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Critical Review

The Efficacy of Motivational Interviewing in Adults With Chronic Pain: A Meta-Analysis and Systematic Review

Dion Alperstein and Louise Sharpe
Department of Psychology, University of Sydney, Sydney, New South Wales, Australia.

Abstract: Motivational interviewing (MI) has become a popular approach for increasing adherence. In this study we investigated whether MI is effective in improving adherence, and pain and physical function for patients with chronic pain. A literature search of randomized controlled trials identified 7 eligible studies with 962 participants with chronic pain. There was a small to moderate overall effect of MI on increased adherence to treatment from baseline to after intervention, but not from baseline to follow-up. Although significant short-term effects of MI were also observed for pain intensity, analyses revealed that this finding might be due to publication bias. There were insufficient studies to examine physical functioning meta-analytically, however, none of the 3 available studies showed that MI resulted in gains in physical function compared with the control group. These results indicate that MI can probably increase short-term adherence to chronic pain treatments, although publication bias cannot be ruled out. Further, it is as yet unclear whether these effects result in improvements in patient function. Although the studies were methodologically strong, they investigated MI in relation to a number of treatments for chronic pain. Future research on the efficacy of MI on adherence to evidence-based self-management interventions for chronic pain is needed.

***Perspective:** MI significantly increased adherence to prescribed chronic pain treatments in the short term, however, effect sizes were small to moderate and publication bias was likely. MI showed some promise in promotion of adherence to pain treatments, but more research is required to confirm its efficacy.*

***Key words:** Motivational interviewing, motivational enhancement, chronic pain, meta-analysis, systematic review.*

Although there are a myriad of available treatments for chronic pain,[8,37,45] the effect sizes associated with these treatments are small and likely to be suboptimal. One factor that might limit the efficacy of available treatments is low rates of adherence.[7] It is estimated that nearly one-third of patients with chronic pain fail to adhere to prescribed medication[5] and adherence rates for other treatments are also low. For example, 30% of patients failed to adhere to physical therapy[26] and only 50% to a cognitive behavioral rehabilitation.[35,36]

Although not widely studied,[5] adherence might be important to improvement of patient outcomes. Although there is insufficient evidence to conclude whether adherence to medication is associated with outcomes,[5] nonadherence to physical therapies was consistently shown to be associated with poorer outcome in a recent review.[21] Further, in a recent study on adherence to a psychosocial program and outcomes, a strong positive relationships between adherence and outcome at the end of a pain management program was found.[35] Furthermore, those who consistently adhered during the intervention not only benefited more in the short term, but they improved further over the following year.[36] Clearly, improvement of adherence is likely to lead to an improvement of patient outcomes.

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Address reprint requests to Louise Sharpe, PhD, Clinical Psychology Unit, School of Psychology, University of Sydney, Brennan MacCallum Building A 18, Sydney, New South Wales 2006, Australia. E-mail: louise.sharpe@sydney.edu.au
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Motivational interviewing (MI) is a person-centered approach that aims to resolve individual's ambivalence about behavior change by strengthening their own motivation and commitment to change.[33] MI was initially developed to improve adherence to drug and alcohol treatment,[32] but has been extended to a range of different indications, such as diet, exercise, and sexual health.[6,27] In clinical settings, MI frequently draws upon the transtheoretical model of behavior change[38] as a conceptual model, which suggests that individuals go through the following stages of change before adopting and maintaining new behaviors: precontemplation, contemplation, preparation, action, and maintenance. Central to this model is the notion that optimal treatment is most effective when individuals are at least in the preparation or action phase for change.[39] Hence, MI is used to help patients achieve an optimal stage of change to promote treatment adherence and ultimately efficacy.

Meta-analyses have shown that there is support for MI in some areas, such as drug and alcohol, diet and exercise, but not other areas, such as HIV-risk behaviors.[6,27] Although the use of MI for chronic pain is frequently advocated,[17,24,41] only 1 systematic review[8] and 1 summary article[12] have examined the effectiveness of MI with chronic pain populations. Both articles acknowledge the lack of empirical research and conclude that MI is a promising approach in promoting adherence to available treatments for chronic pain conditions. However, one of the reviews assessed the effect of MI in acute and chronic pain conditions and included nonrandomized controlled trials.[8] In the other review, half of the included studies in the summary article assessed approaches that were designed to increase adherence but were not based on MI principles.[12] Further, neither review provided a meta-analysis. In the present study we aimed to address these limitations in the current literature by conducting a meta-analysis of randomized controlled trials that examined the efficacy of MI approaches to increase adherence to treatments in the chronic pain population. In this meta-analysis we examined the efficacy of MI on the primary outcome of adherence to treatment. In addition, we investigated the efficacy of MI on the secondary outcomes of pain intensity and function.

Methods

Search Strategy

A literature search was performed on the following electronic databases on February 11, 2014: PsychINFO (1806-February 11, 2014), MEDLINE (1946- February 11, 2014), EMBASE (1947- February 11, 2014), and CINAHL (1981- February 11, 2014). In addition, we applied the ancestry method by hand searching the reference lists of empirical articles and relevant review articles.[11] The search terms used in each database are listed in Table 1. The search terms used in each database varied slightly so that they mapped to database-specific subjects headings. The search was constrained to English text. A detailed overview of the article retrieval process, including exclusion criteria at each stage of the search, is shown in Fig 1. The initial search retrieved 1,180 studies and 133 of these were duplicates, which were excluded, which left 1,047 studies. The remaining studies were initially screened by title and abstract by one author (D.A.). A second author (L.S.) screened 10% of the titles and abstracts to reduce bias in the selection procedure and to ensure inter-rater reliability. Inter-rater reliability was determined using the κ statistic and was rated as excellent ($\kappa = .94$). All articles that either reviewer thought the full text should be retrieved, were read in detail. In total, 974 studies were excluded by title or abstract, leaving 73 studies for which the full text was retrieved.

These 73 studies were read in detail and a further 66 studies were excluded at this stage, leaving 7 relevant articles to be included in the final review. The second reviewer also screened the full text of the chosen studies. There were no discrepancies in the inclusion or exclusion of studies and the final list of 7 studies were included in the current review. The reasons that studies were not included were: participants did not have a chronic pain condition (n = 198); the study did not use MI (n = 603); the article was not a primary peer-reviewed study

Table 1. Search Terms for Each Database in the Literature Search

Database and Search Strategy
PsychINFO
(chronic pain OR intractable pain OR fibromyalgia OR arthritis) AND (motivational interviewing OR motivational enhancement OR motivati* OR transtheoretical OR trans-theoretical OR stages of change) AND (randomized controlled trial OR controlled clinical trial OR randomised controlled trial OR clinical trial OR clinical trials)
MedLine
(chronic pain OR intractable pain OR pain, intractable OR fibromyalgia OR arthritis) AND (motivational interviewing OR motivational enhancement OR motivati* OR transtheoretical OR trans-theoretical) AND (randomized controlled trial OR controlled clinical trial OR randomised controlled trial)
EMBASE
(chronic pain OR intractable pain OR pain, intractable OR fibromyalgia OR arthritis) AND (motivational interviewing OR motivational enhancement OR motivati* OR transtheoretical OR trans-theoretical) AND (randomized controlled trial OR controlled clinical trial OR randomised controlled trial)
CINAHL
(chronic pain OR intractable pain OR fibromyalgia OR arthritis) AND (motivational interviewing OR motivational enhancement OR motivati* OR transtheoretical OR transtheoretical stages of change model OR trans-theoretical OR stages of change) AND (randomized controlled trial OR controlled clinical trial OR randomised controlled trial OR clinical trial OR clinical trials OR Cochrane library)

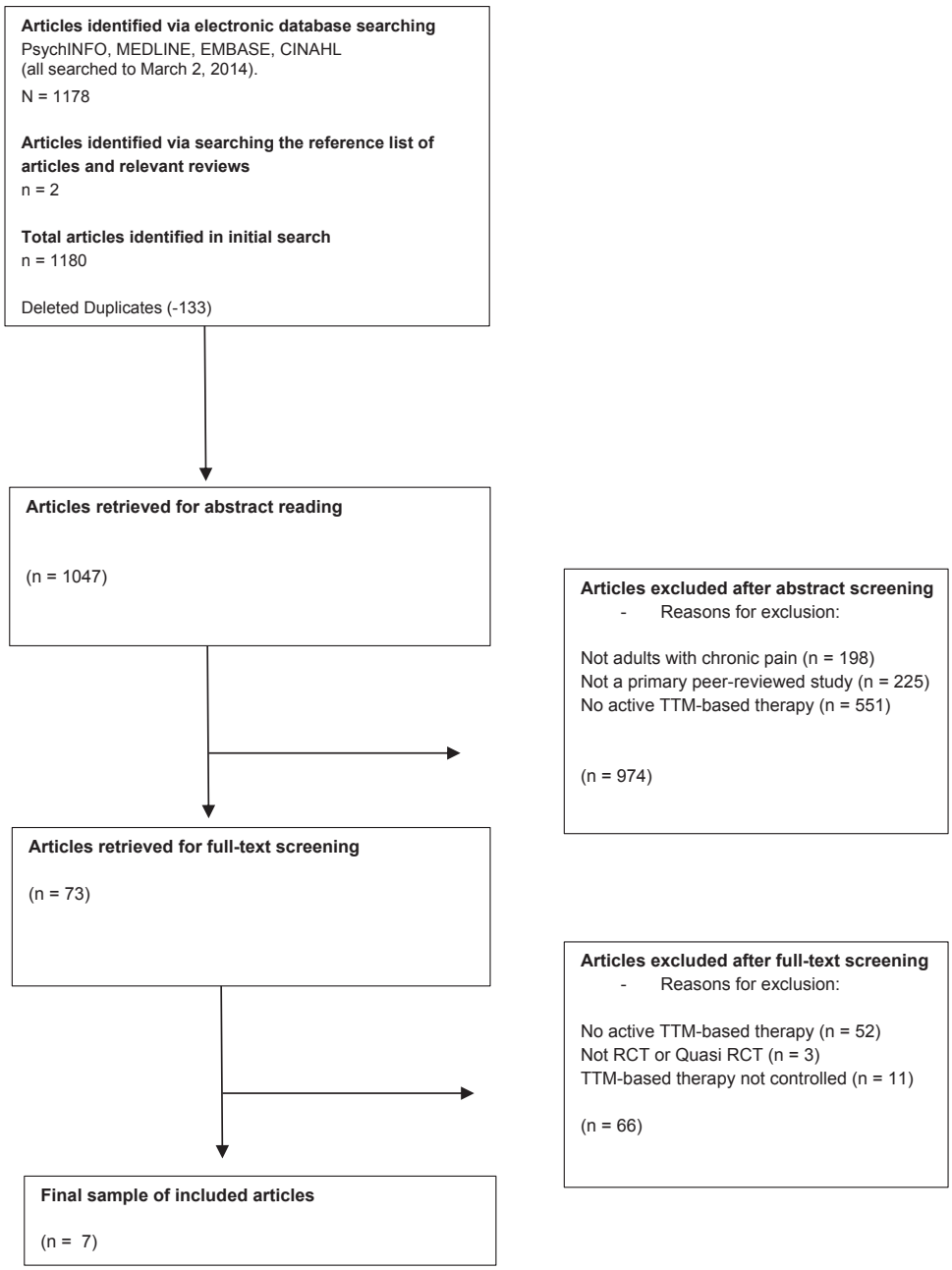

Figure 1. Flow chart of the article retrieval process.

(n = 225); MI was not controlled (n = 11); and the study was not a randomized controlled trial (RCT; n = 3).

Inclusion and Exclusion Criteria

Types of Studies

In this review we considered all studies that were RCTs that compared individuals with chronic pain conditions who received MI with an inactive control group, such as an attention, placebo, or wait-list control group. RCTs were also considered if they compared individuals with chronic pain conditions who received MI in conjunction with another intervention (eg, physical therapy or opioid medication), as long as any additional intervention was controlled for in the other arm, which allowed the unique contribution of MI to be determined. Studies were excluded if they examined MI but did not control for other active treatments. The aim of the study had to include a treatment goal of increased adherence to treatment for chronic pain or improvements in pain intensity or physical functioning and/or disability.

Types of Participants

Participants had to be adults (18 years of age or older) with a benign chronic pain condition, in which pain was reported to have lasted more than 3 months. Studies were excluded if they examined participants with acute pain, pain related to cancer, or pain as a result of surgery.

Types of Interventions

Studies were only included if they used MI approaches on the basis of MI principles.[33] That is, the overarching aim of MI was to improve individual's readiness to change their behavior by endorsement of a person-centered approach to resolve their ambivalence about behavior change and strengthen their own motivation and commitment to change, to result in increased adherence to available treatment. In some studies, MI was used as a preparation for treatment. For example, MI was used to increase individual's readiness to change pain-related behavior with the aim of increasing adherence to a multidisciplinary pain management program. In other studies, MI was used to increase adherence to a treatment that was already available but was poorly adhered to, such as antirheumatic drugs or physical exercise. Therefore, motivational approaches, such as compliance counseling and mental contrasting, that were not on the basis of MI principles were not included. Although MI is really more a therapeutic style or approach than necessarily a discrete intervention, all of the trials included in this meta-analysis separated MI from any other intervention for the research context. Studies were included regardless of the dose of MI (ie, the number and length of sessions), or how the MI was administered (eg, face to face or by telephone).

Outcome Measures

Primary Outcomes

The primary outcome of this review was adherence to prescribed treatment for pain, after treatment and at the 6-month follow-up. We included any measure of adherence that was provided by the authors. Adherence measures included log books that were used to document the duration and intensity of physical activity in studies that aimed to increase physical exercise, participation rates in a study that used MI as a means of increasing adherence to a pain management program, the Freiburger Questionnaire on Physical Activity in a study that aimed to increase physical exercise, and the Compliance Questionnaire Rheumatology to assess adherence to antirheumatic drugs.

Secondary Outcomes

The secondary outcomes were symptoms of pain intensity and physical functioning and/or disability after treatment and at the 6-month follow-up. Pain intensity measures were standardized questionnaires or visual analogue scales used to assess the individual's reported level of pain severity and included the Brief Pain Inventory, Visual Analogue Scale, and Von Korff-Scheme. Physical functioning measures were standardized questionnaires used to assess the participant's level of physical functioning or disability and included the Fibromyalgia Impact Questionnaire—Physical Impairment, Hannover Functional Disability Questionnaire, Rolland-Morris Disability Questionnaire, and the Health Assessment Questionnaire Disability Index.

Quality Assessment

The quality of studies was rated using the Quality Rating Scale.[46] This scale was developed specifically for rating the quality of psychological trials for pain and contains 2 subscales: treatment quality and quality of study design and method. The treatment quality scale contains ratings on a range of variables, including treatment content and setting, treatment duration, use of a manual, adherence to a manual, therapist training, and patient engagement. The quality of study design and method contains ratings on a range of variables related to the sample criteria, attrition, sample characteristics, steps to minimize bias, justification, validity and reliability of outcomes, follow-up measures, statistical analyses, and control group. Higher scores on the Quality Rating Scale indicate higher treatment and methodological quality. The 2 authors (D.A. and L.S.) rated all included studies and the inter-rater reliability was measured using the intraclass correlation coefficient using absolute agreement. The reported quality score was determined by consensus.

Data Extraction

To determine treatment effects on the primary and secondary outcomes, standardized mean differences were extracted from each article. This was achieved by extracting the means, standard deviations, and the number of participants in each group (MI vs control) from studies at baseline, at the conclusion of treatment, and up to 6 months after treatment. Where these statistics were not reported, or baseline data were not relevant to the outcome, such as the measurement of treatment adherence, standardized mean differences were determined by extracting other reported statistics. The authors from 2 studies were contacted to collect data that were not reported so that standardized mean differences could be calculated. The list of studies used in the analysis and the specific methods used to extract data from each study are provided in Supplementary Table 1.

Some studies used more than 1 measure of adherence, pain intensity, or physical functioning. Including multiple measures from a single study would bias our findings in favor of finding a treatment effect. Thus, we chose a single measure from each study on the basis of the reliability and validity of the measure and by determining the most conceptually valid measure for assessment of the effect of MI on adherence and subsequent changes in pain intensity and physical functioning. There was no disagreement between the authors in the selection of outcome measures during the decision-making process.

Analytic Method

A meta-analysis was carried out when 4 or more studies had available data on any primary or secondary outcome. In the case that there was insufficient data to conduct a meta-analysis, a qualitative analysis of data is reported. All meta-analyses were completed using Comprehensive Meta-analysis, version 2.[4] Separate effect size estimates were calculated for continuous

measures of adherence, pain intensity, and physical functioning at post-treatment and 6-month follow-up. Effect sizes were calculated using Hedges *g* and its 95% confidence interval. Hedges *g*, a variation of Cohen *d*, was used to correct for biases associated with small sample size.[18] The magnitude of Hedges *g* can be interpreted as follows: small = .2, medium = .5, and large = .8.[10] An assessment of heterogeneity was carried out for each meta-analysis to determine whether effect size estimates differed by more than one would expect due to chance. Heterogeneity was assessed using the Q statistic. For adherence, heterogeneity was evident across studies and to account for the assumption that the difference between study outcomes was greater than chance a random-effects model was used to calculate effect size estimates. For the remaining outcomes, there was no evidence of heterogeneity. As such, fixed-effects models are presented because it was assumed that effect size estimates only differed by sampling error.[19,29] To account for potential publication bias, the fail-safe N was calculated. The fail-safe N is considered a good measure of publication bias and provides an estimate of the number of studies with a null finding that would be required before the *P* value for the meta-analysis increases to > .05. Thus, the larger the fail-safe N the less likely publication bias is present.

Results

Characteristics of the Study Sample

A total of 7 studies were included in the meta-analysis with a total of 962 chronic pain participants.[2,3,16,28,31,43,47] The key features of the included studies are shown in Table 2. Our analysis included studies with different types of chronic pain conditions, including 3 (n = 484 participants) with chronic lower back pain, 1 (n = 216 participants) with fibromyalgia, 2 (n = 125 participants) with heterogeneous chronic pain conditions, and 1 (n = 137 participants) with rheumatoid arthritis. All studies had an inactive control group, such as an attention control or placebo group. In 6 of the 7 studies, MI was delivered in conjunction with another treatment, and the additional intervention was controlled for in the other arm, which allowed the unique contribution of MI to be determined. Of the 6 studies that had an adjunct treatment, 2 were physiotherapy treatments, 1 was supervised exercise, 2 were the dissemination of educational brochures

Table 2. Characteristics of Studies Included in the Analysis

Reference	Chronic Pain Condition	TTM-Based Intervention	Control Intervention	Common Intervention	TTM Therapist
Ang et al[1]	Fibromyalgia	MI was delivered via 6 telephone calls over a 12-wk period (n = 107)	Education intervention was delivered via 6 telephone calls over a 12-wk period (n = 109)	Supervised exercise prescription and exercise training	Health practitioner or health educator
Basler et al[3]	LBP	Ten-min TTM-based standardized counseling before each physiotherapy session (n = 86)	Placebo ultrasound therapy with an inactivated device (n = 84)	Ten 20-min standardized individual physiotherapy sessions over 5 wk with exercises for homework	Physiotherapists
Habib et al[16]	Chronic pain	One 1- to 1.5-h MI-based assessment interview and one 1.5-h MI-based feedback interview (n = 39)	One 1- to 1.5-h non–MI-based standard pain clinical assessment interview and one 1-h non–MI-based feedback interview (n = 39)	Multidisciplinary pain management workshops were provided after the study intervention	Psychologists
Leonhardt et al[28]	LBP	One to 3 TTM-based motivational counseling sessions of a maximum of 15 to 20 min (n = 101)	General practitioner delivered guidelines with no training. Known to have no effect (n = 104)	Two-h guidelines training	Nurses
Miller et al[32]	Chronic pain	MI-based feedback of the oral history interview (n = 24)	Educational (oral and written) feedback session focused on the gate control theory of pain (n = 23)	Oral history interview regarding marital relationship and conversation about coping with pain	Doctoral level psychologists
Vong et al[43]	LBP	MET was delivered during physical therapy sessions (n = 45)	Usual communication skills consistent with clinical practice (n = 43)	Ten 30-min physical therapy sessions were delivered over 8 wk with prescribed exercise, stretching, and strengthening homework tasks	Physical therapist
Zwikker et al[47]	Rheumatoid arthritis	Two MI-based group sessions of 5 to 7 people were conducted 1 wk apart (n = 57)	Control group was recipient of conjunct treatment (n = 60)	Dissemination of brochures about the adherence to disease-modifying antirheumatic drugs	Pharmacists

Abbreviations: LBP, lower back pain; MET, motivational enhancement treatment.

or guidelines, and 1 was an oral history interview. Individual MI was delivered in 6 of the 7 studies and the remaining study used a group format.

Quality of Included Studies

The inter-rater reliability for the total quality rating score, treatment quality score, and quality of study design and methods score was determined using the intraclass correlation coefficient using absolute agreement and was .901, .968, and .873, respectively. The total quality rating score of each study are shown in Table 3. The mean total quality rating score for the 7 studies was 22.14 (SD 7.36) of a possible 35, and ranged from 12 to 30. The mean subscale scores were 5.29 (SD 1.80) of 9 (range = 3–8) for treatment quality. Across studies, ratings on the treatment content and setting and treatment duration variables were excellent, which indicated that studies provided a clear rationale for the treatment and an adequate description of its content and reported the total treatment duration. Ratings on the therapist training were generally good, although 2 studies failed to report on whether the therapist had been appropriately trained for the relevant procedures in the trial. Ratings on the use and adherence to a manual and patient engagement was generally poor, with only 2 of the 7 studies that reported a treatment manual that described the active components of treatment and only 2 studies that reported evidence that patients actively engaged in the treatment. The mean subscale scores were 16.86 (SD 6.39) of 26 (range = 8–22) for quality of study design and methods. Across studies, ratings on the sample criteria, attrition, justification, validity, and reliability of outcomes, statistical analysis, and use of a control group were excellent. Ratings on the sample characteristic, steps to minimize bias, and reporting of follow-up measures were mixed with 4 of the 7 studies rated as excellent but 3 of the studies rated as poor. The mean score for excellent, average, and poor trials in the validation sample of the quality rating scale was 22.7 (SD 1.95), 18.71 (SD 2.25), and 12.10 (SD 3.17), respectively.[46] Hence, the studies included in this meta-analysis correspond to excellent quality trials.

Effects of MI for Patients With Chronic Pain

The statistical analysis by article for primary and secondary outcomes is shown in Table 3.

Analysis of the Primary Outcome: Adherence

Five studies with 631 participants had available data on adherence to treatment from baseline to after intervention. The Q statistic revealed heterogeneity between the studies (Q = 19.186, P = .001), hence we used a random effect model. Our analyses (Fig 2) revealed that there was a small to moderate overall effect of MI on adherence to treatment from baseline to after intervention (Hedges g = .441, 95% confidence interval [CI], .078–.80, z = 2.384, P = .017). This effect size corresponds to a fail-safe N of 27 studies (z = 4.912).

There were also 5 studies with 757 participants that reported data on adherence to treatment from baseline to 6-month follow-up. In these studies there was significant heterogeneity, as revealed by the Q statistic (Q = 20.629, P < .0005). In contrast to the short-term results, there was no significant overall effect of MI on adherence to treatment at 6-month follow-up (Hedges g = .245, 95% CI, −.091 to .581, z = 1.429, P = .153). Hence, the effect of MI on adherence did not appear to be observed at the 6-month follow-up.

Analysis of the Secondary Outcomes: Pain Intensity and Physical Functioning

There were sufficient data from 4 studies with 449 participants to analyze the effect of MI on the change in pain intensity from baseline to after intervention (Fig 3). In contrast to the analyses for adherence, the analyses revealed homogeneity across studies (Q = 4.221, P = .239), hence we used a fixed effects model. There was a significant, small to moderate overall effect of MI on pain intensity reduction from baseline to after chronic pain treatment (Hedges g = .270, 95% CI, .40–.500, z = 2.298, P = .022). However, this effect should be interpreted within the context of a fail-safe N of only 5 studies (z = 2.884). There were also 5 studies with 610 participants that had data available on the change in pain intensity after MI from baseline to the 6-month follow-up. The effect across these studies was also homogenous (Q = 3.466, P = .483). The short-term outcomes on pain intensity were not replicated in these analyses, which were not significant (Hedges g = .100, 95% CI, −.058 to .259, z = 1.243, P = .214).

Unfortunately, only 3 studies had available data on physical functioning after treatment, and therefore it was not possible to analyze these data quantitatively. The 3 studies[3,43,47] reported outcomes on physical functioning after treatment for 170, 76, and 113 participants, respectively. There was no significant effect of MI on physical function from baseline to after intervention in any of the 3 studies.

There were, however, 5 studies that reported the outcome for 779 participants on physical functioning from baseline to the 6-month follow-up and the results confirmed the short-term outcomes. For physical function, there was homogeneity across studies (Q = 1.663, P = .797). Therefore, for this analysis we used a fixed effects model, which indicated that there was no significant overall effect of MI on physical functioning at the 6-month follow-up (Hedges g = .124, 95% CI, −.016 to .265, z = 1.733, P = .083).

Discussion

The primary aim of this meta-analysis and systematic review was to examine the effect of MI on adherence to prescribed chronic pain treatment. The secondary aim was to examine the effect of MI on pain intensity and physical function. The major finding from this meta-analysis and systematic review was that MI significantly increased adherence to prescribed treatments in the short term, with small to moderate effects sizes.

Table 3. Statistical Analysis According to Article for Primary and Secondary Outcomes

Reference	Adherence Outcome and Measure	Pain Intensity Outcome and Measure	Physical Functioning Outcome and Measure	Meta-Analysis Outcome	Hedges g	95% Confidence Interval	p	Quality Rating Scale (Descriptor)
Ang et al[1]	Adherence to prescribed physical activity measured using the Community Health Activities Model Program For Seniors Questionnaire	Pain intensity measured using the Brief Pain Inventory	Physical functioning measured using the Fibromyalgia Impact Questionnaire–Physical Impairment	Baseline to post				30 (Excellent)
				Adherence	.339	.071–.607	.013*	
				Pain intensity	.099	−.167 to .365	.466	
				Functioning	-	-	-	
				Baseline to FU				
				Adherence	.123	−.144 to .389	.367	
				Pain intensity	.000	−.266 to .266	1.000	
				Functioning	.063	−.203 to .328	.644	
Basler et al[3]	Adherence to prescribed physical activity (average duration of physical activity per day) measured by an exercise log book	Not measured	Functional capacity measured by the Hannover Functional Disability Scale	Baseline to post				28 (Excellent)
				Adherence	.177	−.146 to .499	.283	
				Pain intensity	-	-	-	
				Functioning	.145	−.155 to .444	.344	
				Baseline to FU				
				Adherence	.112	−.210 to .434	.495	
				Pain intensity	-	-	-	
				Functioning	.129	−.170 to .429	.397	
Habib et al[16]	Adherence to pain management program measured by attendance rates to the pain management program	Not measured	Not measured	Baseline to post				13 (Poor)
				Adherence	.649	.177–1.120	.007*	
				Pain intensity	-	-	-	
				Functioning	-	-	-	
				Baseline to FU				
				Adherence	-	-	-	
				Pain intensity	-	-	-	
				Functioning	-	-	-	
Leonhardt et al[28]	Adherence to prescribed physical activity measured by the Freiburger Questionnaire on Physical Activity	Pain intensity measured by the Von Korff-scheme	Physical functioning measured by the Hannover Functional Disability Questionnaire	Baseline to post				20 (Average)
				Adherence	-	-	-	
				Pain intensity	-	-	-	
				Functioning	-	-	-	
				Baseline to FU				
				Adherence	.104	−.169 to .377	.454	
				Pain intensity	.005	−.305 to .315	.975	
				Functioning	.173	−.101 to .447	.216	
Miller et al[32]	Not measured	Pain intensity measured by the Brief Pain Inventory	Not measured	Baseline to post				12 (Poor)
				Adherence	-	-	-	
				Pain intensity	.566	−.014 to 1.146	.056	
				Functioning	-	-	-	
				Baseline to FU				
				Adherence	-	-	-	
				Pain intensity	.448	−.128 to 1.024	.127	
				Functioning	-	-	-	
Vong et al[43]	Adherence to prescribed physical activity measured by an exercise log book	Pain intensity measured by a Visual Analogue Scale	Physical functioning measured by the Rolland-Morris Disability Questionnaire	Baseline to post				24 (Excellent)
				Adherence	1.216	.731–1.701	.000*	
				Pain intensity	.132	−.314 to .577	.562	
				Functioning	.152	−.294 to .598	.504	
				Baseline to FU				
				Adherence	1.200	.715–1.684	.000*	
				Pain intensity	.343	−.105 to .791	.134	
				Functioning	.340	−.108 to .788	.137	
Zwikker et al[47]	Adherence to prescribed medication measured by the Compliance Questionnaire Rheumatology	Pain intensity measured by a Visual Analogue Scale	Physical functioning measured by the Health Assessment Questionnaire Disability Index	Baseline to post				28 (Excellent)
				Adherence	−.034	−.398 to .331	.857	
				Pain intensity	.488	−.225 to .509	.011*	
				Functioning	.142	.179–1.132	.448	
				Baseline to FU				
				Adherence	−.141	−.508 to .226	.450	
				Pain intensity	.122	−.247 to .491	.517	
				Functioning	.000	−.366 to .366	1.000	

Abbreviation: FU, follow-up.
*Significant.

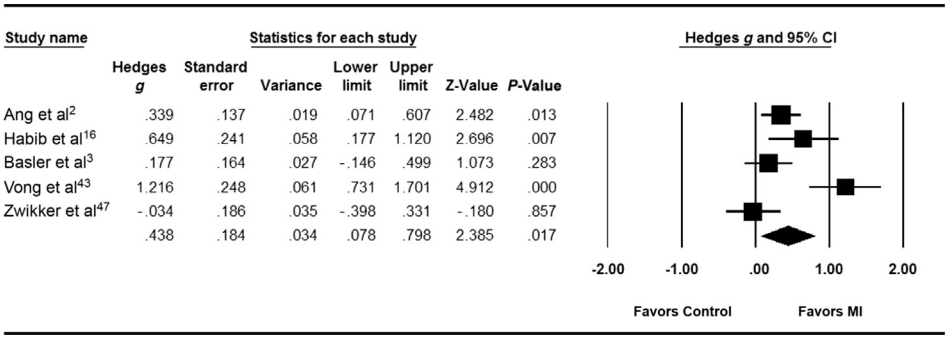

Figure 2. Forest plot of the effect estimates (Hedges *g*) of motivational interviewing on adherence to treatment from baseline to after chronic pain treatment.

However, the effect of MI on adherence was not maintained at the 6-month follow-up. We also confirmed that MI resulted in significant short-term reductions in pain intensity, which were again not observed at the 6-month follow-up. Although it was not possible to conduct a meta-analysis of the short-term effect of MI on physical functioning, none of the studies found a significant short-term effect of MI on physical function. Data at the 6-month follow-up failed to identify an effect of MI on physical function.

Although MI resulted in significant improvements on adherence and pain in the short term, the robustness of these findings need to be interpreted within the context of the limitations of this meta-analysis. The main limitation of this meta-analysis was the small number of MI studies and the resulting lack of statistical power. For adherence and pain, our computed fail-safe Ns of 27 and 5, respectively, were lower than recommended.[40] For pain, the fail-safe N of 5 clearly indicated that the findings should be interpreted cautiously. Because of the relatively few studies in this area, the results that indicated that MI has a short-term effect on adherence were more promising. Nonetheless, the large observed confidence intervals for the effect of MI on adherence (Hedges *g* = .078–.798) indicated that considerably more research is needed before we can confidently conclude that MI significantly improves adherence to pain treatments. Hence, it is premature to include MI as part of the routine treatment of chronic pain patients, although further research should be encouraged.

Adherence is known to be understudied in chronic pain.[7] However, there were a number of ways in which we could have increased the number of studies available for review. First, we could have included a range of designs (eg, case control studies and prospective cohort studies) to increase the available studies. However, these designs are far more likely to favor a therapy that is ineffective because of the lack of control. Therefore, we decided to limit studies to RCTs, so that we could have more confidence in the results. Had we included these studies, we would have at least an additional 3 studies. Notably, of these 3 studies, all showed the efficacy of MI on adherence, and supported the preliminary conclusions offered herein.[1,34,44] Similarly, many studies that investigated MI compared MI combined with some other intervention on a range of outcomes with an unrelated control condition.[13,42] These studies typically found that the combined treatment was effective on 1 or more of the outcomes (eg, pain intensity, physical functioning, and self-efficacy), including adherence (eg, physical activity). However, it was impossible to determine in these designs whether the effect could be attributed to MI or the other active intervention. As such, we decided to be conservative and only include studies in which any additional intervention was controlled for in the other arm, which allowed the unique contribution of MI to be determined.

There were 2 studies that met the inclusion criteria but were nonetheless exceptional and are worth discussing because they might have affected the meta-analytic

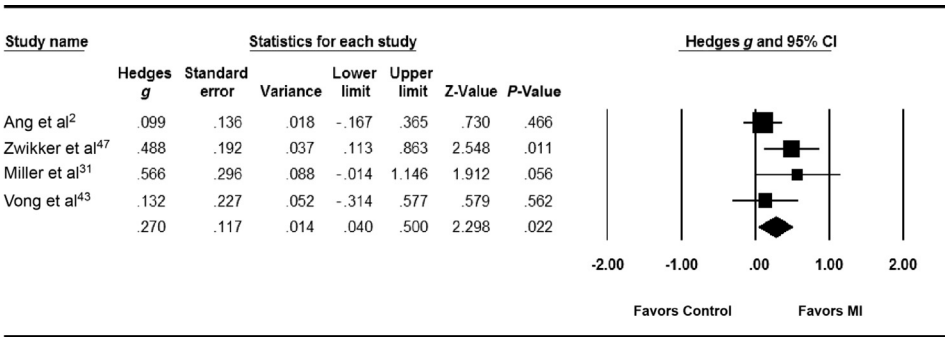

Figure 3. Forest plot of the effect estimates (Hedges *g*) of motivational interviewing on pain intensity reduction from baseline to post chronic pain treatment.

findings. One study was included in the final analysis even though data were only provided before treatment and at follow-up but not after treatment.[28] Because it was found in this study that MI was not efficacious at the 6-month follow-up, it might have significantly contributed to the findings of this meta-analysis, in that MI appeared to be associated with significant short- but not long-term improvements in adherence. The other study that was included was the only study in which the effect of MI on adherence was not assessed, only pain intensity.[32] Furthermore, it was also the only study in which the effect of MI in a couples setting was assessed, as opposed to an individual setting. For these reasons, it could be argued that this study should also not have been included in the final analysis. To account for either of these possibilities we ran the analysis with and without these studies to see if there would be any changes in findings but the results were unchanged.

In the literature on improvement of adherence, there are also a number of other treatments that aimed to improve motivation, such as motivational programs,[14,15] message framing,[23] mental contrasting,[9] and compliance counseling.[22] We decided to only include studies in which the intervention was on the basis of the principles of MI, because of the fundamental differences in treatment modes and the strong empirical support for MI approaches in other areas of psychology.[20,33] The advantage of this method is that we examined the effect of a clearly articulated therapeutic approach on the variables of interest. However, it is possible that there were other approaches to improvement of motivation. Some studies have supported motivational programs, compliance counseling, message framing, and mental contrasting. However, in each of these there are only 1 or 2 studies and the results are mixed.[8] Future research should compare different methods of enhancement of motivation to determine the most efficacious methods. Nonetheless, as a result of the small number of studies included in this review, we were unable to conduct a moderator analysis. This is particularly relevant to the study of MI on adherence to pain treatments.

Some could argue that using functional outcomes, such as pain and disability is not appropriate because the primary target of MI is to improve adherence. However, we disagree for 2 reasons. The first is that adherence is essentially only an important outcome if it translates to better outcomes for patients in important end points, such as pain and disability (which are typically used in reviews of the efficacy of treatments). Second, it is possible that the association between adherence and outcome noted in previous studies[35,36] is not a causal one. That is, it might be that people who benefit more from the intervention, adhere more because of this perceived benefit rather than the fact that adherence promotes more benefit. Studies that manipulate adherence and are able to show gains in important functional outcomes can provide more evidence of the direction of causality.

Despite these limitations, this is the first review to assess the short- and long-term efficacy of MI on adherence to prescribed treatment for pain, and improvements in pain intensity and physical functioning among individuals with chronic pain. Furthermore, the use of strict inclusion and exclusion criteria to not only maximize the homogeneity of the included studies but to ensure studies that controlled for the effects of MI were included, reduced the chances of reporting biased findings. Thus, this review builds upon previous reviews that did not adequately differentiate between acute and chronic pain conditions, included studies that did not adequately control for MI, or included studies that were designed to motivate clients to adhere to chronic pain treatments, that were not on the basis of MI principles.[8,12]

Currently, there is insufficient evidence to show that these improvements in adherence translate into gains in other outcomes, such as pain and physical function. Because these are the primary outcomes of most interventions with which MI is likely to be paired, the real test of the clinical usefulness of MI will not be on the basis of whether MI can promote adherence, but on whether adherence to the intervention improves clinically significant outcomes. In this review we clearly highlighted the need for more research in this area. In one recent study, tailored cognitive behavioral therapy (CBT) that incorporated an MI approach was compared with standard CBT and it was found that there were no differences between the 2 groups in participant engagement and adherence.[25] The authors proposed that this null finding might have been because of the uncharacteristically high rates of engagement and adherence to treatment in both groups. Nonetheless, engagement and adherence in both groups was significantly associated with improved outcomes from before to after treatment, which highlights the need for further research on the processes that underlie adherence. We were unable to identify any other treatments that used MI with CBT-based interventions, although one trial is currently ongoing.[30] We were also unable to determine the necessary dosage of MI or whether it is more effective than other approaches to increasing adherence. Despite the preliminary nature of these findings, our results confirm that MI is likely to improve adherence to treatment in patients with chronic pain, and might have at least short-term effects on pain levels. However, this is an important area for future research, because adherence to treatment is increasingly identified as a problem in pain management.

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Supplementary Data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jpain.2015.10.021.

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