Published in final edited form as:
J Behav Med. 2014 August ; 37(4): 768–780. doi:10.1007/s10865-013-9527-4.

Motivational Interviewing Used in Primary Care A Systematic Review and Meta-analysis

Katherine A. VanBuskirk, M.S.[1,2] and **Julie Loebach Wetherell, Ph.D.**[2,3]

[1]SDSU/UCSD Joint Doctoral Program in Clinical Psychology, San Diego

[2]VA San Diego Healthcare System, San Diego

[3]Department of Psychiatry, University of California, San Diego

Abstract

Objective—This meta-analysis synthesized the findings from randomized controlled trials (RCTs) of motivational interviewing (MI) for health behavior outcomes within primary care populations.

Methods—Published and unpublished RCTs were identified using databases and online listservs. Studies were synthesized by outcome subgroup and meta-regression analyses were conducted to determine potential moderators accounting for heterogeneity within samples.

Results—Mean effect sizes ranged from .07 to .47; significant effect sizes were found for the adherence subgroup of studies (p = .04) and all outcomes combined (p = .02). Professional credentials of intervention deliverer were found to significantly moderate the association between MI and effect size in substance use subgroup (p = .0005) and all outcomes combined (p = .004).

Conclusions—Mean effect sizes were largest in outcomes related to weight loss, blood pressure, and substance use. MI appears to be useful in clinical settings and as few as 1 MI session may be effective in increasing change-related behavior on certain outcomes.

Keywords

Motivational interviewing; primary care; behavior change; mental health; interventions

Background

Although psychological services are expanding throughout the country, many individuals suffering with mental health conditions present first and only to their primary care physician for care. As such, many mental health conditions go undiagnosed and/or undertreated due to lack of psychological training among general medical health care providers and inadequate staffing of trained mental health professionals (Craig & Boardman, 1997; Klinkman & Okkes, 1998). The up-and-coming field of primary care-mental health integration (PC-MHI) is steadily addressing this gap in access to services. One of the leaders in the development of this field is the Veterans Health Administration which began nationwide funding for PC-MHI programs in 2007 (Post & Van Stone, 2008). Within the Veteran's Health Administration, these services have been thus far well utilized, evidencing a 95% increase in

mental health service use within primary care departments from 2008 to 2010 (Johnson-Lawrence, et al., 2012).

Those providing services within these settings are met with a wide range of psychiatric disorders and patient characteristics; as such, a multi-faceted approach to mental health care is necessary. In addition, given the time-limited course of treatment in these settings, evidenced-based treatments are essential to ensuring effective treatments (Johnson-Lawrence, et al., 2012). Research suggests that cognitive-behavioral therapy, problem-solving therapy, and interpersonal therapy are all techniques used within these settings . Motivational interviewing is an additional form of therapy that originated out of substance abuse treatment and has gained notice as an effective treatment for eliciting behavior change (Rubak, et al., 2005).

Motivational interviewing (MI) is a style of therapeutic intervention that seeks to resolve client ambivalence towards changing problematic behavior(s). As chronic “lifestyle-related” diseases steadily become the heaviest burden to modern Western medical systems, effective treatments focused on helping individuals change problematic behaviors are extremely necessary (Goodarz, et al., 2009). MI takes a patient-centered approach that empowers the patient to develop his or her own motivation and creates a therapeutic alliance that is predominantly a partnership, rather than an expert/patient dynamic (Rollnick & Miller, 1995). MI has broadened in application over the past decade beyond the field of addiction, and research has begun to investigate its utility within health behavior topics, such as diabetes management and smoking cessation (Emmons & Rollnick, 2001). As mental health interventions have steadily grown within the field of primary care (Zivin, et al., 2010), a role for MI techniques to be used by mental health providers, as well as general physicians and other professionals has emerged within primary care. Given the limited resources available within health care settings, it is important to ascertain the utility of these approaches within medical settings, and to determine if MI techniques are helpful with all or only some medical conditions that require behavior modification.

Objectives

To this end, the following research question was pursued using a systematic review and meta-analysis: is motivational interviewing effective in improving behavior modification in patients seeking treatment for health conditions in primary care settings, as compared to treatment-as-usual or other interventions, in randomized controlled trials (RCTs)? Motivational interviewing in primary care has been addressed within a narrative review published in 2009 (Anstiss, 2009). Anstiss (11) presents a conceptual review of MI, as well as a discussion of the ways in which MI can be efficacious and advantageous to integrated primary care settings. However, in this review individual studies examining the effectiveness of MI in primary care settings are not addressed and there have been no published meta-analyses found addressing this topic.

Methods

Prior to database searching, eligibility criteria were established for the above research question. Studies were included if the study design stipulated that it was a randomized controlled trial in which the experimental condition(s) used motivational interviewing as a primary technique of the intervention. The experimental condition could be delivered by clinicians, doctors, nurses, or other trained professionals. Studies were included whether or not they included follow-up data. All publication dates were considered in the review; however, the review was limited to articles written or translated into English due to language limitations of the first author. MEDLINE, PsycInfo, and Cochrane Library Review databases were used to provide both medical and psychological searches of the literature. Using EBSCO Host, MEDLINE and PsycInfo were searched simultaneously with the following delimiters: motivational interviewing OR MI[Abstract] AND primary care[Abstract]. To minimize potential publication bias of the database searching, online listservs associated with the Society of Behavioral Medicine and the Motivational Interviewing Network of Trainers (MINT) were also sent requests for published or unpublished manuscripts that may satisfy the above research question. Databases were last searched on November 1, 2012. PRISMA and QUOROM guidelines were consulted for the execution and reporting of this systematic review and meta-analysis (Moher, et al., 1999; Moher, Liberati, Tetzlaff, Altman, & Group, 2009).

Once identified through listserv responses and database searches, the studies were screened at the abstract and title level for eligibility for full-text review screening. If through abstract review, a study appeared to be addressing a primary care-related patient issue with an MI intervention, it was retained for full-text screening. Studies were included if they used a RCT design in which participants were randomly assigned to participate in at least one experimental and one control condition. The experimental condition was required to consist of an intervention that used MI as the primary arm of the treatment; however, if the intervention was a dual-focused treatment (e.g., cognitive-behavioral therapy paired with MI), it was included. As such, if the experimental intervention was described as “using MI techniques” along with two or more other psychological techniques, it was excluded. The control condition was permitted to be treatment-as-usual, waitlist control, or another intervention. Participants were required to be recruited from a primary care setting, although, the intervention was not required to be delivered within the primary care setting. As such, studies were included if they used telephone-based or other forms of treatment intervention. If a study used computer-based therapies instead of a provider delivering the service it would have been excluded; however, there were no such studies found in the literature search. There were no exclusion criteria stipulated for the length of the intervention. The study was required to identify and measure a particular health-related outcome of interest that depended on the study population (e.g., medication adherence in diabetes management).

Data were extracted from articles independently by the first author using a piloted spreadsheet of pertinent variables, including experimental condition, delivery mode, and results. As this review focused on RCTs with group intervention versus control conditions, means, standard deviations, and *p* values were gathered for each group where reported. In

trials involving dichotomous outcomes, Odds Ratios and 95% confidence intervals were gathered, where reported. For those studies in which pertinent outcome information was not reported, corresponding authors were contacted in an attempt to retrieve the data. Meta-analyses were executed using the methods outlined by Murray et al. (2012). These methods delineate the manner in which to conduct meta-analyses when reviewing studies that report multiple results that are not necessarily within the same construct (e.g., one study reporting changes in body weight, physical activity, and blood pressure). For meta-analysis, it is necessary to calculate one effect size per study. Given the heterogeneity of the outcomes of the reviewed studies, meta-analyses were completed first by subgroup of outcome (e.g., effect sizes for substance use). Following subgroup analyses, mixed effects meta-regression analyses were conducted to assess for significant moderator variables that would account for heterogeneity in subgroup analyses. These moderator analyses were conducted only for those subgroups that consisted of four or more studies (to provide sufficient degrees of freedom), and had statistically significant heterogeneity as signified by the *Q*-statistic of the meta-analysis. The meta-analyses were conducted using the inverse variance-weight approach referenced by Murray et al (2012) and originally recommended by Lipsey and Wilson (2001). Analyses were conducted using SPSS macros provided by David Wilson, Ph.D. through his website (Wilson, 2010). Effect sizes were calculated using the “practical meta-analysis effect size calculator”, also available through Dr. Wilson’s website. Random effects models were used due to the significant heterogeneity of study outcomes and results.

Variables for assessment of risk of bias were gathered using the Cochrane criteria (Higgins, et al., 2011) and results are presented in tabular form below (Table 2). The risk of publication bias was minimized through requests via online listservs; however, this risk likely remains in the current review. For the purpose of this review, the most appropriate variables will be presented in tables below.

Results

Through searching MEDLINE and PsycInfo via EBSCO Host and Cochrane Library Reviews, 272 articles were identified for initial screening. For article screening and exclusion process, please see the PRISMA Flow Chart (Figure 1) (Moher, et al., 2009). Literature searching identified 12 studies that fulfilled the above inclusion criteria. Of these 12 studies, 9 evidenced positive results of MI, above and beyond control conditions. Two studies evidenced mixed results, and one did not find significant effects of MI. Half of the original 12 studies assessed the use of MI in relation to substance use; therefore, these studies remained in line with the original use of MI, only tailored to primary care populations. The other 6 studies addressed dietary and exercise-related goals, medication adherence, colorectal screening, and passive smoke exposure within households. Reduction in alcohol use was the primary focus of 3 studies. Details of these studies are summarized in Table 1.

Due to the heterogeneous nature of the study outcomes, a priori subgroups were established for the purpose of conducting meta-analyses. Three studies reported outcomes for diastolic and systolic blood pressure readings (Hardcastle, Taylor, Bailey, & Castle, 2008; Hyman, Pavlik, Taylor, Goodrick, & Moye, 2007; Ogedegbe, et al., 2008); the effect sizes from these

outcomes were grouped together for one meta-analysis. Six studies reported on substance use outcomes (Beckham, 2007; Brown, Saunders, Bobula, Mundt, & Koch, 2007; D'Amico, Miles, Stern, & Meredith, 2008; Hyman, et al., 2007; Mason, Pate, Drapkin, & Sozinho, 2011; Soria, Legido, Escolano, Yeste, & Montoya, 2006). Two studies reported body weight reduction outcomes (Greaves, et al., 2008; Hardcastle, et al., 2008), while 3 studies reported physical activity results (Greaves, et al., 2008; Hardcastle, et al., 2008; Hyman, et al., 2007). Each of these outcome subgroups was meta-analyzed separately. Finally, Menon et al. (2011) reported outcomes related to adherence to colorectal screening recommendations and Emmons et al. (2001) reported outcomes of adherence to passive household smoke exposure; these two studies were grouped together for adherence outcomes meta-analysis. No effect size was possible from results of Schaus et al. (2009) due to missing data. Potential moderators of total clinical contact (a variable calculated through reported average session number and length), professional qualifications of the deliverer of intervention, and age of participant were entered in mixed effects meta-regression analyses. Due to missing data, age was coded as a categorical outcome. All studies reported whether the study focused on adolescents, adults, or both; however, 2 studies did not report the mean age of participants and corresponding authors were not responsive to or able to fulfill requests for data.

Included Studies

In a trial of 897 individuals with at-risk drinking, a significant reduction in alcohol use was evidenced across both genders and both the experimental and control condition. However, MI was found to be associated with significant reductions in alcohol use above and beyond that seen cross-sectionally in men, but not in women. These investigators used 6 sessions of MI; however, sessions were conducted entirely over the telephone. Men receiving telephone-based MI sessions evidenced reduced drinking days and amounts of alcohol consumed on the Timeline Follow-back Questionnaire (TLFB) as compared to those men who received educational pamphlets in the control condition. While both groups of women evidenced reductions in alcohol consumption, no significant differences were found between groups (Brown, et al., 2007). In a smaller study examining 26 individuals with hazardous drinking living in rural Idaho, 1 MI session from a nurse practitioner that lasted 45-60 minutes resulted in significantly reduced alcohol use on a piloted measure. This study also found that 1 MI session was associated with a significant reduction in gamma-glutamyltransferase (GGT) levels within the blood, a marker of alcohol consumption for the prior several weeks (Beckham, 2007; Conigrave, et al., 2002; Daeppen, et al., 1999). A third study looking primarily at alcohol use outcomes found that 2 MI counseling sessions that each lasted approximately 20 minutes evidenced reduced alcohol use in per week and per sitting, as well as reduced estimated blood alcohol concentration levels (as estimated from TLFB data using gender and weight) in college students with binge drinking patterns. These findings were found up through a 12-month follow-up period (Schaus, et al., 2009).

D'Amico et al., (2008) investigated the effectiveness of one 15-20 minute in-person MI session with a trained case manager, followed by one 10-minute booster phone call, in a sample of 64 teens at high-risk of substance abuse in underserved community clinics of Los Angeles county. At three month follow-up, these participants reported significantly lower

marijuana use, significantly lower intentions to use marijuana in the future, and lower perceptions of marijuana use in one's social circle, as compared to those in the control condition (usual care). Results were nonsignificant on alcohol use outcomes. These mixed findings were corroborated by the results of Mason, et al. (2011) in which a sample of 28 female adolescents were not significantly different in self-reported frequency or amount of substance use as compared to the no treatment control condition. However, those receiving the intervention did report significantly less "trouble due to alcohol use," social stress, and substance use prior to sexual activities. These studies suggest that MI may have mixed utility with adolescent populations and may improve harm-reduction behaviors, but be less powerful in affecting substance, in particular alcohol, use amounts and frequency.

Emmons, et al. (2001) targeted passive smoking household exposure in an effort to improve health outcomes among young children of smoking caregivers. In a sample of 279 low-income caregivers with a child 3 years or younger, participants were given one 30-45 minute in-person session with a trained interventionist in the home, boosted by four 10-minute follow-up telephone calls. At 6-month follow-up, participants in the experimental condition had significantly lower nicotine levels in the home as compared to the control group, which received self-help didactic materials. Nicotine levels were measured using objective house monitoring systems, which improves on traditional self-report measurement techniques. While these results were significant, the secondary outcome of smoking cessation was not significantly different between the two conditions, suggesting that targeting household smoke exposure did not generalize to smoking quitting behavior. Soria, et al. (2006) targeted smoking cessation in a sample of 200 current smokers with three 20-minute sessions conducted by family general practitioners in urban primary care centers in Spain. At 12 months, experimental condition participants were approximately 7 times more likely to quit smoking as compared to those who received the control condition, anti-smoking advice.

Smoking cessation rates were also targeted as an outcome in a study attempting to modify three outcomes: smoking cessation, physical activity, and reduced-sodium diet for hypertension. Hyman, et al. (2007) used a unique study design to look at whether targeting behavior change simultaneously or sequentially would produce better treatment gains. This study was further strengthened through predominantly objective measurements of outcomes such as urine cotinine for smoking cessation, pedometer counts for physical activity, and blood samples for health indicators. Participants received three in-person sessions 6 months apart from trained health educators. Each in-person session was followed-up with an average of four 15-minute phone calls. In one arm of the study, MI sessions were geared towards targeting all three outcomes at once ("simultaneous condition") and in the other experimental arm the MI sessions were "sequentially" oriented so that MI sessions were focused on one targeted outcome at a time. At 6-months, the participants in simultaneous and sequential conditions were significantly more likely to reduce sodium as compared to the usual care control group. No other primary outcomes were found to be significantly different between groups at 6-month or 18-month follow-up. Perhaps among the target behaviors, salt reduction was the least complex, and as such, the most likely to be sustained.

Behavioral health outcomes of diet and exercise were targeted by two studies reviewed. Greaves, et al. (2008) conducted the intervention with the largest dosage: up to 11 sessions

of a combination of in-person and telephone contact. The median number of in-person contacts was 8 and the median number of telephone contacts was 1.5. The odds of reaching the primary outcome of 5% weight loss at 6-months was nearly 4 times those of the control condition. The other primary outcome of reaching 150 minutes of moderate activity per week was not significantly different across groups. Hardcastle, et al. (2008) conducted a trial in a sample of 334 adults with cardiovascular risk factors in which participants received up to 5 (mean sessions attended = 2.0) in-person, 20-30 minute sessions from 1 Physical Activity Specialist or 1 Registered Dietician. The MI sessions focused on increasing physical activity and making dietary improvements in the support of healthy weight and blood pressure. Those receiving counseling showed significantly increased walking time and weight reduction as compared to the control group, although the groups did not significantly differ on moderate or vigorous levels of physical activity. While both groups significantly improved eating habits over time, the control group decreased dietary fat significantly more than did the experimental group. The above studies were unfortunately weakened by use of predominantly self-report measures of physical activity and food intake. Finally, another health indicator, hypertension, was targeted in a trial by Ogedegbe, et al. (2008) in which 190 African American participants with uncontrolled hypertension in an urban primary care setting were randomized to receive usual care or four 30-40 minute in-person sessions from trained research assistants regarding hypertensive medication adherence. Medication adherence was measured using electronic pill caps and blood pressure readings for 12 months. Over time, the usual care group evidenced a significant decline in medication adherence from baseline whereas the experimental group did not evidence this decline. Interestingly, despite these findings, all groups significantly decreased systolic and diastolic blood pressure readings over time with no significant differences between groups. As such, it would appear that MI improved the primary outcome as measured by electronic pill caps. However, the health indicator of blood pressure, which is likely the more significant clinical outcome, was not significantly affected by MI and significantly improved over time across both groups.

Menon, et al. (2011) found that MI was not significantly different from control in improving colorectal screening rates. In contrast, the third arm of this study, Stage of Change matched tailored education (TE), was significantly different from control and improved colorectal screening rates. Interestingly, both protocols were delivered over the phone, with TE taking approximately 13 minutes over the phone as compared to approximately 21 minutes for the MI phone calls. A potential limitation of this comparison of interventions is that the TE intervention was developed with baseline data input into computers by the participants. In response to baseline data, the computer generated Stage of Change matched scripts that interventionists then read to the participants over the phone. In contrast, the MI interventionists did not use baseline data information in the delivery of the intervention. However, MI is often formulated as a stage-matched approach, as well; therefore, contrasting TE and MI in this manner may not have been true to the typical formulation and delivery of MI (Miller & Rollnick, 2002).

Meta-Analyses

Table 3 shows the results of the individual meta-analyses by subgroup. The effect size for adherence was significant ($p < .05$); this result is meaningful given that only 2 samples were available for meta-analysis in this subgroup. All other subgroup meta-analyses were nonsignificant ($p < .05$). Insufficient power may be the underlying cause for some of the lack of significance in results, as some studies had moderate mean effect sizes, but the total number of samples to meta-analyze was small. Blood pressure meta-analysis found a mean effect size of .38, although only 3 studies were used in this meta-analysis. Similarly, the meta-analysis of body weight reduction RCTs found a mean effect size of .47 that approached significance ($p = .07$), although only 2 samples were available for meta-analysis. The meta-analysis of all samples found an overall significant mean effect size of .18 ($p = .02$). The *Q*-statistic, which is the test of heterogeneity within samples, was significant for 3 subgroups: blood pressure, substance use, and body weight reduction. The overall meta-analysis of all outcomes was also found to have a significant *Q*-statistic.

Moderator analyses were undertaken to assess for possible underlying variables that may account for the heterogeneity within samples. Results are presented in Table 4. Unfortunately, the small number of samples available for the blood pressure ($k = 3$) and body weight reduction ($k = 2$) prohibited the use of meta-regression analyses due to insufficient degrees of freedom. Meta-regression analyses within the substance use samples found significant effects of the professional credentials of the deliverer ($p = .0005$). It appears that with increasing levels of professional credentials of the deliverer (e.g., from research assistant, to master's level counselor, to physician), effect sizes were seen to increase. The same result was found in the meta-regression of all samples ($p = .004$), suggesting a robust effect of provider qualifications. Total clinical contact was not found to significantly moderate the results ($p > .05$), nor did the age of the participant receiving the intervention ($p > .05$) in both meta-regression analyses.

Quality assessment

Study design and execution quality ranged across the 12 studies surveyed. Risk of bias assessment found that nearly all studies were potentially biased by a lack of allocation concealment and lack of blinding. Allocation concealment is difficult to execute in a RCT of treatment interventions with human populations; especially when informed consent stipulates the difference between the experimental and control conditions. As such, there is likely a ceiling effect in the minimization of bias possible among these types of studies. Improvements could have been made in increasing blinding as only two studies reported blinding assessors to outcomes (Greaves, et al., 2008; Ogedegbe, et al., 2008). Please see table 3 for full results.

Discussion

This investigation sought to study the effectiveness of MI used within primary care settings or with primary care populations. One of the primary findings of this study was that MI continues to be used predominantly with substance use populations. Of the 12 studies reviewed, 7 targeted a substance use-related outcome. The other five studies targeted diet

and exercise, medication adherence, and colorectal screening. Across all 12 studies, 9 demonstrated that MI was more effective at achieving targeted outcomes than were control conditions (e.g., usual care, didactic pamphlets). These results spanned a wide range of behavioral outcomes, such as substance use (self-report and objective GGT levels), household passive smoke exposure, low-impact physical activity time, blood pressure, weight, and self-reported smoking cessation rate. Null or mixed findings were found in an investigation of MI as an effective intervention for colorectal screening (Menon, et al., 2011), medication adherence (Ogedegbe, et al., 2008), and adolescent substance use (although this may be better accounted for by lack of power, as mentioned above) (Mason, et al., 2011). As such, MI has been found to be generally effective in primary care settings, although certain modes of delivery or targets may be better than others.

Interventions varied considerably across several dimensions, such as number and length of sessions, mode of delivery, and qualifications of provider. Five of the reviewed studies used 1 session and 8 of the 12 reviews used 3 or fewer sessions. Therefore, larger numbers of sessions were the rarity among this set of studies. Three or fewer sessions were found to be effective in improvement in substance use (Beckham, 2007; D'Amico, et al., 2008; Schaus, et al., 2009; Soria, et al., 2006), multiple behavior change (Hyman, et al., 2007), and household smoke exposure (Emmons, et al., 2001). A larger (between 4-11) number of sessions was used for diet and exercise (Greaves, et al., 2008; Hardcastle, et al., 2008), alcohol use (Brown, et al., 2007), and medication adherence interventions (Ogedegbe, et al., 2008). It is possible that certain behaviors (e.g., weight loss efforts) may need more than several sessions to improve findings. However, for some behavioral targets, the minimum effective dose may in fact be one session such as for alcohol abuse (Beckham, 2007) and passive smoke exposure (Emmons, et al., 2001). In addition, meta-regression found that total time of clinical contact was not a significant moderator of effect sizes among all outcomes and the substance use subgroup of studies. In addition, sessions need not necessarily be delivered in person. Seven of the 12 studies used telephone calls in the delivery of the intervention. Five of these studies used phone calls as "booster" or follow-up sessions; however, two studies used the telephone as the only mode of delivery of the intervention. Brown, et al. (2007) found significant decreases in alcohol use using up to 6 telephone sessions; however, Menon, et al., (Menon, et al., 2011) did not find MI to be effective when delivered in 1 session to improve colorectal screening. As such, it is possible that telephone-only interventions may need more than 1 session to reach effectiveness. The subtleties of this intervention will be important to target in future research, so as to best identify the minimum effective dose for motivating and enhancing behavior change.

Variety between studies was also evidenced in the qualifications of the individuals delivering the intervention. Three studies used physicians or nurse practitioners to deliver the intervention (Beckham, 2007; Schaus, et al., 2009; Soria, et al., 2006). One study detailed that the intervention was delivered by a master's level therapist (Mason, et al., 2011). The remaining 8 studies described the individuals providing the intervention in terms such as "health educator", "counselor", "interventionist", and "research assistant". Given the growing awareness of cost-effectiveness within health care settings, it is extremely important for the qualifications of interventionists to be well elucidated. With clear information about the design and delivery of the protocol, a cost-effective version of this

may be increasingly feasible to disseminate to clinical practice. Meta-regression analyses found that the professional qualifications of the intervention provider were a significant moderator of the effect sizes. It is possible that MI is more potent when delivered by individuals with higher levels of professional training; however, with better description of interventionist's qualifications, these results would be better elucidated.

Streamlining of reporting of measurement outcomes will also improve the ability to gather implications from investigations, as well as generalize across studies. The effectiveness of MI is being tested among a variety of populations and behavioral outcomes; as such, consistently reporting outcomes such as pre- and post-treatment means and standard deviations will greatly improve the ability to compare effect sizes across studies. These results were only reported by 6 of the reviewed studies and the results were not reported for all targeted outcomes in each study. As such, full reporting of null and significant findings, particularly in tabular form, would better help the literature to better identify the minimum effective dose, the minimum qualifications necessary for the dose to be effective, and the best behavioral outcomes to target with this intervention.

In addition, it is important to note that populations seen within primary care settings are potentially different from those that most often encounter mental health interventions, such as motivational interviewing techniques. MI methods are firmly established within substance abuse treatment centers and other psychological service centers; however, many individuals presenting to primary care settings may have little to no experience with mental health professionals. As such, it is important to determine whether these approaches are helpful in this non-psychological setting. The above results suggest that among those presenting to standard primary care facilities, MI approaches are generally helpful in eliciting behavior change. Finally, MI techniques have been demonstrated to have a broad application. If these techniques are capable of generalizing across conditions (e.g., alcohol use, smoking cessation, weight loss), it is possible that training in these approaches will be a significant resource to addressing the multiple behavior change difficulties that are affecting the average modern primary care patient.

Future research studies would benefit from broadening methodologies beyond comparing MI to usual care. Two studies employed unique designs, such as comparing MI that targeted three behavioral outcomes at once (simultaneously) or sequentially over three visits (Hyman, et al., 2007) or comparing MI to computer-generated, stage-matched tailored education (Menon, et al., 2011). With these increases in study design sophistication, more detailed information can be learned about the effectiveness of MI as compared to other short-term interventions that may be delivered in primary care settings. This study had a number of limitations. First, publication and English language bias may have limited the number of available studies included in this review. In addition, the small number of available RCTs for review and meta-analysis may have led to underpowered study results. Given the heterogeneity of the study outcomes, subgroup meta-analyses were deemed appropriate; however, these subgroup analyses further limit the power to find significant results.

In conclusion, MI was found to be effective in comparison to usual care for a number of different behavioral outcomes with primary care populations. MI has been found to be effective in as little as one 15-20 minute session with an individual with minimal training in MI techniques, although the exact qualifications and training necessary to deliver the intervention require better reporting and clarification by future investigators. Higher levels of professional training may be more efficacious when it comes to obtaining strong effects from brief MI interventions. MI has been found to be effective when delivered either entirely over the phone, or when "boosted" by intermittent phone calls after in-person meetings. As such, this intervention appears to be extremely flexible in its formulation and delivery with this population. Given this flexibility, the literature will be better served by greater clarity in reporting standards, both for protocols and providers, as well as clinical and behavioral outcomes.

Acknowledgments

The authors would like to thank Linda Gallo, Ph.D., for her revisions of an earlier version of this manuscript

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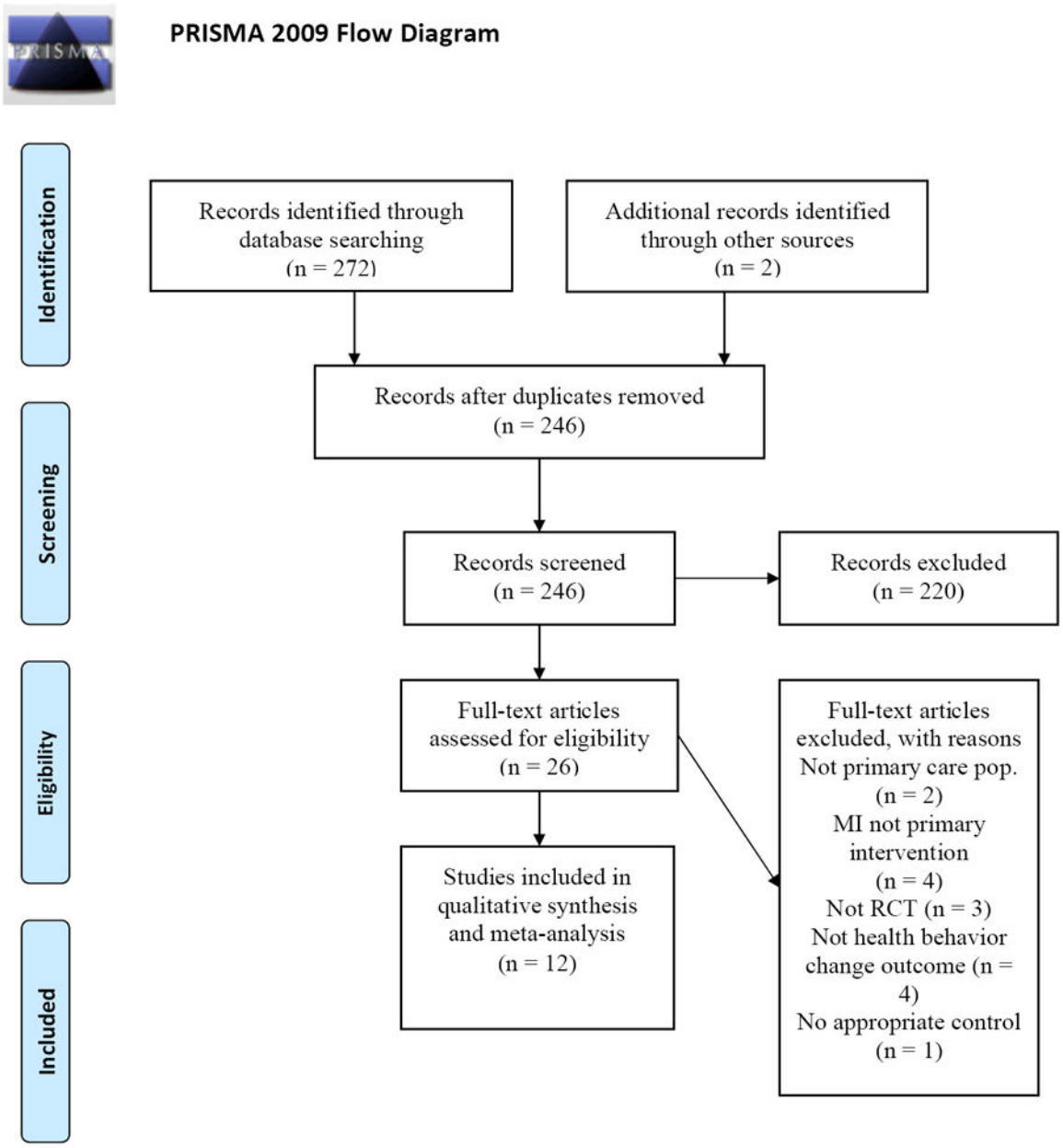

Figure 1.
PRISMA Flow Chart

J Behav Med. Author manuscript; available in PMC 2014 August 01.

Table 1

Motivational Interviewing Used in Primary Care Populations: Primary Outcomes

Authors & Year; Study *n*	Population	MI Intervention; Provider; Control	Outcome	Results
Beckham, 2007; *n* = 26	Low-income community health patients in rural Idaho with at-risk drinking; 97% Caucasian, 3% African American, 58% women, *M* age NR	1 45-60 minute in-person MI session by Nurse Practitioner (NP) vs. No Treatment	AUDIT, 6-Week Alcohol Quantity/Frequency Form, gamma-glutamyltransferase (GGT) blood test	Experimental group reported less daily alcohol use at 6-weeks (M_1 = 1.95 ± NR, M_2 = 3.77 ± NR drinks/day, p = 0.03) and had significantly lower GGT levels (M_1, M_2 = NR, p = 0.03).
Brown et al., 2007; *n* = 897	Primary care patients in Wisconsin with at-risk drinking; 86% Caucasian, 9.2% African American, 6.5% Other, 55% women; *M* age NR	6 telephone-based MI sessions & mailed follow-up letters by trained counselor vs. Mailed didactic pamphlet	Timeline Follow-back Questionnaire	All participants improved over time, with experimental group males evidencing significantly lower drinking days (M_1 = 4.3 ± 5.8, M_2 = 6.6 ± 7.2) and amounts (M_1 = 57.4 ± 105.4, M_2 = 71.5 ± 65.3 drinks/month) than control group males (p's < .001). Results were NS for women (p > .05).
D'Amico et al., 2008; *n* = 64	Low-income community health adolescents with high-risk substance use in Los Angeles County; 85.7% Hispanic, 9.5% African American, 4.8% Caucasian, 52% women, *M* age = 16	1 15-20 minute MI session & follow-up booster phone call by trained case manager vs. Usual Care (UC)	RAND Adolescent/Young Adult Panel Survey	Those who received intervention demonstrated significantly lower intentions to use marijuana (M_1 = 2.75 ± 1.16, M_2 = 2.18 ± 1.09, p = .004) and reported number of marijuana uses (M_1 = 1.21 ± 1.06, M_2 = 0.61 ± 0.87, p = .005) perceived prevalence of use (M_1 = 6.2 ± 2.57, M_2 = 4.91 ± 3.18, p = .004).
Emmons et al., 2001; *n* = 279	Low-income caregivers of child(ren) 3 years or younger; 46% Caucasian, 19% African American, 21% Hispanic, 14% Other, 91.5% women, *M* age = 28	1 30-45 minute MI session & 4 follow-up telephone counseling calls by trained interventionist	Nicotine concentration monitor results in μg/m^3, smoking cessation rates	MI group had significantly lower nicotine levels in kitchen (M_1 = 2.6, M_2 = 6.9 μg/m^3, p < .05) and TV room (M_1 = 2.3, M_2 = 3.5, ± NR μg/m^3, p < .05) as compared to control group. No significant difference in cessation rates between groups.
Greaves et al., 2008; *n* = 141	Primary care patients with BMI ≥ 28 in semi-rural UK; race/ ethnicity NR, 64% women, *M* age 53.9	Up to 11 MI sessions in-person and telephone by health promotion counselor from community vs. UC plus didactic materials	Odds of achieving 5% reduction in weight and/or 150 minutes moderate activity per week	Odds ratio of reaching weight-loss target = 3.96 for intervention group [95% CI: 1.4 - 11.4], no significant difference on physical activity target between control and intervention OR = 1.6, [95% CI: 0.7 - 3.8]
Hardcastle etal., 2008; *n* = 334	Primary care patients with BMI > 28, hypertension, or high cholesterol in the UK; race/ ethnicity NR, 67% women, *M* age 51.1	Up to 5 in-person 20-30 minute, stage-matched MI sessions by Physical Activity Specialist or Registered Dietician vs. UC	Blood pressure, cholesterol, weight, self-reported physical activity, dietary intake	Counseling group significantly increased walking time ($M_{\Delta 1}$ = 198 ± 63, $M_{\Delta 2}$ = -145 ± 109 met-min/wk, p < .01) and BMI ($M_{\Delta 1}$ = -0.21 ± 0.10, $M_{\Delta 2}$ = 0.15 ± 0.10 points, p < .01). Both groups increased fruit & vegetable intake and decreased fat intake, however control group decreased fat significantly more than counseling (p < .001).
Hyman et al., 2007; *n* = 289	African American primary care patients age 45-65 nonadherent to 3 behavioral health outcomes living in the US; 100% African American, 67.3% women, *M* age = 53.3	1 MI session every 3 months focusing either on all behavioral outcomes (SIM) or 1 at a time (SEQ) & telephone follow-up by health educator vs. UC	Urine cotinine (smoking), pedometer counts (physical activity), blood indicators for hypertension, urine sodium level (mEq/L)	At 6 months, for sodium reduction, SIM (M_{SIM} = 169.2 ± 169.2) was better than UC (M_{UC} = 189.3 ± 92.1, p = .01) and SEQ (M_{SEQ} = 200.4 ± 94.8, p = .04). No significant effects on other outcomes at 6- or 18-months. SIM significantly improved readiness to change on smoking and PA (p's = .02; .03)
Mason et al., 2011; *n* = 28	Primary care adolescent women in Philadelphia, PA with at-risk substance use; 82% African	1 20-minute MI session & social network counseling by master's level therapist	Substance use, Readiness Ruler, High-risk sexual behavior	No significant difference between groups on social network, days and number of times substances used (p > .05). Significant differences were found on readiness to

Authors & Year; Study *n*	Population	MI Intervention; Provider; Control	Outcome	Results
	American, 18% mixed race, 100% women, American, 18% mixed race, 100% women, *M* age = 16			receive counseling ($p < .05$). Significant differences were found on trouble due to alcohol use, using substances before sexual intercourse, social stress, and offers to use marijuana (p's < .05). (M_1, M_2 = NR).
Menon et al., 2011; *n* = 515	Primary care patients nonadherent to colorectal screening in Midwestern and Southeastern US; 72.4% African American, 17.7% Caucasian, 9.9% Other, 29.3% women, *M* age = 58.1	1 telephone-based MI session (*M* = 21 minutes) or baseline data-informed, stage-matched tailored education (*M* = 13 minutes) by trained intervention st vs. UC	Colorectal screening (e.g., stool blood test, sigmoidoscopy, colonoscopy) within 12 months of intervention	MI was not associated with significant increase in screening. Tailored education was significantly better than usual care (OR = 2.4, 95% CI = 1.4-4.0).
Ogedegbe et al., 2008; *n* = 190	African American primary care patients with uncontrolled hypertension in NYC; 100% African American, 88% women, *M* age = 54	4 in-person 30-40 minute MI sessions by trained research assistant vs. UC	Medication adherence (Medication Events Monitoring System), blood pressure	MI group did not evidence predicted adherence decline over time (*Predicted* Δ_1 = 1.5% ± .78; *Predicted* Δ_2 = -12.3%, ± 3.7, p = .81). Blood pressure readings were NS between groups.
Schaus et al., 2009; *n* = 363	College students with high-risk drinking at public Southeastern US university; 78% Caucasian, 11% Hispanic, 5% African American, 6% Other; 52% women, *M* age = 20.6	2 in-person 20-minute dual MI-CBT sessions by general physician or nurse practitioner vs. Didactic pamphlet	Time-Line Followback Questionnaire, Healthy Lifestyle Questionnaire, Blood alcohol concentration (BAC) estimated from TLFB	Intervention had significantly lower peak estimated BAC at 3-months (M_1 = .112 ± .007, M_2 =.142 ± .007, p_{trend} = .006), typical BAC (M_1 = 0.57, ± .004, M_2 = 0.73 ± .004, p_{trend} = .02), lower peek number of drinks in a sitting (M_1 = 6.87 ± .40, M_2 = 8.03 ± .38, p_{trend} = .04), and reduced number drinks per week (M_1 = 7.33 ± .62,M_2 = 9.45. ± 72, p_{trend} = 03). Results tended to wane at 12-months.
Soria et al., 2006; *n* = 200	Primary care patients who smoked cigarettes in urban Spain; race/ ethnicity NR, 51.8% women, *M* age = 38.6	3 in-person 20 minute MI sessions by general physician vs. Anti-smoking advice	Smoking cessation self-report, CO-oximetry	Patients evidenced a 6.9 times greater odds of quitting in MI group after 12 months (OR = 6.91, 95% CI: 1.98-24.15) than in control

*Abbreviations: AUDIT – Alcohol Use Disorders Identification Test; BMI – Body Mass Index; CI – Confidence Interval; UK – United Kingdom; SIM – Simultaneous; SEQ – Sequential; PA – Physical Activity; M – Mean; NR – Not Reported, M_1 = Mean experimental group; M_2 = Mean control group; $M_{\Delta 1}$ = Mean Change Experimental Group; $M_{\Delta 2}$ = Mean Change Control Group

Table 2

Cochrane Collaboration Risk of Bias Tool

Author	Sequence Generation	Allocation Concealment	Blinding	Incomplete Outcome Data	Selective Outcome Reporting
Beckham, 2007	+	-	-	+	-
Brown, et al., 2007	+	-	-	+	-
D'Amico, et al., 2008	-	-	-	+	+
Emmons, et al., 2001	+	-	-	+	+
Greaves, et al., 2008	?	-	+	+	+
Hardcastle, et al., 2008	+	-	-	+	+
Hyman, et al., 2007	-	-	-	+	+
Mason, et al., 2011	+	-	-	+	+
Menon, et al., 2011	+	-	-	+	+
Ogedegbe, et al., 2008	+	-	+	+	+
Schaus, et al., 2009	+	-	-	+	+
Soria, et al., 2006	+	-	-	+	-

*
+ = Low risk of bias;

- = High risk of bias;

? = Not enough information reported to estimate risk of bias

Table 3

Main Effects of Meta-Analyses

Outcome Group	Mean ES	Min ES	Max ES	[95% CI]	*p*	*Q*	*k*
Blood Pressure	0.38	-.22	.275	[-.24, .31]	.79	6.87*	3
Substance Use	.22	-.36	1.01	[-.21, .65]	.31	49.36**	6
Body Weight Reduction	.47	.23	.75	[-.04, .99]	.07	6.49*	2
Physical Activity	.07	.02	.25	[-.08, .21]	.37	1.46	3
Adherence	.19*	.11	.30	[.01, .37]	.04	1.20	2
All Outcomes	.18*	-.36	1.01	[.03, .33]	.02	75.32**	16

Results from random effects models.

ES: Effect Size; CI: Confidence Interval; *p: p*-value; *Q: Q* statistic for test of heterogeneity within samples; *k*: number of samples;

* $p < .05$;

** $p < .01$

Table 4

Possible Moderators of Associations Between Motivational Interviewing and Outcomes

Outcome Group	Moderator	*B*	SE	[95% CI]	*p*
Substance Use	Total Contact	-.0003	.001	[-.002, .002]	.76
	Deliverer	.31***	.09	[.14, .48]	.0005
	Age	.17	.21	[-.25, .59]	.42
All Outcomes	Total Contact	.0011	.0006	[-.0001, .002]	.08
	Deliverer	.26**	.09	[.08, .44]	.004
	Age	.23	.22	[-.20, .65]	.29

Results from mixed effects models.

B: Regression beta; SE: Standard Error; CI: Confidence Interval; *p: p*-value;

** $p < .01$;

*** $p < .001$