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Motivational interviewing to increase physical activity in people with chronic health conditions: a systematic review and meta-analysis

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Abstract

Objective: A systematic review and meta-analysis of randomized controlled trials to determine if motivational interviewing leads to increased physical activity, cardiorespiratory fitness or functional exercise capacity in people with chronic health conditions.

Data sources: Seven electronic databases (MEDLINE, PsychINFO, EMBASE, AMED, CINHAL, SPORTDiscus and the Cochrane Central Register of Controlled trials) were searched from inception until January 2014.

Trial selection: Two reviewers independently examined publications for inclusion. Trials were included if participants were adults (>18 years), had a chronic health condition, used motivational interviewing as the intervention and examined physical activity, cardiorespiratory fitness or functional exercise capacity.

Data extraction: Two reviewers independently extracted data. Risk of bias within trials was assessed using the Physiotherapy Evidence Database Scale.

Data synthesis: Meta-analyses were conducted with standardized mean differences and 95% confidence intervals (CIs) were calculated. The Grades of Recommendation, Assessment, Development and Evaluation approach was used to evaluate the quality of the evidence.

Results: Eleven publications (of ten trials) were included. There was moderate level evidence that motivational interviewing had a small effect in increasing physical activity levels in people with chronic health conditions relative to comparison groups (standardized mean differences = 0.19, 95% CI 0.06 to 0.32, p = 0.004). Sensitivity analysis based on trials that confirmed treatment fidelity produced a larger effect. No conclusive evidence was observed for cardiorespiratory fitness or functional exercise capacity.

Conclusion: The addition of motivational interviewing to usual care may lead to modest improvements in physical activity for people with chronic health conditions.

Keywords

Cardiorespiratory fitness, motivational interviewing, physical activity, systematic review

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Introduction

The majority of people with chronic health conditions are not sufficiently active and their poor activity levels correlate with increased morbidity, mortality and disease burden.[1] Efficacious methods that help people with a range of health conditions increase their physical activity are required. Physical activity is defined as bodily movement produced by skeletal muscle,[2] which for the purpose of this review was considered to be daily activities and/or purposeful routine exercise at intensities designed to illicit physiological change. One promising approach that may lead to improved physical activity levels is motivational interviewing, which can be defined as a person-centred directive counselling style used to address individual ambivalence about behaviour change through placing the emphasis on clients producing their own argument for change.[3] Motivational interviewing has been shown to be an effective method of producing health-related behaviour change for people who are overweight or obese, or with substance abuse issues.[4–7]

Consistent with the overall increase in published motivational interviewing trials over the last 20 years,[3] there has been a recent increase in published trials examining the use of motivational interviewing to increase physical activity. Physical activity has been examined to varying extents within more general reviews of motivational interviewing efficacy; however the effect of motivational interviewing on physical activity remains unclear.

One systematic review has examined the effect of motivational interviewing on physical activity,[8] however the review was related to adaptations of motivational interviewing, included only four trials and was conducted 10 years ago and, therefore, may not have synthesized the latest evidence. A further two reviews have examined physical activity, but did not perform a meta-analysis and were based on poor quality data.[9,10] The final four systematic reviews combined physical activity with other outcomes, such as diet, weight loss and healthy behaviours and, therefore, did not examine the impact of motivational interviewing on physical activity in isolation.[4–6,11] No systematic review has focused specifically on the effect of motivational interviewing on physical activity and/or cardiorespiratory fitness and exercise capacity for people with chronic health conditions.

Given the increased use of motivational interviewing as a behaviour change technique, clinicians and researchers would benefit from a systematic review that focuses on identifying the benefits associated with the use of motivational interviewing to increase physical activity for people with chronic health conditions. Specifically, such a review has the potential to provide an evidence base to inform future interventions aimed at increasing physical activity for these populations.

The primary aim of the current review was to examine the effectiveness of motivational interviewing for increasing physical activity for people with a chronic health condition. A secondary aim was to examine the effectiveness of motivational interviewing for increasing cardiorespiratory fitness and exercise capacity in these populations.

Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[12] The review was registered with PROSPERO (international prospective register of systematic reviews: registration number CRD42013003770) prior to the commencement of the search.

Search strategy

Seven electronic databases (MEDLINE, PsychINFO, EMBASE, AMED, CINHAL, SPORTDiscus and the Cochrane Central Register of Controlled trials) were searched for relevant trials from inception until January 2014. Search terms were mapped to subject headings as keywords or MeSH terms when possible. The search terms within the major constructs (motivational interviewing and physical activity/exercise capacity/cardiorespiratory fitness) were combined with the OR operator. Following this, motivational interviewing was combined with

physical activity or exercise capacity or cardiorespiratory fitness using the AND operator. Appendix 1 (available online) details the search strategy implemented for the Medline database. Reference lists of selected trials were also examined to identify other relevant publications.

All titles and abstracts were screened for eligibility by two reviewers independently. A trial was discarded if the abstract indicated that the trial clearly did not meet inclusion criteria. The remaining full texts were then reviewed independently by each reviewer and any discrepancies were resolved by discussion. Authors were contacted to seek clarification as required.

Eligibility criteria

Included trials were required to meet the following criteria.

Population. *People 18 or over with a chronic health condition*. Chronic health condition was defined as a long-term condition with pathophysiological changes or a mental health condition you would expect to be managed by a medical practitioner or allied health professional.

Intervention. *Relies on the three core characteristics of motivational interviewing*[3] *delivered individually with personal contact (i.e. phone or in person)*. Thus the intervention needed to involve:

(a) a clear focus on changing behaviour (i.e. physical activity);
(b) use of empathic (reflective) listening in a collaborative relationship to understand the person's perspective about changing their behaviour; and
(c) emphasis on evoking the person's motivation for change (i.e. person producing their own arguments for change).

Trial design. *Randomized control trial or controlled trial*. Only trials that could isolate the unique contribution of motivational interviewing (i.e. separately from other elements of a treatment package) were included.

Outcomes. To be included trials must have measured one of the following outcomes:

(a) *Physical activity* – measured over a minimum of 24 hours by accelerometer, pedometer, questionnaire or self-report data as long as duration and intensity of activity data could be derived from the measure.
(b) *Cardiorespiratory fitness* – measures of cardiorespiratory fitness (e.g. maximum oxygen uptake (VO_2 max) or peak oxygen uptake (VO_2 peak)).
(c) *Functional exercise capacity* – measured using a field test that is valid and reliable for the specific population being measured. For example, distance covered on a timed walking test, distance or time for a shuttle walking test.

Publication type. *Published in full text following a peer reviewed process to gather the highest quality evidence available*.

Risk of bias in individual trials

The internal validity of all included trials was evaluated independently by two reviewers with the Physiotherapy Evidence Database (PEDro) scale. The validity of the PEDro scale for assessing the quality of clinical trials has been supported by Rasch analysis.[13] In line with guidelines,[14] indicators of internal validity were scored on 10 of these criteria (described later in Table 3, available online). These scores were then summed and scores were used to assign a quality rating: low (0–4); moderate (5–7); or high (8–10).[15]

Data extraction and synthesis of results

Data were extracted independently by two reviewers using a standardized checklist. Discrepancies were resolved by discussion and, if required, consultation with a third reviewer. Extraction data included details on: participants details; health condition and setting; intervention characteristics including measurement and verification of treatment fidelity; comparison group(s) details; assessment times; physical activity, cardiorespiratory fitness and exercise capacity measurements; results.

Intervention effects, postintervention and at follow-up, were calculated for each trial for physical activity, cardiorespiratory fitness and exercise capacity. Standardized mean differences (SMD) with 95% confidence intervals (CIs) were calculated using Review Manager 5.2,[16] as the mean difference divided by the pooled standard deviation. Meta-analyses were conducted using a random effects model on clinically homogenous data, to provide an estimate of the overall effect of motivational interviewing on physical activity, exercise capacity and cardiorespiratory fitness variables. In line with recommendations, I^2 was used to assess statistical heterogeneity across trials.[17,18] According to Cohen[19] a SMD of 0.2 is considered small, 0.5 is moderate and 0.8 or more is large.

Consistent with recommendations,[20] if intention to treat analysis using imputed values was reported in a trial, these data were used. If more than one measure of physical activity was reported, the measure that best reflected total activity was selected for the analysis. For example, where a self-report measure provided data on walking activity, moderate intensity activity and overall activity for a seven-day period, the measure of overall activity was used for analysis. In trials where only medians were reported, these values were treated as means and the interquartile ranges were used to estimate the standard deviations according to the formula: standard deviation = interquartile range/1.35. Where mean and standard deviation were not provided within the article, the authors were contacted in an attempt to obtain these data for the pooled meta-analysis. Change score data were converted into final values prior to entry into the pooled analysis. Where change scores only were provided, final value means were calculated using change score means and baseline data. Baseline intervention and control standard deviations were used to estimate final value standard deviations.

Sub-group analyses were conducted to determine the effect of motivational interviewing for clinically homogenous groups of people with chronic health conditions. In line with recommendations[21] trials that confirmed motivational interviewing treatment fidelity (i.e. standards of competency met using valid and reliable measures) were analysed separately in a sensitivity analysis.

Grading of the quality of evidence

The Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach was adopted to grade the quality of evidence for each outcome to emerge from the review. [22–24] In line with this approach, five factors were examined to determine the quality rating level of the body of evidence (i.e. if downgrading of the evidence was required).

1. Limitations in design and implementation: Evidence was downgraded if the average PEDro scores of trials included in a meta-analysis was less than 4.[15]
2. Indirectness of evidence: Downgrading of evidence pertaining to the effectiveness of motivational interviewing occurred if this evidence was deemed to be compromised by factors such as: (a) indirect comparisons between motivational interviewing and the relevant comparison group; (b) specific qualities of the intervention made it very difficult to generalize outside of this setting (e.g. the dose and fidelity of the motivational interviewing could not be determined in the majority of studies); or (c) the nature of the comparison group (i.e. it has been demonstrated to be less effective than usual care).
3. Unexplained heterogeneity: An I^2 value of 50% has been described as a moderate level of statistical heterogeneity, therefore 50% was used as a cut-off to determine if downgrading was required. [25]
4. Imprecision of results (wide CIs): The quality of evidence was downgraded if CIs were too wide. Evidence was downgraded if the CI for the SMD was equal to or greater than 0.8 (a large effect according to Cohen[26])
5. High probability of publication bias: Selective reporting of trials was determined using a funnel plot, subject to there being a sufficient number of trials (at least $n = 10$).[20]

Results

Figure 1 summarizes the initial identification of trials. The level of agreement across reviewers was good (Kappa = 0.79. 95% CI 0.71 to 0.87) and the search resulted in 11 publications, comprising 10 separate trials selected for final review. To facilitate the final selection process, the corresponding authors of five articles were contacted for clarification of the intervention and/or measurement of outcomes. Three of these authors responded, which led to the inclusion of data from two trials. [27,28]

Trial characteristics

All ten trials were randomized control trials (Table 1). Seven of the trials recruited middle-aged adults who were overweight or obese, or had a diagnosed cardiovascular condition; two trials included participants with multiple sclerosis; [29,30] and one trial included participants with Fibromyalgia.[31] Sample sizes varied from 19 to 334, with five of the ten trials having sample sizes larger than 100 (Table 1). In eight trials, physical activity was the primary outcome, with six trials using questionnaires, [27,28], [30,32–34] one a combination of questionnaire and accelerometer[31] and one a physical activity log[35] to record participants' duration and intensity of activity over a seven-day period. In only two trials were an objective measurement of physical activity included (i.e. an accelerometer or pedometer).[28,31] Three trials included measures of cardiorespiratory fitness,[29,35,36] and two trials examined functional exercise capacity.[29,31]

There was variation in the intervention (Table 2, available online). Motivational interviewing was delivered as the primary intervention in six trials[27–30,33,34] and as an addition to a weight loss programme,[32,35], supervised exercise [31] or educational materials [36] in four trials. There was variation in the specific behaviours targeted by the motivational interviewing. Physical activity was the sole targeted behaviour in three trials.[28,30,31] In four trials physical activity was one of several health behaviours (e.g. diet) targeted,[27,32,34,35] and in two trials participants had the choice between focusing on physical activity or some other health behaviour.[29,33]

Motivational interviewing was most frequently delivered by a combination of face-to-face and telephone.[27–30,32,33] Two trials relied exclusively on face-to-face delivery[34,35] and a further two by telephone alone.[31,36] The number of sessions offered to participants ranged from 1 to 11, and the duration of the interventions ranged from 3 to 18 months (Table 2, available online). There was variation in the dose of motivational interviewing received by participants. Participants in eight trials completed three or more sessions, however, in two trials participants received, on average, an hour or less of motivational interviewing during the intervention period.[33,36] As well, there was variation in who delivered the motivational interviewing, the amount of training that was completed and the number of trials that assessed treatment fidelity (Table 2, available online).

Eight trials reported measuring treatment fidelity.[27,28,30–33,35,37] Three trials[27,30,31] confirmed treatment fidelity using valid and reliable measures of the motivational interviewing intervention (Table 2, available online). In one of these trials, competency was based on demonstrated training proficiency. [27]

Risk of bias

Nine trials were rated as being of moderate quality and one was rated as high quality[29] (Table 3, available online). Seven trials did not report having 85% or more of participants completing at least one outcome measure, with three trials meeting the benchmark.[29,31,36]

Outcome findings

Results are reported according to the three outcomes considered in this review: physical activity, cardiorespiratory fitness and exercise capacity (Table 4).

Physical activity. Data from eight moderate quality trials [27,28,30–35] were pooled for meta-analysis. There was moderate level evidence that motivational interviewing increased physical activity levels for people with health conditions with a small but significant effect observed immediately following the

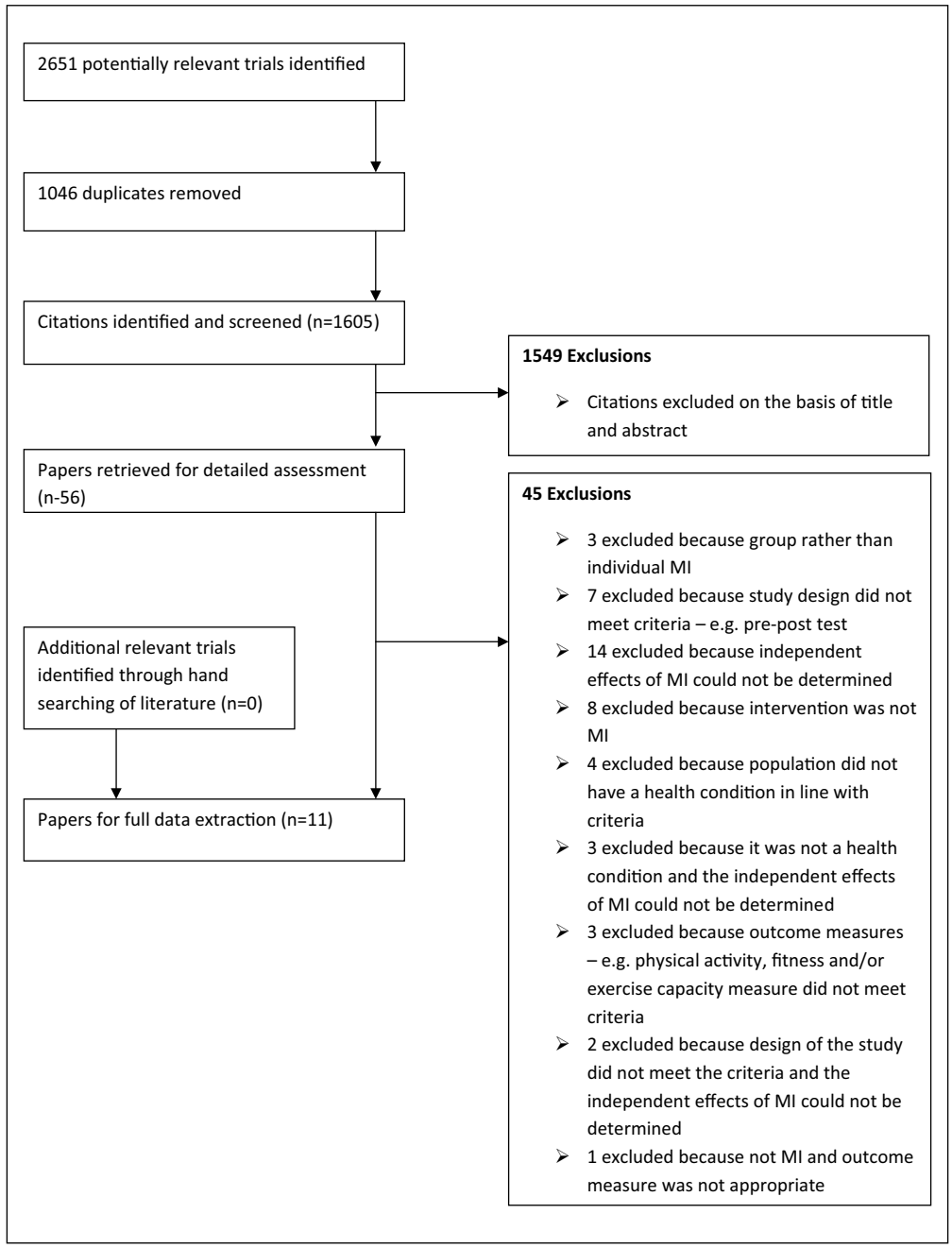

Figure 1. Process for identification of the included trials.

intervention (SMD = 0.19, 95% CI 0.06 to 0.32, p = 0.004, I^2 = 0%) (Figure 2). The potential moderating effect of dose of motivational interviewing (MI) treatment could not be calculated given the lack of specific data pertaining to both the duration of sessions received and adherence (Table 2,

Table 1. Study design characteristics.

Article/citation details	Country	N[a]	Mean age[a] (SD)	Sex[a]	Health condition	Setting	Outcomes	Measures
Ang et al. (2013)[31]	U.S.	216	MI = 46.0 (11.4) EC = 45.7 (11.0)	F = 201 M = 15	Fibromyalgia	Primary health care	Physical activity Cardiorespiratory fitness	1. Accelerometer over 7 days 2. CHAMPS (typical week) 3. 6-minute walk test
Befort et al. (2008)[32]	U.S.	44	44.3 (11.6)	F = 44	Obesity	Community health centre	Physical activity	CHAMPS (7 day)
Bombardier et al. (2008)[29]	U.S.	130	46.2 (9.9)	F = 101 M = 29	Multiple sclerosis	Community residing persons	Cardiorespiratory fitness Functional exercise capacity	1. Bicycle ergometer 2. Time taken to walk 90 m
Bombardier et al. (2013)[30]	U.S.	92	48[b]	F = 79 M = 13	Multiple sclerosis and major depressive disorder or dysthymia	Community residing persons	Physical activity	7 day PAR interview
Carels et al. (2007)[35]	U.S.	35	48.2[c] (10.0)	F = 30[c] M = 5[c]	Obesity	Community	Physical activity Cardiorespiratory fitness	1. PA logs (7 day) 2. Submaximal graded exercise test
Greaves et al. (2008)[27]	U.K	141	51.9[b]	F = 90 M = 51	Overweight/obesity	Community	Physical activity	Modifiable Activity Questionnaire
Hardcastle et al. (2008, 2013)[33,37]	U.K.	334	50.2 (10.6)	F = 224 M = 110	Overweight/obesity, hypertension, hypercholesterolemia	Primary health care	Physical activity	Short interview version of the IPAQ (7 day)
Kreman et al. (2006)[36]	U.S.	24	54[b]	F = 9 M = 15	Hyperlipidemia	Rural Community	Cardiorespiratory fitness	Rockport walk test- to estimate Vo_2 max
Quirk et al. (2012)[34]	Australia	19[d]	73.2 (8.0)[d]	F = 5[d] M = 14[d]	Peripheral artery disease	Not stated	Physical activity	Short interview version of the IPAQ (7 day)
Reid et al. (2011)[28]	Canada	141	60.5 (9.8)	F = 38 M = 103	Acute coronary syndromes	Primary health care	Physical activity	1. 7 day recall interview 2. Godin leisure time physical activity questionnaire 3. Pedometer over 7 days

[a]Unless otherwise specified values are for the entire sample that are randomized.
[b]Standard deviation not reported.
[c]No date were reported for MI and comparison group figures based on what was reported for a larger group prior to randomization to receive MI # gender composition based on data supplied for those accepting invitation.
[d]Values supplied for completers only.
CHAMPS:Community Health Activities Model Program for Seniors; EC: Educational Control; IPAQ: International Physical Activity Questionnaire; MI: Motivational Interviewing; PA: Physical Activity; PAR: Physical Activity Recall; EC: ; IPAQ: ; MI: ; PA: ; PAR: .

Table 4. Summary of meta-analyses for motivational interviewing compared with usual care/comparison for health conditions.

Outcome	Population	No. of trials	No. of participants	Measurement time	Effect size (95% CI), I^2	GRADE
Physical activity	Overweight/obese, MS, CVD, fibromyalgia	8	921	Postintervention	0.19 (0.06 to 0.32), 0%	Moderate[a]
Physical activity	Overweight/obesity	4	498	Postintervention	0.14 (–0.06 to 0.33), 8%	Moderate[a]
Physical activity	Cardiovascular disease	2	115	Postintervention	0.22 (–0.15 to 0.59), 0%	Moderate[a]
Cardiorespiratory fitness	MS, obesity, CVD	3	189	Postintervention	–0.07 (–0.56 to 0.43), 52%	Very low[a,b,c]
Functional exercise capacity	MS, fibromyalgia	2	333	Postintervention	0.13 (-0.08 to 0.34), 0%	Moderate[a]

CVD: cardiovascular disease; GRADE: GRADE working group grades of evidence (see Reason for downgrade); MS: multiple sclerosis.
[a]Reason for downgrade: Lack of direct evidence of participants actually receiving MI as it is intended to be delivered and treatment fidelity not demonstrated in >50% of included trials (Miller & Rollnick, 2013)[3] and/or uncertainty on the dose of MI received by participants.
[b]Reason for downgrade: Unexplained heterogeneity.
[c]Reason for downgrade: imprecision of results.

available online), however there was a tendency for the effect to be larger when the level of participation in the MI intervention was higher.[27,30,35]

Two trials of moderate quality[31,37] examined follow-up physical activity data for the intervention and comparison groups. One trial[31] reported no difference between the motivational interview and educational control group for people with fibromyalgia at either three months (SMD = –0.20, 95% CI –0.47 to 0.06, p = 0.13) or six months (SMD = –0.11, 95% CI –0.38 to 0.15, p = 0.40) following completion of the intervention. Another[37] reported no difference between the motivational interview and usual care groups for people with excess weight, hypertension or hypercholesterolemia at 12 months postintervention (SMD = –0.03, 95% CI –0.31 to 0.24, p = 0.81).

In a meta-analysis of the three trials where treatment fidelity was confirmed,[27,30,31] the pooled effect of motivational interviewing on physical activity was 0.30 (95% CI 0.10 to 0.50, p = 0.003, I^2 = 0%) (Figure 3).

Subgroup analysis. There was variation in the health conditions of participants across the eight trials that examined physical activity.

Four trials examined physical activity following motivational interviewing for people who were overweight, obese or those who had hypertension or hypercholesterolemia.[27,32,33,35] A small non-significant SMD of 0.14 (95% CI –0.06 to 0.33, p = 0.18, I^2 = 8%) was observed in the meta-analysis (Figure 4).

Data from two moderate quality trials examining motivational interviewing for people with cardiovascular conditions[28,34] were pooled. This meta-analysis resulted in a small non-significant SMD of 0.22 (95% CI –0.15 to 0.59, p = 0.25, I^2 = 0%) (Figure 5).

One moderate quality trial examined the effect of motivational interviewing on physical activity in participants with multiple sclerosis who also had major depression or dysthymia.[30] Analysis of postintervention seven-day physical activity data (kcal/kg/week) revealed significantly greater levels of physical activity for participants in the

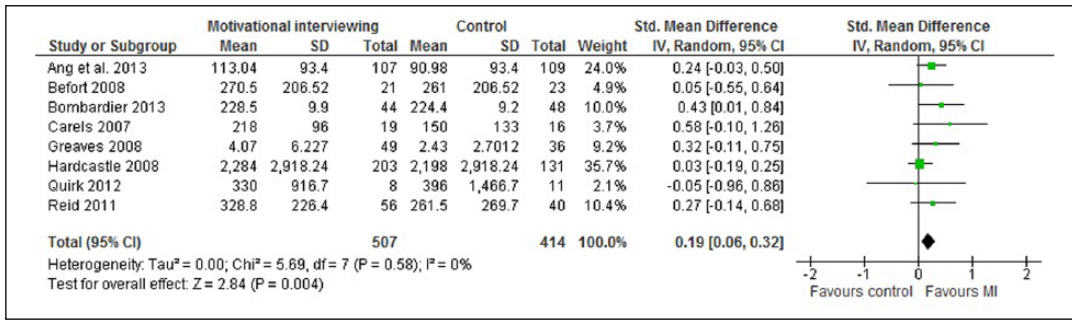

Figure 2. Forest plot of comparison physical activity all conditions.

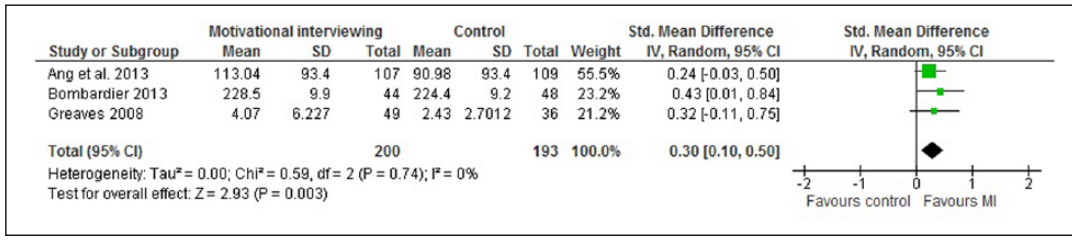

Figure 3. Forest plot of comparison physical activity all conditions sensitivity analysis for treatment fidelity.

motivational interviewing group with a SMD of 0.43 (95% CI 0.01 to 0.84, $p = 0.04$). A further moderate quality trial examined the effect of physical activity in persons with fibromyalgia.[31] Analysis of seven-day accelerometer data revealed a small non-significant SMD of 0.24 (95% CI –0.03 to 0.50, $p = 0.08$).

Cardiorespiratory fitness. One high quality[29] and two moderate quality trials[35,36] examined the effect of motivational interviewing on cardiorespiratory fitness. Very low level evidence indicated no effect of intervention with a SMD of –0.07 (95% CI –0.56 to 0.43, $p = 0.79$, $I^2 = 52\%$) (Figure 6).

Functional exercise capacity. One high quality trial [29] and one moderate quality trial[31] examined the effect of motivational interviewing on exercise capacity . No significant differences between the groups were observed with the meta-analysis (SMD 0.13, 95% CI –0.08 to 0.34, $p = 0.22$, $I^2 = 0\%$) (Figure 7). Bombardier et al.[29] also analysed the data of 88 participants who chose physical activity as the target behaviour of the motivational interviewing prior to randomization. When only data from these participants were analysed, there was a significant positive effect of motivational interviewing with a SMD of 0.56 (95% CI 0.14 to 0.99, $p = 0.01$).

Discussion

The results of a meta-analysis of eight randomized controlled trials provided moderate quality evidence that motivational interviewing may have a small positive effect on self-reported physical activity in people with chronic health conditions. Consistent with previous reviews,[6,8] there was a tendency for the effect to be larger when the level of participation in the MI intervention was higher. [27,30,35] There was no evidence that mode of delivery of the intervention impacted on the size of the effect. Subgroup analysis revealed small to moderate positive effects for people who were overweight, obese or who had hypertension or hypercholesterolemia,[27,32,33,35] cardiovascular conditions[28,34] or

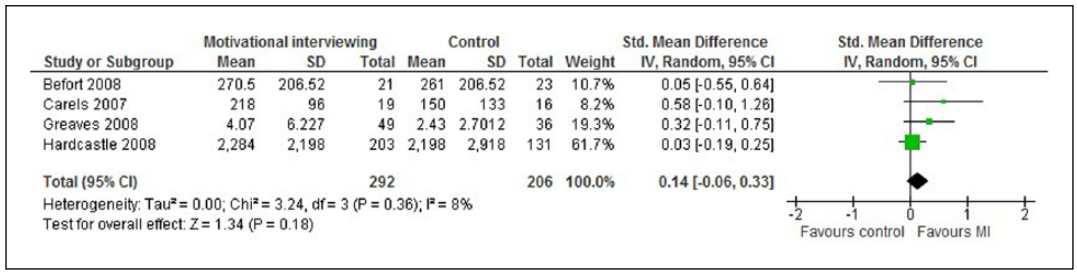

Figure 4. Forest plot of comparison physical activity obesity.

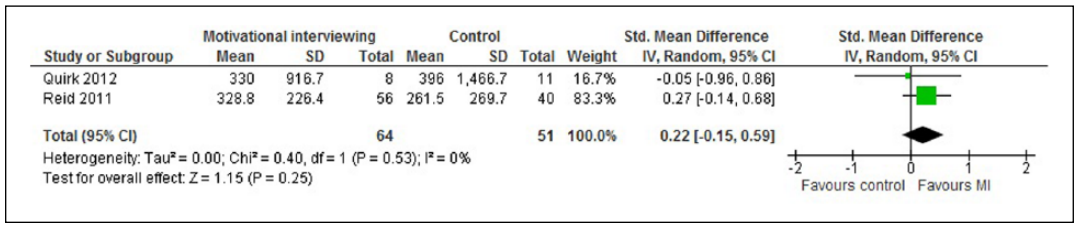

Figure 5. Forest plot of comparison physical activity cardiovascular conditions.

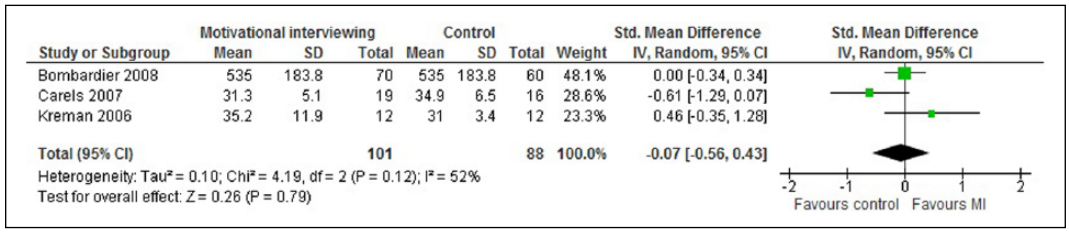

Figure 6. Forest plot of comparison cardiorespiratory fitness.

multiple sclerosis.[30] Even small increases in physical activity levels for people with chronic health conditions can lead to a significant impact on disease burden.[38]

There were several possible explanations why motivational interviewing produced a modest post-treatment effect size. This might be an accurate reflection of the efficacy of the treatment. The present results were consistent with the small effect size produced in a previous large meta-analysis that examined the effect of motivational interviewing on behaviour change.[6] In the one systematic review that demonstrated a large effect of motivational interviewing, diet and physical activity were reported collectively and thus the impact on physical activity alone was not examined.[5]

Another explanation is the variation in treatment fidelity across trials.[21] Variation in the quality of the delivered treatment can have a major impact on outcomes in systematic reviews and is a major source of clinical heterogeneity.[21] The majority of trials examining physical activity did not confirm treatment fidelity (Table 2, available online), thereby raising concerns that participants were not actually receiving motivational interviewing as it is intended to be delivered.[3] Notwithstanding that analyses were based on just three trials[27,30,31] the SMD for the effect of motivational interviewing

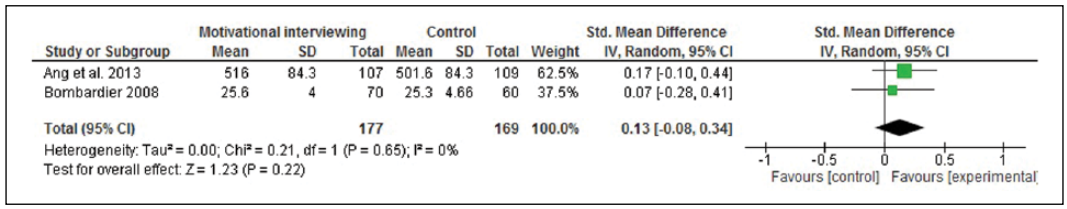

Figure 7. Forest plot of comparison functional exercise capacity.

increased (from 0.19 to 0.30) when trials that did not confirm fidelity were excluded from the analysis. This is consistent with results from a previous meta-analysis of motivational interviewing and weight loss, which demonstrated that the SMD increased from a small effect in trials not measuring fidelity to a medium to large effect in trials that did.[4]

A further important dimension of treatment fidelity relates to the treatment dose (focus, number, frequency and length contact).[39] The dose of motivational interviewing received varied considerably across included trials and could not be determined with any precision in the majority of trials. As well, the majority of included trials the intervention targeted multiple health behaviours, with just three trials focusing exclusively on physical activity (Table 2, available online). The effect of motivational interviewing may be larger when a single outcome is targeted, as demonstrated by the results of the systematic review by Armstrong et al.[4]

The effect of motivational interviewing on cardiorespiratory fitness and functional exercise capacity could not be determined. Results of a pooled analyses revealed motivational interviewing had no effect on cardiorespiratory fitness or functional exercise capacity. However, given high unexplained heterogeneity, large CIs, and uncertainty regarding treatment dose/fidelity, these analyses were downgraded to low and moderate, respectively. One potential explanation for this inconclusive finding is that the observed increases in physical activity may not have been sufficient to lead to an increase in cardiorespiratory fitness or functional exercise capacity.

The evidence from this review provides some support for the inclusion of motivational interviewing for the purposes of increasing physical activity for people with chronic health conditions. Although the demonstrated effect was modest, there are several potential advantages to using motivational interviewing. Meta-analytic reviews have demonstrated that motivational interviewing typically requires less contact hours of treatment relative to other behaviour change strategies[6,40] and it can be effectively delivered by most health professionals with sufficient training.[6] Another advantage is that, given the person-centred nature of the intervention, it has relatively high levels of acceptability among patients.[41] It is also likely that stronger treatment effects will be produced if the intervention is delivered as it was intended (i.e. treatment fidelity is high). As well, even relatively small increases in physical activity can have health benefits with respect to increased life expectancy and cancer risk.[38]

A strength of this review is the meta-analysis of motivational interviewing for physical activity was based on eight trials with a low risk of bias. In addition, the review was conducted in accordance with PRISMA guidelines, quality was assessed using GRADE with results being downgraded as appropriate, and treatment fidelity was considered, further strengthening confidence in the findings.

There were several potential limitations in our analysis. One potential limitation was that the number of included trials was restricted by the use of relatively stringent criteria designed to assess the independent effects of motivational interviewing. A second potential limitation is that included outcomes related to physical activity were confined to self-report measures in six out of eight trials. Trials comparing objective measures, such as accelerometers, with self-report

data have suggested that levels of activity can be overestimated by self-report measures.[42,43] Just two included trials included an objective measure of physical activity (accelerometer or pedometer), and although improvement was reported in favour of the motivational interviewing group, the size of the effect was smaller in both trials relative to the self-report data,[28,31] A further potential limitation relates to the potential impact of combining data from participants with diverse health conditions. However I^2 was low for the pooled analysis based on physical activity and the subgroup analysis revealed similar sized effects across the health conditions. Further research would benefit from confirming motivational interviewing treatment fidelity, measuring physical activity with objective measures (i.e. accelerometers) and ascertaining the impact of treatment dose.

Motivational interviewing leads to modest improvements in physical activity in people with health conditions. Given that with sufficient training motivational interviewing can be delivered effectively by most health professionals, there may be some benefit to incorporating this treatment into clinical practice. However, a stronger recommendation regarding the use of this treatment cannot be made until maintenance of this effect for physical activity has been demonstrated in trials with strong treatment fidelity.

Clinical messages

- Motivational interviewing can lead to modest improvements in physical activity in people with chronic health conditions and there may be benefit in incorporating it into clinical practice.
- The effects of motivational interviewing may be greater if the clinician adheres to the core components of motivational interviewing.

Contributors

All listed authors made a substantial and meaningful contribution to the study and manuscript.

Conflict of interest

The author declares that there is no conflict of interest.

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