

Several limitations should be considered in evaluating our work. First, our search strategy did not likely identify or secure the entire population of studies that have investigated MI. To begin, our sample did not seek the "grey" or unpublished literature (e.g., dissertations) which may have introduced publication bias issues (only including results from statistically significant or strong studies). Recall that in an effort to assess whether publication bias exists, we ran the fail-safe N statistic as well as a funnel plot, both of which suggest that our sample of studies was not biased. Another limitation is that, for pragmatic reasons, studies needed to be published in English, which hobbles generalizability. Second, we may have unintentionally missed studies that fit our inclusion and exclusion criteria. A third limitation is that many of the moderator analyses included very few studies, such as the comparison of individually or group delivered MI. When relatively few studies contribute to a finding, the result is more reactive to outliers and caution is warranted in making inferences, interpretations, and decisions in those cases.

In our view, 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 et al., 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). Further, 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 tests.

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 be of special interest to policy makers and clinical administrators alike.

Further, although a substantial amount of thought, practice, and research has already been devoted to motivational interviewing, we still do not understand the precise links between its processes and outcomes (see Apodaca & Longabough, 2009; 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 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 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, and a *technical* component involving the differential evocation and reinforcement of client change talk.

Finally, a considerable body of theory and research suggests that motivational interviewing 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.

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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.

Thank xxx center who paid for the RAs; thank xxx Library.

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 (2006)	189 / 189	Strong	MI	6 / 120	7 – 9	Cig	-0.35	-0.66 / -0.06
Anton (2005)	39 / 41	Strong	MET	4 / -	1 – 3	Al, Eng	-0.15	-0.70 / 0.41
Baer (2001)	164 / 164	Weak	MET	1 / -	4 years	Al	0.31	0.06 / 0.56
Baker (2002)	11 / 8	Weak	MET	1 / -	10 – 12	Al, Mar, OD	0.01	-0.56 / 0.57
Baker (1993)	25 / 27	Weak	MI	1 / 75	4 - 6	Risks	-0.01	-0.55 / 0.52
Ball – 1 (2007)	34 / 25	Strong	MET	3 / -	IM	Al	0.09	-0.37 / 0.56
Ball – 2 (2007)	34 / 29	Weak	MET	3 / -	IM	Al	0.21	-0.28 / 0.70
Baros (2007)	80 / 80	Strong	MET	4 / -	1 - 3	Al	-0.16	-0.47 / 0.15
Beckham	12	Weak	MET	1 / 52.5	1 - 3	Al	0.86	0.06 /

(2007)	/13							1.65
Bennett (2005)	66 / 45	Weak	MI	1 / 60	7 - 9	Health	0.18	-0.20 / 0.56
Bernstein (2005)	70 / 48	Weak	MI	1 / 20	4 - 6	OD	0.13	-0.19 / 0.45
Bien (1993)	9 / 12	Weak	MI	1 / 60	4 - 6	Al	0.45	-0.34 / 1.24
Booth (1998)	95 / 97	Strong	MI	4 / -	IM	Eng	-0.07	-0.38 / 0.25
Booth (2004)	283 / 294	Strong	MI	4 / -	1 - 3	Eng	-0.03	-0.26 / 0.19
Borrelli (2005)	76 / 96	Strong	MET	4 / 80	10 - 12	Cig	0.28	-0.32 / 0.89
Bowen (2002)	82 / 82	Strong	MI	3 / -	10 - 12	Eng	0.40	-0.04 / 0.85
Brodie (2005)	22 / 18	Strong	MI	8 / 480	4 - 6	Health	0.49	-0.14 / 1.11
Brown (1993)	67 / 64	Strong	MET	1 / -	1 - 3	Al	1.19	0.36 / 2.03
Brown (2006)	13 / 13	Strong	MET	4 / -	4 - 6	Al, IC/SC, OD	-0.18	-0.53 / 0.18
Butler (1999)	202 / 210	Weak	MI	1 / 60	4 - 6	Cig, IC/SC	0.24	-0.15 / 0.62
Carey (2000)	24 / 22	Weak	MET	4 / 360	1 - 3	IC/SC	0.48	0.00 / 0.96

Carroll (2005)	37 / 42	Weak	MET	1 / 60	1 - 3	Al, Eng, IC/SC, OD, Risks	0.03	-0.80 / 0.86
Carroll (2001)	31 / 29	Weak	MI	1 / 105	1 - 3	Eng	0.55	-0.09 / 1.18
Channon (2007)	27 / 20	Weak	MI	4 / 250	13 - 24	Health	0.63	0.05 / 1.21
Colby (2005)	18 / 20	Weak	MET	2 / 47.5	4 - 6	Cig	0.37	-0.16 / 0.91
Colby (1998)	43 / 42	Weak	MI	2 / 52.5	4 - 6	Cig, IC/SC	0.48	-0.43 / 1.38
Connors - 1 (2002)	38 / 38	Strong	MET	1 / 90	IM	Eng	0.23	-0.22 / 0.67
Connors - 2 (2002)	38 / 50	Weak	MET	1 / 90	10 - 12	Al, Eng, GWB, OD	0.44	0.02 / 0.87
Curry (2003)	156 / 147	Weak	MI	5 / -	10 - 12	Cig	0.34	-0.22 / 0.90
Daley (1998)	11 / 12	Weak	MET	9 / -	1 - 3	Eng	1.82	0.38 / 3.26
Davidson (2006)	76 / 73	Strong	MET	4 / 180	IM	Al	-0.09	-0.41 / 0.23
Davis (2003)	Total = 73	Weak	MET	1 / 57	1 - 3	AL, Eng, GWB	0.14	-0.33 / 0.60
Dench (2000)	27 / 24	Weak	MI	2 / 67.5	IM	Eng, IC/SC	0.19	-0.61 / 0.98
Dunn (2006)	45 / 45	Weak	MET	1 / 45	IM	ED Bx, Eng, IC/SC	0.18	-0.24 / 0.59

Elliot - 1 (2007)	168 / 186	Strong	MET	4 / 12.5	10 - 12	Health	-0.13	-0.34 / 0.08
Elliot - 2 (2007)	168 / 135	Weak	MET	4 / 12.5	10 - 12	Health	0.26	0.04 / 0.49
Emmem (2005)	61 / 62	Weak	MET	2 / 150	4 - 6	Al, IC/SC	0.18	-0.21 / 0.57
Emmons (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 (1999)	66 / 307	Weak	MET	1 / 30	10 - 12	Al, Risks	0.15	-0.02 / 0.32
Golin (2006)	30 / 35	Strong	MI	2 / -	1 - 3	A/C, Al, Mar., Eng, OD	0.19	-0.28 / 0.66
Graeber (2003)	15 / 13	Strong	MI	3 / 180	4 - 6	Al	0.69	-0.18 / 1.56
Gray (2005)	90 / 48	Weak	MI	1 / -	1 - 3	Al, Mar., Cig	0.13	-0.30 / 0.57
Grenard (2007)	11 / 7	Weak	MI	1 / 25	1 - 3	AL, Mar., Cig, IC/SC, OD	0.53	-0.92 / 1.98
Handmaker (1999)	7 / 7	Weak	MET	1 / 60	10 - 12	Al	0.21	-0.64 / 1.05
Harland (1999)	88 / 89	Weak	--	3 / -	10 - 12	Health	0.40	-0.01 / 0.81

Haug (2004)	30 / 23	Weak	MET	4 / -	1 - 3	Cig, IC/SC, OD	0.34	-0.36 / 1.04
Helstrom (2007)	38 / 29	Strong	MET	1 / -	4 - 6	Cig	-0.07	-0.94 / 0.80
Hillsdon (2002)	302 / 285	Weak	MET	3 / 48	10 - 12	Health	0.09	-0.07 / 0.25
Hodgins (2004)	28 / 24	Weak	MET	1 / 25	13 - 24	Gam	0.32	-0.26 / 0.91
Hodgins – 1 (2001)	31 / 34	Weak	MET	1 / 32.5	< 1	Gam	0.54	0.05 / 1.03
Hodgins – 2 (2001)	31 / 33	Weak	MI	1 / 32.5	10 - 12	Gam	0.20	-0.45 / 0.84
Hulse (2003)	47 / 37	Weak	MET	1 / 45	4 - 6	Al	0.75	0.30 / 1.20
Hulse (2002)	58 / 62	Weak	MI	1 / -	5 Years	Al	0.14	-0.27 / 0.54
Humfress (2002)	45 / 45	Weak	MET	1 / -	< 1	IC/SC	0.09	-0.32 / 0.50
Ingersoll (2005)	94 / 105	Weak	MET	1 / 67.5	1 - 3	Al	0.34	-0.21 / 0.88
Jaworksi (2001)	26 / 26	Strong	MET	1 / 150	1 - 3	IC/SC, Risks	0.03	-0.51 / 0.57
Johnston (2007)	82 / 92	Weak	MI	1 / 20	4 - 6	Risks	0.19	-0.21 / 0.58
Juarez - 1 (2006)	21 / 15	Weak	MET	/ 70	1 - 3	Al	0.20	-0.46 / 0.85
Juarez - 2 (2006)	21 / 18	Weak	MET	/ 60	1 - 3	Al	0.52	-0.13 / 1.17

Juarez - 3 (2006)	20 / 15	Strong	MET	/ 35	1 - 3	Al	-0.27	-0.94 / 0.40
Juarez - 4 (2006)	20 / 18	Strong	MET	/ 35	1 - 3	Al	-0.04	-0.68 / 0.60
Kahler (2004)	24 / 24	Weak	MET	1 / 60	10 - 12	Al, Eng	0.00	-0.56 / 0.56
Kelly (2006)	28 / 22	Weak	MI	1 / 60	4 - 6	A/C	0.57	-0.03 / 1.17
Kidorf (2005)	98 / 96	Strong	MI	1 / 50	IM	Eng	0.00	-0.28 / 0.28
Kreman (2006)	12 / 12	Weak	MI	1 / 35	1 - 3	Health	0.22	-0.60 / 1.04
Kuchipudi (1990)	45 / 49	Weak	MI	3 / -	1 - 3	Al	-0.02	-0.47 / 0.42
Larimer (2001)	64 / 52	Weak	MET	2 / 120	10 - 12	Al	0.19	-0.18 / 0.56
Litt (2005)	137 / 128	Weak	MET	2 / -	4 - 6	Eng	0.82	0.57 / 1.07
Longabaugh – 1 (2001)	182 / 188	Weak	MET	1 / 50	10 - 12	Al	0.05	-0.15 / 0.26
Longabaugh – 2 (2001)	169 / 188	Weak	MET	1 / 50	10 - 12	Al	0.16	-0.05 / 0.37
Longshore (2000)	40 / 41	Weak	MI	1 / -	10 - 12	Al	0.41	-0.06 / 0.88
Maisto - 1 (2001)	73 / 85	Weak	MET	1.5 / 72.5	10 - 12	Al	0.81	0.47 / 1.14
Maisto - 2 (2001)	73 / 74	Strong	MET	1 / 72.5	10 - 12	Al	0.17	-0.17 / 0.52

Maltby (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 (2006)	166 / 176	Weak	MET	1 / 52.5	4 - 6	Al, Eng	-0.02	-0.23 / 0.19
Martino (2006)	24 / 20	Strong	MET	2 / 120	1 - 3	Al, Eng, IC/SC, OD	0.00	-0.58 / 0.58
McCambridge (2004)	65 / 81	Weak	MI	1 / 60	1 - 3	Al, Mar., Cig, OD	0.47	0.01 / 0.92
McCambridge (2004)	84 / 78	Weak	MI	1 / -	10 - 12	Al, Mar., Cig, OD	0.38	-0.19 / 0.96
Mhurchu 165	47 / 50	Weak	MI	3 / -	1 - 3	Health	0.13	-0.27 / 0.53
Michael (2006)	47 / 44	Weak	MI	1 / 100	< 1	Al	0.22	-0.19 / 0.63
Miller – 1 (1993)	14 / 14	Weak	MET	2 / 180	10 - 12	Al	0.35	-0.38 / 1.07
Miller – 2 (1993)	14/ 14	Strong	MET	2 / 180	10 - 12	Al	0.02	-0.71 / 0.75
Miller (2003)	108 / 104	Weak	MET	1 / 120	1 - 3	Eng	0.00	-0.27 / 0.27
Mitcheson (2007)	12 / 17	Weak	MI	1 / -	1 - 3	OD	0.25	-0.47 / 0.98
Monti (1999)	Total = 62	Weak	MET	1 / 37.5	4 - 6	Al	0.45	-0.01 / 0.91
Morgenstern	33 /	Weak	MET	4 / -	10 - 12	Al	0.54	0.12 /

(2007)	74							0.96
Mullins (2004)	36 / 35	Strong	MI	3 / 180	1 - 3	Eng, OD	0.15	-0.89 / 1.20
Murphy - 1 (2004)	14 / 12	Weak	MET	1 / 50	7 - 9	Al	0.78	0.00 / 1.57
Murphy - 2 (2004)	14 / 14	Strong	MET	1 / 50	7 - 9	Al	0.94	0.18 / 1.71
Naar-King (2006)	25 / 26	Weak	MET	4 / 240	1 - 3	Al, Risks, Mar.	0.41	-0.14 / 0.96
Nock (2005)	39 / 37	Strong	MET	6 / 60	IM	Eng	0.45	-0.01 / 0.91
Peterson (2006)	57 / 67	Weak	MET	3 / 135	1 - 3	Al, Mar., OD	0.01	-0.32 / 0.34
Picciano (2001)	46 / 43	Weak	MET	1 / 105	1 - 3	IC/SC, Risks	0.27	-0.14 / 0.69
Rohsenow (2002)	43 / 43	Strong	MI	2 / 65	< 1	Cig	-0.89	-1.88 / 0.09
Rosenblum (2005)	95 / 91	Strong	MET	20 / 1800	4 - 6	Al, OD	-0.14	-0.42 / 0.15
Saitz (2007)	141/ 146	Weak	MI	1 / 30	1 - 3	Al, Eng	0.10	-0.17 / 0.37
Saunders (1995)	52 / 49	Weak	MI	1 / 60	4 - 6	A/C, IC/SC, Eng, OD	0.20	-0.21 / 0.61
Schermer (2006)	64 / 62	Weak	MI	1 / 30	3 Years	Al	0.43	-0.11 / 0.97
Schmaling (2001)	16 / 16	Weak	MET	1 / 45	IM	IC/SC	0.49	-0.30 / 1.29

Schneider (2000)	30 / 30	Strong	MET	1 / 60	4 - 6	Al, OD	0.02	-0.46 / 0.51
Secades Villa (2004)	20 / 20	Weak	MET	3 / 180	4 - 6	Eng	0.48	-0.21 / 1.17
Sellman – 1 (2001)	40 / 42	Strong	MET	4 / -	4 - 6	Al, GWB	0.29	-0.22 / 0.79
Sellman -2 (2001)	40 / 42	Strong	MET	6 / -	4 - 6	Al, GWB	1.20	0.64 / 1.76
Smith (1997)	6 / 10	Strong	MET	19 / -	4 - 6	Eng, Health	0.82	-0.20 / 1.84
Smith (2001)	40 / 42	Weak	MI	6 / -	10 - 12	Cig	0.09	-0.48 / 0.65
Soria (2006)	114 / 86	Weak	MET	3 / 60	10 - 12	Cig	1.00	0.32 / 1.69
Spirito (2004)	64 / 60	Weak	MET	1 / 40	10 - 12	Al	0.09	-0.42 / 0.61
Stein (2006)	20 / 15	Strong	MI	1 / 60	1 - 3	Al, Mar.	0.22	-0.37 / 0.79
Stein (2002)	45 / 50	Weak	MI	2 / 100	4 - 6	Al	0.11	-0.26 / 0.48
Stein (2006)	69 / 61	Strong	MET	2 / 150	1 - 3	Eng	0.21	-0.14 / 0.55
Stein (2002)	60 / 49	Weak	MI	2 / 100	4 - 6	Al, Risks	0.36	-0.09 / 0.80
Steinberg (2004)	32 / 34	Strong	MET	1 / 40	1 - 3	Eng, IC/SC	1.00	-0.02 / 2.02
Stephans - 1 (2004)	75 / 79	Weak	MET	2 / 180	4 - 6	Mar.	1.20	0.81 / 1.59

Stephans – 2 (2004)	75 / 95	Strong	MET	2 / 180	13 - 24	Mar.	-0.08	-0.39 / 0.22
Stotts (2001)	25 / 25	Weak	MET	2 / 120	IM	Eng, IC/SC, OD	0.30	-0.24 / 0.83
Stotts (2004)	19 / 19	Weak	MET	4 / -	IM	A/C, GWB, IC/SC	0.66	0.02 / 1.30
Stotts (2002)	83 / 83	Weak	MET	3 / 54.5	4 - 6	Cig	0.11	-0.23 / 0.45
Stotts (2006)	17 / 14	Weak	MET	2 / 120	< 1	OD	0.77	-0.06 / 1.60
Tappin (2000)	48 / 49	Strong	MET	1 / -	1 - 3	Cig	-0.12	-0.88 / 0.63
Tappin (2000)	48/ 49	Weak	MI	4 / 150	< 1	Cig	-0.32	-1.17 / 0.53
Tappin (2005)	351 / 411	Weak	MI	3.5 / 105	1 - 3	Cig	0.08	-0.27 / 0.43
Thevos (2000)	91 / 93	Strong	MI		IM	WSDP	0.73	0.31 / 1.15
UKAAT (2005)	293 / 214	Strong	MET	3 / 150	10 - 12	Al, GWB	0.04	-0.13 / 0.20
Valanis (2002)	127 / 127	Weak	MI	--	13 - 24	Eng	0.12	-0.18 / 0.41
Valanis (2003)	126 / 127	Weak	MI	--	13 - 24	Eng	0.34	0.05 / 0.62
Walker (2006)	47 / 50	Weak	MET	2 / 90	1 - 3	Mar.	0.31	0.11 / 0.74

Watkins (2007)	167 / 172	Weak	MI	4 / 180	1 - 3	A/C	-0.01	-0.22 / 0.20
Weinstein (2004)	120 / 120	Weak	MI	7 / -	10 - 12	Parenting	0.31	0.05 / 0.56
Westra (2006)	25 / 30	Weak	MI	3 / 180	IM	A/C, Eng	0.54	-0.03 / 1.10
Wilhelm (2006)	20 / 20	Weak	MI	6 / -	4 - 6	Parenting	0.21	-0.41 / 0.83

Note. Only the first author and year is given. Tx = treatment group; Comp = Comparison group. 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 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 treatment as usual that was not specified. IM = immediately after treatment; A/C = ability or confidence to change; Al= alcohol; Ed Bx= eating disorder Behavior; Eng= engagement or compliance; Gam= gambling; GWB= general wellbeing; IC/SC= intention to change/stages of change; Health= increase healthy behavior; OD = other drugs; Risks = reduce risk taking behavior; Cig = cigarettes and tobacco; WSDP: water – safe drinking practices. Effect sizes averaged across measures and outcomes within each study. CI = Confidence Interval.

Tables 2, 3, and 4 are in a separate document because they are in landscape orientation.

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.

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.

Figure 1. Funnel Plot

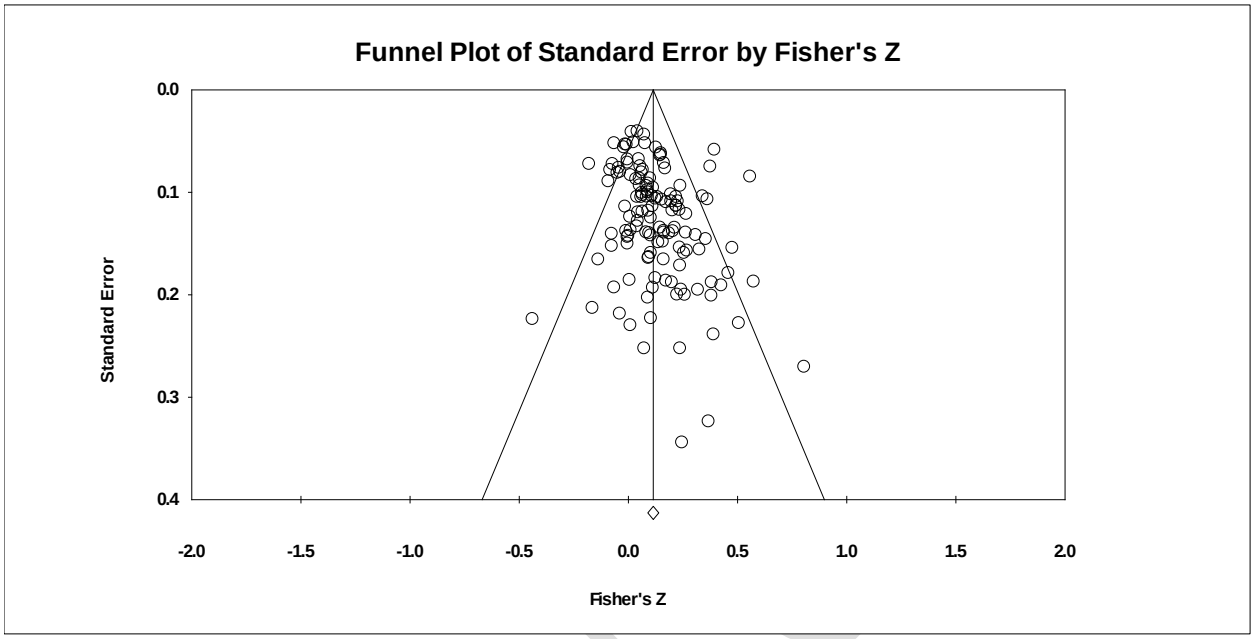

Table 2

Effect Sizes for Overall Effect and Initial Moderators

Variable	k	Effect Size	C.I.	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 wellbeing	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*
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. *k* = number of studies. C.I. = Confidence Interval. df = degrees of freedom. *ns* = nonsignificant. * $p < .05$

Table 3

Moderators among studies comparing MI to weak comparison groups (Waitlist, Written Materials, Nonspecific Treatment as Usual)

Variable	k	Effect Size	C. I.	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. *k* = number of studies. C.I. = Confidence Interval. df = degrees of freedom. *ns* = nonsignificant. * $p < .05$

Table 4

Moderator Analyses for Studies compared to Treatment as Usual Groups with a Specific Treatment Program

Variable	*k*	Effect Size	C.I.	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. *k* = number of studies. C.I. = Confidence Interval. df = degrees of freedom. *ns* = nonsignificant. * $p < .05$